Hermosa Project

Aquifer Protection Permit
SIGNIFICANT Amendment Application

P-512235

Santa Cruz County, Arizona

Prepared for:

South32 Hermosa Inc.
1860 E. River Road Suite 200
Tucson, Arizona 85719

Prepared by:

CLEAR CREEK ASSOCIATES, LLC
221 North Court Avenue
Tucson, Arizona 85701

December 21, 2023

1860 East River Road, Suite 200
Tucson, AZ 85718
USA

T +1 520 485 1300

south32.net

December 21, 2023

Via Electronic Mail
Arizona Department of Environmental Quality
Attention: Mr. Vimal Chauhan, Groundwater Protection
1110 West Washington Street
Phoenix, Arizona 85007
Email: chauhan.vimal@azdeq.gov

Re: Aquifer Protection Program (APP) Permit No. P-512235, Significant Amendment

Dear Mr. Chauhan:

South32 Hermosa Inc. (South32) is hereby submitting this significant amendment application or its Hermosa Project, Hermosa Project, APP No. P-512235.

The primary purposes for this significant amendment are to:

- Expand the tailing storage facility (now referred to as TSF1) by increasing the maximum elevation to 5275 ft and expanding the lateral footprint.
- Revise the Pollutant Management and Discharge Impact areas to reflect the expanded TSF footprint.
- Propose revised monitoring requirements for AZPDES Outfalls 1 and 2.
- Update closure costs and the financial assurance mechanism.

Please feel free to contact either Paul Nazaryk at (970) 903-1792 or myself should you have any questions or require additional information.

Sincerely,

Brent Musslewhite Digitally signed by Brent Musslewhite
Date: 2023.12.22 12:17:07 -07'00'

Brent Musslewhite
Director, Environment and Permitting

Aquifer Protection Permit Application

ADEQ Arizona Department of Environmental Quality

GENERAL INFORMATION

1. **Application to obtain [A.R.S. 49-241]:**
New APP no
Amendment to a current APP Inventory No. P-512235 LTF No. 71251
Description of all amendment requests and justification included in Report Section/Appendix Att D
A copy of the current permit, annotated with any inconsistencies between the permit requirements and the existing facilities or operation, included in Report Section/Appendix Att D
NOTE: ADEQ can provide the permit in WORD file format upon request.

2. **Applicant/Permittee Name [A.A.C. R18-1-503(1)] (see Definitions):**
Company/Government/Entity Name: (RESPONSIBLE FOR ALL PERMIT CONDITIONS)
South32 Hermosa Inc.

3. **Applicant/Permittee - Certification Statement [A.A.C. R18-9-A201(B)(7)]:**
I certify under penalty of law that this Aquifer Protection Permit application and all attachments were prepared under my direction or authorization and all information is, to the best of my knowledge, true, accurate and complete. I also certify that the APP discharging facilities described in this form is or will be designed, constructed, operated, and/or closed in accordance with the terms and conditions the Aquifer Protection Permit and applicable requirements of Arizona Revised Statutes Title 49, Chapter 2, and Arizona Administrative Code Title 18, Chapter 9 regarding aquifer protection permits. I am aware that there are significant penalties for submitting false information, including permit revocation as wells as the possibility of fine and imprisonment for knowing violations.

Authorized person signature:
Name: Brent Musslewhite
Title: Director - Environment and Permitting
Signature Brent Musslewhite Digitally signed by Brent Musslewhite Date: 2023.12.22 12:13:10 -07'00'
Date: December 21, 2023

4. **Applicant/Permittee Address**
Mailing Address: 1860 E River Rd, Suite 200, Tucson, AZ 85718
Billing Address: same
Email Address: Brent.Musslewhite@south32.net
Phone Number: 520-485-1300

5. **Authorized Agent [A.A.C. R18-1-503(3)] (Optional, see Definitions):**
   Name: NA
   Firm Name
   Mailing Address:
   Email Address:
   Phone Number:

6. **Facility Information [A.A.C. R18-1-503(2), A.A.C. R18-9-201(B)(1)]**
   Name: Hermosa Project
   Address: 749 Harshaw Road
   County: Santa Cruz
   Latitude: 31 ° 27 ' 59.4 " Longitude: 110 ° 43 ' 35.8 "
   Coordinate System used for Latitude and Longitude: ☐ NAD27 ☑ NAD83
   Township 22S Range 16E Section: 32 T22S, R16E, sec 32 and T23S R16E; unsurveyed sections 4 and 5
   Driving directions from a major intersection:

7. **Facility Notices of Violation, Consent Orders or Compliance Orders in the last 2 years [A.A.C. R18-9-A202(A)(11), included in Report Section/Appendix** NONE

8. **Facility Owner**
   Company/Government/Entity Name: South32 Hermosa Inc.
   Contact Person Name Brent Musslewhite
   Mailing Address: 1860 E River Rd, suite 200 Tucson, AZ 85718
   Email Address: Brent.Musslewhite@south32.net
   Phone Number: 520-485-1300

9. **Contact Person for Facility Emergencies [A.A.C. R18-9-A202(A)(11)]**
   Name: Brent Musslewhite Title: Director--Environment and Permitting
   Mailing Address: 1860 E River Rd, suite 200 Tucson, AZ 85718
   Email Address: Brent.Musslewhite@south32.net
   Phone Numbers landline: 520-485-1300 mobile phone: 505-801-2977

10. Contact Person(s) for Permit Compliance Schedule Items Notifications (Optional)
ADEQ has developed a tool to track compliance schedule items (CSIs) 30 and 5 days before they are due, and 5 days after they become overdue. The person(s) identified, will receive email notifications in addition to the Applicant/Permittee.

Name(s): Kara Haas

Email Address(es): kara.haas@south32.net

11. Landowner

Company/Government/Entity Name: Arizona Minerals Inc.

Contact Person Name Brent Musslewhite

Mailing Address: 1860 E River Rd, suite 200 Tucson, AZ 85718

Email Address: Brent.Musslewhite@south32.net

Phone Number: 520-485-1300

12. Expected operational life of the Facility [A.A.C. R18-9-A201(B)(1)]
(Start date) 1/8/2018 (Close Date) unknown

13. Facility discharge or influent per day in gallons [A.A.C. R18-14-104, A.R.S. 49-242]: 6,652,000 **(gallons)**
6.480 mgd from WTP2 and 172,000 gpd from WTP1

14. All other federal or state environmental permits issued to the Applicant for the Facility or site, including type and identification number [A.A.C. R18-9-A201(B)(1)], included in Report Section/~~Appendix~~ 12

15. Are you required to file a certificate of disclosure according to A.R.S. §49-109?

☐ Yes, attached in Report Section/Appendix _____

☑ No, not required

16. Evidence that the facility complies with applicable municipal or county zoning ordinances, codes and regulations [A.A.C. R18-9-A201(B)(3)], included in Report Section/~~Appendix~~ 2.11

The proposed activities at the Property are in compliance with zoning laws. ARS 11-812 (county code provisions) does not allow county codes to "Prevent, restrict or otherwise regulate the use or occupation of land or improvements for railroad, mining, metallurgical, grazing or general agricultural purposes, if the tract concerned is five or more contiguous commercial acres."

17. Evidence of technical capability to carry out the terms of the permit (design, construction, and operation) including licenses, certifications, training, and work experience [A.A.C. R18-9-A202(B)] Attached in Report Section/~~Appendix~~ 2.12

Cost Estimates and Financial Assurance Demonstration [A.A.C. R18-9-A201(B)(5) and R18-9-A203]

Is this application for:

1) A new permit? YES___ NO x___
2) Significant Amendment? YES_X_ NO___
   NOTE: Updated cost estimates may be required for a significant amendment as defined by rule if required to address incremental changes in the cost estimate that result from the significant amendment, A.R.S. § 49-243(N)(2)(b).
3) Other Amendment for permit transfer? YES___ NO x___
4) Cost Estimate/Financial Demonstration update? YES x___ NO___
5) Estimate/Financial Demonstration at the direction of ADEQ? YES___ NO x___
6) A permit that has not been amended in the last five years? YES___ NO x___

If you answered "YES" to ANY of the above questions, provide updated cost estimates and a financial assurance demonstration. If you answered "NO" to ALL of the above questions, skip this section and continue to the "Technical Information" Section.

18. Cost Estimates provided in Report Section~~/Appendix~~ Section 9 & Attachment C

Closure costs and a financial demonstration are required even if the Applicant does not intend to close the facility in the near future. The closure and post-closure cost estimates must be based on the closure and post-closure plan/strategy (required by Application Item 32, below). Please see checklists for closure plans/strategies and cost estimate on the ADEQ website: http://www.azdeq.gov/node/542

NOTE: Cost estimates must be derived by an engineer, controller or accountant. Except as exempted by A.R.S. § 32-144.A.7 (employees of mining companies), professional documents, such as reports, plans and specifications, are to be signed by an Arizona registered engineer or geologist (A.R.S. § 32-125). Cost estimates prepared by an engineer, design documents and engineering analysis must be signed and sealed by an Arizona Registered Professional Engineer, and must not include labels such as "Draft", "Preliminary", or "Not for Construction" per A.R.S. § 32-101(B)(10 and 11) and 32-125.

Provide the cost estimates in the spaces provided below and attach supporting documentation for the cost estimates.

a. Construction $ Provided separately
b. Operation $ Section 9 + Attachment C
c. Maintenance $ Section 9 + Attachment C
d. Closure $ Section 9 + Attachment C
e. Post-Closure $ Section 9 + Attachment C

See Attachment C. Construction costs are confidential and provided as a separate document.

19. Financial Assurance Demonstration for either (a) non-government or (b) government:

Indicate which financial assurance demonstration will be provided to cover the cost of Closure and Post-closure. It is preferable to wait for ADEQ to review and approve the cost estimates prior to submitting the finalized financial demonstration required by Item 19; simply indicating the type of demonstration is adequate for submittal of the application. Please see the ADEQ website for financial assurance mechanism templates and instructions at http://azdeq.gov/financial-responsibility-options-apps

Provide information based on whether the Applicant/Permittee is a non-government or government entity:

a. A non-government entity:
   i. Financial Assurance Mechanism selected Performance surety bond
   ii. Details of any financial mechanism held by another government agency for the purpose of closure and post-closure activities described in the closure plan/strategy, provided in Report Section/Appendix NA
   iii. A letter on Company letterhead signed by the Chief Financial Officer, as required by A.A.C. R18-9-A203, is attached in Report Section/Appendix _____
b. A government entity:
   i. A statement that indicates how the entity is capable of meeting the costs listed in the Cost Estimate section above is included in Report Section/Appendix _____

APPLICATION TECHNICAL INFORMATION

20. Facility description, including the following information, is provided in Report Section/~~Appendix~~ Attachment A and Section 2

a. A general description of what the facility does. Section 2

b. When operations began or are estimated to begin. 2018 per Section 2

c. A general description of the facility process as it relates to the discharge, including: Attachment A, Sec 3

i. Operating, proposed and closed discharging facilities, or activities that discharge, Section 2.12.4, Figure 5

ii. source(s) of wastewaters/waste, and Figures 3 and 5

iii. facility or location where the wastewater/waste is discharged. Figure 3

NOTE: see the Definitions section for "discharging facility" and "discharge"

21. Process flow diagram that shows the activity producing the discharge (e.g. wastewater treatment, cooling, manufacturing), including the pertinent elements that affect the quality of the discharge, is included as Report Section/Appendix Attachment A

22. List the discharging facilities and activities that discharge in the table below. Indicate whether they are currently operating/existing, are proposed as new, or are to be closed as part of this permit application, and provide their location [A.R.S. 49-241]. Additional facilities listed in Report Section/Appendix NA

Facility or Activity Name (e.g. Evaporation Pond 1)	Existing, Proposed or to be closed	Latitude	Longitude
Lined Tailing Storage facility	existing, operating	31 ° 27 ' 59.4 "	110 ° 43 ' 35.8 "
Underdrain Collection Pond	existing, operating	31 ° 27 ' 59 "	110 ° 43 ' 39.2 "
AZPDES Outfall 1	existing, operating	31 ° 28 ' 15 "	110 ° 43 ' 43.43 "
AZPDES Outfall 002	existing, operating	31° 27' 56.62"N	110° 43' 11.51"W

23. Map(s) [A.A.C. R18-9-A202(A)(1)], included in Report Section/Appendix Figures Section in main text

Include the following:

1) North arrow All Figures
2) Scale All Figures
3) Topography with sufficient resolution and legible elevations of contours for the facility Figure 2, also Attachment A Drawings
4) Facility location Figure 3
5) Property line(s) and use of adjacent property Figures 2 and 3
6) Overlay of State or Federal land Figure 2
7) All known water wells within 1/2 mile of property boundary Section 2.4, Figure 4
8) Labeled with ADWR Well Number, latitude and longitude Table 1 in Section 2.4, Figure 4
9) Provide the uses and well construction details of the water wells, if known, water level elevations in the wells, and highlight/identify the nearest downgradient well. Tabulation of this data to prevent excessive labeling on the site plan itself is preferred.) Table 1 in Section 2.4

24. Site Plan [A.A.C. R18-9-A202(A)(2), (4) and (8), A.R.S. 49-244], included in Report Section/Appendix Figures Section

Include the following:

1) North arrow Figures 1-5
2) Scale igures 1-5
3) Property lines Figures 1-5
4) Structures Figure 3
5) Water wells Figure 4
6) Injection Wells none
7) Drywells and their uses none
8) Topography Figure 2. Detail provided in Attachment A drawings
9) All known borings exploratory borings are plugged and abandoned
10) 100-year floodplain (FEMA Flood Insurance Rate Map (FIRM) 100-year showing floodplain boundary preferred) ZONE D per original APP application
11) Surface water bodies Harshaw Creek and Alum Gulch shown on Figures 3 and 5
12) Surface water flow direction(s) Figure 3
13) Groundwater flow direction(s) Figure 3. Additional detail provided in Figure 10 of original application
14) Pollutant Management Area (PMA) Figure 5

NOTE: In cases where the site is very large, there are multiple PMAs or there is an excessive amount of information that would make the site plan indecipherable, it may be clearer to provide site plans for discrete areas or provide a separate site plan with the PMA, DIA and POC wells.

15) Discharge Impact Area (DIA). Figure 5

Also, include the following with the latitude and longitude:

1) Discharging facilities/discharge locations and existing and proposed Point of Compliance (POC) locations and/or wells Sections 2.12 and 7
2) Tabulation of this data to prevent excessive labeling on the site plan itself is preferred.
    a. ***For open pit mine facilities***, show the delineation of the passive containment capture zone (PCCZ) and the open pit boundary, if relying on this for BADCT.
    b. ***For Sewage Treatment Facilities*** include effluent sampling and effluent discharge location(s) with latitude and longitude, and setback distance(s) measured from the treatment and disposal components within the sewage treatment facility to the nearest property line of an adjacent dwelling, workplace, or private property.

- **Is this application for a Sewage Treatment Facility (STF)? YES___ NO x___**
- **If you answered "YES" to the question above, skip items #25 through 27, and proceed to item #28.**

25. Characterization of discharge [A.A.C. R18-9-A202(A)(4)], included in Report Section/~~Appendix~~ Tailings materials characterization in Attachment B. Discharges from WTP1 and WTP2 were included in a previous significant amendment application. Additional discharges not proposed.

For all non-STF facilities: provide characterization of discharge to include a summary of known past and proposed facility discharge activities. Provide estimated discharge characteristics or results of actual discharge characterization, and quantities/flow rate. Tabulated data is preferred with laboratory results included as an appendix.

Professional Document Requirements
Please note that, except as exempted by A.R.S. § 32-144.A.7 (employees of mining companies), professional documents, such as reports, plans and specifications, are to be signed by an Arizona registered engineer or geologist (A.R.S. § 32-125). Cost estimates prepared by an engineer, design documents and engineering analysis must be signed and sealed by an Arizona Registered Professional Engineer, and must not include labels such as "Draft", "Preliminary", or "Not for Construction" per A.R.S. § 32-101(B)(10 and 11) and 32-125.

The following application sections are typically considered professional documents: Application Items 26 through 32 (Design Documents, BADCT Description, Hydrogeologic Study, Demonstration of Compliance with AWQS at POC, Monitoring Proposal, Contingency Plan, and Closure/Post-closure Plan/Strategy) and Item 35, 36 and 39 for Sewage Treatment Facilities (Design Report, Engineering Plans and Specifications, and Sludge Treatment facilities).

26. Design Documents [A.A.C. R18-9-A202(A)(3)], included in Report ~~Section/Appendix~~ Attachment A _____

For all non-STF facilities: provide facility design documents, proposed or as-built, indicating the configuration or other engineered elements of the facility affecting discharge. Drawings must be legible with readable font sizes and include sufficient detail to indicate the key design features. When formal as-built plans are not available, provide documentation sufficient to allow evaluation of those elements of the facility affecting discharge, following the demonstration requirements of A.R.S. 49-243(B).
Provide construction specifications and a quality control/quality assurance plan for new facilities.

27. Best Available Demonstrated Control Technology "BADCT" Description[5] [A.A.C. R18-9-A202(A)(5)], included in Report Section/~~Appendix~~ _____ **Section 5 and attachment A**

For all non-STF facilities: provide design information pertaining to all discharging facilities including all calculations/analyses to demonstrate that all facilities are designed per BADCT guidance or rule.

Examples include: facility sizing, stability analyses, water balance, freeboard calculations, liner leakage rate calculations

For further specifics, please see the Mining and Industrial APP Engineering Substantive Checklist on the ADEQ website: http://www.azdeq.gov/node/542.

28. Hydrogeologic Study or justification that a limited study or no study is required [A.A.C. R18-9-A202(A)(8)], included in Report Section/Appendix Section 4. Also Section 5 of original APP Application
For further specifics, please see the Hydrology Substantive Review Checklist on the ADEQ website: http://www.azdeq.gov/node/542. due to TSF being constructed using prescriptive BADCT and AZPDES discharge meeting all surface and groundwater standards, limited hydro study was conducted.

29. Demonstration of Compliance with AWQS at POCs [A.A.C. R18-9-A202(A)(6)], included in Report Section/~~Appendix~~ 6 See Sec. 5 of original APP Application
For further specifics, please see the Hydrology Substantive Review Checklist on the ADEQ website: http://www.azdeq.gov/node/542.

30. Monitoring Proposal [A.A.C. R18-9-A202(A)(9)], included in Report Section/~~Appendix~~ Sec 8

A detailed proposal indicating the alert levels, discharge limitations, monitoring requirements, compliance schedules, and temporary cessation or plans that the Applicant will use to satisfy the requirements of A.R.S. Title 49, Chapter 2, Article 3 and Articles 1 and 2 of Chapter 9. Include as applicable, discharge and groundwater monitoring and operational/inspections. Indicate sampling point(s) with latitude and longitude (e.g. effluent, discharge, groundwater monitoring or other sampling points)

31. Contingency Plan [A.A.C. R18-9-A202(A)(7) and R18-9-A204], included in Report Section/~~Appendix~~ Attachment E

32. Closure and Post-closure Plan/Strategy [A.A.C. R18-9-A202(A)(10)], included in Report ~~Section/Appendix~~ Section 15 of Attachment A

For further specifics, please see the Closure and Post-closure Plan/Strategy and Cost Estimate Checklist on the ADEQ website http://www.azdeq.gov/node/542

Sewage Treatment Facility Applications ONLY (Items 33 through 39)

33. For Sewage Treatment Facilities (STFs), indicate the effluent disposal method(s) to be utilized and the disposal capacity for each method [A.A.C. R18-9-B202]:

Disposal Method	Flow capacity (gal/day)
☐ Beneficial reuse under a Recycled Water Permit	
☐ Surface impoundment primarily for evaporation	
☐ Surface impoundment primarily for recharge to groundwater	
☐ Discharge to a Water of the U.S. under a Clean Water Act Permit (NPDES/AZPDES)	
☐ Vadose zone injection wells	
☐ Injection wells directly into groundwater	
☐ Land application for disposal; not reuse	
☐ Other, describe: ______________	

34. Documentation that the Sewage Treatment Facility is in conformance with the Area-wide 208 Quality Management Plan for Sewage Treatment Facilities [A.A.C. R18-9-A201(B)(6)].
Included in Report Section/Appendix _____

For further information on the 208 requirements, please see the ADEQ website http://www.azdeq.gov/208-review

35. Sewage Treatment Facility Design Report [A.A.C. R18-9-B202], attached in Report Section/Appendix _____

Include information pertaining to all discharging facilities including all calculations/analysis to demonstrate that all facilities are designed per BADCT treatment performance requirements in rule. In addition, include facility sizing, stability analyses, water balance, freeboard calculations, and liner leakage rate calculations. An Arizona registered engineer shall seal the design report.

For further specifics please see the WWTP engineering review checklist on the ADEQ website http://www.azdeq.gov/node/542.

36. Sewage Treatment Facility Engineering Plans and Specifications [A.A.C. R18-9-B203], included in Report Section/Appendix _____

The documents may include manufacturer's specifications and cut sheets and shall be sealed by an Arizona registered engineer.

37. Sewage Treatment Facility Recycled Water classification [A.A.C. R18-11, Article 3]: Select

38. Sewage Treatment Facility Set-back map [A.A.C. R18-9-B201(I)], included in Report Section/Appendix _____

39. Sewage Treatment Facility sludge treatment and disposal description [A.A.C. R18-9-B202]. Included in Report Section/Appendix _____

If treatment or disposal at the facility includes discharging facilities, include the Design and BADCT information required by Items 26 and 27 above. Example of a discharging facility is a sludge drying bed.

END OF APPLICATION FORM

TABLE OF CONTENTS

TABLES

FIGURES

ATTACHMENTS

ACRONYMS AND ABBREVIATIONS

ADEQ	Arizona Department of Environmental Quality
ADWR	Arizona Department of Water Resources
AMI	Arizona Minerals, Inc.
ANCOLD	Australian National Committee on Large Dams
APP	Aquifer Protection Permit
A.R.S.	Arizona Revised Statutes
ASARCO	ASARCO LLC
AWQS	Aquifer Water Quality Standard
AZPDES	Arizona Pollutant Discharge Elimination System
BADCT	Best Available Demonstrated Control Technology
BMP	Best Management Practice
Clear Creek	Clear Creek Associates, LLC
CPe	corrugated polyethylene
cy	cubic yards
Mcy	million cubic yards
DIA	Discharge Impact Area
DL	Discharge Limit
ELG	Effluent Limitation Guideline
EPA	Environmental Protection Agency
ERC	Ecological Resources Consultants, Inc.
ET	evapotranspiration
ft	feet
ft/day	feet per day
GCL	geosynthetic clay liner
gpm	gallons per minute
HDPE	high density polyethylene
MIW	mining influenced water
NOV	Notice of Violation
mg/L	milligrams per liter
µg/L	micrograms per liter

LPSL	low permeability soil layer
MSGP	multi-sector general permit
PAG	Potentially Acid Generating
pCi/L	picocuries per liter
PE	Professional Engineer
PMA	Pollutant Management Area
POC	Point of Compliance
RG	Registered Geologist
SRCE	Standardized Reclamation Cost Estimator
TSF	tailing storage facility
UDCP	Underdrain Collection Pond
VRP	Voluntary Remediation Program
WTP	Water Treatment Plant

1. INTRODUCTION

1.1 APP Background

South32 Hermosa Inc. (South32) is the permittee for Aquifer Protection Permit (APP) P-512235 for the Hermosa Project. South32 is applying to the Arizona Department of Environmental Quality (ADEQ) for a significant amendment to the APP. The initial permit application was submitted to ADEQ in June 2017. ADEQ issued the permit in January 2018 and amended it in August 2020 and August 2021 as described in Section 2.2. ADEQ issued a minor amendment to the permit in June 2023 reflecting a corporate name and address change.[1]

1.2 Proposed Permit Amendment Objectives

The purpose of this significant amendment is to amend the APP to reflect the following conditions:

- Expand the existing lined tailing storage facility (TSF). With the expansion, this facility will be referred to as Tailings Storage Facility 1 (TSF1).
- Permit production tailings and other materials (Section 3.1) to be placed in TSF1.
- Revise the Pollutant Management Area (PMA) to reflect the TSF1 footprint.
- Update the Discharge Impact Area (DIA) to reflect the above revisions.
- Update the Contingency Plan.
- Update closure costs and financial assurance mechanism.

[1] On February 3, 2023, Arizona Minerals Inc. (AMI) completed a name change to South32 Hermosa Inc. (South32) and retained the name, Arizona Minerals Inc. as a trade name.

2. PROJECT INFORMATION

2.1 Project Location

The Hermosa Project location is shown in Figures 1 and 2. The Hermosa Project is located approximately 5 miles south of the Town of Patagonia, Arizona. The property is in T22S, R16E section 32 and T23S, R16E sections 4 and 5, Gila and Salt River Meridian, in Santa Cruz County, Arizona. The U.S. Forest Service manages the surrounding adjacent lands as part of the Coronado National Forest.

The South32 Hermosa Project includes underground mining of the following two deposits:

- A high-grade zinc, lead, and silver sulfide deposit, and
- A high-grade manganese-zinc-silver deposit.

To date, activities completed on the Hermosa Project site include substantial completion of a $30 million cleanup of legacy mining activities under the Arizona Voluntary Remediation Program (VRP), exploration borings drilled from patented land, exploration shaft pad construction, and construction and operation of two water treatment plants.

2.2 Project Background

South32 Limited is a mining company organized under Australian law. In 2018, South32 Limited purchased Arizona Minerals, Inc. (AMI), a Nevada corporation doing business in Arizona, as a wholly owned subsidiary. On February 2, 2023, AMI changed its name to South32 Hermosa Inc. (South32).

Mining activity has taken place intermittently at the site since the early 1870s. It was last operated by the American Smelting and Refining Company, a precursor to ASARCO LLC (ASARCO) from 1925 to 1949. AMI acquired the property in 2016 from ASARCO and the ASARCO Multi-State Environmental Custodial Trust.

In 2017, AMI applied to the VRP and submitted applications for an APP and an Arizona Pollutant Discharge Elimination System (AZPDES) permit for the following facilities:

- A dry-stack TSF with a geomembrane liner designed to receive historical tailings and development rock. Construction of this facility began in 2018. By October 2019, all historic tailings were moved to the lined TSF.
- An underdrain collection pond (UDCP), a lined pond with a leak collection and recovery system (LCRS), designed to collect stormwater runoff and seepage from the TSF. Construction of this facility was completed in October 2018.
- A water treatment plant (WTP1) designed to treat underdrain seepage and stormwater runoff from the TSF and water from the January Adit mine workings prior to discharging

to Alum Gulch. Construction of this facility was completed in July 2018, and it became operational in October 2018.

The locations of these facilities are shown in Figure 3.

AMI (now known as South32) submitted an “other” amendment application to the APP to ADEQ on May 29, 2020. The amended permit allowed:

- Upgrades to the treatment technology in WTP1, and
- Placement of solids from WTP1, solids from the cutting of exploration core, and rock/soil from construction cuts, including material that may be potentially acid-generating (PAG) on the existing lined TSF.

A significant amendment in 2021 permitted a modification to the TSF stacking geometry with no changes to the existing lined TSF footprint. The amendment permitted the placement of treatment solids from WTP2, core cutting solids, drill cuttings, and sediment removed from stormwater BMPs on the TSF. The amendment also permitted discharges at AZPDES Outfall 002 from a second water treatment plant, WTP2. This plant is permitted to discharge up to 4500 gpm to Harshaw Creek. Permitted influent to WTP2 is from some or all of the following sources: groundwater pumped from a wellfield to depressurize and dewater the fractured rock aquifer, groundwater and operational water pumped from underground workings, stormwater runoff (i.e., precipitation that falls directly on the TSF), seepage from the existing TSF, January Adit water, treated water from WTP1, drilling water and core cutting water, and water from stormwater BMPs.

A minor amendment was issued by ADEQ in June 2023, reflecting the company name and address change.

2.3 Project Status

South32 is a mineral exploration and development company focused on the exploration and potential development of the Hermosa Project near Patagonia, Arizona, in Santa Cruz County. The South32 Hermosa Project will include underground mining of the Hermosa sulfide and oxide deposits. Currently, the Hermosa Project is focused on voluntary remediation (including remediation of historic sources of mine-influenced water) and exploration activities. Thus, the active and near-term project consists of the following facilities and activities:

- Exploration, drilling, and groundwater management,
- Management of legacy tailings/soils and exploration materials in the existing lined TSF,
- Water treatment at WTP1 and WTP2,
- Construction activities, including exploration shaft and decline and associated ventilation and safety activities,

- Ancillary activities, including fueling from diesel and gasoline tanks, chemical handling, power generation, access and haul road construction and use, and associated exploration and administrative buildings.

2.4 Well Inventory

Water supply wells within ½ mile of the project boundary are shown in Figure 4. Information regarding these wells is provided in Table 1 below. Wells are labeled with the registration number assigned by the Arizona Department of Water Resources (ADWR). ADWR classifies wells as exempt or non-exempt. An exempt well is a well having a pump with a maximum capacity of not more than thirty-five gallons per minute (gpm), which is used to withdraw groundwater under Arizona Revised Statutes (A.R.S.) § 45-454. A non-exempt well is a well having a pump with a maximum capacity of **more** than thirty-five gpm which is used to withdraw groundwater. The nearest downgradient well is well 642746, a stock water well owned by the U.S. Forest Service.

AMI (now known as South32) owns the non-exempt wells shown in Figure 4 listed in Table 1. Wells or borings classified by ADWR as monitor wells, exploration boreholes, or geotechnical wells are not shown in Figure 4. However, it should be noted that water usage from ADWR files may not reflect actual water use. For example, there are some wells in Table 1 that are monitoring wells.

Table 1: Exempt and Non-Exempt Wells Within One-Half Mile of Project Site
Source: ADWR database

ADWR Well Registry ID	Alternate Well Name	Well Owner	Water Use (source: ADWR)	Well Type (ADWR Designation)	Well Depth (ft)	Latitude (decimal degrees)	Longitude (decimal degrees)
226139	MW-2	ARIZONA MINING INC.	COMMERCIAL, STOCK	EXEMPT	1005	31.46467224	-110.7286994
226398	HDS-349	ARIZONA MINERALS INC	STOCK	EXEMPT	1045	31.45933091	-110.7287022
226902	JA-2	ARIZONA MINERALS INC	COMMERCIAL	EXEMPT	125	31.47224474	-110.7299335
227120	WW-1	ARIZONA MINERALS INC	INDUSTRIAL	NON-EXEMPT	1325	31.45401571	-110.7117564
227699	BW-1	ARIZONA MINERALS INC	INDUSTRIAL	NON-EXEMPT	1000	31.45401435	-110.7032606
236188		ARIZONA MINERALS INC.	DEWATERING	NON-EXEMPT	0	31.46200158	-110.7287019
236189		ARIZONA MINERALS INC.	DEWATERING	NON-EXEMPT	3090	31.4620557	-110.7244682
236190		ARIZONA MINERALS INC.	DEWATERING	NON-EXEMPT	0	31.4620465	-110.7202262
236191		ARIZONA MINERALS INC.	DEWATERING	NON-EXEMPT	0	31.46203282	-110.7181
236192		ARIZONA MINERALS INC.	DEWATERING	NON-EXEMPT	3624	31.46203282	-110.7181
236193		ARIZONA MINERALS INC.	DEWATERING	NON-EXEMPT	1315	31.46203282	-110.7181
236194		ARIZONA MINERALS INC.	DEWATERING	NON-EXEMPT	4320	31.46471715	-110.7202204
236195		ARIZONA MINERALS INC.	DEWATERING	EXEMPT	0	31.45937601	-110.7244708
236196		ARIZONA MINERALS INC.	DEWATERING	EXEMPT	3193	31.46473983	-110.7223487
238105		ARIZONA MINERALS INC	DEWATERING	NON-EXEMPT	0	31.4620465	-110.7202262
238256		ARIZONA MINERALS INC.	DEWATERING	NON-EXEMPT	0	31.46063681	-110.7318614
515312	USFS	CORONADO NATIONAL FOREST	DOMESTIC	EXEMPT	140	31.45131891	-110.7287095
604557		HALE RANCH,	STOCK	EXEMPT	82	31.46194994	-110.7053334
604558		HALE RANCH,	DOMESTIC, STOCK	EXEMPT	135	31.45665792	-110.7032449
620838	Welch Well Shaft	ARIZONA MINERALS INC.	INDUSTRIAL	NON-EXEMPT	412	31.46199154	-110.7117172
620839	Josephine Shaft	ASARCO INC,	INDUSTRIAL	NON-EXEMPT	750	31.46604141	-110.7276355
642738		CORONADO NATL FOREST,	STOCK	EXEMPT	0	31.46328282	-110.7042671
642746		CORONADO NATL FOREST,	STOCK	EXEMPT	0	31.47662284	-110.7352942

Continued on next page

ADWR Well Registry ID	Alternate Well Name	Well Owner	Water Use (source: ADWR)	Well Type (ADWR Designation)	Well Depth (ft)	Latitude (decimal degrees)	Longitude (decimal degrees)
910210	JA-1	ARIZONA MINERALS INC.	COMMERCIAL	EXEMPT	110	31.47224474	-110.7299335
913354	HDS-130	ARIZONA MINERALS INC	INDUSTRIAL, STOCK, IRRIGATION	NON-EXEMPT	550	31.46466695	-110.7138332
913499	HDS-188	ARIZONA MINERALS, INC.	IRRIGATION, STOCK	EXEMPT	800	31.46470346	-110.718092
920323	HDS-356 or VW20-16	ARIZONA MINERALS INC	INDUSTRIAL, COMMERCIAL	EXEMPT	3576	31.46203282	-110.7181
920459	HT-1	ARIZONA MINERALS INC.	TEST, INDUSTRIAL	NON-EXEMPT	3700	31.46199154	-110.7117172
920577	HDS-321	ARIZONA MINERALS INC	INDUSTRIAL, COMMERCIAL	NON-EXEMPT	600	31.45401435	-110.7032606
921646	AW-1	ARIZONA MINERALS INC	DOMESTIC	NON-EXEMPT	1006	31.45132342	-110.7265888

Notes:
ADWR = Arizona Department of Water Resources
ft = feet

2.5 Facility Compliance History

There are no outstanding compliance issues. There have been no NOVs, consent orders, or compliance orders in the past two years.

2.6 Applicant and Permittee

South32 Hermosa Inc., 1860 E. River Road Suite 200, Tucson, AZ 85718.

2.7 Landowners

Arizona Minerals, Inc. (now known as South32 Hermosa Inc.) Same address as above.

2.8 Facility's Emergency Contact Person

Primary Contact – Emergency Response Coordinator:

Contact Name: Brent Musslewhite
Job Title: Director, Environment and Permitting
Address: 1860 E. River Road Suite 200, Tucson, AZ 85718
Office Number: 520-485-1300
Site Security Office: 520-539-8082
Email: Brent.Musslewhite@south32.net

Secondary Contacts – Back-Up for Emergency Response Coordinator:

Contact Name: Kara Haas
Title: Principal, Environment
Address: 749 Harshaw Road, Patagonia, AZ 85624
Email: Kara.Haas@south32.net
Site Security Office: 520-539-8082
Email: Kara.Haas@south32.net

Contact Name: Sarah Richman
Job Title: Manager, Environment and Permitting
Address: 1860 E. River Road Suite 200, Tucson, AZ 85718
Office Number: 520-485-1300
Site Security Office: 520-539-8082
Email: Sarah.Richman@south32.net

2.9 Physical Address

749 Harshaw Road, Patagonia, AZ 85624

2.10 Legal Description

The Property consists of parcel numbers 105-50-001A (253.23 acres), 105-50-001B (41.23 acres), 105-49-003 (14.3 acres), and 105-49-002 (20.11 acres) as shown on Figure 2.

2.11 Zoning

Mining activities on more than 5 contiguous acres are not subject to local zoning requirements pursuant to A.R.S. § 11-812(A)(2).

2.12 Technical Capability

2.12.1 South32

- Brent Musslewhite. Director, Environment & Permitting, has over 26 years of experience in environmental, permitting and remediation projects associated with mining. He received a BS in Soil Science in 1994 and MS in Soil Science in 2002.
- Sarah Richman. Manager, Environment & Permitting, has over 7 years of permitting experience with 5 years focused on mining in Arizona. She received an MS in Environmental Science and Management in 2013.
- Paul Nazaryk. Principal, Environmental Planning & Approvals, has over 30 years of environmental compliance and permitting experience in both the private and public sectors. He received a JD in law and an MA in environmental policy & planning.
- Tomas Goode, PhD, RG, Arizona Registered Geologist No. 43616. Principal Hydrogeologist for South32 Hermosa Project with more than 20 years of experience including well field development for municipalities and mining, groundwater flow modeling in variably saturated environments, and applications of geophysical methods in hydrogeology. He received a BS double-major in History and Applied Environmental Geoscience in 1998, an MS degree in Hydrology in 2000, and PhD in Hydrology in 2012.
- Aldo Brigneti. Hermosa Responsible Tailings Facility Engineer has over 25 years of engineering experience in mine water, environmental, and tailings management. He received a BS degree in Civil Engineering in 1988 and an MSc degree in Civil Engineering in 1992.
- Kara Haas. Principal, Environment, has over 17 years of environmental experience, and has worked on a variety of projects including environmental permitting, compliance, and

reclamation at mining sites. She received a BS degree in Geology in 2000 and a MS degree in Hydrogeology in 2002.

2.12.2 Clear Creek Associates, LLC

As the hydrogeological consultant on the Project, Clear Creek Associates LLC (Clear Creek), is registered with the Arizona Board of Technical Registration to perform work that falls within the statutory definition of Geological practice. The Clear Creek team includes the following individuals:

- Douglas Bartlett, Registered Geologist (R.G.) Arizona Registered Geologist No. 25059. Principal Hydrogeologist for Clear Creek. Mr. Bartlett has over 30 years of technical experience. He received a BS degree in Geology in 1977 and an MS degree in Geology in 1984.
- Alison Jones, R.G. Arizona Registered Geologist No. 44511. She is a Senior Associate at Clear Creek where she manages mining support and environmental projects. She has over 30 years of technical experience. Ms. Jones received a BS degree in Geology in 1979 and an MS degree in Geology in 1983.

2.12.3 NewFields

As the engineering consultant for TSF1 and UDCP at the Property, NewFields personnel are registered Professional Civil Engineers capable of performing civil design work. The NewFields team includes the following individuals:

- Craig Thompson, P.E. Registered Professional Engineer (P.E.) in Arizona (License No. 63431) and Colorado (License No. 49559). Senior Engineer for NewFields. Mr. Thompson has over 13 years of engineering experience. He received a BS degree in Civil Engineering in 2009.
- R. Michael Smith, P.E. Registered P.E. in Colorado (License No. 28114), Nevada (License No. 16194) and Alaska (License No. CE8785). In addition, Mr. Smith formerly held PE licenses in Arizona and Wyoming. Mr. Smith has over 40 years of Civil Engineering experience, the last 35 of which have been focused on civil design and construction for the mining industry. Mr. Smith received a BS in Civil Engineering in 1983 (University of Colorado).

2.12.4 Permitted APP Facilities

The currently permitted APP facilities are listed in Table 2 below.

Table 2: APP-Regulated Facilities

Facility	Latitude	Longitude
Lined Tailing Storage Facility (TSF)	31° 27’ 59.4” N	110° 43’ 35.8” W
Underdrain Collection Pond (UDCP)	31° 27’ 59” N	110° 43’ 39.2” W
AZPDES Outfall 001	31° 28’ 15” N	110° 43’43” W
AZPDES Outfall 002	31° 27’ 56.62” N	110° 43’11.51” W

2.13 Financial Capability

The proposed changes to the APP for this significant amendment require revisions to the closure costs for the TSF. These are included in Attachment C. An appropriate form of financial assurance will be provided to meet the requirements of A.R.S. §49-243(N)(2) and A.A.C. A.A.C. R18-9-A203. Attachment C also includes a letter from the South32 Hermosa, Inc. Chief Financial Officer affirming that the company has the resources for the project and that a financial assurance mechanism will be provided after closure and post-closure costs are approved by ADEQ.

3. MATERIALS CHARACTERIZATION

A variety of production tailings have been prepared using benchtop metallurgical processing. The tailing samples span a range of lithologic types that are expected during mine production. Preparation of such tailings is ongoing. The Materials Characterization memo in Attachment B presents the results of geochemical characterization of materials to date.

Tailings were characterized using industry standard techniques to gauge their potential to produce acidic contact water or metal release, or both. Data are provided for:

- Acid-base accounting (ABA),
- NAG pH (Table 1),
- Synthetic Precipitation Leaching Procedure (SPLP), and
- Humidity Cell Testing (HCT).

4. HYDROGEOLOGY

Limited hydrogeologic data are provided in this application for the following reasons:

- According to Sections 2.3.1 (Siting Criteria for Process Solution Ponds) and Section 2.5.1 (Siting Criteria for Tailing Impoundments) in the BADCT Manual (ADEQ, 2004), "the Prescriptive BADCT criteria are designed to eliminate the need for considering site hydrogeology and vadose zone characteristics and minimize the need for consideration of other site factors."
- Discharges from the WTP will be treated to AWQSs and applicable surface water quality standards.

Based on these considerations, this application meets the requirements of A.A.C. R-18-9-A202(A)(8).

South32 has an ongoing groundwater monitoring program. The information below is included to provide general hydrogeologic context of the project area.

4.1 Aquifer Description

The primary aquifer in the project area is bedrock. Groundwater flows in secondary porosity, i.e. fractures, faults, and voids within the bedrock complex. Alluvium may be present in drainages, but this alluvium is neither thick (not more than a few feet), nor aerially extensive, nor is it a significant water-bearing unit. In general, bedrock outcrops at the surface. Porosity of fractured bedrock aquifers is generally low, around 1 to 2 percent. Mineralization can result in higher porosities.

Depths to groundwater at the project site range from approximately 15-20 feet MW-3 (POC-2) near the January Adit, to over 300 feet bls in the northern part of the Project site. In general, depths to water decrease to the north as the land surface elevation decreases.

Groundwater flow is towards the north, with localized northeast and northwest flows, depending on the location. This is consistent with the topography, which declines to the north towards Sonoita Creek. Based on static groundwater levels, the horizontal hydraulic gradient ranged from 0.025 at the site's southern part to about 0.013 at the northeastern part.

Groundwater is recharged from precipitation at higher elevations. Water level trends observed in wells near washes indicate some recharge occurs in the washes and drainages which carry surface flows to the north and northwest.

5. BADCT DEMONSTRATIONS

5.1 Tailing Storage Facility Expansion

The existing TSF was designed and constructed under the Voluntary Remediation Program (VRP) as a dry stack, lined, permanent storage area for historic tailings and development rock, some of which may be PAG. It was designed and constructed using prescriptive BADCT as described by ADEQ (2004). The design was later amended in 2020 to modify the stacking geometry to increase storage capacity and allow for additional materials to be placed in the facility. The existing TSF is currently permitted to store historic tailings, development rock from the exploration decline, filter cake from WTP1 and WTP2, core cutting material from exploration core sample preparation, construction rock, drill cuttings, and sediments from stormwater BMPs.

The TSF is currently permitted to store 2.6 million cubic yards (mcy) of material with a maximum permitted crest elevation of 5175 feet. In this significant amendment application, the applicant proposes to increase storage capacity. The expansion of the TSF, henceforth called "TSF1", will increase the geomembrane-lined footprint laterally from the current footprint of approximately 28 acres to approximately 55 acres. TSF1 will create 5.4 mcy of additional storage capacity, bringing the total storage capacity to approximately 8 mcy. TSF1 will have a maximum stacking height of 243 feet reaching a maximum elevation of 5275 feet amsl. With the issuance of this significant amendment, the following materials will be permitted to be placed in TSF1:

- Historic tailings
- Production tailings (dry stack)
- Development rock from exploration and future mine development
- Soil and rock from construction cuts, including PAG
- Solids associated with water treatment including filter cake
- Core-cutting solids
- Drill cuttings
- Assay rejects
- Sediments from vehicle and equipment wash sumps
- Sediments from stormwater BMPs

Dry stack historic and production tailings are the primary material placed in TSF1. Water treatment solids including filter cake from WTP1 and WTP2, core cutting solids, drill cuttings, assay rejects, sediments from vehicle and equipment wash sumps, and sediments from stormwater BMPs constitute a small amount (<2%) of the total TSF1 volume.

The proposed design documents for TSF1 are provided in Attachment A. The design is in general compliance with applicable ADEQ Prescriptive BADCT requirements, ANCOLD (Australian National Committee on Large Dams), and GISTM (Global Industry Standard on Tailings Management) standards. The basic elements of the design, BADCT, and closure are summarized in the sections below.

5.1.1 Design and BADCT Elements

TSF1 is designed in general accordance with the prescriptive BADCT guidelines and will utilize the same discharge control elements that were previously approved for the existing TSF. Information regarding all elements of TSF1 BADCT are provided in Attachment A. Design elements for the TSF1 include:

TSF Perimeter Road (forms embankment for West and East Internal Detention Ponds):

- Foundation preparation and removal of low strength and/or deleterious material.
- Constructed from cut/fill operations with upstream (internal) slopes of 2.5H:1V and downstream (external) slopes of 2.0H:1V in fill conditions / 1.5H:1V in cut conditions.
- Composite lining system on upstream embankment slope consisting of 60 mil double-sided textured high-density polyethylene (HDPE) geomembrane overlying either 12 inches of compacted low-permeability soil layer (LPSL) or geosynthetic clay liner (GCL). See Drawing A220 in Attachment A for lining system plan view. This liner system is compatible with a wide range of materials and is used industry-wide for tailing storage facilities, waste rock piles, heap leach pads, and process solution ponds.
- One-way light vehicle access road with 1.5-foot high safety berms, 16-foot travel width, 6 inches of wearing course, and stormwater diversion channels as required.
- Haul road with 3-foot high safety berms, 38.5-foot travel width, 6 inches of wearing course, and stormwater diversion channels as required.

Basin BADCT Elements:

- Foundation preparation and removal of low-strength and/or deleterious material.
- Constructed from cut/fill operations and graded for composite liner placement.
- Composite lining system consisting of 60 mil double-sided textured HDPE geomembrane overlying either 12-inches of compacted LPSL or GCL. See Drawing A220 in Attachment A for lining system plan view.
- An 18-inch layer of protective layer material overlying the geomembrane liner.
- An underdrain system consisting of corrugated polyethylene (CPe) pipe collectors in topographic lows and a dendritic system of 4-inch diameter collector CPe pipe peripheral to the primary collectors. See Drawing A230 in Attachment A for underdrain system plan view.

Filtered Tailings Stack (Dry Stack) BADCT Elements:

- Placement of tailings to achieve optimal moisture content:
  - Spread tailings with a dozer to a nominal thickness not to exceed 12-inches (loose) in depth and compacted through selective routing of the haulage equipment and dedicated smooth drum vibratory compactors.
  - As necessary, the filtered tailings will be moisture conditioned using a tractor and a disc to facilitate drying prior to compaction.
  - If needed, lime treatment will occur by spreading quick lime (~1% by dry weight) over the surface of the filtered tailings and discing the lime into the wet tailings lift to expedite drying.

    - Tailings moisture content at the time of compaction will be within 3% of the optimum moisture content as determined by ASTM D698 (Standard Proctor). Once the required moisture content is achieved, the filtered tailings will be compacted to a minimum of 93% of the maximum dry density also derived from ASTM D698.
- 3.0H:1V compound slope comprised of 25-foot high 2.5H:1V open slopes in combination with 12.5-foot benches.
- Internal stormwater diversion channels to pass peak flows from the design storm (see Section 11 of Attachment A).
- Armored exterior tailings slopes to minimize water and wind erosion of the dry stack TSF.
- An internal haul ramp having a 10% grade will be maintained to access each of the lifts as the TSF is stacked.

Instrumentation BADCT Elements:

- Vibrating wire piezometers will be placed on the geomembrane surface to monitor the operational performance of TSF1 and measure any potential hydraulic head on the liner system. Two additional vibrating wire piezometers, P7 and P8, will be installed during filtered tailings placement to monitor phreatic conditions within the stack.

The external stormwater diversion channels, underdrain outlet pipework (concrete encasement), the UDCP, and its pumping system to WTP1 were designed and constructed as part of the VRP project and will continue to be BADCT elements. To accommodate the increased TSF1 footprint and the resulting increased amount of water reporting to the UCDP (Section 10.1 of Attachment A and Appendix J of Attachment A), the pumping capacity at the UCDP will be increased by adding a larger capacity pump and a reclaim pipeline from the UDCP to WTP2.

5.1.2 Stability and Discharge Reduction

The TSF1 expansion will not adversely impact stability. A geotechnical evaluation, including an evaluation of stability, is provided in Section 9 of Attachment A. Stability analyses were performed using Slide v9, a two-dimensional slope stability program for evaluating circular and noncircular failure surfaces in soil or rock slopes using limit equilibrium methods. Factors of safety were evaluated for static, seismic, and post-seismic conditions. All met the minimum factors of safety considered acceptable by ANCOLD and BADCT design standards.

The entire TSF basin and interior slopes of the perimeter road will be lined with 60-mil double-sided textured HDPE geomembrane (Sections 5.4.2 and Attachment A). This membrane will serve as the principal containment and will be deployed directly on top of a compacted LPSL or GCL. Estimated TSF leakage flow rates are provided in Table 5.3 and Appendix G.1 of Attachment A.

5.1.3 Closure

The closure strategy includes capping TSF1 with 1 to 2 feet of reseeded growth media underlain by a capillary break created by a combination of armoring berms on the exterior slopes of TSF1 and a rock layer (capillary break) placed on the top surface of TSF1 after it has reached the design capacity. The TSF1 closure strategy is provided in Section 15 in Attachment A. Closure configuration drawings (Drawing A600, A610, and A615) are provided in Attachment A.

The objective of the closure strategy is to minimize infiltration and post-closure underdrain flows from the TSF. Post-closure underdrain flow is expected to be very low, based on actual flows observed for the VRP TSF that are less than 1 gpm after a month-long period of no precipitation. It should be noted that these small flows are on the existing VRP TSF that does not have a closure cap in place. Flows will be further reduced after a closure cap is established. Post-closure underdrain flows will continue to be collected and transmitted to WTP1 until a passive treatment system (e.g. an evapotranspiration [ET] cell) can be constructed in the UDCP.

Post-closure will require maintenance of the closure cap until a vegetated surface can be established. The closure surface will be monitored, inspected, and repaired, if needed, to address water erosion. In addition to the closure cap, the access roads, stormwater diversion channels, and UDCP areas will also be monitored, inspected, and repaired if needed.

Closure Costs are discussed in Section 7, and details are provided in Attachment C.

6. OTHER PROPOSED REVISIONS

The proposed revisions to the APP are provided in a redlined version of the permit in Attachment D of this application. Some of the more significant proposed revisions are:

- Increase in TSF extent, elevation, and volume of materials to be placed in TSF1.
- Inclusion of production tailings, assay rejects, solids associated with water treatment including filter cake from WTP1 and WTP2, and sediments from vehicle and equipment wash sumps to the materials that will be placed in TSF1.
- Contingency plan revisions as noted in Attachment E.
- Revisions to the Compliance Schedule.
- Allowing another potential source of water that will be routed to WTP2 as, “incidental and intermittent operational water from surface activities.” The sources of this water are small and sporadic, and not expected to include pollutants that cannot be treated at WTP2.
- Increasing monitoring frequency of discharges at Outfalls 1 and 2 to monthly and collection of these samples as 8-hour composite samples, similar to the methodology for the AZPDES discharge monitoring.
- Addition of two vibrating wire piezometers within the footprint of TSF1 for operational monitoring purposes.

7. POLLUTANT MANAGEMENT AREA, DISCHARGE IMPACT AREA AND POINTS OF COMPLIANCE

The proposed PMA and DIA are shown in Figure 5.

7.1 Pollutant Management Area

The PMA has been revised to include the expanded TSF1 footprint.

7.2 Points of Compliance

The current APP has 4 Points of Compliance (POCs), as shown in Figure 5. Three are conceptual and one is an actual well. The POCs are:

A conceptual POC (POC-1) is downgradient of the TSF.

Latitude: 31° 28' 15.21" N

Longitude: 110° 43' 48.83" W

POC-2 (MW-3) is 200 feet downgradient of the Outfall 1 AZPDES discharge and serves as a POC for the TSF and UDCP.

Latitude: 31° 28' 18.91" N

Longitude: 110° 43' 48.83" W

POC-3 is a conceptual location approximately one mile to the north-northwest and downgradient of the WTP1 outfall.

Latitude: 31° 29' 1.7" N

Longitude: 110° 44' 16.4" W

Conceptual POC (POC-4) is at the estimated downgradient extent of surface flow in Harshaw Creek, downgradient of WTP2 outfall, as shown in Figure 5. The coordinates are as follows:

Latitude: 31° 32' 2.4" N

Longitude: 110° 43' 29.3" W

7.3 Discharge Impact Area

The DIA has been revised to include the expanded TSF1 footprint. Other portions of the DIA, including the Harshaw Creek and Alum Gulch extents, are unchanged. (Figure 5).

8. PROPOSED MONITORING REQUIREMENTS

8.1 Compliance Discharge Monitoring

South32 proposes to change the monitoring methodology of the AZPDES discharges 1 and 2 to conform to the discharge monitoring methodology required under AZPDES Permit No. AZ0026387. The APP discharge monitoring analyte list will not change. Monitoring frequency for the APP compliance discharge monitoring will be increased to monthly to conform to the AZPDES permit. APP discharge monitoring samples will be collected as 8-hour composite samples, rather than as grab samples. This proposed revision is shown in Table 9 of the proposed APP revisions (Attachment D).

8.2 Operational Monitoring

South32 proposes the following revisions to operational monitoring:

- Adding two vibrating wire piezometers, P7 and P8, to the operational monitoring as prescribed in Table 8 of the APP (Attachment D). The piezometers are used to measure the phreatic surface on top of the liner. The performance standard requires that the phreatic surface shall be less than 1.5 feet.
- The performance standard for the TSF facility height will be revised to "Does not exceed 5,275 feet."

No other changes to operational monitoring are proposed.

8.3 Compliance Groundwater Quality Monitoring

Compliance groundwater monitoring is currently required semi-annually at POC-2. South32 does not propose any revisions to groundwater monitoring as prescribed in Table 10 of the APP.

9. CLOSURE AND POST CLOSURE COSTS

The updated closure strategy for TSF 1 is provided in Attachment A. Closure strategies for other previously permitted APP-regulated facilities are unchanged. Closure and post-closure costs were estimated using the Standardized Reclamation Cost Estimator (SRCE). All SRCE model outputs are provided in Attachment C. The revised closure/post-closure cost estimate was calculated by SRCE to be $24,657,909.

The following table, extracted from Attachment C, summarizes the closure and post-closure costs associated with APP facilities.

Description	Closure	Post Closure	Total
Tailings Storage Facility	$5,448,890	$0	$5,448,890
Reclamation Monitoring and Maintenance	$0	$843,522	$843,522
Water Treatment Plant 1	$0	$5,338,646	$5,338,646
January Adit Plug	$1,800,000	$0	$1,800,000
Underdrain Collection Pond (Passive Treatment System)	$1,376,004	$2,447,783	$3,823,787
Passive Closure Bridge	$1,251,837	$0	$1,251,837
Subtotal Operational and Maintenance Costs (direct cost)	**$9,876,731**	**$8,629,951**	**$18,506,682**
SRCE Indirect Cost (total indirect cost as % of direct cost)		33%	
SRCE Indirect Cost	**$3,282,815**	**$2,868,412**	**$6,151,227**
Total	**$13,159,546**	**$11,498,363**	**$24,657,909**

10. CONTINGENCY PLAN

A revised Contingency Plan is provided in Attachment E.

11. COMPLIANCE SCHEDULE

South32 proposes revisions to some Compliance Schedule Items as shown in Attachment D. Compliance Schedule Item #5 has been completed; therefore, South32 recommends that it be removed. Compliance Schedule Item #3 should also be removed as it is redundant; it is addressed by Section 6.9 of the permit.

12. PERMITTING AND LEGAL REQUIREMENTS

South32 currently has the following authorizations/permits:

- Mining Multi-Sector General Permit Authorization AZMS-81380.
- Arizona State Mine Inspector State ID# 13-03295.
- ADEQ Voluntary Remediation Program Site Code #505143-02.
- APP No. P-512235.
- AZPDES Permit No. AZ0026387 (ADEQ, 2021).
- ADEQ Air Permit (pending).

13. REFERENCES

Arizona Department of Environmental Quality, 2004. Arizona Mining Guidance Manual BADCT, Publication no. TB 04-01.

Arizona Minerals, Inc., 2017. ASARCO January Adit (Norton Mine) Aquifer Protection Permit Application, Santa Cruz County, Arizona. Submitted to Arizona Department of Environmental Quality, August 14.

Arizona Minerals, Inc., 2020. Hermosa Project –Trench Camp Property Aquifer Protection Permit Amendment Application, P-512235, Santa Cruz County, Arizona. Submitted to Arizona Department of Environmental Quality, June 5.

Arizona Department of Environmental Quality, 2021. Arizona Pollution Discharge Elimination System (AZPDES) Permit AZ00226387 issued to Arizona Minerals Inc.

FIGURES

ATTACHMENT A

Hermosa Lined TSF Design Amendment

ATTACHMENT B

Materials Characterization

ATTACHMENT C

Memorandum:
Standardized Reclamation Cost Estimator (SRCE)
And
CFO Letter

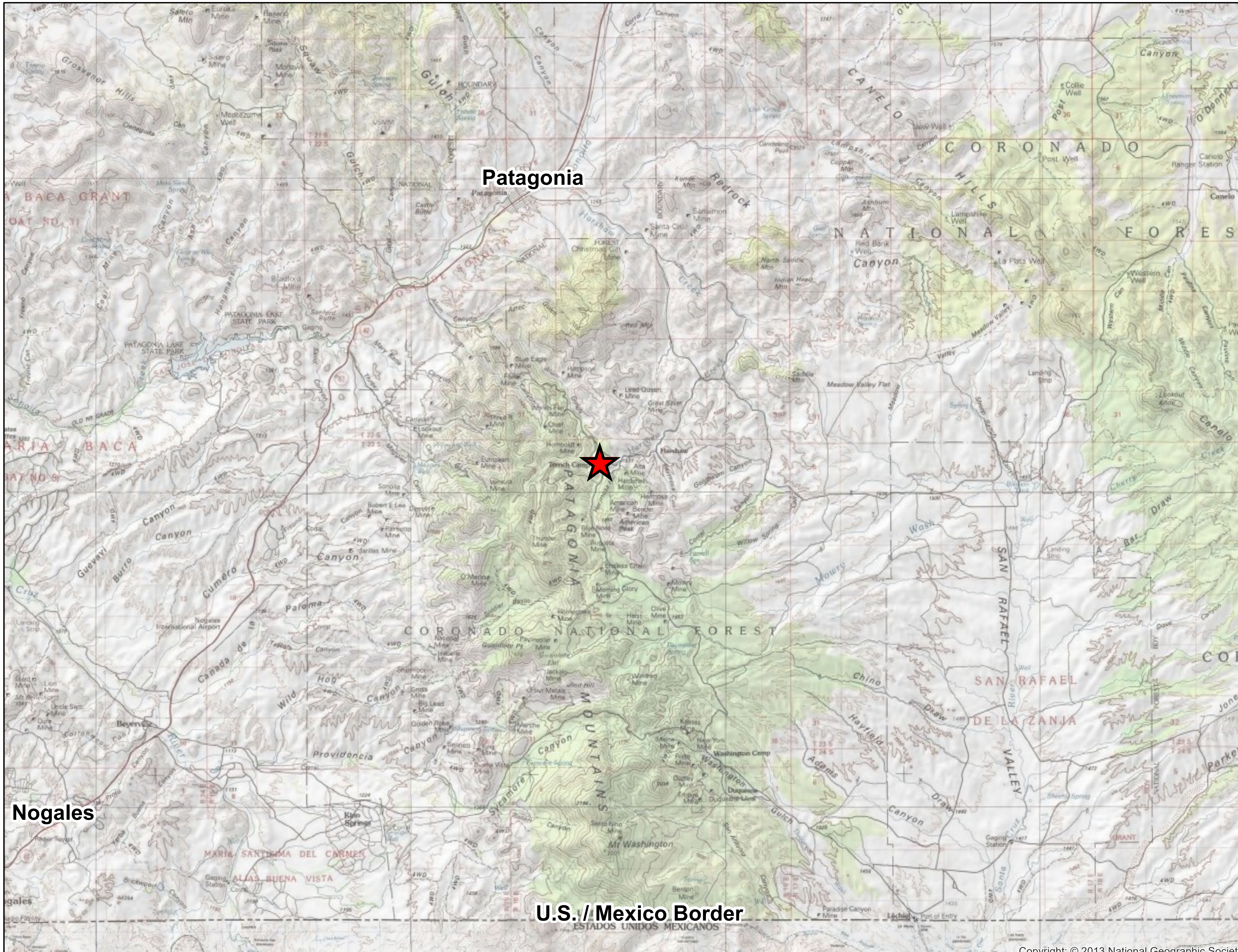
ATTACHMENT D

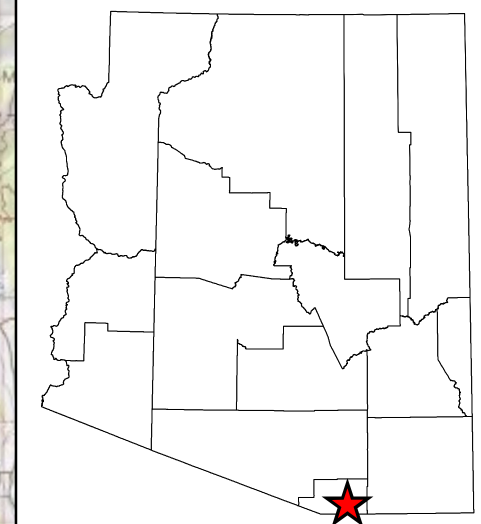
Proposed Aquifer Protection Permit Revisions

ATTACHMENT E

Contingency Plan

FIGURES





Legend

Project Location

0 1 2 4

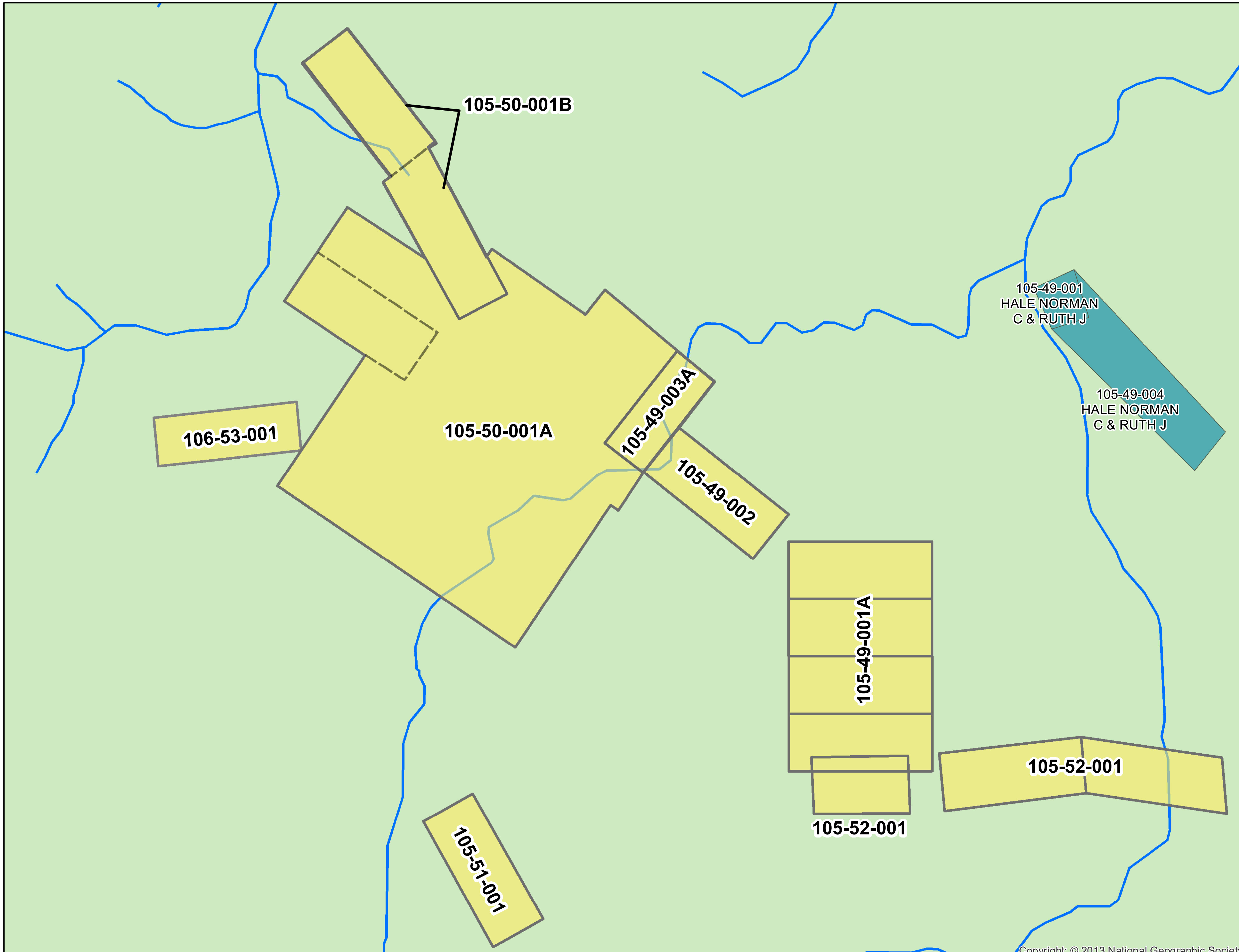
Miles

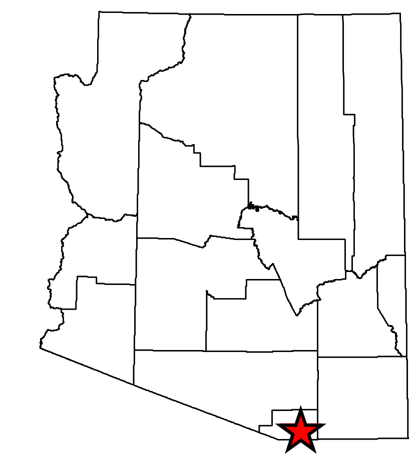
Projection: UTM Zone 12N NAD83

Date	File ID
6/22/2020	AZM-019B

CLEAR CREEK ASSOCIATES

FIGURE 1
Project Location
Hermosa Project
APP No. P-512235





Legend

- Arizona Minerals Inc. Properties with Parcel #
- USFS - Coronado National Forest
- Private Property

105-52-001 = Parcel #

0 500 1,000 2,000
Feet

Projection: UTM Zone 12N NAD83

Source: https://gis.santacruzcountyaz.gov/arcgis/rest/services/ParcelSearch/Parcels/MapServer

Date	File ID
11/27/2023	S32-006

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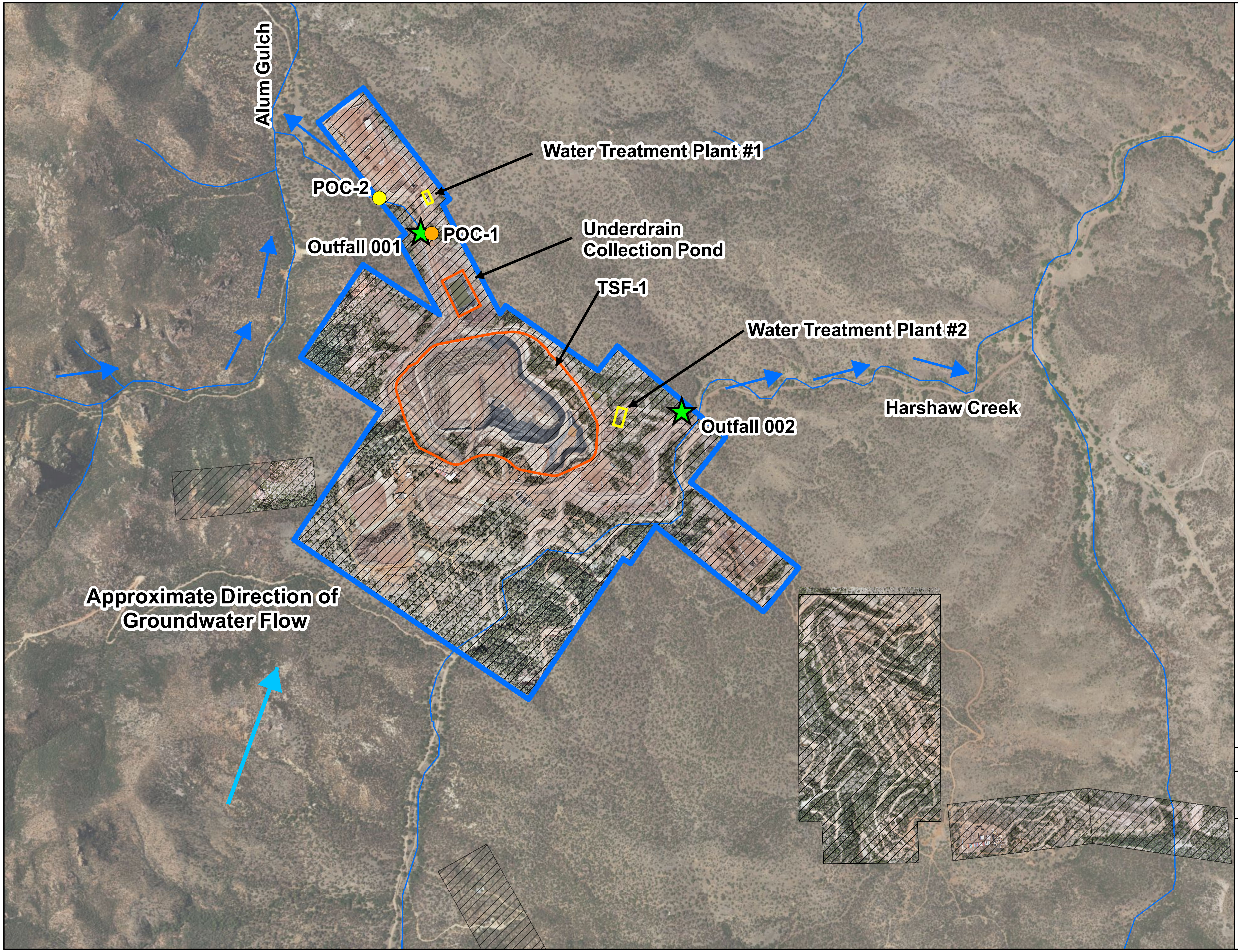
FIGURE 2
Land Ownership
Hermosa Project
APP No. P-512235

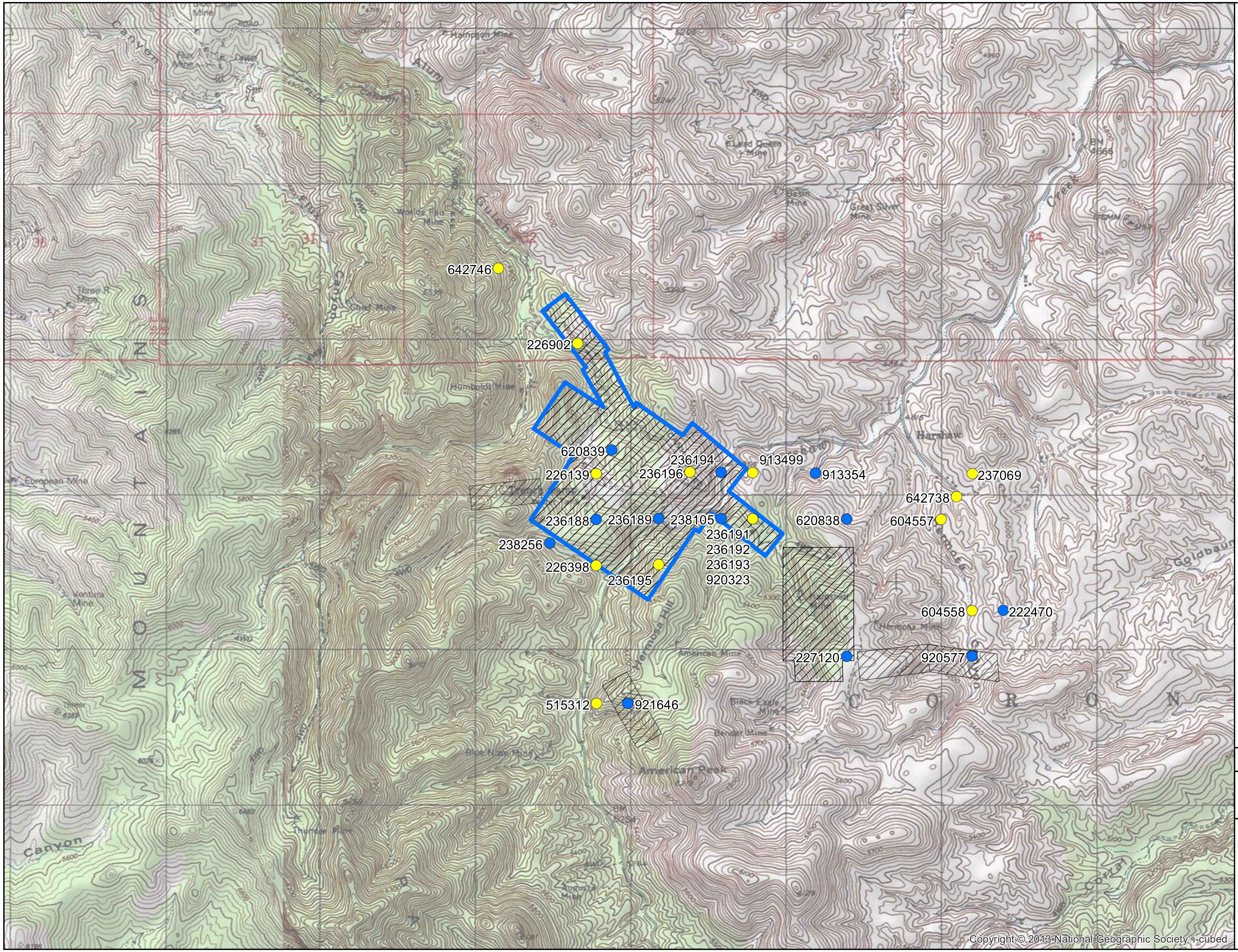


Date 11/14/2023

File ID S32-003

CLEAR CREEK ASSOCIATES

FIGURE 3
Site Plan
Hermosa Project
APP No. P-512235



Legend

- APP Project Area
- South 32 Hermosa Project Private Land
- Exempt Well
- Non-Exempt Well

0 2,000 4,000
Feet

Notes:
Projection: UTM Zone 12N NAD83
Well coordinates listed in Table 1

Date 12/15/2023	File ID S32-004A

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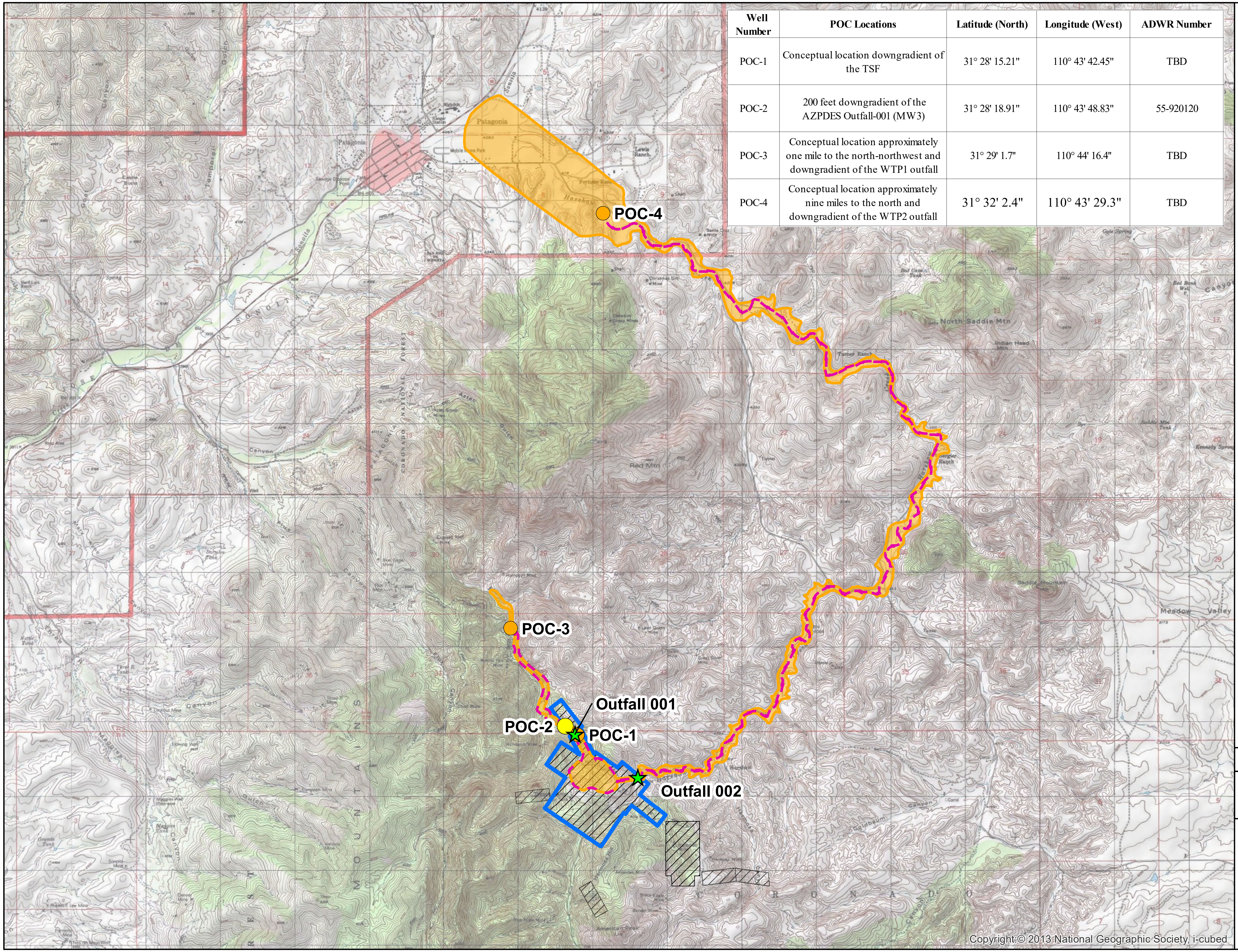
FIGURE 4
Exempt and Non-Exempt
Wells within One-Half Mile

Well Number	POC Locations	Latitude (North)	Longitude (West)	ADWR Number
POC-1	Conceptual location downgradient of the TSF	31° 28' 15.21"	110° 43' 42.45"	TBD
POC-2	200 feet downgradient of the AZPDES Outfall-001 (MW3)	31° 28' 18.91"	110° 43' 48.83"	55-920120
POC-3	Conceptual location approximately one mile to the north-northwest and downgradient of the WTP1 outfall	31° 29' 1.7"	110° 44' 16.4"	TBD
POC-4	Conceptual location approximately nine miles to the north and downgradient of the WTP2 outfall	31° 32' 2.4"	110° 43' 29.3"	TBD



Legend

- APP Project Area
- South32 Hermosa Project Private Land
- WTP Discharge Outfall
- Conceptual POC
- Existing POC
- Pollutant Management Area
- Discharge Impact Area

0 4,000 8,000
Feet

Projection: UTM Zone 12N NAD83

Date	File ID
11/14/2023	S32-005

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Figure 5
Pollutant Management Area, Discharge Impact Area, and Points of Compliance (POC)

ATTACHMENT A

Hermosa Lined TSF Design Amendment

HERMOSA PROJECT
TAILINGS STORAGE FACILITY 1 (TSF1)
AQUIFER PROTECTION PERMIT (APP) SIGNIFICANT AMENDMENT
BEST AVAILABLE DEMONSTRATED CONTROL TECHNOLOGY (BADCT) DESIGN

SANTA CRUZ COUNTY, ARIZONA

Prepared for:
South32 Hermosa Inc
1860 East River Road
Suite 200
Tucson, AZ 85718

Prepared by:
NewFields Mining Design & Technical Services
9540 Maroon Circle, Suite 300
Englewood, CO 80112

NewFields Job No. 475.0014.035
December 8, 2023

Registered Professional Engineer (Civil)
CERTIFICATE NO.
63431
CRAIG M.
THOMPSON
12/8/23
Date Signed
ARIZONA, U.S.A.
EXPIRES 3/31/26

NewFields
Perspective. Vision. Solutions.

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GLOSSARY OF TERMS AND ABBREVIATIONS

Acronym	**Definition**
AASHTO	Associate of State Highway and Transportation Officials
ACC	Arizona Administrative Code
ADEQ	Arizona Department of Environmental Quality
ADWR	Arizona Department of Environmental Resources
AE	Accountable Executive
AL	Alert Level
AMI	Arizona Minerals Incorporated
amsl	Above Mean Sea Level
APP	Aquifer Protection Permit
AQL	Acceptable Quality Limit
ASTM	American Society for Testing and Materials
ANCOLD	Australian National Committee On Large Dams
AWQS	Aquifer Water Quality Standard
BADCT	Best Available Demonstrated Control Technology
bgs	below ground surface
BMP	Best Management Practices
BoD	Board of Directors
CD	Consolidated drained
cDSS	Cyclic direct simple shear
cfs	Cubic feet per second
CIU	Isotropically consolidated undrained
CAU	Anisotropically consolidated undrained
CN	Curve Number
CPe	Corrugated Polyethylene
CPTu	Cone Penetration Testing with Pore Pressure
CQA	Construction Quality Assurance
CQC	Construction Quality Control
CRR	Cyclic resistance ratio
CSR	Cyclic stress ratio
CU	Consolidated Undrained
cy	Cubic yards
DBA	Dam Breach Analysis
DSS	Direct Simple Shear
EoR	Engineer of Record
ERC	Emergency Response Coordinator
FoS	Factor of Safety
GCCM	Geosynthetic cementitious composite mat
GCL	Geosynthetic Clay Liner
GISTM	Global Industry Standard on Tailings Management
GMPE	Ground motion prediction equations
Gpm	Gallons per minute
GTR	Global Tailings Review

GLOSSARY OF TERMS AND ABBREVIATIONS

Acronym	Definition
HDPE	High-Density Polyethylene
HMR	Hydrometeorological Report
ID	Inner Diameter
IDF	Inflow Design Flood
IR	Independent Reviewer
ksf	Kips per square foot
k_H	horizontal pseudostatic earthquake coefficient
k_v	Coefficient of permeability
LSDS	Large-scale direct shear
LCRS	Leak Collection and Recovery System
LOM	Life of Mine
LPSL	Low Permeability Soil Layer
Ma	One million years
MASW	Multichannel analysis of surface waves
MCE	Maximum Credible Earthquake
Mcy	Million cubic yards
MDD	Maximum dry density
MHS	Material Handling System
mil	A thousandth of an inch
MPE	Maximum Probable Earthquake
mst	Million short tons
MTO	Material Take-off
NewFields	NewFields Mining Design and Technical Services
NOAA	National Oceanic and Atmospheric Administration
Non-PAG	Non-potentially acid generating
NRCS	National Resources Conservation Service
NSHM	National Seismic Hazard Model
OMC	Optimum Moisture Content
PAG	Potentially acid generating
pcf	pounds per cubic foot
PGA	Peak Ground Acceleration
PI	plasticity index
PICC	Physical Impact of Climate Change
PMF	Probable Maximum Flood
PMP	Probable Maximum Precipitation
PSD	Particle size distribution
psf	Pounds per square foot
psi	Pounds per square inch
RCP	Representative Concentration Pathways
RQD	Rock quality designation
RTFE	Responsible Facility Tailings Engineer
R_U	Excess pore pressure ratio

GLOSSARY OF TERMS AND ABBREVIATIONS

Acronym	**Definition**
SHA	Seismic Hazard Assessment
South32	South32 Hermosa Incorporated
SPT	Standard Penetration Test
SRO	Southern Regional Office
TSF	Tailings Storage Facility
TSF1	Tailings Storage Facility 1
UDCP	Underdrain Collection Pond
USCS	Unified Soil Classification System
USDA	United States Department of Agriculture
USGS	United States Geological Survey
VRP	Voluntary Remediation Program
VWP	Vibrating Wire Piezometer
WQCS	Water Quality Compliance Section
WRCC	Western Regional Climate Center
WTP	Water Treatment Plant

1. INTRODUCTION

NewFields Mining Design and Technical Services, LLC (NewFields) was commissioned by South32 Hermosa Inc. (South32), formerly known as Arizona Minerals Inc (AMI), to complete an "Issued for Tender" design for the Tailings Storage Facility 1 (TSF1). TSF1 will be an expansion to the permitted and constructed Voluntary Remediation Program (VRP) Tailings Storage Facility (TSF). The VRP TSF was submitted as the "Tailings and Potentially Acid Generating (PAG) Material Remediation, Placement and Storage Project" dated June 5, 2017 (NewFields, 2017b) and is currently permitted under the Aquifer Protection Permit (APP) Program (No. P-512235) issued by the Arizona Department of Environmental Quality (ADEQ).

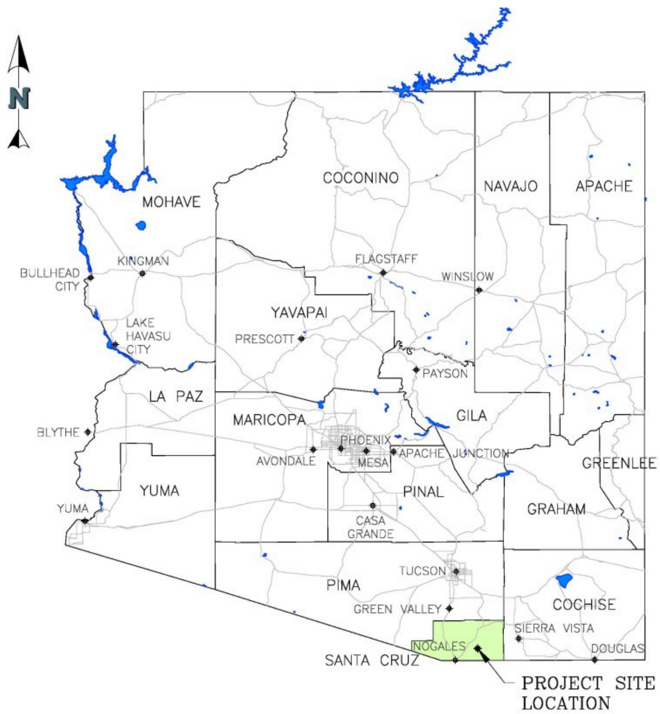
The existing VRP TSF addressed relocation of historic tailings piles onto a Best Available Demonstrated Control Technology (BADCT) compliant geomembrane lined dry stack TSF. The material contained within the historic tailings piles was excavated, placed, moisture conditioned (dried) as necessary and mechanically compacted in the existing VRP TSF (in essence, the material was placed as an engineered fill).

The proposed TSF1 is part of the planned transition from a VRP project to an operating mine. The Hermosa Project includes a proposed underground mining operation from which tailings will be filtered and mechanically placed in TSF1 and will be used for cemented paste backfill. In addition, PAG and non-PAG waste rock will be generated from mine development. PAG waste rock reporting to the surface will be stored within TSF1. Non-PAG waste rock reporting to the surface will be placed in TSF1, a non-PAG waste rock stockpile, or utilized as construction material. For the purposes of this report, the nomenclature "waste rock" and "development rock" should be considered equivalent. For example, "PAG waste rock" is equivalent to "PAG development rock."

TSF1 is required to store the additional waste rock and filtered tailings from the proposed mining activities. TSF1 will cover approximately 55 acres, have a maximum stacking height of 243 feet, and provide approximately 6.9 Mcy of storage capacity for dry stack filtered tailings and PAG waste rock. The TSF1 design is presented in this report along with supporting "Issued for Tender" design documents. The design is being submitted in accordance with requirements outlined in the APP Program administered by ADEQ.

The Hermosa project location is approximately 50 miles southeast of Tucson, Arizona in Santa Cruz County, and approximately 8 miles north of the U.S.-Mexico border. The site is accessed through the town of Patagonia via Harshaw Road. The location of the project is shown in Figure 1.1.

FIGURE 1.1 PROJECT VICINITY MAP



1.1. Scope of Work

NewFields design scope included the following elements:

- Compiled geotechnical testing performed to date to develop a geotechnical design basis for TSF1.
- Designed TSF1 to an "Issued for Tender" engineering level. The design ties into the existing VRP TSF as well as other proposed onsite infrastructure and complies with the following guidelines/standards:
  - Australian National Committee on Large Dams (ANCOLD),
  - Global Industry Standard on Tailings Management (GISTM), and
  - ADEQ's BADCT Manual.
- Designed surface water management systems for TSF1.
- Ecological Resource Consultants updated the water balance to model contact water management for the TSF and appurtenant infrastructure.
- Generated material take-offs (MTOs) and unit rates for construction capital and operational cost estimation.

- Generated a stand-alone TSF1 Design Report. The report includes TSF1 Design Drawings and work completed as part of the design effort as well as historical information relevant to the design.

NewFields project deliverables included the following:

- Standalone NewFields' TSF1 Design Report (this report).
- TSF1 Design Drawing Set (see Drawings).
- Technical Specifications for Construction Materials and Methodology (Appendix E).
- Material Take-Offs (issued under separate cover).
- Construction Capital, Operating and Closure Cost Estimates (issued under separate cover).

1.2. Existing VRP TSF

The existing VRP TSF was constructed in 2018 and 2019 as part of the ADEQ VRP Project (NewFields, 2017b). It addressed relocation of historic tailings formerly stored in unlined areas on the Trench Camp property. Historic tailings were exhumed and placed onto a BADCT compliant geomembrane lined dry stack TSF. The VRP TSF is sited in the northwest portion of the Trench Camp property and includes a perimeter road which fully encompasses a synthetically lined dry stack tailings basin area. The perimeter road provides light vehicle access, containment of surface water runoff and passive resistance to slope failure at the downstream toe of the dry stack TSF. The infrastructure constructed as part of the VRP TSF project includes an Underdrain Collection Pond (UDCP), TSF access/perimeter roads and basin, internal and external surface water diversion structures, and other associated infrastructure.

The existing VRP TSF employs a composite liner consisting of a 60 mil double-sided textured high-density polyethylene (HDPE) geomembrane overlying a compacted low permeability soil layer (LPSL) or geosynthetic clay liner (GCL). To protect the geomembrane, reduce head on the composite liner system and facilitate long-term drainage of the tailings, a granular protective layer was designed and placed over the geomembrane. The Protective Layer is augmented by a dendritic, perforated corrugated polyethylene (CPe) pipe network placed across the basin at regular intervals with collection header pipe work located in topographic lows within the TSF basin to collect percolation through the stack and convey the flow via gravity to the concrete encased underdrain outlet pipe work and into the existing UDCP located downstream of the facility. In addition to percolation, stormwater runoff from direct precipitation within the lined footprint will also be transmitted to the external UDCP through the Protective Layer and pipe network.

The UDCP contains underdrainage flows and direct precipitation runoff from the TSF. The pond is double geomembrane lined (60 mil double-sided textured HDPE geomembrane) with a leak collection and recovery system (LCRS) located between the primary and secondary liners. Water collected in the UDCP is pumped to Water Treatment Plant (WTP1) for treatment. To protect against extreme storm events, the existing UDCP employs an emergency spillway (NewFields, 2017a).

External stormwater conveyance structures were constructed to divert surface water flows around the facilities through engineered diversion channels. These diversion channels are fitted with riprap or rock armoring to minimize erosion and sediment transport.

The material contained within the historic tailings piles was excavated, placed, moisture conditioned (dried) as necessary and mechanically compacted in the existing VRP TSF. In essence, the materials were placed as an engineered fill. The VRP tailings relocation work is complete, and all historic tailings piles have been relocated onto a dry stack VRP TSF that is in general compliance with the applicable prescriptive BADCT design criteria as specified in ADEQ's BADCT Manual.

AMI was acquired by South32 during construction of the VRP TSF. After the acquisition, South32 paused the Exploration Decline development. The APP authorization allows for placement of waste rock from the Exploration Declines or shafts but since the Exploration Declines were paused, the waste rock was not delivered to the VRP TSF during construction. Absent the waste rock from the Exploration Declines, the VRP TSF was completed to an interim geometry. Additional information regarding the construction of the existing VRP TSF can be referenced in the Interim Record of Construction Report (NewFields, 2020a).

1.3. TSF Amended Design

In August 2020, South32 submitted a significant amendment which included a change to the stacking geometry of the existing VRP TSF. The Amended Design expanded the remaining capacity in the facility through lateral and vertical expansion of the stacking while remaining entirely within the permitted and constructed geomembrane lined TSF basin. ADEQ approved the Amended Design in a permit amendment issued in August 2021. With the Amended Design, South32 has permitted additional storage capacity which increases the remaining storage in the current TSF to 1.5 Mcy for the following materials:

- Waste rock.
- WTP1 and WTP2 filter cake.
- Core cutting solids from exploration core sample preparation.

- Construction rock material.
- Drill cutting material.
- Sediments from stormwater Best Management Practices (BMPs).

1.4. Hermosa Project Mining Production

The sulfide portion of the ore body at the Hermosa Project is planned to be developed as an underground mining operation from which minerals will be extracted through a milling and flotation process. After mineral extraction, a portion of the tailings will be used for cemented paste backfill (underground) and the remaining tailings will report to the surface, be filtered, and mechanically placed in TSF1. In addition to tailings, PAG and non-PAG waste rock will be generated during underground development. PAG waste rock reporting to the surface will be stored within the dry stack TSF. Non-PAG waste rock reporting to the surface will be placed in TSF1, a non-PAG waste rock stockpile, or utilized as construction material.

1.4.1. Tailings Storage Facility 1 (TSF1)

As part of the potential transition to an active mining project, the proposed TSF1 will expand the VRP TSF both vertically and laterally to create storage for production tailings. TSF1 will expand to the south and east, creating storage capacity for 5.4 Mcy of additional material. TSF1 will not provide adequate storage capacity to contain the LOM filtered tailings. An additional TSF eventually will be required to create the storage capacity to contain the remaining LOM filtered tailings.

TSF1 will utilize the existing UDCP constructed as part of the VRP TSF containment system. Contact water reporting to the UDCP will continue to be pumped to the existing WTP1 but will also have the option to be pumped to Water Treatment Plant 2 (WTP2). TSF1 will also utilize the existing stormwater diversion channels to prevent stormwater run-on.

1.4.2. TSF and Related Features Description

The basic design approach for the existing, ADEQ-approved TSF forms the basis of design for TSF1. The expansion is designed to be in compliance with applicable prescriptive standards in ADEQ's BADCT Manual as well as ANCOLD and GISTM design guidelines.

TSF1 includes a perimeter road which fully encompasses a synthetically lined TSF basin area capable of storing filtered tailings and waste rock from the mining operation. TSF1 is designed to safely collect and convey to the UDCP at least the 100-yr peak storm flows that result from direct precipitation on the TSF (BADCT 2.5.1.2), while maintaining prescriptive freeboard requirements.

In addition, TSF1 has also been sized to pass the Probable Maximum Flood (PMF) through an engineered spillway. The TSF1 emergency spillway consists of a reinforced concrete spillway entrance channel on the TSF Perimeter Road (embankment) at the West Internal Detention Pond and transitions to a concrete infilled Geocell on the downstream embankment slope. The emergency spillway daylights into a stilling basin at the base of the downstream embankment slope.

A TSF perimeter road, acting as an embankment when constructed in fill, is an integral part of the containment. It is designed around the perimeter of the TSF to provide light vehicle access, containment of surface water runoff and passive resistance at the downstream toe of the dry stack TSF to enhance slope stability of the dry stack tailings.

The TSF is lined with a composite liner system consisting of a 60 mil double sided textured HDPE geomembrane overlying a LPSL or GCL. To protect the geomembrane, reduce hydrostatic head on the composite liner system and to facilitate long-term drainage of the tailings, a granular Protective Layer is specified over the geomembrane liner (see Section 6.3). The Protective Layer is augmented by a dendritic, perforated CPe pipe network (see Section 5.5.4) placed in topographic lows to collect percolation through the tailings and convey the flow via gravity to the external UDCP located downstream of the TSF.

Underdrain flow collected in TSF1 will tie into the existing TSF pipe network, where it will be conveyed to the existing UDCP. The UDCP is sized to contain underdrainage flows from the TSF basin and direct precipitation runoff from the TSF footprint and pond for the 100-yr storm event (BADCT 2.3.1.2). The pond is double lined with an LCRS located between the primary and secondary liners. In the event of leakage through the primary liner, the LCRS will convey seepage flows to a sump for removal thereby reducing head and the propensity for seepage through the secondary geomembrane liner. Water collected in the UDCP will be pumped to either WTP1 or WTP2.

TSF1 and UDCP Design Criteria can be referenced in Appendix A.

1.4.3. Stormwater Management

The stormwater management systems are designed to prevent run-on to the TSF by collecting and conveying external meteoric flows around the TSF to natural downstream drainages. This system consists of a series of stormwater diversion channels and culverts located upstream and along the periphery of the TSF. The conveyance structures are sized to pass peak flows resulting from at least the 1,000-yr/24-hr storm event. A plan view showing the stormwater management can be referenced on Drawing A400 for TSF1.

1.5. Use of This Report

This report is prepared exclusively for South32. No third party, other than the design team (NewFields), shall be entitled to rely on any information, conclusions, opinions, or other information contained herein without the express written consent of South32.

2. PROJECT SETTING

The project area was evaluated to develop an understanding of the facility setting and inherent site conditions. The following sections address local conditions required for the design.

2.1. Site Conditions

The project is situated on private lands within the Sierra Vista District of the Coronado National Forest in the Patagonia Mountains due west of Harshaw, Arizona, and is accessible by Harshaw Road and Flux Canyon Road. Regional forest vegetation generally consists of juniper, mexican pinyon, and mesquite trees with several different species of grasses and shrubs. Area elevations range from approximately 4,800 to 5,300 feet above mean sea level (amsl). The main drainages in the area are Alum Gulch, which flows northwest and Harshaw Creek, which flows northeast. Both drainages empty into Sonoita Creek. Alum Gulch and Harshaw Creek are ephemeral drainages that experience flows during precipitation events. The area experienced over a century of historical underground mining activities with evidence still observable as open adits and shafts.

2.2. Geology

2.2.1. Regional Geology

The site is located in the Patagonia Mountains within the Basin and Range Physiographic Province. This area is characterized as a Precambrian deformed basement with Mesozoic granitic intrusives widely placed in conjunction with block faulting (Drewes, 1981). Compressional stresses during the North American Cordillera building events within the region occurred over a 37 million year (Ma) period, which produced two large scale thrust faults having a total estimated displacement of 124 miles. Subsequent crustal extension during Basin and Range formation produced a series of northwest trending normal and strike-slip faults. Rocks within the region generally consist of Precambrian igneous basement, Paleozoic sedimentary sequences, Mesozoic igneous intrusive and extrusive rocks and sedimentary rocks, and Cenozoic volcaniclastic and sedimentary rocks.

2.2.2. Local Geology

The Patagonia Mountains are comprised of Precambrian igneous juxtaposed with Paleozoic sedimentary and Mesozoic igneous rocks by faulting. The Mesozoic igneous rocks consist of similar chemical composition: intrusives are dominantly monzonite, diorite, and granodiorite; and extrusives consist of latite, andesite and rhyolite (Simons, 1972).

The project site is located within an area dominated by surficial Cretaceous andesites and Tertiary rhyolite tuffs, tuffaceous sandstones, and breccias. The volcanic packages overlay northeast dipping Paleozoic carbonate sediments. The carbonate sequences are exposed at the surface south of the project. Faulting throughout the area generally maintains a northwest trend. The Harshaw Creek and Guajolote Faults are the dominant normal faults with smaller normal and reverse faults present throughout. The Harshaw Creek Fault is concealed by the andesite and rhyolite flows near the project site. These faults are not considered active, according to the USGS Quaternary Fault and Fold Database.

2.3. Geologic Hazards

Examination of the geologic conditions around the TSF and ancillary facilities was conducted through examination of aerial photos and site reconnaissance. The surface geology is stable and does not present a landslide threat to the constructed facilities. It should be noted that the near surface bedrock in the area is highly fractured and cut slopes in the fractured bedrock must be monitored for signs of near surface instability. If instability is identified, slope stabilization may be required. The site APP (No. P-512235) requires periodic inspections of TSF slope conditions.

All slopes at the site are currently being monitored by South32 using InSAR (interferometric synthetic aperture radar) technology, as an early warning tool for ground deformation.

2.4. Seismic Hazard

A seismic hazard assessment (SHA) was completed to identify ground motions necessary for design (Appendix B). Prescriptive requirements referenced in ADEQ's BADCT Manual as well as global standards necessary to achieve South32 design requirements were considered.

BADCT requirements necessitate consideration of both the maximum probable earthquake (MPE) and the maximum credible earthquake (MCE). The MPE event is defined as the maximum earthquake that is likely to occur during a 100-year interval with a 20 percent probability of exceedance (approximately a 450 year return event), and the MCE is the largest deterministic event considered possible under the current tectonic regime. The MCE event should be used for design if loss of life is expected during a slope failure.

In addition to the BADCT requirements, recommendations from ANCOLD (ANCOLD, 2019) and GISTM (GTR, 2020) were considered for development of the seismic design parameters. Both guidance documents relate the hazard classification/consequence to ground motions associated with varying earthquake return periods. Return periods between 200 and 10,000 years were considered.

Ground motions associated with the maximum credible earthquake and various risk levels were assessed using both deterministic and probabilistic methods to estimate potential earthquake ground motions at the Hermosa Project site. Deterministic calculations were completed after identification of seismogenic faults near the Project using four of the Pacific Earthquake Engineering Center Next Generation of Ground Motion Attenuation Phase 2 Project (PEER NGA-West2) ground motion prediction equations (GMPE). Probabilistic ground motions were estimated using the USGS Unified Hazard Tool. The results of the SHA indicate:

- The regional seismic hazard has been categorized as moderate to low (Pearthree, 1998).
- The historic earthquake search indicates few sizeable seismic events have been recorded within the vicinity of the Project since 1850.
- Sixteen mapped faults were identified with Quaternary activity within 124 miles of the Project. Approximately 25 percent of the faults indicate displacement has occurred during the Holocene (past 15,000 years), 30 percent indicate displacement in the late Quaternary (past 130,000 years), 30 percent indicate displacement in the mid Quaternary (past 750,000 years), and the remainder of the faults indicate older activity.
- Foundation conditions below the facility are based on a seismic site class B.
- Deterministic MCE ground motions are controlled by a M6.7 rupture (the maximum magnitude expected for this fault system) of the Santa Rita Fault Zone at a distance of approximately 20 miles. The MCE median and 84th percentile PGA values are 0.07g and 0.13g, respectively. Calculated PGA values significantly decrease for fault sources exceeding 20 miles from the Project.
- Probabilistic PGA ground motions were estimated as 0.02g, 0.03g, 0.06g, 0.10g, 0.15g, and 0.22g for return periods of 200-year, 475-year, 1,000-year, 2,500-year, 5,000-year, and 10,000-year, respectively. Hazard deaggregation of the probabilistic events indicates a dominant contribution from the shallow crustal gridded area sources with earthquake magnitudes from approximately M5.0 to M6.0. The regional fault systems do not contribute significantly to the hazard.

The SHA was developed using the USGS Unified Hazard Tool which utilizes data from the 2014 National Seismic Hazard Model (NSHM). The SHA results were compared against data from the 2018 NSHM utilizing the same inputs (latitude, longitude, site classification) and determined to have nominal differences.

2.5. Surface Conditions

The vegetation at the project site is typical of oak-pine forests, evergreen oak woodlands, and scrub grasslands. The vegetation cover is fair to good fluctuating throughout the year. The United States Department of Agriculture (USDA) National Resources Conservation Service (NRCS) maps for the area indicate that the soils are primarily classified as hydrologic soil group D. Type D soils are classified as having the potential for low infiltration and high runoff rates. The geography consists of many canyons and drainages with generally steep terrain. The natural surface conditions consist of a thin veneer of colluvium and residual soils overlying highly fractured bedrock.

2.6. Climate

Summer is the primary wet season for the site where southerly winds and influx of moisture trigger widespread thunderstorm activity, known as the North American Monsoon. The summer monsoons contribute more than half of the annual precipitation at site and generally occur as high intensity and short duration thunderstorms that cover a small area. Summer monsoon activity is generally not continuous but has wet and dry cycles referred to as burst and break periods, respectively. Bursts are periods of increased moisture and high thunderstorm activity lasting for one week to three weeks. Breaks represent periods of dry westerly airflow lasting from two to seven days.

2.6.1. Temperature

The average temperatures range from 65-96 degrees Fahrenheit during the day and 28-65 degrees Fahrenheit at night. The average monthly temperatures for Patagonia, Arizona, approximately 5 miles northwest of the site, are presented in Table 2.1 (ERC, 2017).

TABLE 2.1 – AVERAGE MONTHLY TEMPERATURES FOR PATAGONIA, ARIZONA

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
High (°F)	65	67	72	79	87	96	94	92	90	83	73	65
Low (°F)	28	30	34	39	46	55	65	64	57	44	33	28

2.6.2. Precipitation and Evaporation

Precipitation values for the project site were determined based on measured site-specific data and data from three regional meteorological stations. Regional data was collected from the Western Regional Climate Center (WRCC) for stations Nogales 6N, Patagonia, and Canelo 1. The site-specific climate data record is considered the most representative and the primary source for determining the average monthly precipitation values. The estimated precipitation values for the project location are shown in Table 2.2 (ERC, 2017).

TABLE 2.2 – ESTIMATED MONTHLY PRECIPITATION STATISTICS FOR THE TSF

Month	Estimated Monthly Precipitation	
	Avg (in)	Std Dev (in)
January	1.66	1.84
February	0.88	0.97
March	2.51	1.65
April	0.35	0.33
May	0.38	0.46
June	0.87	1.24
July	5.66	1.88
August	5.59	1.57
September	4.38	1.80
October	0.63	0.82
November	0.63	0.60
December	1.64	0.81
Annual	25.18	5.00

Evaporation values for the project site were determined based on measured site-specific data and data from a regional meteorological station. Regional data was collected from the WRCC Nogales 6N station. The site-specific data record is considered the most representative and the primary source for determining the average monthly evaporation values, but the site data does require some adjustments (ERC, 2017). The estimated pan and pond evaporation values for the project location are shown in Table 2.3 (ERC, 2017).

TABLE 2.3 – ESTIMATED MONTHLY EVAPORATION STATISTICS FOR THE TSF

Month	Estimated Monthly Evaporation	
	Pan Evaporation (in)	Pond Evaporation (in)
January	3.13	2.26
February	3.76	2.71
March	5.47	3.94
April	6.22	4.48
May	8.94	6.44
June	10.41	7.50
July	5.16	3.72
August	4.72	3.40
September	4.63	3.33
October	5.93	4.27
November	4.35	3.13
December	2.98	2.14
Annual	65.70	47.31

Details regarding climatic conditions at the site can be found in Appendix C in the Ecological Resource Consultants Technical Memorandum (ERC, 2017).

2.6.3. 24 Hour Storm Precipitation Depth

Determination of precipitation associated with the various 24 hour frequency storm events was obtained from the National Oceanic and Atmospheric Administration (NOAA) Precipitation Frequency Data Server. Reported precipitation values are for Latitude 31° 27’ 20” N, Longitude 110° 42’ 47” W, and are shown in Table 2.4 (ERC, 2017) and presented in Appendix A (design criteria).

TABLE 2.4 – POINT PRECIPITATION FREQUENCY ESTIMATES

Frequency (yr)	Duration (hr)	Precipitation Depth (in)
1	24	1.86
2	24	2.31
5	24	2.87
10	24	3.32
25	24	3.93
50	24	4.40
100	24	4.88
500	24	6.02
1,000	24	6.53

2.6.4. 72 Hour Storm Precipitation Depth

Determination of precipitation associated with the 100-yr /72-hr storm event was calculated by Ecological Resource Consultants in the Technical Memorandum titled, "South32 Mine Site Precipitation Analysis" (ERC, 2020). Various storm duration data was obtained from the NOAA Precipitation Frequency Data Server. Reported precipitation values are for Latitude 31° 27' 20" N, Longitude 110° 42' 47" W, and are shown in Table 2.5 (ERC, 2020). A rainfall distribution for the 72-hour hyetograph with a recurrence of 100 years was developed by Ecological Resource Consultants as a center peaking storm. The storm distribution was developed such that all smaller duration 100-year storm events were embedded within the 72-hour storm.

TABLE 2.5 – NOAA POINT PRECIPITATION FREQUENCY ESTIMATES (100 YR STORM EVENT)

Duration	5 min	10 min	15 min	30 min	60 min	2 hr	3 hr	6 hr	12 hr	24 hr	48 hr	72 hr
Precipitation Depth (in)	.939	1.43	1.77	2.38	2.95	3.40	3.50	3.99	4.51	4.84	5.51	6.07

2.6.5. Probable Maximum Precipitation (PMP) Storm Precipitation Depth

The general (72 hr) and local (6 hr) Probable Maximum Precipitation (PMP) design storms events were derived from the methodology outlined in Hydrometeorological Report No. 49 (HMR 49) Probable Maximum Precipitation Estimates, Colorado River and Great Basin Drainages. The general and local PMP storm precipitation depths can be referenced in Table 2.6 and were developed by Ecological Resource Consultants (ERC, 2017).

TABLE 2.6 – PMP STORM EVENTS

Duration	Local PMP (6 hr)	General PMP (72 hr)
Precipitation Depth (in)	14.63	20.81

2.6.6. Climate Change

South32 commissioned a Physical Impact of Climate Change (PICC) Assessment. The PICC Assessment produced site specific data regarding estimated changes to climate parameters considering various Representative Concentration Pathways (RCP). Climate change projections were developed from a range of local and international data including: The Climate Explorer, The World Bank Climate Change Knowledge Portal, as well as the NOAA websites. Table 2.7 summarizes site specific changes to the climate parameters provided to NewFields for RCP4.5 and RCP8.5 for the years 2030, 2050, and 2090.

TABLE 2.7 – CLIMATE CHANGE SUMMARY TABLE

Climate Parameter	Description	RCP[2] 4.5			RCP[2] 8.5		
		2030	2050	2090	2030	2050	2090
Temperature	Annual Average (°C) Annual Average (°F)	+1.3 +2.3	+2.0 +3.6	+2.6 +4.8	+1.4 +2.5	+2.5 +4.5	+5.0 +8.9
Rainfall	Annual Average (%)[1]	-10.2	-12.2	-11.5	-3.6	-7.5	-8.1
Rainfall	Design Storm Intensity 100-yr, 1,000-yr, PMP (%)	+6.5	+10.1	+13.8	+7.0	+13.0	+27.4
Atmosphere	Annual Relative Humidity (%)	-1.35	-2.03	-2.73	-1.57	-2.79	-5.82
Solar Radiation	Annual Mean Daily Solar Exposure (%)	+0.2	+0.3	+0.4	+0.2	+0.4	+0.8
Wind Speed	Annual Near Surface Wind Speed (%)	+1.1	+1.7	+2.2	+1.3	+2.3	+4.7

Notes: [1]For average quarterly rainfall changes refer to South32 PICC Assessment Data.
[2]RCP – Representative Concentration Pathways is a greenhouse gas concentration trajectory.

2.7. Historic Workings

The site has experienced historical underground mining activities. South32 has provided NewFields with information regarding the historic workings and NewFields has plotted and categorized them according to depth, where workings greater than 100 feet deep were considered inconsequential in terms of potential subsidence. During the 2022 TSF1 geotechnical field investigation, NewFields investigated mapped historic workings located within the TSF1 footprint. NewFields was only able to identify one historic working known as “TSF AML 3” which was a backfilled shaft. The remaining historic workings, labeled as “TSF AML 1” and approximately “10 unidentified near surface features”, were drilled and/or test pitted. The drilling and test pitting did not identify any voids and confirmed the features were no longer present in these areas. Most likely, these features were excavated to non-existence or removed during past construction projects. All other historic workings mapped below the TSF footprint are at significant depth below the ground surface ranging from approximately 200 feet to over 1,000 feet.

As part of the design, NewFields developed a remediation design for “TSF AML 3” including sections and details. The design includes excavation of engineered fill to access the top of the backfilled shaft, additional excavation (approximately 10 vertical feet) to competent bedrock, construction of a 3 ft concrete plug, 7 ft of compacted cemented rockfill, and placement of fill required to achieve the finished grade elevation for liner placement in TSF1. Additional detail regarding the remediation of the underground works can be referenced on Drawing A500.

3. GEOTECHNICAL CHARACTERIZATION

Multiple geotechnical site investigations have been completed to support the various stages of the project including test pits, boreholes, geophysics, and subsequent laboratory testing programs. The geotechnical site investigations used to develop the basis of design for TSF1 are documented in Table 3.1.

TABLE 3.1 – GEOTECHNICAL INVESTIGATIONS SUMMARY TABLE

Date	Facility	Company	Description
Jan 2017	VRP TSF	NewFields	Purpose: Identify and characterize the engineering properties of subsurface material beneath the VRP TSF footprint and surrounding areas with a focus on defining depth and condition of historic tailings piles. Identify and characterize potential borrow sources for construction materials. Activities: Test pits, boreholes, geophysics, and laboratory testing.
Jun 2017	VRP TSF	NewFields	Purpose: Augment the January 2017 geotechnical investigation focusing on potential construction material borrow areas. Activities: Test pits and laboratory testing.
Jan 2018	Infrastructure Pad	NewFields	Purpose: Identify and characterize the engineering properties of subsurface material beneath the Infrastructure Pad as well as characterize the engineering properties of the anticipated engineered fill material. Activities: Test pits and laboratory testing.
Aug 2021	TSF1	NewFields	Purpose: Collect data for the existing material stockpile at the Infrastructure Pad and surrounding areas to qualify potential sources for construction material borrows. Activities: Test pits and laboratory testing.
November 2021	TSF1	NewFields	Purpose: Collect material samples (core) for laboratory testing from the pilot hole drilling program at the proposed main and ventilation shaft locations. Samples to be evaluated for potential source of construction aggregate material for the TSF and other infrastructure. Activities: Laboratory testing.

VRP – Voluntary Remediation Program, TSF – Tailings Storage Facility, TSF1 – Tailings Storage Facility 1

TABLE 3.1 – GEOTECHNICAL INVESTIGATIONS SUMMARY TABLE (CONTINUED)

Date	Facility	Company	Description
February 2022	VRP TSF	NewFields	Purpose: Obtain additional data on the VRP TSF, such as moisture content, phreatic condition, state, and strength of the in-place tailings. Install piezometers for monitoring purposes. Activities: CPTu, seismic velocity measurements, piezometer installations, sonic coring and sampling, and laboratory testing.
July 2022	TSF1	NewFields	Purpose: Identify and characterize the engineering properties of subsurface material beneath TSF1. Identify and characterize potential borrow sources for construction materials. Investigate potential historic mine workings. Activities: Test pits, boreholes, and laboratory testing.

VRP – Voluntary Remediation Program, TSF – Tailings Storage Facility, TSF1 – Tailings Storage Facility 1

3.1. Geotechnical Investigations

3.1.1. VRP TSF

TSF1 will expand upon the existing VRP TSF resulting in new filtered tailings placement overtop of the existing tailings mass and eventually extending upgradient into the adjacent basins. The geotechnical investigations specific to the VRP TSF as well as the construction quality assurance (CQA) testing form part of the basis of knowledge for foundation conditions. During 2017 and 2018 three geotechnical site investigations were completed to support the design and construction of the existing VRP TSF. The investigations included rotary boring through historic tailings deposits (subsequently moved onto the lined VRP facility), near surface soil and rock, test pits, and surface based geophysical surveys on the historic tailings piles to identify depth of the tailings deposits to assist in defining the tailings quantities for relocation. Laboratory tests were subsequently completed for select samples. A detailed summary and data from these investigations, along with observations and laboratory results can be referenced in the relevant sections of the TSF Amended Design Report (NewFields, 2020b) listed below:

- Section 3.0 (Geotechnical investigation summary)
- Drawing A070 (Geotechnical investigation plan view)
- Appendix D.1.1 (January 2017 borehole and test pit logs)
- Appendix D.1.2 (June 2017 test pit logs)
- Appendix D.1.3 (January 2018 test pit logs)
- Appendix D.2.1 (January 2017 laboratory data)
- Appendix D.2.2 (June 2017 laboratory data)

- Appendix D.2.3 (January 2018 laboratory data)

In addition to the geotechnical investigation programs, confirmatory CQA laboratory and field testing was conducted during construction. In general, the CQA testing included earthworks (index, compaction, permeability, strength, liner interface friction, etc.), geosynthetics and concrete. CQA testing results can be referenced in the Interim Record of Construction Report (NewFields, 2020a).

As part of the GISTM implementation and continued monitoring of the VRP TSF, a post-construction geotechnical investigation was completed during Q1 2022. The investigation included 8 seismic piezocone (CPTu) soundings accompanied by pore pressure dissipation tests and seismic velocity measurements. In addition, twinned geotechnical boreholes were completed to obtain in-situ tailings samples and install a network of vibrating wire piezometers (VWPs) within the tailings. The scope of the campaign was to expand the understanding of the in-situ tailings, such as the moisture content, phreatic condition, density, shear strength, and ultimately to confirm the original design criteria. The data also served to verify that tailings placement, completed under full-time CQA oversight, was adequate to achieve the design basis.

Preliminary CPTu data was utilized to aid in selecting depths for collection of both bulk and in-situ samples. Sample locations primarily targeted zones of high and low cone resistance and/or zones, interpreted during probing, that could have excess pore pressure. In addition to targeting these zones, bulk sonic core samples were collected at periodic intervals during the program to assess material types and moisture conditions. In-situ tube samples were primarily obtained using a pitcher sampler due to the stiffness of the in-situ tailings. Prior to the use of the pitcher sampler, multiple attempts at various locations utilizing traditional Shelby tube direct push techniques resulted in crumpling of tubes due to very stiff tailing conditions. It should be noted, however, that four direct push Shelby tube samples were successfully collected in less stiff zones.

Upon completion of the field program, select bulk samples were tested for index properties (moisture content, specific gravity, particle size distribution, Atterberg limits, etc), and in-situ thin wall tube samples were used for more detailed engineering characterization. Data from the investigation was used to refine characterization of the existing VRP tailings.

3.1.2. TSF1

NewFields completed the following geotechnical investigations specific to the TSF1 design:

- Evaluation of the material stockpiles located on the Infrastructure Pad as potential construction material borrow sources. The materials were generated from excess cut from exploration related construction activities and placed in onsite material stockpiles. In addition, the Shaft Platform and Plant Site areas have been evaluated as potential construction material borrow sources. A summary of the geotechnical investigation is presented in Section 3.1.2.1 through Section 3.1.2.2 and detailed information can be referenced in Appendix D.1.

- Geotechnical laboratory testing on select samples obtained from drilling activities at the proposed main and ventilation shaft locations to qualify the potential waste rock material as a construction borrow source. A summary of the laboratory testing is presented in Section 3.1.2.3 and detailed information can be referenced in Appendix D.2.
- A geotechnical investigation including boreholes and test pits in the TSF1 footprint and surrounding areas. The purpose of the site investigation was to identify and characterize the engineering properties of subsurface materials and identify and characterize potential borrow sources for construction materials. A summary of the investigation is presented in Section 3.1.2.4.

3.1.2.1. Existing Stockpile at the Infrastructure Pad (Construction Borrow)

Approximately 250,000 cubic yards (cy) of excess cut material from exploration related construction activities was stockpiled onsite. During 2021, NewFields completed a geotechnical investigation consisting of large rock gradations (performed in the field), test pits, material sampling and subsequent laboratory testing at NewFields' geotechnical laboratory located in Elko, Nevada. The geotechnical investigation was focused on qualification of the stockpile as a potential construction borrow source for TSF1 construction. The location of the existing stockpile can be referenced in Figure 1 of Appendix D.1.

Listed below is a summary of results from the geotechnical field investigation at the existing Infrastructure Pad material stockpile:

- Three large rock gradations were completed in the field resulting in the following average particle size distribution (PSD) of the material stockpile:

Sieve Size	**16”**	**8”**	**6”**	**4”**	**3” (see note 1)**
Avg Percent Passing	100%	79%	72%	63%	57%

Note: [1] Large rock gradation was stopped at minus 3” material at which point a representative 3” minus material was sampled for subsequent laboratory testing.

- The majority of the stockpile is 16” minus material with the exception of occasional larger particles randomly dispersed throughout the stockpile. The larger particles were only visually identified and were not quantified due to the limited quantity.

- The large rock gradations and test pits were performed on the upper part of the stockpile and therefore the information obtained from the stockpile is representative of this zone.
- The material stockpile consisted mainly of clayey sand and clayey gravel. The test pits showed a relatively homogeneous distribution of material throughout the sampled zone.

Listed below is a summary of results from the lab testing of the stockpile samples.

- Ten material samples (-3” material) were tested in the laboratory resulting in the following average PSD:

Sieve Size	**3”**	**2”**	**1.5”**	**1”**	**0.75”**	**0.5”**	**0.38”**
Avg Percent Passing	100%	96%	91%	84%	79%	73%	69%
Sieve Size	**#4**	**#10**	**#16**	**#40**	**#50**	**#100**	**#200**
Avg Percent Passing	65%	58%	50%	35%	31%	22%	17%

- The samples consisted of 3” minus material, which represents approximately 57% of the stockpile volume as determined by the large rock gradations.
- The average fines content (less than 75 µm) was measured to be approximately 17%.
- The average plasticity index (PI) was 13.

The gradation and Atterberg limits were utilized to determine a screen size which would produce a product capable of meeting the LPSL specification for permeability (max 1.0 x 10^{-6} cm/sec). Based on the laboratory test results, a 3/4" scalping screen was selected to produce the candidate LPSL material. The -3/4” material was screened from select samples and showed passing permeability results with approximately 4% bentonite amendment. Utilizing the data obtained from the field and laboratory testing, it was estimated that the stockpile would yield approximately 112,500 cubic yards of LPSL material if screened on the 3/4” sieve.

The material contained within the existing stockpile located at the Infrastructure Pad should not be considered durable and will not be suitable for concrete aggregate, riprap, protective layer, or drainage aggregate. Laboratory testing of the aggregate in the stockpile resulted in the following:

- LA Abrasion: 41% average loss with a range of 39% to 45% loss.
- Sodium Sulfate Soundness: 56% average loss with a range of 13% to 83% loss.
- Slake Durability: 83% average loss with a range of 78% to 90% loss.

Additional information regarding the existing material stockpile at the Infrastructure Pad can be referenced in Appendix D.1.

3.1.2.2. Shaft Platform and Plant Site Areas (Construction Borrow)

Samples from the proposed Plant Site Platform and Shaft Platform areas were evaluated for use as both LPSL and aggregate materials. Samples from TP21-03 (shaft platform area) and TP21-07 (plant site area) were screened on the ¾" sieve and tested for their potential use as LPSL material, as these samples contained the greatest percentage of fines. Results indicate that with a 4% bentonite amendment, the minimum permeability requirement can be achieved, thus LPSL material could be produced from these locations. The potential quantity of LPSL in these areas should be considered low. The existing stockpile located on the Infrastructure Pad should be considered the primary source of LPSL.

An aggregate testing suite was also performed on plus ¾" material from representative samples. Sample TP21-06, collected in the shaft platform area, yielded a 67% loss during the LA Abrasion test, therefore, the shaft platform cut area should not be considered as a viable borrow source for Protective Layer or construction aggregates. Samples TP21-07 and TP21-13, collected in the plant site area, exhibited a 7% and 25% loss in the LA Abrasion test, respectively and were classified as Type I in the slake durability test. As a result, this material could be used as Protective Layer material or construction aggregates. In order to better quantify the extent of these potential borrow sources for use as Protective Layer and/or construction aggregates, an investigation prior to construction is recommended.

Additional information regarding the Shaft Platform and Plant Site areas can be referenced in Appendix D.1.

3.1.2.3. Main and Ventilation Shaft Waste Rock

Drilling was completed to identify samples that are representative of non-PAG waste rock that will be encountered during shaft development. This material was evaluated as a potential borrow source for Protective Layer and Drainage Aggregate material that will be required for TSF1 construction. Additionally, PAG waste rock samples were also tested to characterize strength parameters.

During development of the pilot holes, at least one sample per lithology was provided to NewFields for laboratory testing including non-PAG and PAG samples (geochemical analysis of the waste rock was performed by others). Core samples were crushed at a local laboratory for subsequent testing to evaluate geotechnical properties of the waste rock and to classify the material as a potential source for Protective Layer and/or Drainage Aggregate for future TSF construction. In NewFields' opinion, the crushed samples should be considered representative of a secondary or tertiary crushed material.

Laboratory testing of the non-PAG waste rock samples indicate the following:

- LA abrasion (50% maximum loss), sodium sulfate soundness (10% maximum loss) and slake durability (classification as Type 1) laboratory results show the material generally meets or exceeds durability requirements specified for Drainage Aggregate.
    - Los Angeles abrasion resulted in 21 of 22 passing tests (average 16%) in the Meadow Valley Andesite, Hardshell Volcanics, Older Volcanics, and Concha 1 lithologies. The only failing test was in the Concha 1 lithology. The available testing indicates that the Concha 1 lithology is not a viable source for Protective Layer or Drainage Aggregate production.
    - Sodium sulfate soundness (coarse aggregate) resulted in 18 of 22 passing tests (average 5%) in the Meadow Valley Andesite, Hardshell Volcanics, Older Volcanics, and Concha 1 lithologies. The failing tests were in the Hardshell Volcanics and Older Volcanics lithologies.
    - Sodium sulfate soundness (fine aggregate) resulted in 12 of 22 passing tests (average 13%) in the Meadow Valley Andesite, Hardshell Volcanics, Older Volcanics, and Concha 1 lithologies. The failing tests were in the Hardshell Volcanics, Older Volcanics, and Concha 1 lithologies.
    - Slate durability resulted in 10 of 10 passing tests (all classified as Type 1).
- Sodium sulfate soundness determines an aggregates resistance to disintegration by weather and in particulate freeze-thaw cycles. Aggregates utilized for Protective Layer and Drainage Aggregate will be buried beneath the stacking. Due to the site temperature data as well as application within the design (buried) the aggregates exposure to freeze-thaw cycles will be very limited.
- The main and ventilation shaft waste rock should be considered a source of construction aggregates (for Protective Layer and Drainage Aggregate) for TSF construction including Meadow Valley Andesite, Hardshell Volcanics, and Older Volcanics lithologies. A crushing and screening operation would be required to produce acceptable gradations.

Direct shear tests were conducted on the PAG core samples produced from the pilot holes drilled at the main and ventilation shaft locations. The tests utilized an 8-inch square mold, which required removal of particles greater than ¾-inch diameter prior to testing according to the test standard. Sample materials were remolded to 95% of the maximum dry density (MDD) per ASTM D1557. Each sample was inundated with water, loaded using various normal loads, allowed to consolidate, and sheared at a rate of 0.01 inches per minute. Testing continued until approximately 15% max strain was obtained. Normal loads used during testing were 2, 4, and 8 kips per square foot (kip/ft^2). Direct shear test results are summarized in Table 3.2.

TABLE 3.2 – MAIN AND VENTILATION SHAFT SAMPLE DIRECT SHEAR TESTING RESULTS

Description	Location[1]	Mohr-Coulomb Strength Properties	
		ϕ (degrees)	Cohesion (psf)
Main Shaft	HSVOL-21-01	48.0	1523
	HSVOL-21-02	34.5	1182
Ventilation Shaft	HSVOL-21-09	45.8	3031
	OLDVOL-21-04	44.8	1522

Figure 3.1 presents the direct shear test results overlayed on commonly used rockfill shear strength envelopes (Leps, 1970). The green markers represent the waste rock (main and ventilation shaft) test results interpreted as large strain, and the shaded blue lines represents the Leps "low density, poorly graded, weak particles", "average rockfill", and "high density, well graded, strong particles" failure envelops. Based on the lab data, the "high density, well graded, strong particles" was most representative of the rock however, "average rockfill" was conservatively selected as the large strain shear strength failure envelop for the main and ventilation shaft waste rock.

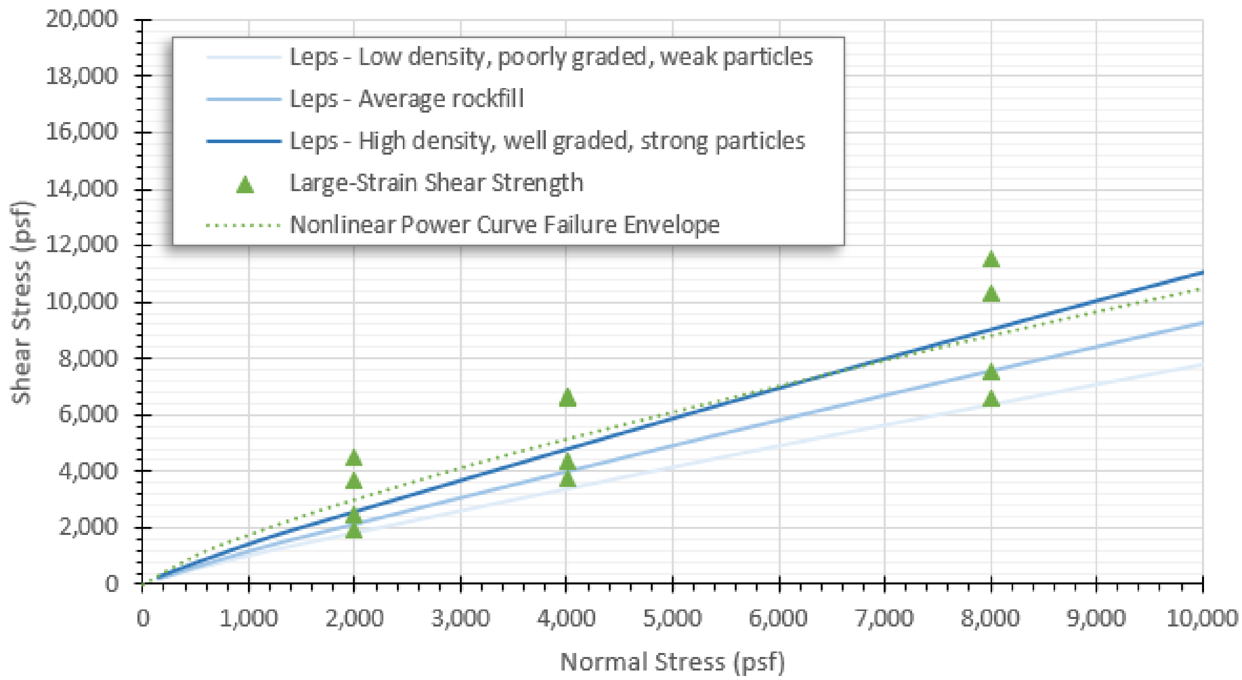


FIGURE 3.1 – DIRECT SHEAR TEST RESULTS FOR THE MAIN AND VENTILATION SHAFT SAMPLES

Additional information regarding the laboratory testing results for the main and ventilation shaft samples can be referenced in Appendix D.2.

3.1.2.4. 2022 Geotechnical Investigation

In 2022, a geotechnical investigation was completed in association with the designs of TSF1. The geotechnical investigation included 13 boreholes and 33 test pits in the vicinity of the TSF1 footprint. The purpose of the site investigation was to identify and characterize subsurface materials beneath the proposed expansion area, identify and characterize potential borrow sources for construction materials, and obtain additional information regarding historical workings within the proposed TSF1 footprint.

The drilling program was advanced to depths between 14 and 106 ft below ground surface (bgs) with a 600-T full-size truck mounted sonic rig.

Driven samples were retrieved using a Standard Penetration Test (SPT) split-spoon sampler (1.38-inch inner diameter (I.D.)) and a larger brass-lined split-barrel modified California sampler (3-inch O.D., 2.5-inch I.D). In accordance with ASTM D1586, a 140-pound automatic trip hammer with a drop height of 30 inches was used to drive the samplers.

NewFields personnel logged the subsurface conditions based on the material recovered from sonic core. Samples were classified using the Unified Soil Classification System (USCS) which separates soils into groups with similar engineering characteristics. Soil samples were transported to NewFields laboratory for subsequent laboratory characterization.

Borehole logs are provided in Appendix D.3, and the logs summarize material classifications, penetration resistances and observations made at the time of drilling. In some cases, field classifications have been altered on the final boring logs based on the results of the laboratory test program. Material boundaries presented on the logs represent the approximate location of material type changes. However, the actual transition between the material types may be gradual.

Excavation of the test pits was completed to characterize near surface soil conditions. Test pits were excavated to depths up to 20 ft bgs using a CAT 345 hydraulic excavator. The excavation depth was limited by the machine reach of the excavator or equipment refusal at bedrock. Descriptions of materials encountered were recorded in the field, and bulk disturbed samples of representative materials were obtained for laboratory testing. After completion, the test pit excavations were backfilled with spoil materials and recompacted to the original ground surface elevation. Test pit logs are presented in Appendix D.4.

Groundwater was not encountered during drilling or test pitting. All borehole and test pit locations for TSF1 are shown on Drawing A150. Please note, BH-08 was performed in a known historical shaft. The borehole was drilled in the center of the shaft to a depth of approximately 106 feet. Clayey gravel backfill and tailings were encountered until the borehole was terminated.

3.2. Subsurface Conditions

TSF1 will expand upon the existing TSF resulting in new tailings placement over the top of the existing tailings mass and eventually extend upgradient into the adjacent basins. The geotechnical investigations previously described form the basis of knowledge for the TSF1 foundation conditions.

Natural subsurface conditions below TSF1, outside of the existing VRP TSF, consist of a thin veneer of colluvium and residual soils overlying highly fractured bedrock that grades relatively quickly to competent rock (approximately 25 feet below the existing ground surface). Residual deposits are generally located on the upper portions of the slopes and colluvium deposits within hillside swales. The residual soils are derived from weathering of the andesite bedrock, and the colluvium deposits are similar in nature with the exception that they have been reworked during downgradient transportation. The soils are spatially variable, and generally consist of low to medium plasticity clay, silty and clayey sand, and sandy gravel. Standard penetration blow counts indicate the materials are typically dense to very dense. Practical refusal due to hard rock is expected approximately 5 to 25 feet below ground surface, but outcropping rock is present in numerous areas around the sites. Bedrock is highly weathered to fresh andesite with decomposition decreasing with depth. The rock hardness typically varies from weak to strong, and the near surface rock is generally intensely to highly fractured with multiple rubblized zones identified in the borings. Near surface rock quality designation (RQD) values indicate poor to very poor rock mass quality.

South32 has an ongoing groundwater level monitoring program. Monitoring indicates that groundwater levels are greater than 200 feet below TSF1 finished grade and will not impact development of TSF1.

3.3. Construction Quality Assurance (Existing VRP TSF)

Laboratory testing completed for development of the existing VRP TSF included measurement of general index properties as well as shear strength and hydraulic conductivity of relevant foundation and construction materials. A summary of relevant test work is summarized in the following subsections. A complete summary of this data along with laboratory data sheets can be found in the Interim Record of Construction Report (NewFields, 2020a).

3.3.1. Index Properties

The index properties of historic tailings and construction materials within the existing VRP TSF were evaluated using particle size analyses and Atterberg limits. These parameters were used to divide the soils into groups with similar engineering properties. Each sample was subsequently categorized according to the USCS. Index properties from construction quality control testing are summarized in Table 3.3.

TABLE 3.3 – SUMMARY OF INDEX PROPERTIES

Material	Material Classification	Gradation	Plasticity
Historic Tailings	Multiple classifications	Minus 6” Avg 35.5% passing #200	Majority of samples were non-plastic (75%)
Engineered Fill	Predominantly poorly graded gravel and clayey gravel (GP-GC)	Minus 8” Avg 11.4% passing #200	Avg PI was 11 (medium plasticity)
Low Permeability Soil Layer	Clayey sand (SC)	Minus 2” Avg 29.2% passing #200	Avg PI was 23 (high plasticity)
Friction Layer	Poorly graded gravel (GP)	Minus 0.375” Avg 0.9% passing #200	Non-plastic
Protective Layer	Well-graded to poorly-graded gravel (GW-GP)	Minus 1.5” Avg 5.4% passing #200	Mostly non-plastic (if plastic, sample had low fines content)
Drainage Aggregate	Poorly graded gravel (GP)	Minus 1.5” Avg 1.6% passing #200	Non-plastic
Rock Armor	Well-graded to poorly-graded gravel and clayey gravel (GP-GW-GC)	Minus 8” Avg 8.7% passing #200	Avg PI was 13 (medium plasticity)

3.3.2. Permeability

During construction of the existing VRP TSF, confirmatory flexible wall and rigid wall permeability tests were completed for the historic tailings, LPSL, Protective Layer and Drainage Aggregate. Permeability data from CQA testing is summarized in Table 3.4.

TABLE 3.4 – PERMEABILITY TEST DATA

Material	Lower Bound (cm/sec)	Upper Bound (cm/sec)	Arithmetic Mean (cm/sec)
Historic Tailings	1.0×10^{-7}	1.4×10^{-4}	1.7×10^{-5}
Low Permeability Soil Layer	6.2×10^{-8}	7.2×10^{-7}	3.9×10^{-7}
Protective Layer	5.9×10^{-3}	1.4×10^{-1}	5.3×10^{-2}
Drainage Aggregate	2.2×10^{-2}	1.6×10^{-1}	9.2×10^{-2}

3.3.3. Shear Strength

Shear strength of relevant materials were measured using both the direct shear device and consolidated undrained (CU) triaxial compression tests. Mohr-Coulomb strength parameters developed from the test data are summarized in Table 3.5. Strength parameters were developed from the CU triaxial tests and are summarized in Table 3.6.

TABLE 3.5 – DIRECT SHEAR TEST DATA

Location	Material Type	Sample Type	USCS Group Symbol	Angle of Internal Friction (deg)	Cohesion (psf)
TF-28-R	Historic Tailings	Remolded	SM	37.9	101
EF-17-R (engineered fill sample)	Engineered Fill	Remolded	GC	39.3	1008
EF-39-R (engineered fill sample)	Engineered Fill	Remolded	GC	37.8	1357

TABLE 3.6 – CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST DATA

Location	Material Type	Sample Type	USCS Group Symbol	Friction Angle (deg)	Cohesion (psf)
Combination of TF-002-R / TF-003-R / TF-004-R	Historic Tailings	Remolded	SP/SC	34.6	0
TF-077-R FC-001-C	Historic Tailings / Filter Cake mixture (3 TF :1 FC ratio)	Remolded	SM	37.8	154
TF-1	Historic Tailings	Remolded	SC	33.5	173
TF-2	Historic Tailings	Remolded	CL	33.4	194
TF-1 and FC-1	Historic Tailings / Filter Cake mixture (3 TF :1 FC ratio)	Remolded	SC	35.6	0
TF-2 with FC-1	Historic Tailings / Filter Cake mixture (3 TF :1 FC ratio)	Remolded	CL	37.1	-259
TF-2 with FC-2	Historic Tailings / Filter Cake mixture (3 TF :1 FC ratio)	Remolded	CL	35.3	113
BH-04 @ 44' - 45' depth	Historic Tailings[1]	In situ	CL-ML	36.0	36
BH-08 @ 35' - 37' depth	Historic Tailings[1]	In situ	GM	38.2	8

Notes: [1]Sampled from post-construction geotechnical investigation discussed in Section 3.1.1.

3.3.4. Cyclic Direct Simple Shear

Cyclic direct simple shear (cDSS) and post cyclic direct simple shear (DSS) were completed on the historic tailings placed in the VRP TSF. The goal of the testing program was to evaluate the historic tailings for seismic liquefaction potential considering the placement criteria defined in the Technical Specifications (Appendix E). The following conditions were utilized during the testing program:

- The minimum placement criteria defined in the Technical Specification: 90% relative compaction at +3% OMC as determined by the Standard Proctor.
- A range of ground motions as defined in the Seismic Hazard Assessment for 1:2,475 AEP (active care during operations and closure) and 1:10,000 AEP (passive care at closure) events.
- The sample was deemed to have liquefied ("failure") when excess pore pressure ratio (r_u) exceeded 95%. Cycles to failure were recorded at an excess pore pressure ratio equal to 95%.
- The number of equivalent uniform cycles related to the earthquake magnitude was calculated for both the 2,475-year (N_{eq}=3) and 10,000-year (N_{eq}=5) return period seismic events.
- A cyclic stress ratio (CSR) was calculated based on seismic design parameters and in-situ stress conditions.

- Post cyclic DSS were performed to establish post seismic strength values.

The cDSS and post cyclic DSS test results are summarized in Table 3.7.

TABLE 3.7 – HISTORIC TAILINGS CYCLIC DIRECT SIMPLE SHEAR TEST RESULTS

Test ID (Combined Bulk Synthetic Tailings Sample (2020))	Remolded		Consolidated			Cyclic		Post-Cyclic
	ω_0 (%)	γ_0 (pcf)	σ'_{vc} (psf)	ω_c (%)	γ_c (pcf)	τ_{cy} / σ'_{vc}	N [1]	S_r / σ'_{vc}
TF-002R, TF-003R, TF-004R (90% MDD, +3% OMC)	17.6	106.3	1240	20.8	109.8	0.13	>500 [2]	0.15
TF-002R, TF-003R, TF-004R (90% MDD, +3% OMC)	16.9	105.8	1250	21.5	107.1	0.20	215	0.20

Notes: [1] Number of cycles to achieve liquefaction based on an excess pore water pressure ratio exceeding 0.95.
[2] Cyclic loadings terminated after a 0.76 excess pore water pressure ratio was achieved.

The cDSS testing results indicate the historic tailings are highly resistant to seismic liquefaction when tailings are placed in accordance with the Technical Specifications and when subjected to seismic loading equivalent to the passive care design earthquake (1:10,000 AEP).

3.3.5. Interface Shear Strength

Large-scale direct shear (LSDS) testing was used to evaluate the interface shear strength of select samples placed in intimate contact with the AGRU 60 mil double sided textured HDPE microspike geomembrane under a range of anticipated loads at the site. The following samples were evaluated:

- Soil (LPSL) – Geosynthetic (HDPE geomembrane) interface
  - LPSL was bentonite amended (2% by weight) and a friction layer was applied to the LPSL at the interface between the LPSL and the HDPE vs Agru 60 mil double sided textured HDPE microspike geomembrane. Friction layer is discussed in Section 6.9.
- Geosynthetic (GCL) – Geosynthetic (HDPE geomembrane)
  - Cetco Bentomat DN-9 (15 lb/in peel) GCL vs Agru 60 mil double sided textured HDPE microspike geomembrane.

A 12 inch by 12 inch shear box was used for the test. The LPSL sample was an in-place record sample during construction. The soil was placed in the upper shear box and compacted to 95% relative compaction per ASTM D1557. This level of compaction is consistent with the Technical Specifications for the project. Each shear specimen was loaded under a nominal stress, and then soaked in water for 24 hours. The specimens were then consolidated at normal loads of 5, 10, and 20 kips per square foot (ksf) for 24 hours prior to shearing.

Interpreted peak and residual strength values are shown in Table 3.8. The LPSL/HDPE and LPSL/GCL interfaces were selected for laboratory testing because they are the limiting interfaces for strength within the TSF. Additional geosynthetic interfaces exist within the TSF (e.g., GCL versus the underlying prepared subgrade) but are considered to have greater shear strength.

TABLE 3.8 – INTERFACE SHEAR STRENGTH TEST RESULTS

Sample	Soil	Geomembrane	Peak Strength		Residual Strength	
			ϕ (deg)	C (psf)	$\phi_{Residual}$ (deg)	$C_{Residual}$ (psf)
LPSL-006-R	LPSL with 2% bentonite and friction layer	Agru 60 mil double sided textured microspike HDPE	28	665	21	275
Hydrated Bentomat DN-9 (15 lb/in peel) GCL	NA	Agru 60 mil double sided textured microspike HDPE (dull side against GCL)	21	1045	11	620
Hydrated Bentomat DN-9 (15 lb/in peel) GCL	NA	Agru 60 mil double sided textured microspike HDPE (shiny side against GCL)	20	1340	11	745
Hydrated Bentomat DN-9 (15 lb/in peel) GCL	NA	Agru 60 mil double sided textured microspike HDPE (dull side against GCL)	22	1185	7	1025

Figure 3.2 and Figure 3.3 present the residual interface shear strength test results for the LPSL vs HDPE geomembrane interface and GCL vs HDPE geomembrane interface, respectively. A nonlinear power curve failure envelope is presented for the LPSL vs HDPE geomembrane interface and a pentalinear curve is presented for the GCL vs HDPE geomembrane interface. The green markers represent the residual interface shear test results, and the gray line represents the failure envelope. Please note, test results for both the Agru microspike textured patterns ("shiny" and "dull" sides) were nominally different.

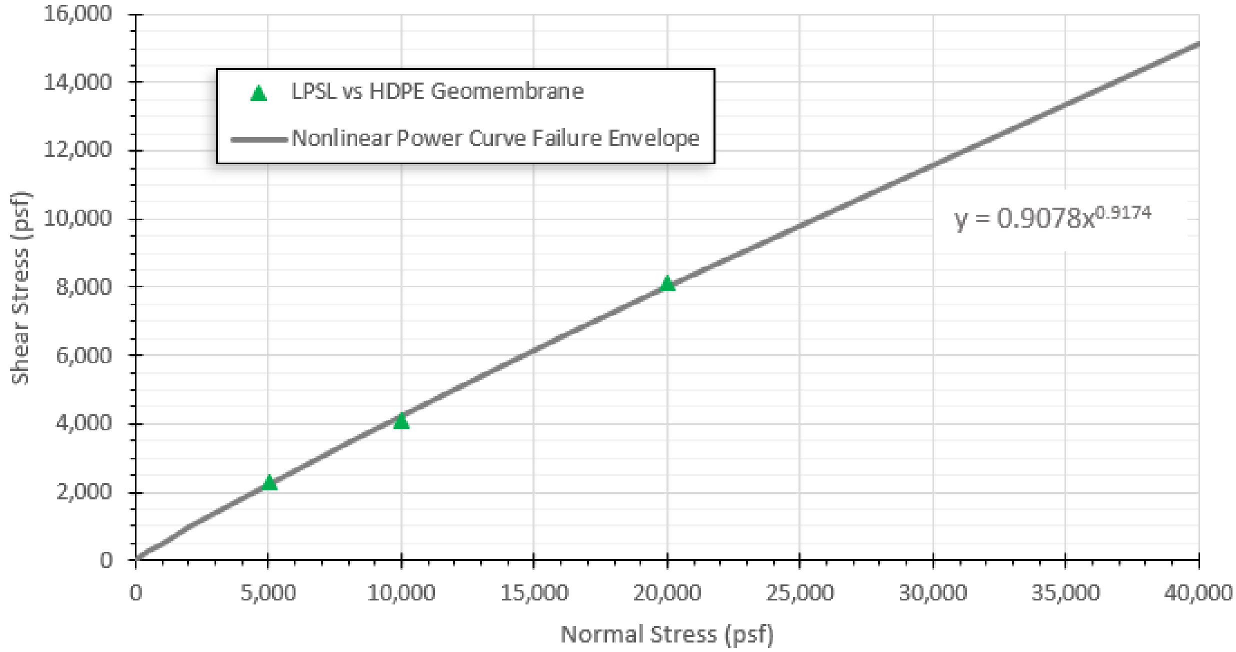


FIGURE 3.2 – RESIDUAL INTERFACE SHEAR STRENGTH RESULTS FOR THE LPSL/HDPE INTERFACE AND NONLINEAR POWER CURVE FAILURE ENVELOPE

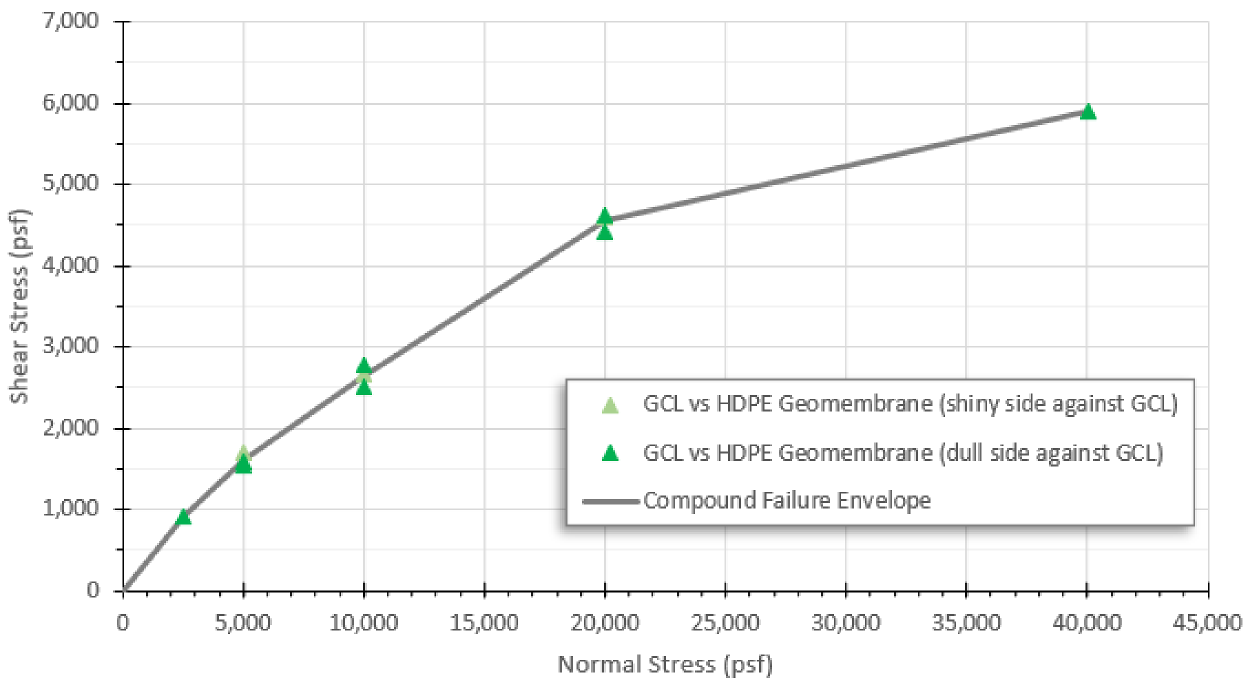


FIGURE 3.3 – RESIDUAL INTERFACE SHEAR STRENGTH RESULTS FOR THE GCL/HDPE INTERFACE AND PENTALINEAR FAILURE ENVELOPE

3.3.6. Liner Integrity Testing

Geomembrane liner integrity tests were performed as part of the CQA testing during the VRP TSF project. The test parameters and results are shown in Table 3.9 and the laboratory data sheets can be referenced in Appendix D.5.4.

TABLE 3.9 – LINER INTEGRITY TEST DATA

Substrate	Geomembrane	Superstrate	Normal Load (ksf)	Duration (hrs)	Result
Bentomat DN-9 (15 lb peel) GCL	Agru 60 mil double sided textured microspike HDPE	Protective layer	16.5, 30, 40	24/load	Pass
Low permeability soil layer	Agru 60 mil double sided textured microspike HDPE	Protective layer	16.5, 30, 40	24/load	Pass

Notes: No geomembrane liner punctures observed after loading.

3.4. Future Filtered Tailings (Synthetic)

Throughout project development synthetic tailings samples (tailings synthesized by grinding ore in the lab) have been provided by South32 for geotechnical characterization. Tailings samples were generated in 2018, 2020 and 2022. Laboratory characterization included index testing, compaction, permeability, consolidation, and strength testing. Based on the measured index data, the synthetic tailings samples are similar (non-plastic, silty sand) with nominal particle distribution differences. It is NewFields' understanding, the 2022 samples are most representative of the future production filtered tailings but there has not been any substantial changes in the process. The 2022 samples are slightly coarser due to an adjustment in the primary grind size and are more representative samples of the ore body. Laboratory test results for synthetic tailings can be referenced in Appendix D.5.2. All samples are referred to as "combined bulk synthetic tailings sample" by year in Section 3.4.1 through Section 3.4.6.

3.4.1. Index Properties

The index properties were evaluated using particle size analyses, Atterberg limits, and specific gravity. The synthetic tailings samples were all silty sands (USCS SM group symbol), 100 percent passing the #4 sieve, between 41.8% and 47.7% passing the #200 sieve (75 µm), P80 equal to approximately 175 µm, non-plastic, and had a specific gravity between 2.9 and 3.0. All synthetic tailings samples (for each year) associated with the various ore types (Concha, Deeps, Epitaph and Scherler) were combined into one bulk sample for subsequent tests. The synthetic tailings index properties are summarized in Table 3.10.

TABLE 3.10 – SYNTHETIC TAILINGS INDEX PROPERTIES

Sample Description	Material Description (Classification)	Percent Passing				Atterberg Limits			Specific Gravity
		#4	#40	#100	#200	PL	LL	PI	
Combined Bulk Synthetic Tailings Sample (2018)[1]	Silty Sand (SM)	100	99.3	73.8	47.4	NP	NP	NP	3.0
Combined Bulk Synthetic Tailings Sample (2018)[1]	Silty Sand (SM)	100	100	74.2	47.7	NP	NP	NP	3.0
Combined Bulk Synthetic Tailings Sample (2020)	Silty Sand (SM)	100	99.8	69.1	45.2	NP	NP	NP	2.9
Combined Bulk Synthetic Tailings Sample (2022)	Silty Sand (SM)	100	99.8	67.7	41.8	NP	NP	NP	2.9
Combined Bulk Synthetic Tailings Sample (2022)	Silty Sand (SM)	100	100	70.0	45.0	NP	NP	NP	2.8

Notes: [1]Samples were combined after index testing.

3.4.2. Compaction Properties

Standard proctor compaction tests were performed on tailings samples to determine the optimum moisture content (OMC) and MDD. Results indicate that the OMC ranges from 10.8% to 14.4% and MDD ranges from 116.1 to 130.9 pounds per cubic foot (pcf). Compaction results are summarized in Table 3.11.

TABLE 3.11 – SYNTHETIC TAILINGS PROCTOR TEST RESULTS

Sample Description	Optimum Moisture Content (%)	Maximum Dry Density (pcf)
Combined Bulk Synthetic Tailings Sample (2018)	11.7	130.9
Combined Bulk Synthetic Tailings Sample (2020)	11.8	125.0
	10.8	127.0
Combined Bulk Synthetic Tailings Sample (2022)	14.4	116.1
Combined Bulk Synthetic Tailings Sample (2022)	13.9	117.3

3.4.3. Permeability Properties

Permeability testing using a flexible wall permeameter were performed. Permeability tests were performed at confining pressures between 2 and 20 ksf and relative compactions between 90% and 95%. Permeability results are presented in Table 3.12 and range from 5.5×10^{-4} to 2.4×10^{-6} centimeters per second (cm/sec). Based on the filtered tailings index properties and placement criteria, the permeability of the in-place compacted tailings should be expected to be in the range of 10^{-6} cm/sec rather than 10^{-4} cm/sec.

TABLE 3.12 – SYNTHETIC TAILINGS FLEX WALL PERMEABILITY TEST RESULTS

Sample Description	Confining Pressure (ksf)	Coefficient of Permeability k (cm/sec)
Combined Bulk Synthetic Tailings Sample (2020)[1]	2 ksf @ 90% MDD	5.5E-04
	20 ksf @ 90% MDD	1.4E-04
	50 ksf @ 90% MDD	6.1E-05
	50 ksf @ 95% MDD	1.8E-05
Combined Bulk Synthetic Tailings Sample (2022)	3 ksf @ 90% MDD	5.3E-06
	6 ksf @ 90% MDD	2.4E-06
	9 ksf @ 90% MDD	3.4E-06

Note: [1] Based on engineering experience and the filtered tailings index properties shown in Table 3.10 (greater than 41.8% passing the #200 sieve), the 2022 permeability test results are most likely representative of the in-place filtered tailings permeability expected during operations. The 2020 permeability test results show a larger coefficient of permeability than what would be expected for this type of material placed as a compacted fill.

3.4.4. Consolidation Test Results

One dimensional consolidation tests were performed on the synthetic tailings samples at 90% and 95% relative compaction as determined by the standard proctor. Consolidation results are presented in Table 3.13.

TABLE 3.13 – SYNTHETIC TAILINGS ONE DIMENSIONAL CONSOLIDATION TEST RESULTS

Sample Description	e_o	Relative Compaction (%)	Compression Index (C_C)
Combined Bulk Synthetic Tailings Sample (2020)	0.580	90%	0.11
	0.585	90%	0.10
	0.495	95%	0.16
	0.497	95%	0.06

3.4.5. Strength Testing

Consolidated drained (CD) and consolidated undrained (CU) triaxial compression testing was performed on the synthetic tailings samples at 90%, 95%, and 98% relative compaction as determined by the standard proctor. Strength parameters were developed from the test data and are summarized in Table 3.14.

TABLE 3.14 – SYNTHETIC TAILINGS TRIAXIAL COMPRESSION TEST RESULTS

Sample Description	Test Description	Friction Angle (deg)	Cohesion (psf)
Combined Bulk Synthetic Tailings Sample (2020)	Consolidated Drained @ 90% MDD	35.7	17
	Consolidated Drained @ 95% MDD	36.8	0
	Consolidated Undrained @ 90% MDD	35.6	98
	Consolidated Undrained @ 95% MDD	37.3	0
	Consolidated Undrained @ 98% MDD	38.7	0
Combined Bulk Synthetic Tailings Sample (2022)	Consolidated Undrained @ 90% MDD (isotropic consolidation)	36.1	72
	Consolidated Undrained @ 90% MDD (anisotropic consolidation)	34.9	387

Figure 3.4 presents the CU triaxial test results for the 2022 combined bulk synthetic tailings sample plotted in stress path space (mean stress vs deviator stress). The critical state friction envelope is also presented. The orange lines represent the isotropically consolidated test results, and the blue lines represent the anisotropically consolidated test results. In general, the filtered tailings initially exhibit contractive behavior at small strains followed by phase transformation to dilative behavior as they strain to critical state. Brittle tailings behavior was not exhibited.

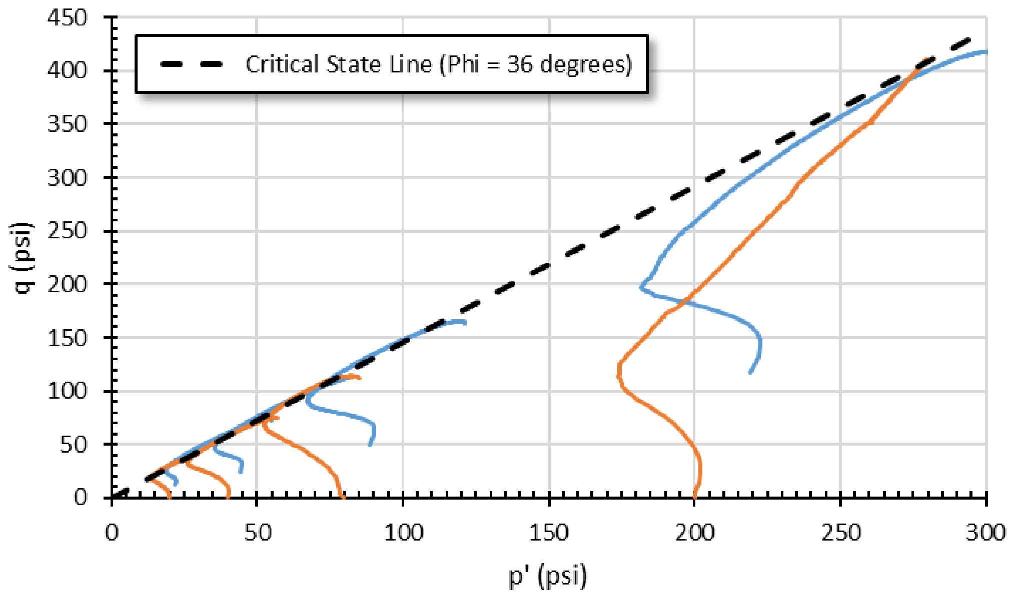


FIGURE 3.4 – CU TRIAXIAL TEST RESULTS PLOTTED IN PQ SPACE

Consolidated drained direct shear tests (ASTM D3080) were conducted and Mohr-Coulomb strength parameters developed from the test data are summarized in Table 3.15.

TABLE 3.15 – SYNTHETIC TAILINGS DIRECT SHEAR TEST RESULTS

Sample Description	Friction Angle (deg)	Cohesion (psf)
Combined Bulk Synthetic Tailings Sample (2018)	38.1	373

Consolidated undrained direct simple shear tests (ASTM D6528) were also completed and test results are summarized in Table 3.16.

TABLE 3.16 – SYNTHETIC TAILINGS DIRECT SIMPLE SHEAR TEST RESULTS

Sample Description	Consolidation Stress (psi)	Undrained Shear Strength (S_u / σ'_{vc})
Combined Bulk Synthetic Tailings Sample (2022) @ 90% MDD and +3% OMC	20	0.34
	80	0.36

3.4.6. Cyclic Direct Simple Shear

Cyclic direct simple shear (cDSS) and post cyclic direct simple shear (DSS) tests were completed on synthetic tailings samples provided by South32. The goal of the testing program was to evaluate the future production filtered tailings for cyclic liquefaction potential considering the placement criteria defined in the Technical Specifications (Appendix E) and site specific seismic criteria (Appendix B). The laboratory testing scope and data interpretation were completed similar to that previously discussed for the historic tailings (Section 3.3.4).

The cDSS and post cyclic DSS test results are summarized in Table 3.17.

TABLE 3.17 – SYNTHETIC TAILINGS CYCLIC DIRECT SIMPLE SHEAR TEST RESULTS

Test ID (Combined Bulk Synthetic Tailings Sample (2020))	Remolded		Consolidated			Cyclic		Post-Cyclic
	ω_0 (%)	γ_0 (pcf)	σ'_{vc} (psf)	ω_c (%)	γ_c (pcf)	τ_{cy} / σ'_{vc}	N [1]	S_r / σ'_{vc}
Combined Bulk Synthetic Tailings Sample from 2020								
1047 (90% MDD, +3% OMC)	13.7	113.3	675	18.9	114.6	0.165	>95 [2]	0.72
1048 (90% MDD, +3% OMC)	13.7	112.5	675	17.6	113.1	0.188	17	0.47
1049 (90% MDD, +3% OMC)	13.4	112.9	675	17.7	113.9	0.210	7	0.46
1050[3] (90% MDD, +3% OMC)	13.5	111.1	3375	17.5	115.0	0.192	7	0.24
1051[3] (85% MDD, +3% OMC)	14.7	108.2	675	19.4	110.0	0.170	9	0.13
1052[3] (95% MDD, +3% OMC)	13.9	119.3	675	15.5	119.5	0.200	11	1.08
Combined Bulk Synthetic Tailings Sample from 2022								
CDSS-1RR (90% MDD, +3% OMC)	16.1	106.3	14.5	18.8	116.2	0.15	17	0.36
CDSS-2RR (90% MDD, +3% OMC)	16.1	106.3	14.5	18.5	112.5	0.18	7	0.27

Notes: [1] Number of cycles to achieve liquefaction based on an excess pore water pressure ratio exceeding 0.95.
[2] Cyclic loadings terminated after a 0.91 excess pore water pressure ratio was achieved.
[3] Performed as a sensitivity analysis by varying consolidation pressure and density.

Figure 3.5 shows the FoS against cyclic liquefaction for in-place filtered tailings compacted to a minimum 90% relative compaction considering both the 1:2,500 and 1:10,000 AEP events for the pore water pressure condition of zero.

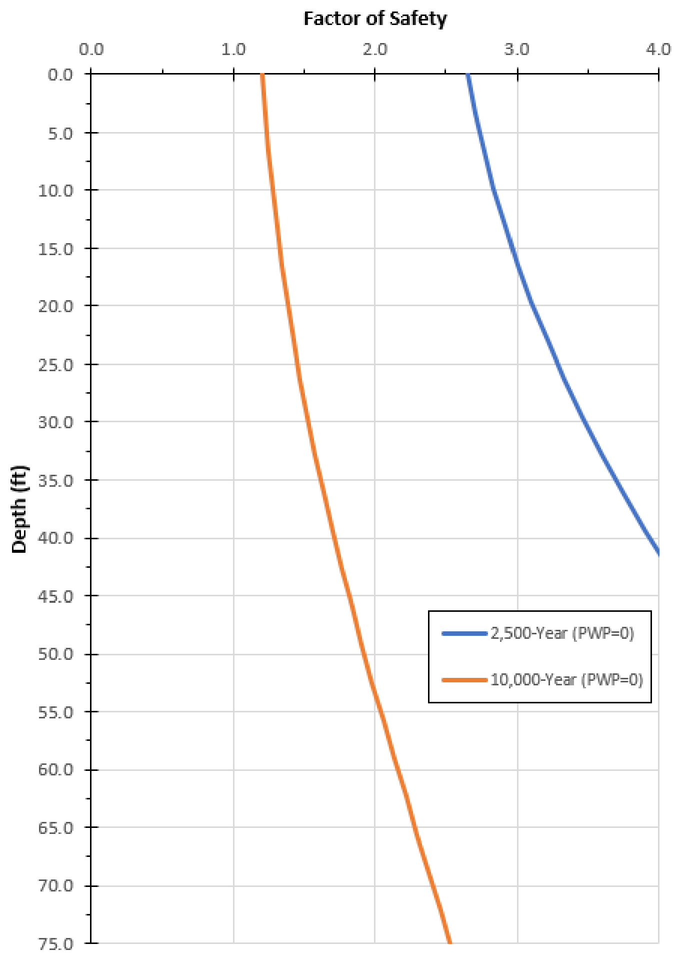


FIGURE 3.5 – FACTOR OF SAFETY AGAINST CYCLIC LIQUEFACTION

Results of the cyclic liquefaction assessment indicated:

- Filtered tailings placed to a minimum of 90 percent relative compaction are highly resistant to cyclic liquefaction considering the design earthquake (1:10,000 AEP).
- Considering the results, the project has elected to be conservative by increasing the minimum relative compaction to 93 percent. The Technical Specifications will incorporate the minimum 93% relative compaction for filtered tailings placement.
- Phreatic conditions within the filtered tailings influence the liquefaction resistance. Analysis uncertainties include the long-term pore water pressure conditions within the facility. Unsaturated materials are generally non-liquefiable but as the materials approach saturation the possibility of liquefaction is present given the necessary loading conditions and material state. If materials are sufficiently saturated to liquefy, the evaluation indicates that increasing phreatic head increases the risk of liquefaction. Hydrostatic loading condition is not expected to occur given the facility does not retain water, the filtered tailings are required to meet

compaction and moisture placement criteria outlined in the Technical Specifications (minimum 93% relative compaction and within 3% of OMC), and the in place filtered tailings are graded to drain to promote stormwater runoff during precipitation events. Without long-term ponding or storage of water within the TSF, there is no long-term ponded water source to develop sufficient driving head, to cause this condition.

Additional detail regarding the cDSS and post cyclic DSS test results as well as the liquefaction analysis can be referenced in Appendix F.

4. TAILINGS STORAGE FACILITY DESIGN STANDARDS

South32 is utilizing the following TSF design standards, regulations, and/or guidelines for the Hermosa Project:

- ADEQ BADCT Guidance Manual (Arizona design standard for TSFs and Process Solution Ponds).
- Arizona Department of Water Resources (ADWR) Dam Safety Regulations (Arizona design regulations for jurisdictional dams). ADWR Dam Safety Regulations apply to the existing UDCP.
- ANCOLD Guidelines on Tailings Dams (Australian design guidelines for TSFs).
- GISTM (Global design guidelines for TSFs).
- South32 Dam Management Standard (South32 requirements within company).

It is important to note, TSF1 requires filtered tailings to be transported to the dry stack, spread in 1 ft (300mm) lifts, manipulated via discing to reduce moisture content, and compacted. Essentially the dry stack is an engineered fill. The BADCT Guidance Manual, ANCOLD Guidelines on Tailings Dams, and GISTM do not specifically address dry stack TSFs and in general are written for traditional slurry facilities. Therefore, the standards, regulations, and/or guidelines in some cases are not pertinent to a dry stack facility. Each guidance manual is discussed below:

4.1. Local Design Standards

4.1.1. ADEQ BADCT Guidance Manual

The following facilities were designed in general accordance with the prescriptive criteria contained within the ADEQ BADCT Guidance Manual and applicable to Tailings Impoundments and Process Solution Ponds. Relevant sections of the BADCT Manual are annotated beside the various design elements.

- Existing TSF (Tailings Impoundments – BADCT Section 2.5)
- Existing UDCP (Process Solution Ponds – BADCT Section 2.3)
- TSF1 (Tailings Impoundments – BADCT Section 2.5)

The prescriptive design criteria defined in the ADEQ BADCT Guidance Manual which were utilized in the TSF and UDCP designs can be referenced in Appendix A. Three deviations exist in the design from the prescriptive design criteria. The first and second deviation is the aggregate size (1.5-inch maximum particle size) in the Protective Layer immediately above the 60 mil double sided textured HDPE geomembrane and the aggregate size (2-inch maximum particle size) in the LPSL immediately below the 60 mil double sided textured HDPE geomembrane. Liner puncture testing was performed on the composite liner system using (bottom to top) the LPSL (or GCL), 60 mil double sided textured HDPE geomembrane, and Protective Layer. The composite system was placed in a load cell, loaded to 30,000 psf (pressure representative of loads expected at full stacking of TSF1), and showed no liner punctures. See Section 3.3.6 for liner integrity testing results. The Protective Layer and LPSL still meet the design intent of the BADCT manual for liner integrity and provide a level of protection equal to the prescriptive BADCT criteria. The third deviation from the prescriptive guidance is the pipe spacing within the Protective Layer was increased from 20 to 90 foot spacing. The 4-inch diameter pipe utilized in the TSF1 design is greater than the minimum 3-inch diameter specified in the BADCT Manual and the 4-inch diameter pipe at 90 foot spacing satisfies the design intent of the BADCT Manual for minimizing hydraulic head over the liner system. Therefore, this element provides an equal level of protection to the prescriptive BADCT criterion for this element. See Section 5.5.4 for underdrain collection system (piping) details.

4.1.2. ADWR Dam Safety

The existing UDCP according to the Arizona Administrative Code (AAC), Title 12 Natural Resources, Chapter 15 Department of Water Resources is a jurisdiction Dam. The existing UDCP was permitted through the Arizona Department of Water Resources (ADWR) Dam Safety and complies with all relevant ADWR requirements.

ADWR classifies dams by size and downstream hazard potential. Size classification is determined by either the storage capacity of the facility or height of the embankment. Hazard potential is determined by evaluating the consequences associated with the release of water from the dam, either by failure or improper operation. The existing UDCP is classified as an intermediate dam with a low hazard potential under ADWR criteria. The Intermediate size classification is based on the height (~56.5 ft) of the dam which falls in the bracketed height range intermediate dam of between 40 to 100ft. The prescriptive design criteria outlined by ADWR for the UDCP can be referenced in Appendix A.

Please note, the ADWR Dam Safety program does not regulate TSFs in the state of Arizona.

4.2. International Design Standards

The TSF design also meets international design standards, regulations, and/or guidelines which are in some cases more stringent than ADEQ BADCT and/or ADWR Dam Safety criteria. As a responsible operator, South32 is committed to complying with ANCOLD, GISTM, and its own internal Dam Management Standard.

4.2.1. ANCOLD Guidelines

The design criteria outlined in the ANCOLD Guidelines on Tailings Dams consistent with a dam failure and environmental spill consequence category of "High C" were utilized in the TSF and UDCP designs and can be referenced in Appendix A.

4.2.2. GISTM Guidelines

The design criteria outlined in GISTM consistent with a consequence category of "Significant" were utilized in the TSF and UDCP designs and can be referenced in Appendix A.

4.2.3. GISTM Roles

South32 has also appointed roles for the Hermosa Project consistent with GISTM. The Hermosa Project utilizes a team consisting of a Board of Directors (BoD), Accountable Executive (AE), Responsible Tailings Facility Engineer (RTFE), Engineer of Record (EoR), and Independent Reviewer (IR). Each role has defined and documented responsibilities and are described below:

- **Board of Directors (BoD):** Entity with the final decision-making authority and holds the authority to set policies, objectives, and overall direction and oversee the executives.
- **Accountable Executive (AE)**: Directly answerable to the CEO, communicates with the BoD, and who is accountable for the safety of tailings facilities and for minimizing the social and environmental consequences of a potential tailings facility failure.
- **Responsible Tailings Facility Engineer (RTFE)**: An engineer appointed to be responsible for the tailings facility. The RTFE has clearly defined, delegated responsibility for management of the tailings facility and has appropriate qualifications and experience compatible with the level of complexity of the tailings facility.
- **Engineer of Record (EoR)**: The qualified engineering firm responsible for confirming that the tailings facility is designed, constructed, and decommissioned with appropriate concern for integrity of the facility, and that it aligns with and meets applicable regulations, statutes, guidelines, codes, and standards.
- **Independent Reviewer**: Independent, objective, expert commentary, advice, and, potentially, recommendations to assist in identifying, understanding, and managing risks associated with tailings facilities.

4.3. Design Standard Comparisons

TABLE 4.1: TSF DESIGN CRITERIA SUMMARY

Design Criteria	BADCT (ADEQ APP/ADWR)	ANCOLD (High C)	GISTM (Significant)
Wet Season Storage Allowance	Water Balance	Water Balance	-
Extreme Storm Storage	100-yr/24-hr	Risk assessment or 100-yr/72-hr (fall back method)	-
Contingency Freeboard	2 ft	0.5 m	-
Design Flood for Spillway	TSF - None UDCP - 1/4PMF (ADWR Dam Safety)	PMF	1,000-yr (active) 10,000-yr (passive)
Design Earthquake Loading	450-yr	2,000-yr (active) 10,000-yr (passive)	1,000-yr (active) 10,000-yr (passive)
Static FOS	1.3	-	-
Pseudostatic FOS	1.0	-	-
FOS (short term drained)	-	1.5	-
FOS (short term drained) Potential loss of containment	-	1.5	-
FOS (short term undrained) No potential loss of containment	-	1.3	-
FOS (post seismic)	-	1.0 - 1.2	-

5. TSF DESIGN

TSF1 is designed as a lined permanent storage area for PAG waste rock and filtered tailings from future mining production. TSF1 is located within the Trench Camp property as a proposed lateral and vertical expansion of the existing VRP TSF footprint. The lateral expansion is primarily to the east, but smaller lateral expansion is also planned on the north, west, and south side of the existing VRP TSF. All the materials placed within the TSF will be placed and compacted similar to a standard earthen engineered fill placement operation. Placement of filtered tailings under strict compaction requirements is of paramount importance to the long-term stability of the dry stack TSF and to the storage capacity cited in this design.

TSF1 is designed with a perimeter berm surrounding an internal geomembrane lined basin. The first element of construction will be to grade the perimeter road, which will generally have upstream (internal) slopes of 2.5H:1V (horizontal:vertical) and downstream slopes of 2.0H:1V in fill conditions and 1.5H:1V in cut conditions. At the margins of the facility the TSF basin is created from the interior slope of the perimeter berm. The area inside of the perimeter road crest is referred to as the basin and designed with a composite liner system consisting of either an LPSL or GCL overlain by a 60 mil double sided textured HDPE geomembrane. To protect the geomembrane, reduce head/hydraulic gradient on the liner and to facilitate long-term drainage of the dry stack, a granular Protective Layer is designed over the liner and augmented by a dendritic CPe pipe network placed in topographic lows. The pipe network for TSF1 will tie into the existing TSF pipe network, which will convey any underflow to the existing UDCP. Water collected in the UDCP will be pumped to WTP1 and/or WTP2 for treatment.

5.1. TSF Sizing

During operations South32 will generate the following materials:

- Waste Rock (PAG and non-PAG) from underground exploration and possible future mine development. Please note, “waste rock” and “development rock” are considered equivalent nomenclature in this report.
- Tailings which will be de-watered at the Filter Plant.
- Miscellaneous materials include solids from water treatment including filter cake from WTP1 and WTP2, core cutting material, construction PAG cut, drill cuttings, sediments from stormwater BMPs, assay rejects, and sediments from vehicle and equipment wash sumps.

Waste rock generated from mine development will be classified as PAG or non-PAG. PAG waste rock brought to ground surface will be directed to the TSF for permanent placement:

- Initial PAG waste rock generated from development of the main shaft and ventilation shaft as well as potential future mine development will be placed within the TSF1 geomembrane lined footprint on the northern side of the stacking. The PAG waste rock will act as a rock buttress on the downstream side of the stacking limits. The initial placement geometry of the PAG waste rock is presented in plan view and section on Drawing A305 and Drawing A307, respectively. The initial PAG waste rock placement will occur prior to filtered tailings production.

- PAG waste rock generated during potential future production will be placed in TSF1.

Non-PAG waste rock brought to ground surface will be directed to TSF1, the non-PAG waste rock stockpiles, or utilized as construction material.

Tailings generated from the mineral recovery process will be directed to the Filter Plant. After filtration, filtered tailings will be used as cemented paste backfill or stored on the surface in TSF1. Miscellaneous materials will also be hauled and placed in TSF1 as a co-mingled material with filtered tailings or waste rock.

The expansion of TSF1 will provide an additional approximately 5.4 Mcy of total storage capacity beyond that provided by the currently permitted design (i.e., the Amended Design approved by ADEQ in 2021). Table 5.1 shows the quantities for the various materials to be placed within TSF1 (estimated by South32).

TABLE 5.1: MATERIAL QUANTITIES REQUIRING SURFACE STORAGE

Description	Approximate Tonnage (Mst)	Approximate Volume (Mcy)
Filtered tailings placed in TSF1	7.70	5.29
Waste Rock placed in dry stack TSF (PAG)	1.81	1.10
Construction PAG Rock Cut	0.03	0.02
Miscellaneous Materials placed in dry stack TSF	0.15	0.10
Contingency	0.57	0.39
Material to be stored in the TSF1	***10.3***	***6.9***

The volume of filtered tailings and waste rock placed in the facilities was calculated using dry densities of 108 and 125 pcf, respectively. The dry densities were determined as follows:

- 93% of the MDD as determined by the Standard Proctor (ASTM D698)
  - 93% is the minimum acceptable relative compaction defined in the Technical Specifications for placement of filtered tailings and waste rock in the TSF.
  - Laboratory results show a lower bound MDD of 116.1 pcf (see Section 3.4.2), which equates to 108 pcf at 93% relative compaction.

- The waste rock from mine development was estimated at an average in-place density of 125 pcf based on NewFields experience with similar materials on the VRP Project and other mining projects.

Using the densities listed above, the storage capacity of TSF1 are shown in Table 5.2.

TABLE 5.2: FACILITIES STORAGE CAPACITY

TSF Description	Incremental Storage Capacity (Mcy)	Cumulative Storage Capacity (Mcy)
Existing VRP TSF[1]	1.1	1.1
TSF-AD	1.5	2.6
TSF1	5.4	8.0

Note: [1] Material placement (historic tailings and waste rock) was completed as part of the VRP Project.

For additional information regarding filtered tailings, waste rock or miscellaneous material storage refer to the Design Criteria in Appendix A.

5.2. Primary Design Components

Design of TSF1 consists of the following elements:

- TSF Perimeter Road (forms embankment for West and East Internal Detention Ponds)
  - Foundation preparation and removal of low strength and/or deleterious material.
  - Constructed from cut/fill operations with upstream (internal) slopes of 2.5H:1V and downstream (external) slopes of 2.0H:1V in fill conditions / 1.5H:1V in cut conditions.
  - Composite lining system on upstream embankment slope consisting of 60 mil double sided textured HDPE geomembrane overlying either 12 inches of LPSL or GCL. See Drawing A220 for lining system plan view.
  - One-way light vehicle access road with 1.5 ft high safety berms, 16 ft travel width, 6 inches of wearing course, and stormwater diversion channels as required.
  - Haul road with 3 ft high safety berms, 38.5 ft travel width, 6 inches of wearing course, and stormwater diversion channels as required.
- Basin
  - Foundation preparation and removal of low strength and/or deleterious material.
  - Constructed from cut/fill operations and graded for geomembrane placement.
  - Composite lining system consisting of 60 mil double sided textured HDPE geomembrane overlying either 12 inches of LPSL or GCL. See Drawing A220 for lining system plan view.
  - 18 inches of Protective Layer material overlying the geomembrane liner.

  - Underdrain system consisting of CPe pipe collectors in topographic lows and a dendritic system of 4-inch diameter collector CPe pipe peripheral to the primary collectors. See Drawing A230 for underdrain system plan view.
- Filtered Tailings Stack
  - 3.0H:1V compound slope comprised of 25 ft high 2.5H:1V open slopes in combination with 12.5 ft benches to be placed at 25 ft vertical intervals.
  - Internal stormwater diversion channel to pass peak flows from the design storm (see Section 9).
  - Rock armored tailings slopes to minimize water and wind erosion of the dry stack TSF.
- Instrumentation
  - Vibrating wire piezometers will be used to monitor the performance of TSF1. Vibrating wire piezometers will be placed on the geomembrane surface to measure hydraulic head on the liner system. Additional vibrating wire piezometers will be installed during filtered tailings placement to monitor phreatic conditions within the stack.
- The external stormwater diversion channels, underdrain outlet pipework (concrete encasement), the UDCP and its pumping system for TSF1 were designed and constructed as part of the VRP project.

5.3. Site Preparation

Prior to construction activities, growth media will be removed and stockpiled in an approved Growth Media Storage Area for use during future reclamation activities. See Drawing A100 for the Growth Media Storage Area location. The growth media stockpile will be placed at an approximate 3H:1V slope and revegetated. Best management practices (BMPs) will be employed to minimize erosion and sediment transport such as control of surface runoff and installation of silt fencing around the downstream perimeter toe. After removing growth media, the basins will be graded to reduce slopes for liner system placement, generate borrow materials and promote flow to the basin low point.

5.4. TSF Perimeter Road (Embankment)

The TSF is circumscribed by an elevated perimeter road which is used to provide light vehicle and haul road access, passive slope stability resistance, as well as contact water containment (contact water is considered any water which comes in contact with TSF materials). The perimeter road was designed considering the following parameters:

TSF1 Perimeter Road (forms embankment for West and East Internal Detention Ponds):

- 2.5H:1V upstream (internal) side slopes.

- 2.0H:1V downstream (external) side slopes in fill (2.5H:1V if over 30 vertical feet).
- 1.5H:1V downstream (external) side slopes in cut.
- Light Vehicle Road (2 way) / Haul Road: 45 ft width measured from internal to external edge of road:
  - 36 ft driving width with 6 inches of wearing course.
  - (2) 3 ft high safety berms.
  - 10 percent maximum grade.
- Light Vehicle Road (1 way): 25 ft width measured from internal to external edge of road:
  - 16 ft driving width with 6 inches of wearing course.
  - (2) 1.5 ft high safety berms.
  - 15 percent maximum grade.
- Existing Light Vehicle Road Raise (1 way) at TSF1 Emergency Spillway: 18 ft width measured from internal to external edge of road:
  - 12 ft driving width with 6 inches of wearing course.
  - (2) approximately 3 ft high jersey barriers.

  Stormwater diversion channel along the external perimeter of the TSF to capture and convey non-contact meteoric water around the TSF.

The perimeter road subgrade will be prepared prior to construction by clearing, grubbing and removal of unsuitable materials encountered, including organics, low strength materials and soils that have high a propensity for consolidation under load. Once the foundation is stripped of vegetation, growth media and other deleterious materials, the exposed soil will be scarified, moisture conditioned if necessary and compacted to form a firm and unyielding surface in preparation for fill placement. The subgrade will be compacted to a minimum depth of eight inches to 95 percent MDD in accordance with ASTM D1557 (modified proctor) exceeding the prescriptive BADCT 2.5.2.3. Upon completion of the perimeter road subgrade, perimeter road fill placement will occur to the grades, elevations and geometry shown in the Design Drawings. The interior face of the perimeter road will utilize a composite liner system consisting of 12 inches of LPSL overlain by a 60 mil double sided textured HDPE geomembrane (BADCT 2.5.2.4). The LPSL portion of the composite liner has a GCL alternative option in areas defined by the engineer (see Drawing A220). The composite liner system is described in greater detail in Section 5.5.2.

Detailed requirements regarding the perimeter road subgrade preparation and fill placement are presented in the Technical Specifications (Appendix E). The profile of the TSF1 perimeter road can be referenced on Drawings A240 and A242 and typical TSF perimeter road sections can be referenced on Drawing A260.

For TSF1, the TSF Perimeter Road forms the East and West Internal Detention Pond areas (see Drawing A400) located within the geomembrane lined footprint at the toe of the stacking in lowest elevation areas. During normal operations, precipitation and any resulting stormwater runoff infiltrates into the armoring berms and Protective Layer material prior to reaching the East or West Internal Detention Pond areas. Stormwater runoff will only collect in these areas during extreme storm events (i.e., PMP) for a short period of time. Stormwater runoff reporting to the East and West Internal Detention Pond areas is conveyed to the UDCP via two Detention Pond outfall pipes (two 24-inch diameter CPe pipes) located at the base of each internal detention pond area.

5.4.1. TSF1 Emergency Spillway

To reduce risk of failure of the TSF Perimeter Road (embankment), South32 has elected to construct a retrofit emergency spillway on the TSF Perimeter Road (embankment) at the West Internal Detention Pond. The emergency spillway has been sized to safely pass the routed PMF and provide light vehicle access cross the control section. The TSF1 Emergency Spillway consists of the following:

- Reinforced concrete control section on the TSF Perimeter Road (light vehicle access point).
  - 6 inches thick reinforced concrete with cutoffs at spillway entrance and exit.
  - 10H:1V slide slopes (10%).
  - 3.5 ft deep (crest to invert), 40 ft width at spillway invert, and 110 ft width at spillway crest.
- Transition to concrete infilled Geocell anchored on the downstream TSF Perimeter Road slope.
  - Concrete infilled GEOWEB (or equivalent) with anchoring system.
- Reinforced concrete stilling basin at the base of the emergency Spillway
  - 12-inch-thick reinforced concrete
  - 7.75 ft deep, 17 ft long, and 40 ft wide
- TSF Perimeter Road (embankment) raise
  - 2 ft vertical raise using Engineered Fill
  - 1.5H:1V composite lined upstream slope (60 mil double sided textured HDPE geomembrane overlying GCL) and 2H:1V downstream slope
  - 12 ft driving width with 6 inches of wearing course.
  - (2) approximately 3 ft high jersey barriers.

Information regarding the TSF1 Emergency Spillway and the TSF Perimeter Road (embankment) raise can be referenced on Drawing A270 (plan view) and Drawings A272 through A274 (sections and details).

5.5. Basin

Prior to placement of the liner system, the basin area will be cleared of any vegetation and stripped of any existing growth media. Growth media will be hauled to dedicated storage areas shown in the Design Drawings for use during future reclamation.

In general, the existing topography within the TSF1 footprint provides drainage to the underdrain collection outlet points, however, some grading will be required to address localized drainage issues to ensure that positive drainage exists in all areas within the TSF1 basin. Additionally, localized slopes steeper than a 2.5H:1V will be flattened or reduced to provide an acceptable slope for geomembrane installation. After the basin is graded, a 12-inch thick layer of LPSL material or GCL will be placed on the subgrade. A 60 mil double sided textured HDPE geomembrane will be placed over the LPSL or GCL. See Drawing A220 for geomembrane, LPSL and GCL placement areas.

The basin areas for the existing TSF and proposed TSF1 are as follows (measured by geomembrane lined area):

- Existing VRP TSF: 1,261,600 sf
- TSF1: 1,198,400 sf
- Total: 2,460,000 sf

Typical details of the basin composition can be referenced on Drawing A264, and detailed descriptions of the basin components are discussed in the following subsections.

5.5.1. Grading Plan and Geomembrane Surface Preparation

The basin will be rough graded to maximum slopes of 2.5H:1V and upon completion, the surface will be smoothed and compacted with finish rolling using a smooth drum compactor. This will create an acceptable surface for placement of the liner system and will also serve to bed any larger stones into the subgrade, preventing any unbedded sharp protrusions which might translate through the LPSL or GCL and result in liner distress. Compacted subgrade shall be prepared in accordance with requirements outlined in the Technical Specifications (Appendix E) prior to LPSL or GCL placement.

5.5.2. Liner System

The basin liner system will consist of a composite liner, containing either an LPSL or GCL base overlain by a geomembrane (60 mil double sided textured HDPE). The soil component, 12 inches of LPSL, will have a coefficient of permeability (k_v) that is less than or equal to 1.0×10^{-6} cm/sec. The LPSL will be placed, moisture conditioned and compacted to produce a smooth, unyielding surface prior to geomembrane deployment. If required, a friction layer or frictional component will be used to enhance interface strength of the composite liner system where LPSL is used. Friction layer, consisting of ⅛ to ¼ inch nominally sized sand and gravel, will be spread across the LPSL surface using a radial broadcaster. The very thin layer of sand and gravel will be static smooth drum rolled (not vibratory compacted) into the surface of the LPSL layer to create small asperities in the LPSL top surface. Loose material that is not embedded in the LPSL will be removed from the LPSL surface using an air lance of other similar method. The small asperities created on the top surface of the LPSL will enhance the interface friction value at the contact between the geomembrane and LPSL. A GCL (Cetco Bentomat DN9 or similar) is considered an acceptable alternative to the 12-inch LPSL in designated areas of the TSF basin, see Section 6.11.3 for detailed GCL information, but geotechnical considerations prevent its use throughout the entire facility. LPSL and GCL limits can be referenced on Drawing A220. It should be noted that residual strength values for this interface were selected to model slope stability analysis due to the high probability of movement along this interface during operations. The residual interface strength values defines where GCL can be placed with the TSF footprint.

The geomembrane liner component will overlie the LPSL/GCL component of the composite liner system and will consist of a 60 mil double sided textured HDPE geomembrane (see Section 6.11.1 for detailed geomembrane information). The geomembrane will be anchored on the edge of the perimeter road at a setback of 3 ft from the upstream hinge point of the perimeter berm crest. The anchor trench will be continuous with dimensions 3 ft deep by 2 ft wide. The geomembrane limit is presented on Drawing A220, and the geomembrane sections and details are presented on Drawing A264.

Based on laboratory data the seepage fluid from the existing tailings, production filtered tailings and PAG waste rock will be somewhat variable. The majority of contact fluid will have near neutral pH and moderate levels of total dissolved solids dominated by calcium sulfate salts. Water contacting PAG waste rock will be slightly acidic and far below the acidity threshold that is tolerated by the geomembrane. See Appendix E.2 for information specific to polyethylene geomembrane chemical resistance.

Leakage flow rates were estimated using a common solution for flow through geomembrane defects (Giroud et al., 1997). Using the inputs in Table 5.3, the leakage flow rates for TSF1 and total TSF area were calculated. For further details, see the leakage rate calculation presented in Appendix G.1.

Please note, the TSF leakage rate calculation conservatively assumes a constant head of 1.5 ft on the composite liner system (to date the piezometers placed on top of the geomembrane are showing zero head). Due to the nature of the facility's design, a constant head will not be maintained on the composite liner system. Given the filtered tailings will be placed as a compacted earthen material, at water contents near optimum moisture content, minimal underdrainage solution is expected at the base of the dry stack tailings material. The Protective Layer (see Section 5.5.3) and underdrain collection system (see Section 5.5.4) will collect and convey any fluids reporting to the drainage system through the tailings mass (as a function of tailings mass consolidation and infiltration) to keep the hydraulic gradient on the liner to a minimum. Observed flow rates (on the order of 1 gpm during the dry season) and piezometer measurements (on the geomembrane liner) from the VRP TSF confirm 1.5 ft of constant head is a conservative assumption.

TABLE 5.3 – ESTIMATED TSF LEAKAGE FLOW RATE

Description	TSF1 (LPSL)	TSF1 (GCL)	Total TSF (LPSL)	Total TSF (GCL)
Number of Defects	4 per acre	4 per acre	4 per acre	4 per acre
Contact Quality Factor	0.21	0.21	0.21	0.21
Area of Circular Defect	1.08E-3 ft^2 (1 cm^2)	1.08E-3 ft^2 (1 cm^2)	1.08E-3 ft^2 (1 cm^2)	1.08E-3 ft^2 (1 cm^2)
Hydraulic Head Above Geomembrane	1.5 ft	1.5 ft	1.5 ft	1.5 ft
Area of Geomembrane	937,400 ft^2	261,000 ft^2	1,619,700 ft^2	840,300 ft^2
Permeability of Underlying Soil Layer	3.28E-8 ft/s (1.0E-6 cm/s)	1.64E-10 ft/s (5.0E-9 cm/s)	3.28E-8 ft/s (1.0E-6 cm/s)	1.64E-10 ft/s (5.0E-9 cm/s)
Thickness of Underlying Soil Layer	1 foot	0.25 inch	1 foot	0.25 inch
Leakage Rate	0.0777 gpm	0.0025 gpm	0.1343 gpm	0.0085 gpm
Total Leakage Rate (LPSL + GCL)	**0.0802 gpm**		**0.1428 gpm**	

Note: The estimated seepage rates through the composite liner system, shown above, conservatively assume a constant head on the geomembrane of 1.5 ft.

5.5.3. Protective Layer

The composite liner system with an overlying Protective Layer component is designed to control seepage through the base of the TSF. It is commonly employed in the mining industry and has been proven to be effective for environmental control of contact fluids. An 18 inch thick Protective Layer zone composed of 1½ inch minus granular material will be placed over the geomembrane. The Protective Layer will serve to prevent damage to the geomembrane during waste rock and filtered tailings placement and to act as a drainage layer to reduce head or hydraulic gradient on the geomembrane by collecting and transmitting drainage from the tailings mass to the underdrain collection system. Typical TSF1 Protective Layer sections and details are presented on Drawing A264.

One deviation from prescriptive BADCT standards is the aggregate size (1.5-inch maximum particle size) in the Protective Layer immediately above 60 mil double sided textured HDPE geomembrane. Liner puncture testing was performed on the composite liner system showing no geomembrane liner punctures at the loads expected from the tailings and waste rock mass above the liner. See Section 3.3.6 for liner puncture testing results.

5.5.4. Underdrain Collection System

The underdrain collection system, consisting of a series of pipes located in topographic lows, will collect drainage from the base of the facility and convey flow to the external UDCP via concrete encased underdrain outlet pipes. The underdrain pipe system will be used to augment the performance of the Protective Layer and reduce hydraulic head over the liner. The underdrain collection pipes are perforated CPe pipe surrounded by Drainage Aggregate with the Drainage Aggregate wrapped in non-woven needle punched geotextile. The underdrain system is designed to enhance drainage and flow transference from beneath the stacking. In addition, the geotextile wrap will minimize migration of fines into the Drainage Aggregate from the Protective Layer and therefore pipes. It is NewFields' opinion that the seepage velocities are quite low at the tailings mass/protective layer interface, given flux at this interface is on the order of 1 gpm (over an existing area of 1,261,600 ft^2). Considering the low seepage velocity, the potential for fines migration from the tailings mass into the protective layer is also quite low.

The underdrain collection system is designed with 4 inch diameter perforated CPe piping spaced at 90 ft on center in a "herring bone" pattern. The 4 inch diameter CPe pipe collectors connect with primary collectors consisting of 8 inch and 24 inch diameter perforated CPe pipes located in the topographic lows within the TSF basin. The piping is designed to limit hydraulic head on the liner to an average and maximum head less than the values specified in the BADCT (2.5.2.4). Refer to Appendix G.2 for pipe spacing design calculations. Underdrain collection pipe alignments and pipe sizes are presented on Drawing A230, and sections and details are presented on Drawing A264.

Given the tailings will be placed as a compacted earthen material, at water contents near optimum moisture content, minimal underdrainage solution is expected at the base of the dry stack tailings material. The well-compacted tailings material placed near optimum moisture content will produce hydraulic conductivities near 1×10^{-6} cm/sec. Some fluids may be generated at the base of the facility from consolidation and associated drainage of the tailings over time, but the head and hydraulic gradient on the liner is expected to be minimal. This has proven to be true for the VRP TSF, where observed flow rates from the underdrain outlet pipes are less than 1 gpm after periods of no precipitation.

The underdrain collection system was designed considering the following:

- Collect underdrainage from the tailings due to consolidation.
- Decrease the overall hydraulic head on the geomembrane liner (BADCT prescribed average and maximum limits) to reduce the propensity for seepage through the liner system.
- Allow for long-term drainage of the tailings mass through the closure period.
- Maintain the hydraulic gradient on the composite liner system at or below unity.

The proposed TSF1 underdrain collection system will tie into the existing system at designated locations as shown on Drawing A230.

5.5.4.1. Pipe Integrity

The TSF is designed to be compliant with prescriptive BADCT guidelines which recommend corrugated, perforated HDPE pipe (of 3-inch or larger diameter) and a protective/drainage layer designed to convey flow for removal by gravity so that the average and maximum hydraulic head over the geomembrane liner is less than two and five feet, respectively. The Association of State Highway and Transportation Officials (AASHTO) recommends maximum allowable long-term strain of 5 percent for corrugated HDPE pipes in buried applications (AASHTO, 2007). This guidance was developed for roadway design and is not feasible or applicable to deep burial applications of corrugated HDPE pipe in high stress mining applications.

Recommendations from Lupo (2010) and Smith et al. (2005) suggest dual-wall CPe pipe is suitable for deep burial applications which exceed the maximum burial depth proposed for TSF1. Lupo (2010) discusses that geopipes have been found to remain open with ring deflections up to 20% but result in a loss of flow carrying capacity. Similarly, Smith et al. (2005) suggests buckling occurs (i.e., catastrophic failure of geopipe) with ring deflections between 25% and 35%.

The Burns-Richard (1964) solution was utilized to estimate ring deflections for the underdrain collection system pipes (4, 8, 12, and 24 inch diameters) utilizing the maximum burial depth and backfill materials. Pipe parameter inputs utilized in the calculations were developed from ADS (2009) and AASHTO (2007) guidance. Soil and load parameters were developed based on engineering judgement and experience with similar materials. All calculation inputs and results can be referenced in Appendix G.3. The following soil and load parameters were used for all pipe diameters evaluated:

- Modulus of soil reaction at 5' cover = 700 psi
- Poisson's ratio = 0.30
- Unit weight of soil = 125 pcf
- Height of fill above crown = 243 ft

Utilizing Burns-Richard (1964) the underdrain collection pipes are estimated to have ring deflections ranging from approximately 12.7% to 13.7% at a maximum burial depth of 243 ft. The pipe deflection will result in an approximate cross sectional area loss of 4.1% to 6.0%.

The piping (corrugated, dual wall, perforated N-12 HDPE) utilized in the underdrain collection system for the TSF is estimated to experience less than 20% ring deflection at maximum burial depth. Based on general industry guidance, the piping will retain structural integrity but will lose cross-sectional area and therefore flow carry capacity. As stated previously, the tailings are placed as a compacted earthen material, at water contents near optimum moisture content, where minimal underdrainage solution is expected at the base of the dry stack tailings mass. Since the design concept is predicated on underdrain collection pipe flowing only partial flow (no more than 50%), the estimated loss in pipe flow carrying capacity is not an issue.

5.5.5. TSF Basin Underdrain Outlet

The underdrain outlet for TSF1 was constructed as part of the existing TSF and will not require any modifications as part of the TSF expansion. At the underdrain inlet (upstream toe of the embankment/perimeter road), the perforated underdrain collection pipes transition to solid reinforced concrete encased HDPE pipe. The geomembrane at the upstream embankment face was attached to the concrete encasement by heat fusing the geomembrane to an HDPE embedment placed in the concrete pipe encasement. The concrete encased outlet pipe is routed under the embankment/perimeter road where it outlets into the existing UDCP. At the concrete encased HDPE pipe outlet, valves were installed to control flow to the UDCP in the event the pond required repairs.

It is important to note that the valves placed at the outlet must remain open during normal operations. Locks are currently in place on the TSF outfall pipes on the crest of the UDCP and the locks restrict the valves from being closed during normal operations. These locks can only be removed to close the valves, under emergency conditions such as repair of the UDCP liner system after approval of the General Manager of Operations, RTFE and the EOR. Shutting the valves for a prolonged period has the potential to create an elevated phreatic surface in the TSF which could compromise the stability of the dry stack. The operator should take care and adequate precautions when scheduling and completing any required maintenance of the underdrain system or UDCP where the valves are required to be shut.

To the greatest extent possible, the valves should only be closed for maintenance in the UDCP during dry periods of the year with a favorable meteoric forecast. The operator should also have temporary pumps available to manage water that may collect within the TSF basin during periods of planned maintenance within the UDCP. Pumped flows from the TSF basin, during periods of planned maintenance in the UDCP, will have to be directed to WTP1 for treatment.

5.6. Existing Underdrain Collection Pond

The UDCP was constructed downstream of the TSF during the VRP Project. Specific information about the UDCP design can be referenced in Section 5.6 of the APP BADCT Design Report (NewFields, 2017b) and information about the Underdrain Collection Pond construction can be referenced in the TSF Interim ROC Report (NewFields, 2020a). Summary information regarding the UDCP can be referenced in Table 5.4.

TABLE 5.4 – EXISTING UDCP DETAILS

	Description
Purpose/Contents	Storage of precipitation runoff/draindown from the TSF prior to pumping to water treatment.
Location	Located directly downstream and external to the TSF.
Type	Earthfill with composite liner system on upstream face and in the basin. The pond liner system consists of a geonet sited between two 60 mil double sided textured HDPE geomembranes overlying a GCL.
Maximum Embankment Height	56.5 ft (crest to downstream toe). Constructed from Engineered Fill.
Embankment Length	552 ft (crest length constructed as Engineered Fill).
Storage Volume	12.6 Mgals (at pond crest) 9.9 Mgals (at spillway invert) 8.9 Mgals (at freeboard elevation located 2 ft below spillway invert)
Watershed	All potential run on is captured and routed around the UDCP utilizing external stormwater diversion channels.
Typical Section	Engineered Fill placed at a minimum of 95% MDD (ASTM D1557) at ~5H:1V u/s slope, 2H:1V d/s slope and 25 ft wide crest. Section includes liner system located on the u/s side consisting of a geonet sited between two 60 mil double sided textured HDPE geomembranes all overlying a GCL. The crest also has 6 inches of wearing course, 8 ft high wildlife fence and light vehicle safety berm.
Instrumentation	2 vibrating wire piezometers installed along the max section of the UDCP embankment at the base of the engineered fill. One piezometer is located under the embankment crest, and another is located approximately 60 ft northeast and downstream of the first piezometer. 2 settlement monuments were constructed on the UDCP embankment crest near the max section and approximately 50 ft to the northeast of the max section line.
Outlet Works	None.
Spillway Type	Trapezoidal emergency spillway constructed in cut.
Design/as-built data available	As-built data is available in the NewFields Record of Construction report titled, "Hermosa Project, Tailings and Potentially Acid Generating (PAG) Material Remediation, Placement and Storage Project, Tailings Storage Facility (TSF), Interim Record of Construction Report" issued April 6th, 2020.

The existing UDCP crest has a footprint measuring 230 ft by 350 ft and is approximately 45 ft deep. The pond is designed with a 25 ft wide perimeter access road around the crest which widens to 50 ft along the southeastern leg of the pond crest to allow for pump maintenance that may be required. The pond slopes are 2H:1V and the bottom of the pond is graded to a low point. At the low point, two sloping decant structures house submersible reclaim pumps to transfer solutions collected in the pond to WTP1.

The pond liner system consists of geonet sited between two 60 mil double sided textured HDPE geomembrane layers overlying a GCL. The pond has an LCRS, where a gravel filled sump exists between the geomembrane liners in the low point of the pond. In the event of seepage through the primary (top) liner, 4 inch diameter perforated CPe collection pipe are installed along the interior toe of the pond slopes to collect and convey any seepage flows to the LCRS sump. Any potential leaks are detected by automated water level actuation switches that will turn the LCRS submersible pump on to evacuate the zone between the two geomembrane liners. The switch and pump are housed in a sloping decant consisting of an HDPE pipe that extends down the slope of the pond between the primary and secondary geomembrane liners and terminates in the LCRS sump.

5.6.1. Existing UDCP Design Storms

The existing UDCP is sized to contain or safely pass the following:

- ADEQ BADCT Storage: 100-yr/24-hr storm event runoff from the expanded TSF footprint, 100-yr/24-hr direct precipitation over the pond area, drain down from the TSF, and maintain a minimum of 2 feet of freeboard.
- ADWR Dam Safety Emergency Spillway: Minimum of 5 feet of total freeboard and/or the Inflow Design Flood (IDF) (1/4 PMF) maximum water depth above the spillway invert crest plus 3 feet, whichever is greatest.
- ANCOLD Wet Season Storage (High C Environmental Spill): Water balance model to determine minimum storage. See Section 8.
- ANCOLD Minimum Extreme Storm Storage (High C Environmental Spill): 100-yr/72-hr storm event runoff from the TSF footprint, 100-yr/72-hr direct precipitation over the pond area and maintain a minimum of 1.64 feet (0.5 meter) of freeboard.
- ANCOLD Emergency Spillway (High C Dam Failure): Pass peak flows from the routed PMF through an engineered spillway (no freeboard required).
- GISTM Emergency Spillway: Convey 1,000-yr/24-hr storm event through an engineered spillway (no freeboard specified).

Detailed information regarding the modeling of the stormwater management within the TSF and Underdrain Collection Pond is presented in Section 8 (Water Balance) and Section 9 (Stormwater Management).

5.6.2. Existing UDCP Emergency Spillway

The existing UDCP employs an emergency spillway designed to safely pass flows resulting from the routed IDF (1/4 PMF) while maintaining a minimum 3 ft of freeboard in the emergency spillway assuming the UDCP is full to the emergency spillway invert. In addition, the existing UDCP emergency spillway can safely pass flows resulting from the routed PMF. The UDCP emergency spillway geometry does not need to be adjusted to account for the TSF1 expansion.

The emergency spillway was constructed in cut and can be referenced on Drawing A405. As a part of the TSF1 expansion, South32 has elected to improve the UDCP emergency spillway by installing Geosynthetic cementitious composite mat (GCCM) (Concrete Canvas CCX or equivalent). The GCCM will provide a robust revetment on the emergency spillway surface protecting the spillway from potential erosion which could propagate into the UDCP embankment. For the UDCP emergency spillway calculations refer to Appendix G.5.

5.6.3. Existing UDCP Pumping System

Pumpback pipes, pumps and support pipes were constructed in the UDCP sump along the southwestern leg to pump fluid to WTP1. A submersible pump was installed in a sloping 12 inch diameter carbon steel sloping decant, which is situated between two 6 inch diameter pipe supports, hereafter referred to as the pumpback system. This system of pipes is supported at the pond crest by a reinforced concrete anchor and steel pipe support frame. Currently, the pumping system has a duplicate, acting as a secondary system that resides immediately adjacent to the primary solution pumpback system. The secondary system was provided for use during periods of maintenance of the primary system or for a contingency should the primary pump not be operational.

As part of the TSF1 expansion, the system will be upgraded to pump water to either WTP1 or WTP2 by modifying the existing infrastructure. The primary pumping system will continue pumping contact solution to WTP1 and the secondary system will be converted to pump contact solution to WTP2. In general, converting the existing system to pump to WTP2 will require the following:

- Installation of a new submersible pump (660 gpm) with minimum pumping rates determined by the Water Balance (Section 8).
- Installation of a reclaim pipeline from the existing UDCP to WTP2. The reclaim pipeline consists of a pipe in pipe configuration to maintain double containment for contact solutions.

5.7. TSF Horizontal Drain

Prior to placement of additional material on the interim VRP TSF footprint, the current or interim tailings surface will be graded to drain at a minimum of 3% from the center on the tailings mass down gradient toward the existing underdrain. In order to augment drainage, horizontal drains will be installed at the interface between the reclaimed historic tailings surface and the waste rock. The horizontal drains will consist of 4-inch diameter perforated CPe pipes surrounded by free draining gravel (drainage aggregate) which is encapsulated by a 10 oz/yd^2 non-woven geotextile. The horizontal drains will daylight into the existing underdrain collection system. The combination of the sloped historic tailings surface and TSF horizontal drains will promote drainage of meteoric water, which infiltrates through the waste rock, into the existing underdrain system. By collecting and conveying infiltration water reporting to the horizontal drain system to the underdrain system, the existing compacted historic tailings mass will remain unsaturated.

5.8. Armoring Berms

As the stacking progresses, armoring berms will be placed on the exterior slopes of the dry stack TSF in an identical manner to the berms placed on the existing VRP TSF. The armoring materials will consist of waste rock or other suitable material. Typical sections of the armoring berms can be referenced on Drawing A260. This material will be placed initially as a berm that is approximately 5 ft high around the perimeter of the dry stack as the filtered tailings are being placed in the TSF. As the tailings level reaches the top of a given berm, a new 5 ft high berm will be placed on top of the dry stack tailings and the new berm will coalesce with the berm beneath it in a manner that produces a continuous armoring face on the external dry stack tailings. The armoring berms will reduce the potential for wind and water erosion of the tailings stack. Additionally, the armoring berms will act as a capillary break between the tailings and growth media cover, planned for placement at closure.

For information regarding the rock armoring placement to date refer to the TSF Interim ROC Report (NewFields, 2020a).

5.9. Instrumentation and Facility Performance Monitoring

Instrumentation for TSF1 will include vibrating wire piezometers to measure hydraulic head on the liner system. The piezometers will be placed on the geomembrane surface in the Protective Layer next to the underdrain collection pipe work. Additional vibrating wire piezometers will be installed during future filtered tailings placement to allow real time monitoring of phreatic conditions within the stack by the operations staff. Proposed instrument locations along with details of the instrumentation specific installation can be referenced on Drawing A222.

5.10. Material Placement

The TSF will be stacked to the geometries shown on Drawing A300. Filtered tailings (once produced), waste rock, and miscellaneous materials will be delivered to the TSF using truck haulage. The material will be spread, moisture conditioned (as needed), and compacted in accordance with the Technical Specifications as a dry stack essentially creating an Engineered Fill. To date, South32 has permitted the following materials to be placed in the TSF: waste rock (from mine development), PAG construction cut, WTP1 and WTP2 filter cake, drill cuttings, core cutting solids, and sediments from stormwater BMPs. As part of the TSF1 expansion, filtered tailings will require storage on lined containment. The currently permitted and proposed new materials are discussed below:

5.10.1. Waste Rock (Permitted Material)

Waste rock from mine development which is determined to be PAG will be hauled and placed in the TSF as a compacted standard earthen fill placement operation. Due to the unknown gradation of the waste rock, the placement procedures outlined in the Technical Specifications address a wide range of materials. It is anticipated that the waste rock will generally be a 12-inch minus rock fill containing trace amounts of sand and fine grain soil material. Detailed placement criteria for the waste rock can be referenced in the Technical Specifications presented in Appendix E. Non-PAG waste rock from mine development can also be hauled and placed in the TSF as a compacted standard earthen fill, as necessary.

5.10.2. Construction Cut (Permitted Material)

PAG material from construction activities will be hauled and placed in the TSF as a compacted standard earthen fill placement operation. The construction cut may be generated as a result of various construction projects performed on site. Due to a fairly similar lithology across the property, the material properties for the construction cut material are assumed to be similar to the properties of the engineered fill which was placed during cut to fill operations during VRP TSF construction. The construction cut material is anticipated to be mainly poorly graded gravel (GP) or clayey gravel (GC) that is 8-inch minus, averaging ~10% passing the no. 200 sieve with a low to medium plasticity. The design accounts for approximately 20,000 cubic yards of PAG construction cut material. Detailed placement criteria for the construction cut material can be referenced in the Technical Specifications presented in Appendix E.

5.10.3. Miscellaneous Material

5.10.3.1. WTP Filter Cake (Permitted Material)

The WTP1 and WTP2 filter cake is anticipated to have the following material properties (based on WTP1 and WTP2 filter cake control samples).

- Particle size distribution (by dry weight)
  - 100 percent passing the no. 4 sieve.
  - 20 – 100 percent passing the no. 200 sieve.
- Non-plastic soil.

- Moisture content will range between ~360% and ~390% (based on dry weight of solids) upon arrival to the TSF.

Upon placement in the TSF, the WTP filter cake will be spread and dried to reduce the material moisture content. The filter cake will then be mixed with tailings, on site native borrow material and/or waste rock at a minimum ratio of 3 (tailings/onsite native borrow/waste rock) to 1 (filter cake). After mixing, the material will be placed in 12-inch maximum loose lifts and compacted to 93 percent of the MDD as determined by ASTM D698. Detailed placement criteria for the filter cake material can be referenced in the Technical Specifications presented in Appendix E.

5.10.3.2. Core Cutting Material (Permitted Material)

The core cutting material that is generated from trimming rock core samples for metallurgical testing will be hauled and placed in the TSF. The anticipated material properties are as follows:

- Particle Size Distribution (by dry weight)
  - Approximately 100 percent passing the 1-inch sieve
  - Approximately 76 percent passing the no. 4 sieve
  - Approximately 72 percent passing the no. 10 sieve
  - Approximately 69 percent passing the no. 40 sieve
  - Approximately 64 percent passing the no. 200 sieve
- Material will be saturated upon arrival to the TSF.

Upon placement in the TSF, the core cutting material will be spread and dried to reduce the material moisture content. The core cutting material will then be mixed with tailings, on site native borrow material and/or waste rock at a minimum ratio of 3 (tailings/onsite native borrow/waste rock) to 1 (core cutting material). After mixing, the material will be placed in 12-inch maximum loose lifts and compacted to 93 percent of the MDD as determined by ASTM D698. Detailed placement criteria for the core cutting material can be referenced in the Technical Specifications presented in Appendix E.

5.10.3.3. Drill Cuttings (Permitted Material)

The drill cutting material that is generated from exploration activities will be hauled and placed in the TSF. Upon placement in the TSF, the drill cutting material will be spread and dried to reduce the material moisture content. The drill cutting material will then be mixed with tailings, on site native borrow material and/or waste rock at a minimum ratio of 3 (tailings/onsite native borrow/waste rock) to 1 (drill cutting material). After mixing, the material will be placed in 12-inch maximum loose lifts and compacted to 93 percent of the maximum dry density as determined by ASTM D698. Detailed placement criteria for the drill cutting material can be referenced in the Technical Specifications presented in Appendix E.

5.10.3.4. Sediments from Stormwater BMPs (Permitted Material)

The sediments generated from site stormwater BMPs will be hauled and placed in the TSF. Upon placement in the TSF, the sediments will be spread and dried to reduce the material moisture content. The sediments will then be mixed with tailings, on site native borrow material and/or waste rock at a minimum ratio of 3 (tailings/onsite native borrow/waste rock) to 1 (sediment). After mixing, the material will be placed in 12-inch maximum loose lifts and compacted to 93 percent of the maximum dry density as determined by ASTM D698. Detailed placement criteria for the sediments can be referenced in the Technical Specifications presented in Appendix E.

5.10.3.5. Assay Rejects (New Material)

Assay rejects generated as part of the exploration process are anticipated to be hauled and placed in the TSF. Upon placement in the TSF, the material will be spread and moisture conditioned, as necessary. The material will then be mixed with tailings, on site native borrow material and/or waste rock at a minimum ratio of 3 (tailings/onsite native borrow/waste rock) to 1 (assay rejects). After mixing, the material will be placed in 12-inch maximum loose lifts and compacted to 93 percent of the maximum dry density as determined by ASTM D698. Detailed placement criteria for the assay rejects can be referenced in the Technical Specifications presented in Appendix E.

5.10.3.6. Sediments from Vehicle and Equipment Wash Sumps (New Material)

Sediments generated from vehicle and equipment wash sumps are anticipated to be hauled and placed in the TSF. Upon placement in the TSF, the sediments will be spread and dried to reduce the material moisture content, as necessary. The sediments will then be mixed with tailings, on site native borrow material and/or waste rock at a minimum ratio of 3 (tailings/onsite native borrow/waste rock) to 1 (sediment). After mixing, the material will be placed in 12-inch maximum loose lifts and compacted to 93 percent of the maximum dry density as determined by ASTM D698. Detailed placement criteria for the sediments can be referenced in the Technical Specifications presented in Appendix E.

5.10.4. Filtered Tailings (New Material)

If the Hermosa Project moves into production, filtered tailings generated from the Filter Plant will be hauled and placed in the TSF at an average rate of approximately 4,000 cubic yards per day. The filtered tailings are a silty sand (SM) and the geotechnical material properties are well understood (refer to Section 3.4). The filtered tailings will be hauled to the TSF, dumped, spread to a nominal thickness not to exceed 12-inches (loose) in depth, and compacted. Material placement procedures are summarized in Section 11.3 and detailed placement criteria for the filtered tailings can be referenced in the Technical Specifications presented in Appendix E.

6. CONSTRUCTION MATERIALS

Construction materials for TSF1 will be generated from mass grading activities, processing (crushing and screening), and/or imported materials. The material borrow sources will be in situ material generated from mass grading, the existing material stockpile located at the Infrastructure Pad and non-PAG waste rock generated from mine development. Information specific to the various construction materials considered for TSF construction is provided in the following sections.

6.1. Engineered Fill

Engineered fill materials will be generated from mass grading activities within the TSF basin and TSF1 Perimeter Road. The fill will consist primarily of fractured rock and near surface overburden soil after removal of any growth media and/or deleterious materials. Engineered fill materials are expected to be generated as a result of ripping with a dozer up to approximately 25 ft and drill and blast thereafter. Significant variability in engineered fill should be expected across the site due to varying degrees of fracturing and weathering. However, it should be noted that the majority of the near surface soils will be acceptable as engineered fill. Engineered fill will be placed, compacted, and tested in accordance with the requirements outlined in the Technical Specifications (Appendix E).

6.2. Low Permeability Soil Layer (LPSL)

The LPSL will consist of predominantly fine-grained soils with a coefficient of permeability (k_v) less than or equal to 1×10^{-6} cm/sec. The LPSL will be placed in 6-inch lifts, moisture conditioned and compacted to produce a smooth, unyielding surface prior to geomembrane deployment. Any rocks protruding from the finished LPSL will be removed through hand picking and the voids will be filled with replacement fine grained low permeability material and recompacted. LPSL will be placed, compacted, and tested in accordance with the requirements outlined in the Technical Specifications (Appendix E).

Although LPSL borrow sites were identified on the Trench Camp Property, each has been developed and fully utilized for the construction of the existing VRP TSF. As described in detail in Section 3.1.2.1, the existing material stockpile located on the Infrastructure Pad was investigated as a potential LPSL borrow source. Using the data obtained from the geotechnical investigation, the following will be performed to create onsite LPSL for TSF1:

- Process the existing material stockpile on the Infrastructure Pad by screening the material on the ¾” sieve.

- Amend the minus ¾" material with 4% bentonite. During construction of the VRP project, in-situ bentonite amendment was achieved using a soil stabilizer-reclaimer. This process of mixing bentonite into a site construction borrow source produced an acceptable and consistent LPSL material conforming to the Technical Specifications and prescriptive BADCT requirements.

The material stockpile at the Infrastructure Pad will be utilized for creation of LPSL due to the lack of in situ LPSL borrow areas located on the Trench Camp, Alta and Hardshell properties. GCL is an acceptable substitute for LPSL but is limited by geotechnical stability considerations. TSF1 can utilize GCL instead of LPSL in the composite liner system in the areas shown on Drawing A220.

6.3. Protective Layer

The Protective Layer material will consist of 1½ inch minus granular material with less than 10% passing the No. 200 sieve. The Protective Layer material will be placed directly on the geomembrane liner at a minimum thickness of 18-inches. This material will be placed and tested in accordance with the requirements outlined in the Technical Specifications (Appendix E).

As described in detail in Section 3.1.2.3, drilling was completed to collect samples of non-PAG waste rock that will be encountered during mine development and this material was evaluated as a potential Protective Layer borrow source. Using the data obtained from the geotechnical laboratory testing, the following will be performed to create onsite Protective Layer material:

- The main and ventilation shaft waste rock will be considered the primary source of Protective Layer for TSF1 construction. The raw feed waste rock will have to be crushed and screened.
- A crushing and screening operation is required to produce acceptable gradations. During construction of the existing VRP TSF, a crushing and screening plant was used successfully to process Protective Layer from excess cut produced on the Trench Camp property. It is assumed the same process (crushing/screening) will be replicated for TSF1 construction.

Requirements for the Protective Layer material can be referenced in the Technical Specifications (Appendix E). Placement geometry of the Protective Layer can be referenced on Drawing A264.

6.4. Drainage Aggregate

Drainage Aggregate will be utilized in the TSF underdrain collection system. As described in detail in Section 3.1.2.3, drilling was completed to collect samples of non-PAG waste rock that will be encountered during mine development and this material was evaluated as a potential Drainage Aggregate borrow source. Using the data obtained from the geotechnical laboratory testing, the following will be performed to create onsite Drainage Aggregate material:

- The main and ventilation shaft waste rock will be considered the primary source of Drainage Aggregate for TSF1 construction.
- A crushing and screening operation is required to produce acceptable gradations.

Requirements for the Drainage Aggregate material can be referenced in the Technical Specifications (Appendix E). Placement geometry of the Drainage Aggregate can be referenced on Drawing A264.

6.5. Road Wearing Course

Road Wearing Course will be processed from an acceptable on-site borrow or a local import source. Requirements for the road wearing course material can be referenced in the Technical Specifications (Appendix E). Placement geometry of the road wearing course can be referenced on Drawing A260.

6.6. Pipe Bedding

Pipe bedding will be placed to the springline around the base of culverts and densified in accordance with the requirements outlined in the Technical Specifications (Appendix E). This material can be generated from a local borrow or imported C-33 concrete sand. Placement geometry of the pipe bedding can be referenced on Drawing A610.

6.7. Pipe Backfill

Pipe backfill will be placed after the pipe bedding, in accordance with the requirements outlined in the Technical Specifications (Appendix E). This material can consist of on-site native sand or sand and gravel with a maximum particle size of 3 inches. Placement geometry of the pipe backfill can be referenced on Drawing A610.

6.8. Riprap

Riprap will be processed from an acceptable on-site borrow or imported from a local source. Requirements for the riprap material can be referenced in the Technical Specifications (Appendix E). Placement geometry of the riprap can be referenced on Drawings A260, A320, A600 and A610.

6.9. Friction Layer

If required, a Friction Layer will be placed on the LPSL prior to geomembrane installation to provide increased shear strength of the composite liner system. The Friction Layer material consists of a ½ inch minus crushed aggregate with no more than 10% passing the No.16 sieve. It is placed using a radial spreader in a ⅛ to ¼ inch thick layer cast over the compacted LPSL. The Friction Layer is smooth drum rolled (not vibratory compacted) into the LPSL creating an LPSL layer with small asperities along the LPSL/geomembrane interface. All excess or loose friction layer material will be removed from the finished surface after rolling using an air lance or similar method. During construction of the existing VRP TSF, Friction Layer material was imported from Cal Portland in Rio Rico, and it is assumed that the material will continue to be imported for TSF1, if required.

To determine if Friction Layer is required, large scale interface direct shear testing will be performed on the LPSL (processed from the existing stockpile material on the Infrastructure Pad) and HDPE geomembrane interface. Once the LPSL is created (see Section 6.2), the interface strength of the composite liner system will be measured in the laboratory. If the residual interface shear strength is less than 20 degrees, a Friction Layer will be utilized to increase the interface strength between the LPSL and geomembrane. See Appendix E for the Friction Layer Technical Specifications.

6.10. Armoring Berms

The armoring berm material is assumed to be sourced from mine waste rock or suitable on-site construction cut material, as necessary. The material shall consist of an 8 inch minus granular material with no more than 15% passing the No. 200 sieve. It will be placed as a 5 ft high berm around the perimeter of the dry stack as the filtered tailings are being placed in the TSF. As the tailings level reaches the top of a given berm, a new 5 ft high berm will be established, and the new berm will coalesce with the berm beneath it in a manner that produces a continuous armoring face on the external dry stack tailings slope. The armor berm gradation was developed considering a combination of soil retention filter criteria between the armoring berms and filtered tailings as well as resistance to erosion from stormwater runoff and wind.

The armoring berms established during 2018 and 2019 on the exterior of the existing VRP TSF stack have performed well throughout the various monsoon seasons to date. Future armoring berms are planned to be placed in the same manor and geometry as the existing armoring berms. See Appendix E for the armoring berm Technical Specifications.

6.11. Geosynthetics

6.11.1. HDPE Geomembrane

The entire TSF basin and the interior slopes of the perimeter road will be lined with 60 mil double sided textured HDPE geomembrane as the principal environmental containment. The geomembrane, in general, will be deployed directly on top of approved LPSL or GCL (in approved areas). The geomembrane panels will be heat bonded through fusion or extrusion welding techniques. This layer is the first line of defense against potential seepage and has proven to be very effective in numerous applications throughout the world.

The geomembrane materials used during construction shall meet all the requirements outlined in the Technical Specifications (Appendix E). Construction quality control (CQC) and CQA testing and inspection of the liner will be undertaken to verify that the liner is placed in accordance with the design requirements and industry standards. CQC and CQA testing and inspection requirements can be referenced in the Technical Specifications (Appendix E). During procurement of HDPE geomembrane for construction, conformance testing will be necessary to confirm the HDPE / LPSL residual interface shear strength value and the HDPE / GCL residual interface shear strength value (if a different HDPE or GCL material is selected than utilized for the VRP project).

Typical application of the geomembrane can be referenced on a number of Drawings including but not limited to A260 through A264.

6.11.2. Geotextile

Non-woven geotextile will be installed around the drainage aggregate which surrounds the underdrain collection pipes in the TSF basin and under riprap in the stormwater diversion channels. The geotextile is a 10 oz/yd^2 non-woven needle punched fabric conforming to the requirements summarized in the Technical Specifications (Appendix E). Typical applications for geotextile in this design can be referenced on Drawings A260 and A264.

6.11.3. Geosynthetic Clay Liner

GCL (Cetco Bentomat DN-9 – 15 lb/in peel) consists of bentonite sandwiched between two layers of geotextile (non-woven and needle punched for this application). See Appendix E.2 for the Cetco GCL Technical Data Sheet. The GCL was evaluated for suitability based on the ability to achieve an equivalent permeability of 1x10^{-6} cm/sec or less at a thickness of 1 foot. Hydraulic equivalency calculations for GCL are presented in Appendix G.4 showing a required GCL hydraulic conductivity value of 3.8x10^{-8} cm/sec. Published technical data for GCL products indicate a hydraulic conductivity of approximately 5x10^{-9} cm/sec which exceeds the minimum required hydraulic equivalency value and therefore satisfies the regulatory requirements (kmax ≤ $1x10^{-6}$ cm/sec).

Stability is a concern with the use of GCL due to the low residual strength at both the GCL interface against the overlying HDPE geomembrane liner and the inherent internal strength of the bentonite core (particularly when hydrated). The use of GCL within the TSF was evaluated using measured residual interface shear strength values and a limit equilibrium slope stability evaluation. Interface shear strength laboratory testing results can be referenced in Section 3.3.5 and the slope stability modeling can be referenced in Section 7. As a result of this evaluation, the GCL can only be used in the TSF where sufficient passive resistance to failure exists downstream of the GCL application. TSF1 can utilize GCL in the composite liner system in the areas shown on Drawing A220.

7. GEOTECHNICAL EVALUATION

The results of the geotechnical evaluation for TSF1 are discussed in the following sections along with descriptions of the subsurface model development and relevant engineering properties. Results of the geotechnical evaluations were completed to ensure acceptable performance throughout the life cycle of the facilities.

7.1. Stability Evaluation

Stability analyses were performed using the computer program Slide v9. Slide is a two-dimensional slope stability program for evaluating circular and noncircular failure surfaces in soil or rock slopes using limit equilibrium methods. Global stability was evaluated under static, seismic (pseudostatic), and post seismic conditions. Spencer's method of slices was implemented within the program to evaluate the factor of safety for the facility slopes. The factor of safety can be defined as the resisting forces along a potential failure plane divided by the gravitational and seismic driving forces. Factors of safety exceeding 1.0 indicate stability.

The minimum acceptable factors of safety for the Hermosa project are shown in Table 7.1 and are considered acceptable by ANCOLD and BADCT design standards. The minimum acceptable factors of safety are also summarized in the Design Criteria in Appendix A.

TABLE 7.1 – FACTOR OF SAFETY CRITERIA

Scenario	Minimum FOS
Static	1.5
Pseudostatic	1.0
Post Seismic	1.0 - 1.2

7.1.1. Design Ground Motions

To evaluate stability during seismic loading, a pseudostatic analysis applies an additional destabilizing horizontal force to the potential slide mass to represent the inertial effects of an earthquake. This horizontal force is related to the peak ground acceleration (PGA) and is calculated as the weight of the sliding mass multiplied by a horizontal pseudostatic earthquake coefficient (k_h).

The k_h value is typically considered as a portion of the PGA due to the fact that during an earthquake the acceleration within the potential sliding mass is cyclic and varies over the duration of the earthquake. Therefore, an average horizontal coefficient is assigned that is typically less than the PGA experienced at the base of the structure. The current evaluation applied a 50 percent reduction to the PGA for the k_h value.

7.1.2. Stability Model Development

The stability of TSF1 was evaluated for the sections presented on Figure 1 in Appendix H. Four sections were selected as representing critical sections for evaluation of TSF1. Critical sections were selected at locations and orientations based on the following criteria:

- Maximum tailings stacking height to model the maximum load of the facility.
- Perpendicular to tailings stacking contours to capture the steepest tailings slope.
- At locations where the TSF basin base grades slope towards the facility toe which increases driving forces along the composite liner interface placed in the TSF basin.

The stability models were developed considering the following information:

- As-built survey data representing finished grade for the VRP TSF including the perimeter road (embankment), basin, and stacking for the remediated historic tailings (NewFields, 2020a).
- As-built survey limits for the VRP TSF composite liner systems (geosynthetic-soil and geosynthetic-geosynthetic) (NewFields, 2020a).
- Proposed Perimeter Road and basin grading including limits of the composite liner systems (geosynthetic-soil and geosynthetic-geosynthetic) as shown in Drawing A220.
- Proposed stacking geometries for filtered tailings, waste rock and miscellaneous materials as shown in Drawing A300. Exterior stacking slope at a 3.0H:1V compound slope to a maximum elevation of 5,275 ft amsl.
- A piezometric surface was applied approximately 1.5 feet above the geomembrane liner to simulate minor accumulation of draindown from the tailings. Based on the expected transmissivity of the underdrainage system, this is considered to be a conservative assumption.
- Natural groundwater was not included in the stability evaluations as hydrostatic groundwater levels are at significant depth.

7.1.3. Material Properties

The stability analyses were completed using material properties developed from the laboratory results as well as NewFields' familiarity with foundation and construction materials at the Hermosa project. The material properties are summarized in Table 7.2 and discussed in the following paragraphs.

The possibility for select materials to exhibit a temporary reduction in shear strength immediately following seismic excitation was evaluated with the pseudostatic and post seismic stability loading scenarios. Lower permeability or loose materials can reduce strength from the development of excess pore pressure during and following shaking. The phenomenon is temporary but can result in a critical loading scenario for some facilities. Based on the requirements for moisture control and compaction of the tailings, these materials are not considered to be prone to significant development of excess pore pressure, but modest temporary loss of strength is possible. Reclaimed and production tailings materials (identified in Table 7.2) were conservatively assumed to lose 20 percent of their strength for the pseudostatic and post seismic scenario.

TABLE 7.2 – MATERIAL PROPERTIES USED IN THE STABILITY ANALYSES

Material	Moist Unit Weight (pcf)	Drained Shear Strength	Pore Pressure Condition
Reclaimed (VRP) Tailings Note 1	130	ϕ = 34°	Hydrostatic
Production Tailings Note 1	125	ϕ = 36°	
HDPE/LPSL Interface	135	Figure 3.2	None
HDPE/GCL Interface	120	Figure 3.3	
Engineered Fill	135	ϕ = 32°	
Foundation	130	ϕ = 38°	
Waste Rock	130	Leps (Average Rockfill)	Hydrostatic

Note: [1] Shear strength reduced by 20 percent to account for softening and potential generation of excess pore pressure for the post liquefaction loading scenario.

Reclaimed (Historic) Tailings: Material properties for the reclaimed tailings are based on laboratory test data and were modeled as a purely frictional material using Mohr-Coulomb strength criterion for each loading scenario. Results of the strength testing can be referenced in Section 3.3.3. For the pseudo-static and post seismic loading scenarios, a 20 percent reduction in shear strength was applied to account for development of pore pressure and therefore a decrease in shear strength.

Production (Filtered) Tailings: Material properties for the production tailings were based on laboratory test results of the synthetic tailings samples and were modeled as a purely frictional material using Mohr-Coulomb Strength criterion for each loading scenario. Results of the strength testing can be referenced in Section 3.4.5. For the pseudo-static and post seismic loading scenarios, a 20 percent reduction in shear strength was applied to account for development of pore pressure and therefore a decrease in shear strength.

Waste Rock: Waste Rock shear strength properties were developed based on the Leps average non-linear strength envelope for rockfill materials (Leps, 1970). This model generally shows decreasing shear strength with increasing normal stress due to mechanical degradation of particles. The average rockfill strength envelope was considered representative of the rock expected from mine development based on the laboratory data presented in Section 3.1.2.3.

HDPE/LPSL and HDPE/GCL Interface: The composite liner system interfaces were modeled as a nonlinear power curve (HDPE/LPSL) and pentalinear (HDPE/GCL) failure envelope for all loading scenarios with parameters developed from interface shear testing (refer to Section 3.3.5). Residual strength values from testing were used to select the design shear strength because residual strengths more closely represent potential long term behavior of the interface when loaded in the TSF due to potential impacts from construction and/or operations activities, material placement procedures, thermal expansion/contraction, earthquake induced displacement, and dry stack settlement.

Engineered Fill: Engineered fill was modeled as a purely frictional material using Mohr-Coulomb strength criterion for all loading scenarios. The modeled value was developed from shear strength testing. This shear strength model is a conservative assessment based on site specific test results of the gravelly clay materials used for engineered fill during the VRP project (refer to Section 3.3.3). Similar engineered fill is expected for future construction.

Foundation: Based on subsurface conditions discussed in Section 3.2, a thin veneer of granular soil overlying bedrock is typical for both facilities. For the stability analysis, the foundation was modeled as a homogenous material with a purely frictional shear strength using Mohr-Coulomb strength criterion in all loading conditions. The modeled value was selected based on observed conditions across the site.

Miscellaneous materials will be mixed with tailings and/or waste rock during placement at a 3 (tailings/waste rock): 1 (miscellaneous material) ratio. Miscellaneous materials include solids from water treatment including filter cake, drill and core cuttings, sediments from stormwater BMPs, assay rejects, and sediments from vehicle and equipment wash sumps. Due to the relatively small quantity and infrequent delivery of the material, mixing with waste rock and tailings will occur during placement in the TSF. Blended samples consisting of 3:1 reclaimed tailings to water treatment plant filter cake were selected and tested because this will represent the lowest strength of the possible material blends (see Section 3.3.3 for lab results). Strength testing showed no strength reduction at a 3:1 ratio (3 tailings to 1 miscellaneous material) and therefore all miscellaneous materials were modelled using the same values as the blended material.

7.1.4. Stability Evaluation Results

Stability analyses results indicate the TSF will remain stable for all loading conditions. Calculated factors of safety are presented in Table 7.3 and output graphics are included in Appendix H. The results document the minimum static and pseudostatic, factors of safety and the critical failure mode.

TABLE 7.3 – CALCULATED MINIMUM FACTORS OF SAFETY

Section	Description	Minimum Factor of Safety		
		Static	Pseudostatic	Post Seismic
A	TSF1 Northwest Side	1.7	1.1	1.5
	TSF1 Southeast Side	2.2	1.2	1.6
B	TSF1 North Side	1.9	1.2	1.6
C	TSF1 North Side	1.9	1.0	1.6
D	TSF1 Southwest Side	2.2	1.2	1.6

7.2. Settlement Evaluation

A settlement evaluation was completed to estimate subgrade settlement beneath the facility. The estimated settlement is based on elastic theory and the results were used to verify that the geomembrane liner has adequate strain compatibility and drainage and outlet structures underlying the embankment will not be subjected to excessive deflections. It was assumed that any compression and related settlement of embankment fill materials will occur during construction (given the granular nature of the engineered fill) and will not influence the long-term performance of the facility. Results from the geotechnical investigations were used to develop a generalized subsurface stratigraphy and to identify appropriate compressibility parameters for the materials. Since competent bedrock is near the ground surface, the estimated maximum potential settlements beneath the TSF embankment is less than 3 inches underneath the maximum facility loads. Less settlement is expected where tailings loadings are smaller or when the depth to competent rock is less. Based on the results, the estimated settlement will not compromise the liner system and/or the ability for the TSF to function as designed.

7.3. Cut Slopes

The various cut slopes around TSF1 will be cut back at 1.5H:1V. In cases of extended cut slopes (greater than approximately 30 vertical feet), a compound slope of 2H:1V shall be constructed using 30 vertical feet of 1.5H:1V slope combined with a 15 foot bench. Based on data collected during the geotechnical investigations and experience throughout the existing TSF project construction, NewFields believes these slopes are globally stable. Although globally stable, dislodged blocks and minor surface raveling of weathered bedrock could occur and should be evaluated. A visual evaluation immediately after construction must be completed by qualified personnel to observe features within the rock mass and provide a final assessment of stability. If slope configuration requires adjustment during construction, the geotechnical engineer should be contacted to re-evaluate and to update slope cut configurations if appropriate.

8. WATER BALANCE

An update to the water balance was completed by Ecological Resource Consultants using a standard interactive spreadsheet approach to modeling the contact water management for the TSF. The objective of the water balance is to model the various water demands and sources on site considering the expanded TSF1 geometry. The model was developed using a daily time-step and includes meteoric inputs/outputs (precipitation and evaporation) as these parameters can have a significant impact on Underdrain Collection Pond. In addition, the model includes inflow from the historic underground works (referred to as the January Adit) and outflows to WTP1 and WTP2.

ERC's analysis utilized actual historic daily site precipitation data (2008 – 2022) and precipitation estimates that include modifications for potential future climate change impacts. A flow diagram showing the inputs and outputs to the system and how the various elements in the model interact is presented in Figure 8.1.

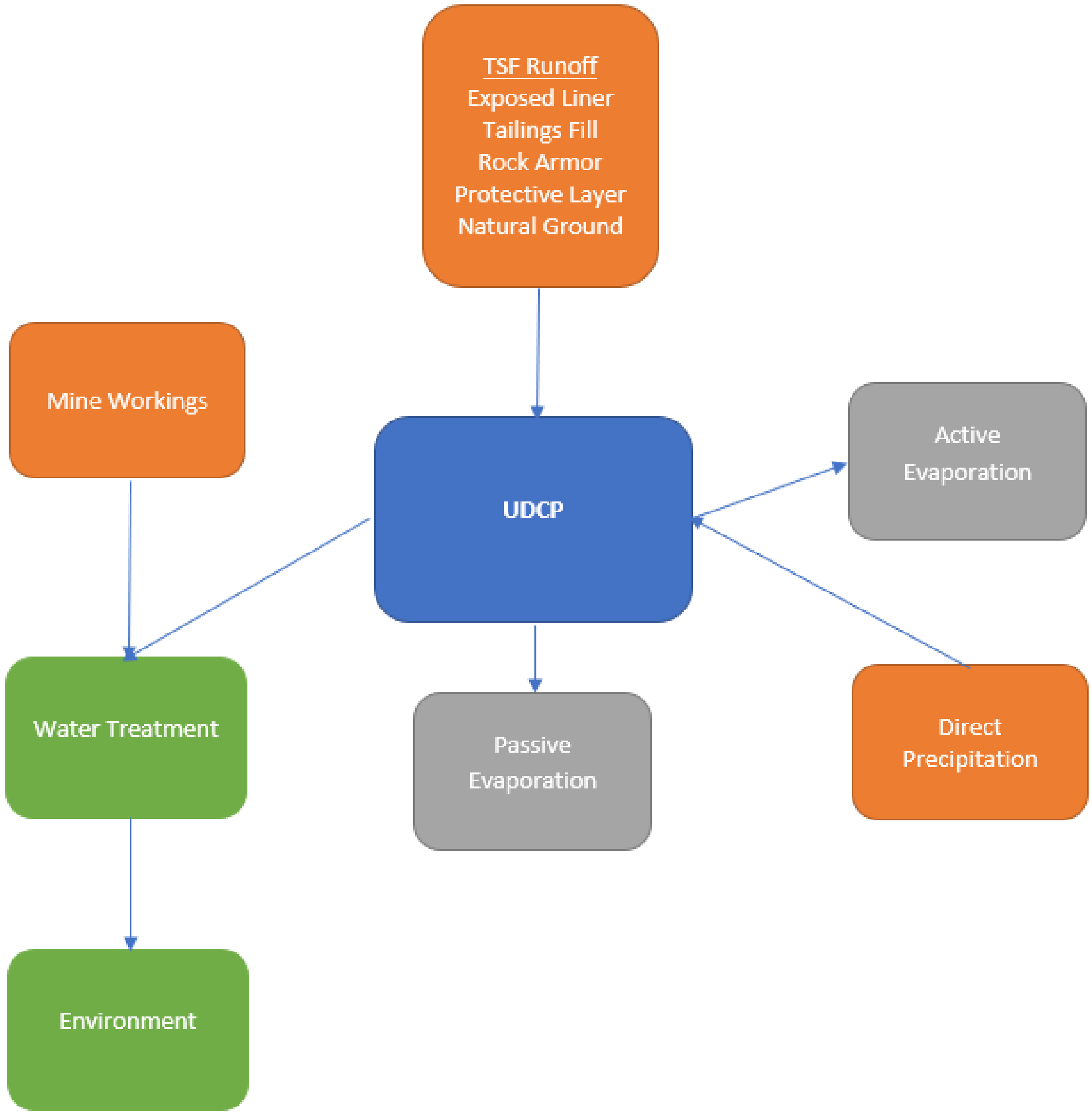


FIGURE 8.1 – WATER BALANCE MODEL SCHEMATIC

8.1. Model Development

The water balance is the sum of inflows minus the sum of outflows. Inflows consist of precipitation, stormwater runoff, existing mine workings dewatering flow, and filtered tailings draindown. Outflows consist of passive and active evaporation and pumping to the WTPs from the UDCP. Movement of the inputs and outputs through the system occur at various times during the water balance period based on operational parameters, material properties, TSF configuration and time of year.

Water inflows are listed below:

- **Precipitation** directly over the UDCP.
- **Stormwater Runoff** from the TSF (reports to the UDCP).
- **Existing mine workings dewatering flow** assumed to be a constant 20 gpm inflow to WTP1, is based on current pumping rates provided by South32. Due to future groundwater management activities, the existing mine workings are not expected to contribute inflow to WTP1 during mining. Existing mine workings dewatering flow was conservatively included throughout the years modelled.
- **Groundwater management wells** are pumped to WTP2 for treatment. Flowrate is expected to change over time.
- **Filtered tailings draindown** estimated based on observations of actual draindown (approximately 1 gpm) occurring at the existing VRP TSF after periods of little to no precipitation. Draindown rates were proportioned to the existing VRP TSF area and pro-rated for the TSF1 expansion.

Water outflows are listed below:

- **Passive Evaporation** from the UDCP using pond evaporation rates.
- **Active Evaporation** using evaporative blowers was estimated to be 50 gpm at a 50% utilization rate based on an evaporator efficiency study done on another similar project.
- **Pumping to WTP from UDCP** used to determine required pumping rates to meet pond operational and freeboard requirements.
- **WTP1 and WTP2 effluent** assumed to be discharged to the environment and/or utilized within the operation.

The model specifically tracks normal daily runoff to the UDCP. Pond water storage volumes are tracked against capacities. The model also calculates the amount of runoff that could be expected were the 100-yr storm to occur at any point. This value is used to determine if runoff from the 100-yr storm can be stored on any given day in addition to the normal operating volume expected in the ponds. Operating decisions such as the pumping capacities to WTP1 and WTP2 from the UDCP greatly influenced the TSF water balance results. WTP1 also includes historic mine underground workings water in addition to the inflow from the Underdrain Collection Pond.

Climate change was considered in the water balance to account for predicted changes in precipitation and evaporation from the current time through the end of mine life. According to the PICC risk assessment, summarized in Section 2.6.6, the site's annual precipitation is expected to decrease in future years while rainfall from the design storms is predicted to increase.

Evaporation is also expected to increase because climate change is anticipated to result in an increase in solar radiation and wind speed, both of which increase evaporation. For conservatism, the water balance assumes no reductions in the amount of annual precipitation or increases in annual evaporation but assumes an increase (7%) in the 100-year storm.

8.2. Water Balance Results

The water balance analysis and results can be referenced in detail in Appendix I. In summary, the water balance utilized historic site-specific precipitation data and projected climate change values to model the existing UDCP, proposed TSF1 expansion, WTP1 and WTP2 system over a 9-year period using a daily time step. The goal of the water balance was to establish a minimum UDCP pumping rate to maintain design storm storage (i.e., 100-yr storm event) and freeboard. Three scenarios were evaluated in the water balance:

- Scenario 1 uses the historical precipitation data and requires the model results to remain below the emergency spillway invert. This scenario includes the 2017 historical site precipitation data which includes a 30-day stretch producing 18.1 inches of rainfall equating to a recurrence interval greater than the 1,000-yr storm.
  - In 2017, the site recorded 4.56 inches of precipitation in a single day, 12.39 inches in a 7-day period and 18.1 inches in a 30-day period. For comparison, the 24-hour duration 25-year, 50-year and 100-year storm events for the site are 3.93 inches, 4.40 inches and 4.88 inches, respectively (ERC, 2017). It is important to note, the 7-day (12.39 inches) and 30-day period (18.1 inches) storms values exceed the 7-day/30-day 1,000-year storm events. This year is the controlling factor in the water balance.
- Scenario 2 uses the historical precipitation data (with the 2017 data omitted to remove the 1,000-yr/30-day event) with a climate change adjusted 100-yr/24-hr storm (ADEQ BADCT design storm). The scenario models the daily pond level and adds the 100-yr/24-hr storm to verify that freeboard requirements (2 feet) are maintained.
- Scenario 3 uses the historical precipitation data (with the 2017 data omitted to remove the 1,000-yr/30-day event) with a climate change adjusted 100-yr/72-hr storm (ANCOLD design storm). The scenario models the daily pond level and adds the 100-yr/72-hr storm to verify that freeboard requirements (1.6 feet) are maintained. The 100-yr/72-hr storm is adjusted in the model as the full storm depth minus the daily precipitation from that day as well as the two preceding days.

The water balance scenarios resulted in the following minimum pumping rates:

- Scenario 1 (daily precipitation record including the 1,000-yr/30-day event in 2017)
  - Existing UDCP – 660 gpm

- Scenario 2 (daily precipitation record excluding the 1,000-yr/30-day event in 2017 but including a theoretical daily 100-yr/24-hr event evaluation)
  - Existing UDCP – 400 gpm
- Scenario 3 (daily precipitation record excluding the 1,000-yr/30-day event in 2017 but including a theoretical daily 100-yr/72-hr event evaluation)
  - Existing UDCP – 350 gpm

Using the ADEQ BADCT and ANCOLD guidance, the minimum pumping/treatment rate for the UDCP to WTP1 and WTP2 is 400 gpm but South32 has conservatively selected to use 660 gpm (see Section 5.6.3). Detailed information regarding the Water Balance can be referenced in Appendix I.

9. STORMWATER MANAGEMENT

The intent of the stormwater management plan is to prevent damage and to preserve the environmental setting in the proximity of the TSF, UDCP and downstream receiving points. The stormwater management plan includes the following:

- External stormwater conveyance structures.
  - Collect and convey surface water flows around the facilities through engineered diversion channels and culverts.
  - Armor sections of channels or outlet points to minimize erosion and sediment transport.
- Internal TSF stormwater conveyance structures.
  - Internal diversion channels located at the perimeter of the TSF stacking to convey surface water runoff from the dry stack facility slope to the internal detention pond areas.
  - Internal detention pond areas to collect flow from the internal diversion channels. Please note, the internal detention ponds only collect water during extreme precipitation events. During normal operations, precipitation infiltrates into the armoring berms and Protective Layer prior to reaching the internal detention ponds. The infiltration is collected and conveyed by the underdrain collection system (perforated pipes) at the base of the facility and transferred to the external UDCP.
  - Detention pond outfall pipes to convey surface water runoff from the internal detention ponds to the UDCP.
- UDCP to manage runoff and underdrain flow from the TSF.
- Implement BMPs in design and construction.

The stormwater structures were designed according to the prescriptive guidelines and standards presented in Table 9.1 and Table 9.2 for the TSF and UDCP, respectively:

TABLE 9.1 – TSF DESIGN CRITERIA SUMMARY (FLOOD)

Design Criteria	ADEQ BADCT	ANCOLD[1]	GISTM[2]
Internal conveyance (containment)	100-yr / 24-hr 2' freeboard (min)	100-yr / 72-hr 1.64' freeboard (min)	Not specified
Internal conveyance (emergency spillway)	Not specified	PMF (no freeboard requirement)	Active Care: 1/1,000 Passive Care: 1/10,000 (no freeboard requirements)
External conveyance	100-yr / 24-hr 1' freeboard (min)	-	Active Care: 1/1,000 Passive Care: 1/10,000 (no freeboard requirements)

Notes: [1] Based on High C Dam Failure and Spill Consequence Classification. [2] Based on a Significant Consequence Classification.

TABLE 9.2 – UNDERDRAIN COLLECTION POND DESIGN CRITERIA SUMMARY (FLOOD)

Design Criteria	ADEQ BADCT	ADWR Dam Safety (UDCP Only)[1]	ANCOLD[2]	GISTM[3]
Internal storage (containment)[4]	100-yr / 24-hr 2’ freeboard (min)	Not specified	100-yr / 72-hr 1.64’ freeboard (min)	Not specified
Internal conveyance (emergency spillway)	Not specified	0.25 PMF (3’ freeboard requirement)	PMF (no freeboard requirement)	Active Care: 1/1,000 (no freeboard requirements)
External conveyance	100-yr / 24-hr 1’ freeboard (min)	100-yr / 24-hr 1’ freeboard (min)	-	Active Care: 1/1,000 (no freeboard requirements)

Notes: [1] Based on ADWR Dam Safety Low Dam Hazard Class. [2] Based on High C Dam Failure and Spill Consequence Classification. [3] Based on a Significant Consequence Classification. [4] A water balance model (see Section 8) was developed to determine the minimum pumping rates required to maintain adequate storage volume for the design flood criteria considering stormwater runoff from the TSF, direct precipitation over the pond, and draindown from the TSF.

9.1. Hydrologic Model

The hydrologic modeling system HEC-HMS (version 4.9), a precipitation-runoff simulation computer program developed by the Army Corps of Engineers, was used to calculate the magnitude and timing of the peak flows as well as volumes resulting from specified storm events. HEC-HMS was used to simulate water flow through a network of interconnected drainage basins. Separate HEC-HMS models were created for the stormwater system external to the TSF and for the stormwater system internal to the TSF reporting to the UDCP. The watershed areas were divided into sub-basins such that flows and volumes could be calculated at various points within the watershed where design elements were located. Peak flows and volumes were calculated using HEC-HMS to complete the design calculations.

9.2. Watershed Delineation

In order to design the necessary hydraulic structures to control runoff, site-wide watershed maps were developed to establish inputs for the hydrologic models. Based on the facility layouts, a watershed map was established to determine the catchment areas contributing to each design element and the information was input into HEC-HMS. See Appendix G.5 for the site wide watershed maps.

9.2.1. Watershed Characteristics

Specific watershed characteristics such as area, land/drainage average slope, infiltration/runoff capacity and lag time, were used to estimate peak flows. Areas, average slope, initial abstraction, and lag time values within each sub-basin are included in Appendix G.5.

- **<u>Contributing area and average slope of the site specific catchments</u>** were established using AutoCAD Civil 3d based on site topography data.
- **<u>Infiltration and runoff characteristics</u>** of the soils within the catchment area were estimated by using the USDA NRCS curve number (CN) method (USDA NRCS, 1986). A higher CN value represents a higher runoff potential and a lower CN value represents a lower runoff potential. Selection of an appropriate CN to represent the watershed area was based on the type of soil, in-situ soil moisture content, ground cover, and rainfall intensity as described in Table 9.3. A photo of the typical landscape is presented in Figure 9.1.

TABLE 9.3 – HYDROLOGY CHARACTERISTICS – CURVE NUMBER

Land Type	Curve Number	Description
Natural Ground	72	The NRCS maps for the area indicate that soils in the watershed area are primarily classified as hydrologic soil group D. Type D soils are classified as having the potential for low infiltration and high runoff rates. Vegetation is typical of the Pinyon-Oak-Juniper Woodland and a CN of 72 was used to represent the existing ground surface. It was calculated as an average between the “oak-aspen” and “pinyon-juniper” cover types, fair ground cover condition and soil group D from NRCS Urban Hydrology for Small Watersheds TR-55 Table 2-2d.
Dry stack tailings with armoring face	85	The granular nature of the rock armoring on the exterior slope of the dry stack tailings will help to absorb precipitation and/or delay its release as runoff. A CN of 85 was assigned to the dry stack tailings surface.
Protective Layer	72	The protective layer (drainage layer) will absorb precipitation and delay its release as runoff due to its granular nature and free draining properties. A CN of 72 was assigned to the protective layer.
Geomembrane	100	The geomembrane surfaces were assigned a CN of 100 because no absorption will occur on the geomembrane surface.
Roadways/ Bare Soil	95	The roadways and disturbed areas were assigned a CN of 95 because limited absorption will occur on these surfaces.

FIGURE 9.1: PHOTO OF TYPICAL LANDSCAPE

- **Lag time and unit hydrograph development:** The time component of the unit hydrograph (runoff versus time) is a function of the topography, average watershed slope and infiltration characteristics of the watershed. The lag time (time from the rainfall midpoint to the outlet of the watershed), which can be calculated based on geometric and physiographic characteristics of the watershed, is integral to developing the NRCS unit hydrograph. Refer to Appendix G.5 for calculation details and results for individual basins.

9.3. Design Storm Event and Distribution

Precipitation values were developed by Ecological Resource Consultants and are presented in Section 2.6 for the 100-yr/24-hr (BADCT), 100-yr/72-hr (ANCOLD), 1,000-yr/24-hr (GISTM) and general and local PMP (ADWR Dam Safety/ANCOLD) design storms. Precipitation characteristics of this upland desert region are variable and cyclic. Approximately 50 percent of the rainfall comes during the period from July through October in “monsoonal” thunderstorms, which are often accompanied by strong winds. Design storm events are assigned to each design element on the project and are consistent with BADCT, ANCOLD and GISTM guidance document requirements.

9.4. Climate Change

Climate change was considered in the sizing of the stormwater conveyance structures as well as the UDCP. See Section 2.6.6 for projected climate parameters changes provided to NewFields for RCP4.5 and RCP8.5 for the years 2030, 2050, and 2090. For TSF1 during mining operations, the RCP8.5 2030 (+7.0%) was used to modify the climate data. For passive closure, the RCP8.5 2090 (+27.4%) was used to modify the climate data.

9.5. Peak Flow and Volume Results

The peak discharges were estimated using HEC-HMS and are included in Table 9.4 and Table 9.5. Detailed design calculations can be referenced in Appendix G.5.

TABLE 9.4: INTERNAL HYDROLOGIC MODEL RESULTS

Conveyance Structure (TSF1)	Peak Flow (cfs)			
	100-yr/24-hr	100-yr/72-hr	1,000-yr/ 24-hr	Local PMP
Internal Watershed 1 (IWS1) Diversion	108.8	158.6	156.7	636.6
Internal Watershed 2 (IWS2) Diversion	79.3	119.8	115	470.4
Internal Watershed 3 (IWS3) Diversion	63.4	97.2	91.9	375.3
Internal Watershed 4 (IWS4) Diversion	36.1	60	52.8	211.7
TSF1 Emergency Spillway	0	0	0	1074.6
TSF1 UDCP Emergency Spillway	0	0	0	682.3*
TSF1 Internal Closure Channel	-	-	-	491.8
TSF1 West Pond Closure Spillway	-	-	-	845.3
TSF1 East Pond Closure Spillway	-	-	-	433.2
Detention Structure (TSF1)	**Maximum Stored Volume (acre-ft)**			
	100-yr/24-hr	**100-yr/72-hr**	**1,000-yr/ 24-hr**	**Local PMP**
UDCP	16.7	21.7	24.6	33.9*

*Result assumes UDCP water level is at the spillway invert at start of HEC-HMS model.

TABLE 9.5: EXTERNAL HYDROLOGIC MODEL RESULTS

Conveyance Structure (TSF1)	Peak Flow (cfs)			
	100-yr/24-hr	100-yr/72-hr	1,000-yr/ 24-hr	Local PMP
Access Road Diversion (EWS2)	25.3	41.3	34.3	119.7

9.6. Internal Stormwater Diversion Channel Sizing

The internal stormwater diversion channels are sized to convey the peak flow utilizing a trapezoidal or triangular cross section. The channel depths are determined based on the flow depths calculated using Manning's formula for open channel flow utilizing the computer program FlowMaster. A Manning's roughness "n" coefficient is estimated using the output from HEC-15 modeling for riprap armored channels and a coefficient of 0.035 for internal TSF diversion channels. The maximum design storm utilized to size the diversion channels is listed in Table 9.6. Detailed design calculations can be referenced in Appendix G.5.

TABLE 9.6: DIVERSION CHANNEL SIZING RESULTS

Conveyance Structure	Channel Side Slopes (xH:1V)	Channel Bottom Width (ft)	Min. Channel Slope	Channel Depth (ft)	Design Storm	Max Flow Depth (ft)
TSF1 West Internal Detention Pond (IWS 1)	2.5	0	1.0%	10	100-yr/72-hr	3.3
					Local PMP	5.6
TSF1 West Internal Detention Pond (IWS2)	2.5	0	1.0%	10	100-yr/72-hr	3.0
					Local PMP	5.0
TSF1 East Internal Detention Pond (IWS3)	2.5	0	1.0%	10	100-yr/72-hr	2.8
					Local PMP	4.6
TSF1 East Internal Detention Pond (IWS4)	2.5	0	1.0%	10	100-yr/72-hr	2.3
					Local PMP	3.7

The TSF1 West and East Internal Detention Ponds as well as the UDCP were modelled in HEC-HMS for maximum water elevation considering the design storms. The maximum water elevations are listed in Table 9.7 and detailed design calculations can be referenced in Appendix G.5. Please note, the ponds are assumed to be empty at the start of the model unless otherwise stated in the table.

TABLE 9.7: DETENTION POND SIZING RESULTS

Conveyance Structure	Pond Crest Elevation (ft amsl)	Allowable Water Elevation** (ft amsl)	Maximum Water Elevation (ft amsl)			
			100-yr/ 24-hr	100-yr/ 72-hr	1000-yr/ 24-hr	Local PMP
TSF1 West Internal Detention Pond	5,042.0	5,036.5	5,029.1	5,031.0	5,031.5	5,040.8
TSF1 East Internal Detention Pond	5,127.0	5,125.0	5,102.4	5,104.6	5,105.1	5,119.2
TSF1 UDCP	4,965.06	4,958.06	4,949.5	4,953.8	4,956.1	4,962.3*

*Result assumes UDCP water level is at the spillway invert at start of HEC-HMS model. The UDCP can safely pass the PMP peak flows. There is no freeboard requirement for the PMP event.
**Allowable water elevation represents pond crest elevation minus freeboard (use for extreme storm storage for 100-year design storms).

9.7. External Stormwater Diversion Channel Sizing

The external stormwater diversion channels are sized to convey the peak flow utilizing a trapezoidal or triangular cross section. The channel depths are determined based on the flow depths calculated using Manning's formula for open channel flow utilizing the computer program FlowMaster. A Manning's roughness "n" coefficient is estimated using the output from HEC-15 modeling for riprap armored channels. The maximum design storm utilized to size the diversion channels is listed in Table 9.8. Detailed design calculations can be referenced in Appendix G.5.

TABLE 9.8: DIVERSION CHANNEL SIZING RESULTS

Conveyance Structure	Channel Side Slopes (xH:1V)	Channel Bottom Width (ft)	Min. Channel Slope	Channel Depth (ft)	Design Storm	Max Flow Depth (ft)
Haul Road Diversion Channel	2.5	0	10%	4	100-yr/72-hr	1.6

HEC-RAS (v6.4) was used to model steady-state channel hydraulics through the stormwater diversion channels in closure. Both the active and passive closure scenarios are included in the hydraulic model. Active closure uses the 1,000-yr/24-hr storm event, intensified by the 2090 RCP8.5 climate change hydrologic predictions, to model the runoff-producing event while passive closure uses the PMP storm, intensified by the 2090 RCP8.5 climate change hydrologic predictions. Peak flows calculated within HEC-HMS were input into the HEC-RAS model at key locations (watershed junctions).

No channel flooding resulted from the 1,000-yr 24-hr storm in the Active Closure scenario. However, the larger PMP storm produced flooding over access roads adjacent to the TSF in several locations during the Passive Closure scenario. There are five main areas of flooding in the Passive Closure scenario, as shown in Figure 9.2.

- Area 1: located west of the TSF, near the upstream end of the existing stormwater diversion channel. In this area, stormwater that overflows from the external stormwater diversion channel will spill over onto the access road. The maximum ponding depth on the roadway and against the TSF downstream embankment toe is approximately 1 foot.
- Area 2: located west of the TSF directly downstream of Area 1. In this area, stormwater that overflows from the external stormwater diversion channel will spill over onto the access road. The maximum ponding depth on the roadway and against the TSF downstream embankment toe is approximately 9 inches.
- Area 3: located west of the TSF directly downstream of Area 2. In this area, stormwater that overflows from the external stormwater diversion channel will spill over onto the access road. The maximum ponding depth on the roadway and against the TSF downstream embankment toe is approximately 2 feet.

- Area 4: located north and downstream of the UDCP. In this area, stormwater that overflows from the external stormwater diversion channel will spill over onto the access road and UDCP downstream embankment slope. The maximum ponding depth on the roadway and against the UDCP embankment is approximately 2.5 feet. Please note, prior to passive closure the UDCP will be decommissioned and the area will be converted to a passive treatment system.
- Area 5: located outside of the area of TSF1 and appurtenant infrastructure.

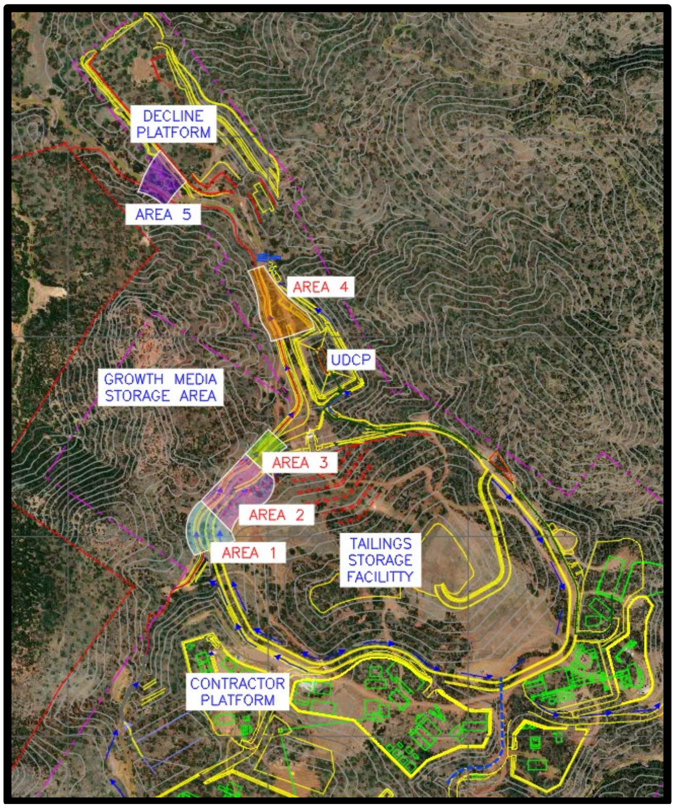


FIGURE 9.1: EXTERNAL STORMWATER DIVERSION CHANNEL AREAS (PASSIVE CLOSURE)

During passive closure, it is recommended that the access road adjacent to the existing stormwater diversion channel be utilized as an extended floodplain during the PMP storm event. Riprap armoring is recommended on the downstream toe of the TSF embankment. The recommended height of riprap on the downstream TSF embankment toe can be referenced on Drawing A615.

- 3 foot of riprap height from station 18+00 to station 27+00.
- 2 foot of riprap height from station 27+00 to station 34+50.

9.8. Culvert Sizing

The culverts are sized using the Bentley computer program CulvertMaster. Table 9.9 presents the design storm, peak flow, slope, number, and diameter of the culverts. Detailed design calculations can be referenced in Appendix G.5.

TABLE 9.9: PIPE SIZING RESULTS

Conveyance Structure	Design Storm	Peak Flow (cfs)	Slope (%)	Number of Culverts	Culvert Diameter (ft)
TSF1 West Pond Closure Spillway Culverts (active closure)	100-yr/ 24-hr*	124.2	2.4	3	3.5
TSF1 East Pond Closure Spillway Culverts (active closure)	100-yr/ 24-hr*	63.6	1.0	2	3

*Culverts installed as part of TSF1 closure to be utilized to maintain access to the site during operations. The culverts will be removed and replaced with an armored open channel spillway capable of safely passing the PMF passive closure.

9.9. Riprap Revetment

The riprap revetment was designed using the US Department of Transportation Federal Highway Administration Design of Roadside Channels with Flexible Linings, Hydraulic Engineering Circular No. 15 (HEC 15). Riprap revetment was designed for the minimum 100-yr/24-hr storm event to minimize erosion. Plan view locations of the riprap can be referenced on Drawings A400 and A600. The channel sections and details showing riprap sizing can be referenced on Drawings A260, A320, and A610.

10. CONSTRUCTION SEQUENCING

In general terms TSF1 will be constructed in compliance with the Design Drawings and Technical Specifications by third party contractors. The construction sequencing provides the anticipated order for construction elements and major components associated with the completion of TSF1.

- TSF1 Expansion Construction
  - Remediation of the historic shaft (Drawing A500)
  - Existing UDCP Emergency Spillway Revetment Installation (Drawings A405 and A407)
  - Waste Rock Buttress Construction Access Road (Drawing A302)
  - Waste Rock Buttress Placement (Drawings A305 and A307)
  - Construct reclaim pipeline from the existing UDCP to WTP2 (Drawing A200).
  - Excavate, load, haul, and stockpile growth media within the disturbance footprint at the Growth Media Storage Area (Drawing A202)
  - Construct TSF1 Notch (Drawing A205)
  - Construct TSF1 Perimeter Road (Drawings A200, A210, A240-A242, and A260)
  - Grade TSF1 Basin (Drawings A200, A210, and A260)
  - Construct Emergency Spillway and Embankment Raise (Drawings A270, A272, and A274)
  - TSF1 LPSL/GCL placement (Drawing A220)
  - TSF1 geomembrane installation (Drawing A220)
  - TSF1 instrumentation installation (Drawing A222)
  - TSF1 underdrain piping system (Drawing A230-A234)
  - TSF1 detention pond outfall pipe extension (Drawing A270)
  - TSF1 Protective Layer placement (all areas that receive geomembrane)
  - Placement of armoring berms, filter tailings, waste rock and miscellaneous material in TSF1 (Drawing A300)
  - TSF1 Haul Ramp (Drawing A310)
- TSF1 Closure Construction
  - Place closure cap over the entire area of the TSF and hydroseed (Drawings A600 and A610)
  - Revegetate growth media storage area after material is placed on TSF (Drawing A600)
  - Construct permanent closure channels at the dry stack toe consisting of LPSL, geotextile and riprap (Drawings A600 and A610)
  - Construct closure spillway and culverts though the perimeter road (Drawing A600)
  - TSF UDCP to be filled and converted to a passive treatment system (Drawing A600)

- Complete external stormwater diversion channel upgrade at time of passive closure (Drawing A615)
- Maintain closure cap as necessary.

11. FACILITY OPERATIONS

11.1. Waste Rock from Mine Development

Waste rock (also referred to as development rock) generated from mine exploration and development will be classified as PAG or non-PAG (by others). PAG waste rock brought to ground surface will be directed to the following locations for permanent placement:

- Initial PAG waste rock generated from the main and ventilation shaft construction as well as initial mine development will be placed within the TSF geomembrane lined footprint on the northern side of the stacking. The PAG waste rock will act as a rock buttress on the downstream side of the stacking limits. The initial placement geometry of the PAG waste rock is presented on Drawing A305. The initial PAG waste rock placement will occur prior to filtered tailings production.
- PAG waste rock generated during potential future production will be placed in TSF1.

Non-PAG waste rock brought to surface will be directed to the following locations for placement:

- TSF1, the non-PAG waste rock stockpiles, or utilized as construction material.

11.2. Filter Plant Design

Utilizing test results from filtration laboratory test work on the production tailings, the Filter Plant was designed to achieve 12.3% moisture content by dry weight of solids (11% metallurgical moisture content). Based on Standard Proctor compaction test results (2018 – 2022) for the production tailings the OMC ranges from 10.8% to 14.4% with an average of 12.2%. The Filter Plant target moisture content is approximately equal to the average OMC obtained from the Standard Proctor. Although the Filter Plant is designed to target 12.3% moisture content, it is based on ideal laboratory conditions. It is reasonable to expect that the actual tailings moisture content produced from the Filter Plant will be variable. Due to the expected variation in filtered tailings moisture content, methods to address variable moisture content and general upset conditions at the site are addressed later in this section.

11.3. Material Placement in the TSF

The TSF will be stacked to the geometries shown on Drawing A300. Filtered tailings, waste rock, PAG construction cut, and miscellaneous materials (solids from water treatment including filter cake from WTP1 and WTP2, drill and core cuttings, sediments from BMPs, assay rejects, and sediments from vehicle and equipment wash sumps) will be delivered to the TSF via truck haulage. The projected quantities of each material are summarized in Table 11.1. A TSF1 filling curve (Drawing A350) and yearly stacking plan (see attached Figures 1 through 4) were developed to show the progression of the facility over time.

TABLE 11.1 PERMITTED AND NEW MATERIAL QUANTITIES (PROJECTED)

DESCRIPTION	VALUE	COMMENT
Filtered Tailings (new material)	5,500,000 cy (8,000,000 tons)	Filtered tailings will be placed in the TSF or directed underground as cemented paste backfill. Quantity listed in this table is filtered tailings reporting to TSF for surface storage. Assumed placed density of 108 pcf (93% relative compaction).
Waste Rock from exploration and mine development (permitted material) also referred to as “development rock”	1,100,000 cy (1,900,000 tons)	Waste Rock will be generated from exploration and mine development including the Main and Ventilation Shafts. Assumed placed density of 125pcf.
Construction PAG rock cut (permitted material)	20,000 cy	Estimated quantity based on planned future construction work. Value provided by South32.
Miscellaneous Material (permitted and new materials)	~100,000 cy (~12,000 cy per year for 8 years) ~1.25% of total storage volume	WTP1 and WTP2 Filter Cake (permitted) Core Cutting Material (permitted) Drill Cuttings (permitted) Sediment from Stormwater BMPs (permitted) Assay Rejects (new) Sediments from Vehicle and Equipment Wash Sumps (new) Miscellaneous Solids from Water Treatment (new) Include a 10% contingency

Filtered tailings will be hauled to the TSF, dumped, spread with a dozer to a nominal thickness not to exceed 12-inches (loose) in depth, and compacted through selective routing of the haulage equipment and dedicated smooth drum vibratory compactors. As necessary, the filtered tailings will be moisture conditioned using a tractor and a disc to facilitate drying prior to compaction. If required, lime treatment will occur by spreading quick lime (~1% by dry weight) over the surface of the filtered tailings and discing the lime into the wet tailings lift to expedite drying. Lime addition per layer will be restricted to a maximum of 3% by weight. Tailings moisture content at the time of compaction must be within 3% of the OMC as determined by ASTM D698 (Standard Proctor). Once the required moisture content is achieved, the filtered tailings will be compacted to a minimum of 93% of the MDD also derived from ASTM D698. It is imperative that moisture and compaction specifications are satisfied during operations to ensure first and foremost the stability of the dry stack under both static and seismic loading conditions. During the compaction effort, the tailings surface will be graded to drain to minimize ponding and potential rewetting of the in-place tailings. It is important to understand that the filtered tailings placement operation will require a dedicated staff and equipment fleet to be successful. Essentially, the filtered tailings will be placed as an engineered fill that will be controlled by the placement and CQA monitoring requirements defined in the Technical Specification (see Appendix E).

When filtered tailings are placed in accordance with the Technical Specifications, the tailings mass will be highly resistance to liquefaction (see Appendix F). This approach to placement is viable as demonstrated during the VRP TSF project when over 1,000,000 cubic yards of historic tailings were exhumed from tailings piles (located on site) and placed in the VRP TSF using the approach described above. CQA verification testing, including over 400 moisture density tests, performed during the project showed that not only is it possible to place tailings in this manner but that this approach results in a dense stable tailing mass (NewFields, 2020a).

11.4. Filtered Tailings Placement Approach ("Proof of Principle")

As referenced above, the future production tailings placement in TSF1 utilizes a similar placement methodology employed during the VRP project. The historic tailings placement performed during the VRP project serves as a "proof of principle" case for the production tailings placement approach outlined in this design. The historic tailings were placed over the course of two years (2018 and 2019) which included the annual monsoon seasons. During historic tailings placement, in situ moisture contents in the historic tailings piles ranged from slightly below OMC to 10% over OMC. Even the wettest tailings were successfully managed on the TSF surface by moisture reduction through mixing with drier tailings and/or discing.

Where moisture contents could not be reduced quickly enough, quick lime (~1% to 2% by dry weight) was added to the tailings surface and the lime was disced into the wet tailings to expedite drying. Quick lime was applied to the wettest tailings, when inclement weather was in the forecast, or after a rain event that wetted uncompacted tailings. Lime was quite effective at expediating drying of the historic tailings. Lessons learned from the VRP project include the following:

- Placement of on-specification tailings should be a priority whenever weather permits. The placement surface must be compacted and graded to promote stormwater runoff away from active and completed work areas. Completing areas of on-specification tailings (compacted and properly graded) reduces the risk of significant rework due to moisture addition to uncompacted tailings from meteoric events or as a result of ponding on the surface of compacted tailings.
- Do not actively place tailings during heavy rain events. Utilize a short-term storage provision to protect on-specification tailings from meteoric moisture addition. Stockpiling tailings was used with some success during the VRP project but more robust protection, such as a covered

storage area is a better option. The process design, completed by Fluor, includes short term covered storage of filtered tailings.

- Coordinate tailings placement activities between rain events during monsoonal periods. It was an effective approach used during the VRP construction, particularly if small placement areas were observed. It allowed placement, compaction, and grading prior to the next meteoric event.
- Use lime treatment when tailings need to be dried quickly. This was effective during the VRP project, when there were relatively short breaks between rain events and quick drying of tailings was required.
- Tailings that were hauled to the TSF were better protected in end dumped piles during rain events than tailings that were spread and not compacted. This method was used during the VRP TSF stacking to allow tailings placement in relatively short time frames between rain events. This tailings placement strategy of leaving tailings in end-dumped piles, is also an option to protect tailings by encouraging meteoric runoff on the active tailings stacking surface during production, if tailings cannot be spread and compacted prior to precipitation events. The end-dumps piles placed during the VRP were quite effective at limiting infiltration and rewetting of tailings during meteoric events.
- Placement of overly wet tailings in 12-inch lifts resulted in a loss of truck trafficability. If overly wet tailings are hauled to the TSF, it was better to spread them in a shallower lift to allow continued placement while wet tailings were being dried on grade through discing, lime amendment or mixing with the lift beneath to reduce moisture content as quickly as possible.
- Five (5) foot high armoring berms established on the exterior slopes of the dry stack TSF have been effective in reducing wind and water erosion of the stacking slope. The material and geometry utilized for the VRP project has performed well throughout the various monsoon seasons to date.

The lessons learned during the VRP project were considered during development of the TSF1 expansion design.

11.5. Managing Upset Conditions during Filtered Tailings Placement

Successful tailings placement at the Hermosa Project requires a robust strategy for managing upset conditions to ensure that the placement criteria is achieved, and operational continuity is maintained. The design team and South32’s management approach will have defined tools that can be used to address tailings placement on the TSF during upset conditions. The approach will address process upsets associated with the Paste Plant and Filter Plant and placement upsets associated with weather and TSF surface conditions. The following summarizes the approach South32 will take to manage upset conditions during filtered tailings placement.

The upset conditions management plan will consider the following:

- The Filter Plant is designed to target optimum moisture content, it is expected the actual tailings moisture content produced from the Filter Plant will be variable.
- During the VRP project, over 1 Mcy of historic tailings were placed using haulage equipment, dozer, tractor with disc, lime addition (as needed), and compactor. Approximate placement rates were 3,500 cy/day during the monsoonal season and 4,400 cy/day during the non-monsoonal season. Experience gained during the VRP construction is an excellent indicator that tailings placement method proposed is viable considering the average placement rate for the project is approximately 4,000 cy/day.
- Based on experience with lime treatment of wet tailings during the monsoon season, moisture content can be reduced quickly to get tailings compacted and graded to drain during breaks in weather.
- Placement of filtered tailings will require a robust set of tools. The upset tailings management plan considers conditions that are likely to occur and addresses both process and ambient condition variables in developing tools for the operator to use for focused tailings placement. Upset conditions can be a result of the following:
    - Mechanical upset: Equipment failure and/or required equipment maintenance activities resulting in the inability to filter tailings or inability to place tailings as cemented paste backfill.
    - Process upset: Inability of the Filter Plant to dewater tailings to the required specification.
    - Weather and placement upset: Precipitation event (rain or snow) prevents placement, un-trafficable placement surface, or overly wet filtered tailings material prevents conformance with the placement criteria (compaction and moisture content) outlined in the Technical Specifications.

Table 11.2 provides a short description of the operational upset conditions.

TABLE 11.2 FILTERED TAILINGS OPERATIONAL UPSET EVENTS DEFINITIONS

Upset Event Name	Description
Mechanical Upset	➢ The paste plant is not able to deliver cemented paste backfill underground. All filtered tailings report to the TSF increasing the required placement rate/time (approximately double). ➢ Equipment failure or maintenance activities result in reduced or suspended throughput.
Process Upset	➢ Filtration plant is unable to dewater tailings to the required specification (i.e., ore material property variability requires adjustment in filtration plant). Process upsets can result in overly wet filtered tailings where the material may not be transportable via haul truck, trafficability at the placement surface may be lost, and/or increased effort (time) to moisture condition the filtered tailings at the TSF, to get the tailings within specification and ready for compaction. ➢ Un-transportable filtered tailings material may occur if the filtered tailings product is overly wet. Filtered tailings will be transported loose in the bed of the haul truck. During transport, the filtered tailings will be exposed to vibrations. If the filtered tailings are overly wet, the filtered tailings can liquefy.
Weather Upset	➢ Precipitation (rain or snow) resulting in temporary suspension of filtered tailings placement at the TSF. Any in-place filtered tailings left uncompacted will take on additional moisture. All filtered tailings must be compacted and graded to drain prior to precipitation events. Additionally, active and completed placement surfaces may require maintenance to repair erosion or areas that are ponding.
Placement Upset	➢ Un-trafficable placement surface area will occur if the filtered tailings are overly wet. Filtered tailings placement will be slowed or stopped in this area until moisture content can be reduced, and access can be restored.

Management of upset conditions will include the following general strategies.

- In-facility management: methods of managing filtered tailings within the TSF geomembrane lined footprint.
  - Moisture conditioning (drying) of the filtered tailings with conventional equipment (tractor and disc).
  - Moisture reduction through lime amendment.
- Temporary storage areas: short-term filtered tailings storage structures or stockpiles.
- Recirculation of the filtered tailings through the Filter Plant for refiltration.
- Alternative placement areas: strategic filtered tailings disposal as underground cemented paste backfill.

11.6. Armoring Berms

The exterior face of the TSF will be constructed of armoring berms to provide erosion protection as an ongoing part of the tailings stacking operation. The armoring berm material is assumed to be sourced from mine waste rock or suitable on-site construction cut material, as necessary. It will be placed as a 5 ft high berm around the perimeter of the dry stack as the filtered tailings are being placed in the TSF. As the tailings level reaches the top of a given berm, a new 5 ft high berm will be established, and the new berm will coalesce with the berm beneath it in a manner that produces a continuous armored face on the external dry stack tailings slope. The berms constructed during 2018/2019 on the exterior of the existing VRP TSF stack have performed well throughout the various monsoon seasons to date. Future armoring berms are planned to be placed in the same manor and geometry as the existing armoring berms.

11.7. Operations, Maintenance and Surveillance

During construction and on daily, weekly, monthly, and yearly intervals thereafter or after major storm or surface water events, the TSF and Underdrain Collection Pond will be inspected to identify damage, degeneration and/or potential discharges. Each inspection will include a visual inspection to identify unusual scour or degradation of materials, sloughing, rolling rock or visible seepage in addition to a physical inspection to verify design capacities are not exceeded. All inspection records will remain on-site or at an approved location. For a summary of the TSF and Underdrain Collection Pond operations, maintenance, and surveillance plan refer to Appendix J.

If the inspection identifies damage, degeneration and/or an accidental discharge, the Contingency Plan will be utilized to determine the next course of action.

12. CONTINGENCY PLAN

A Contingency and Emergency Response Plan was prepared in accordance with AAC. R18-9-A204 to define the actions if a discharge results in any of the following:

- A violation of an Aquifer Water Quality Standard (AWQS) or an Acceptable Quality Limit (AQL)
- A violation of a discharge limitation
- A violation of any other permit condition
- An exceedance of an Alert Level (AL), or
- An imminent and substantial endangerment to the public health or the environment occurs

The Contingency and Emergency Response Plan can be referenced in Attachment E of the Hermosa Project Aquifer Protection Permit Significant Amendment Application (P-512235).

13. FACILITY CLOSURE STRATEGY

The TSF1 closure configuration plan view is presented on Drawing A600. The closure strategy includes capping the Dry Stack TSF with 1-2 feet of reseeded growth media underlain by a capillary break created by a combination of armoring berms on the exterior slopes of the TSF and a rock layer (capillary break) placed on the top surface of the TSF after active mining is complete. The side slopes of the final TSF will have a 3H:1V compound slope with 2.5H:1V open slopes broken every 25 ft in vertical elevation rise by a 12.5 ft wide bench. The compound slope configuration will aid in reducing meteoric water runoff velocities, thereby reducing the propensity for erosion of the closure cap on the sides of the TSF. The top of the TSF will be graded to form a swale that flows to an outfall (along the haul road alignment), where flows from the top of the reclaimed TSF will be directed to the base of the TSF. Flows reporting to the base of the TSF from the outfall and from the TSF slope areas will be collected in closure channels (located inside of the TSF perimeter berms) and conveyed around the TSF base where they will be directed, via a TSF spillway, to a permanent stormwater diversion channel or natural drainage. The layout of the closure channels can be referenced on Drawing A600. Details of the closure channels can be referenced on Drawing A610.

It should be noted that meteoric flow collecting in the closure channel will be separated from the underdrain system by an LPSL layer which will serve to minimize infiltration into the underdrain system. Surface water flow reporting to the closure surface will exit TSF1 on both the western and eastern side of the facility (see Drawing A600). The western and eastern spillways will utilize culverts to pass flow under the site access roads while the mine is in operation. When the site moves to a passive closure phase, the culverts that pass beneath the access road adjacent to TSF1 will be removed and replaced with a riprap armored open channel spillway.

It is expected that the post-closure underdrain flows from the TSF will be minimal because the closure cap will minimize infiltration and very little water is expected to be entrained within the tailings mass because the tailings will be largely unsaturated at closure. This expectation of very low underdrain flow post-closure is supported by actual dry season (non-monsoonal) flows that are currently being observed for the VRP TSF that are less than 1 gpm (after a month long period of no precipitation). It should be noted that these small flows are on the existing VRP TSF that does not yet have a closure cap in place. Flows will be reduced once a closure cap is in place. The underdrain flows will continue to be collected and transmitted to active water treatment systems. Active water treatment will remain in-place until a passive treatment system can be proven to effectively address post closure contact water chemistry and a passive treatment system can be installed in the UDCP area. Maintaining active treatment post closure will allow the engineer to evaluate post closure underdrain water chemistry and expected flow rate ranges to effectively design a passive treatment system.

The closure strategy for siting a passive treatment system remains unchanged from the approved closure strategy for the VRP project. The approach is to reduce the UDCP size post closure (lower the embankment elevation), fill the remaining pond storage area with a passive treatment substrate that effectively addresses the remaining underflow water chemistry, site an effluent or contact water delivery system that feeds the bottom of the substrate, and design an appropriate outfall to the natural drainage downstream of the pond/passive treatment system. The specific mix of substrate will be developed through observation of pilot scale passive treatment cells during the post-closure period. Results of the pilot scale testing, post closure effluent chemistry variability, and flow rate variability will form the design basis for the permanent passive treatment system to be sited. Until an effective passive treatment approach can be demonstrated, active treatment of underdrain flows will continue.

The following actions are being taken during operations to simplify eventual TSF1 closure:

- During operations, the TSF dry stack side slopes are constructed to the ultimate closure configuration which is a composite 3H:1V slope. Minimal grading will be required to transition from operations to closure.
- During construction, growth media material will be removed from the TSF footprint and stockpiled adjacent to the TSF for placement of the closure cap.
- The UDCP is planned to be converted to a passive treatment system for treatment of post closure seepage from the TSF. The TSF will be constructed so that all percolation through the stack will be collected and conveyed to these areas via gravity. This will minimize pumping and construction effort required during closure.

- A pilot scale passive treatment system will be utilized during active operations as a proof of principle for post closure design.
- The water treatment plants required during active operations will be utilized for active treatment until a passive treatment system can be established.

13.1. Standardized Reclamation Cost Estimator (SRCE)

NewFields has prepared a SRCE model (version 1.4.1) to estimate closure costs associated with the "Issued for Tender" Hermosa Project TSF1 APP Significant Amendment BADCT Design Drawings. The SRCE model is software that was developed as a collaborative effort between the Nevada Division of Environmental Protection (NDEP) Bureau of Mining Regulation and Reclamation (BMRR), the US Department of Interior Bureau of Land Management (BLM) and the Nevada Mining Association (NvMA). The SRCE model was developed by these agencies to provide a template for the calculation of mine site reclamation costs in an effort to provide consistent, complete, and accurate estimates. ADEQ recommends (but does not require) that applicants use the SRCE model to estimate closure costs as can be seen on the "Individual Aquifer Protection Permit Closure and Post-Closure Plan/Strategy and Cost Estimate Checklist" (p. 1) (available at https://static.azdeq.gov/forms/app_cost_est_checklist_mining_indust.pdf).

NewFields prepared the SRCE model for the elements identified as APP discharging facilities in the current permit amendment. The following facilities were included in the model:

- Existing WTP1.
- Existing Underdrain Collection Pond.
- Existing TSF including the proposed TSF1 expansion.
- Existing WTP2.

Model inputs were developed based on existing aerial site topography, as-built data from the VRP project construction, and the proposed TSF1 grading. Conceptual closure drawings for the TSF1 design, created to show the closure strategy, can be referenced in Drawings A600 through A615. A technical memo summarizing the SRCE model assumptions, inputs and results as well as SRCE model outputs can be referenced in Attachment C of the Hermosa Project Aquifer Protection Permit Significant Amendment Application (P-512235).

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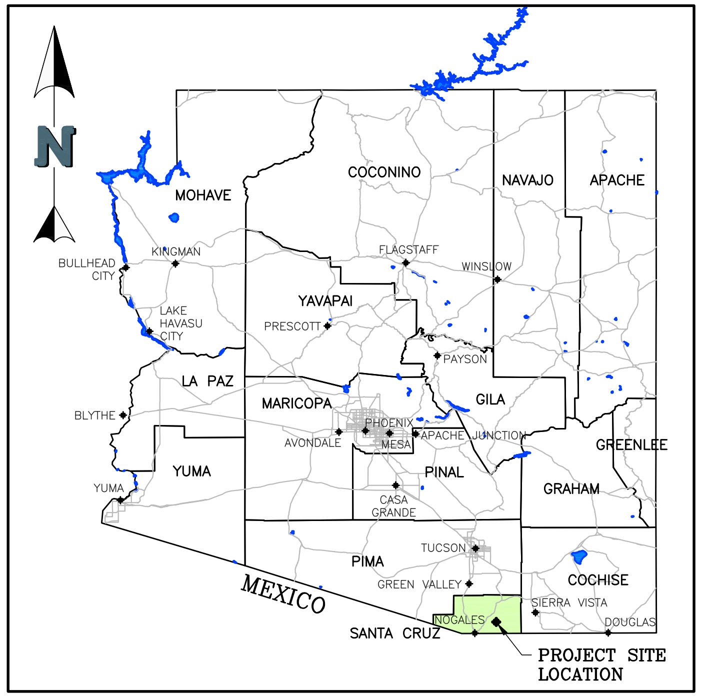
DESIGN DRAWINGS



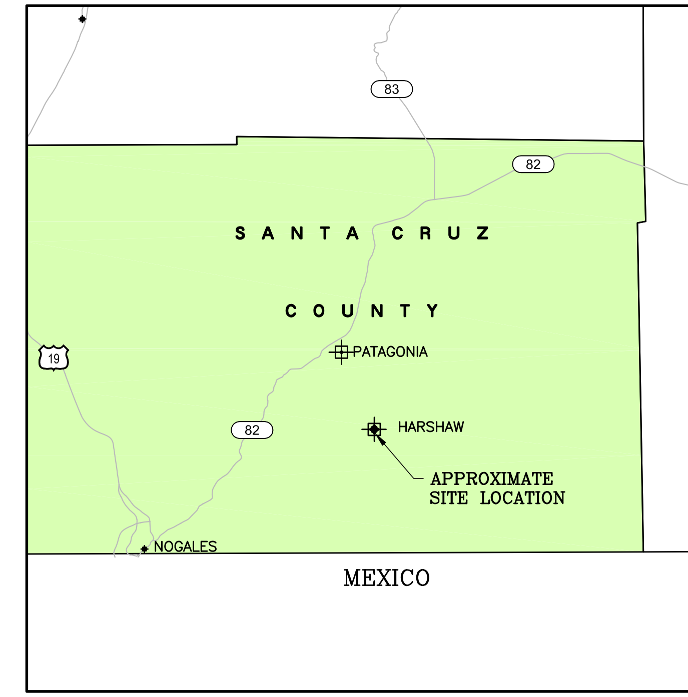
COUNTY MAP

HERMOSA PROJECT
TAILINGS STORAGE FACILITY 1 (TSF1)

AQUIFER PROTECTION PERMIT (APP) SIGNIFICANT AMENDMENT

BEST AVAILABLE DEMONSTRATED CONTROL TECHNOLOGY (BADCT) DESIGN

ISSUED FOR TENDER
DECEMBER 8, 2023



VICINITY MAP

DRAWING LIST

DWG NO.	DRAWING TITLE	REV
A000	COVER SHEET	0
A025	GEOLOGIC PLAN VIEW	0
A050	EXISTING CONDITIONS (PRIOR TO PRODUCTION)	0
A100	TSF1 GENERAL ARRANGEMENT	0
A150	TSF1 GEOTECHNICAL SITE INVESTIGATION PLAN VIEW	0
A200	TSF1 PLAN VIEW	0
A202	PROPOSED GROWTH MEDIA STORAGE AREA	0
A205	TSF1 NOTCH	0
A210	TSF1 BASIN GRADING ISOPACH	0
A220	TSF1 GEOMEMBRANE PLAN VIEW	0
A222	TSF1 INSTRUMENTATION PLAN VIEW	0
A230	TSF1 PIPING PLAN VIEW	0
A232	WEST RECLAIMED TAILINGS REGRADE AND HORIZONTAL DRAIN PIPE LAYOUT	0
A234	EAST RECLAIMED TAILINGS REGRADE AND HORIZONTAL DRAIN PIPE LAYOUT	0
A240	TSF1 PERIMETER ROAD PROFILES (1 OF 2)	0
A242	TSF1 PERIMETER ROAD PROFILES (2 OF 2)	0
A250	TSF1 PERIMETER ROAD ALIGNMENT TABLE	0
A260	TSF1 BASIN SECTIONS AND DETAILS (1 OF 3)	0
A262	TSF1 BASIN SECTIONS AND DETAILS (2 OF 3)	0
A264	TSF1 BASIN SECTIONS AND DETAILS (3 OF 3)	0
A270	TSF1 EMERGENCY SPILLWAY	0
A272	TSF1 EMERGENCY SPILLWAY SECTIONS AND DETAILS (1 OF 2)	0
A274	TSF1 EMERGENCY SPILLWAY SECTIONS AND DETAILS (2 OF 2)	0
A276	TSF1 STILLING BASIN CONCRETE DETAILS	0
A300	TSF1 STACKING PLAN VIEW	0
A302	WASTE ROCK BUTTRESS CONSTRUCTION ACCESS ROAD PLAN AND PROFILE	0
A305	WASTE ROCK BUTTRESS PLAN VIEW	0
A307	WASTE ROCK BUTTRESS SECTIONS	0
A310	TSF1 STACKING HAUL RAMP PLAN AND PROFILE	0
A320	TSF1 STACKING HAUL RAMP ALIGNMENT TABLE, SECTIONS AND DETAILS	0
A325	TSF1 STACKING HAUL RAMP ACCESS INTERSECTION	0
A350	TSF1 STACKING FILLING CURVES	0
A400	SURFACE WATER MANAGEMENT PLAN VIEW	0
A405	EXISTING UNDERDRAIN COLLECTION POND	0
A407	EXISTING UNDERDRAIN COLLECTION POND SPILLWAY PLAN AND PROFILE	0
A410	POND FILLING CURVES	0
A500	UNDERGROUND WORKING REMEDIATION DETAILS	0
A600	TSF1 ACTIVE CLOSURE PLAN VIEW	0
A610	TSF1 CLOSURE SECTIONS AND DETAILS	0
A615	TSF1 PASSIVE CLOSURE SPILLWAY AND DIVERSION CHANNEL PLAN VIEW	0

TEXT ABBREVIATIONS:

TSF – TAILINGS STORAGE FACILITY
DIA – DIAMETER
MIN – MINIMUM
CPeP – CORRUGATED POLYETHYLENE PIPE
ADEQ – ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY
WTP – WATER TREATMENT PLANT
TSF1 – TAILINGS STORAGE FACILITY 1

OWNER:

SOUTH32

2210 East River Road
Tucson, AZ 85718

Registered Professional Engineer (Civil)
CERTIFICATE NO. 63431
CRAIG M. THOMPSON
Date Signed 12/8/23
ARIZONA, U.S.A.
Expires 3/31/26

NewFields

9540 Maroon Circle, Suite 300, Englewood, CO 80112
Phone: 720.508.3300 www.newfields.com

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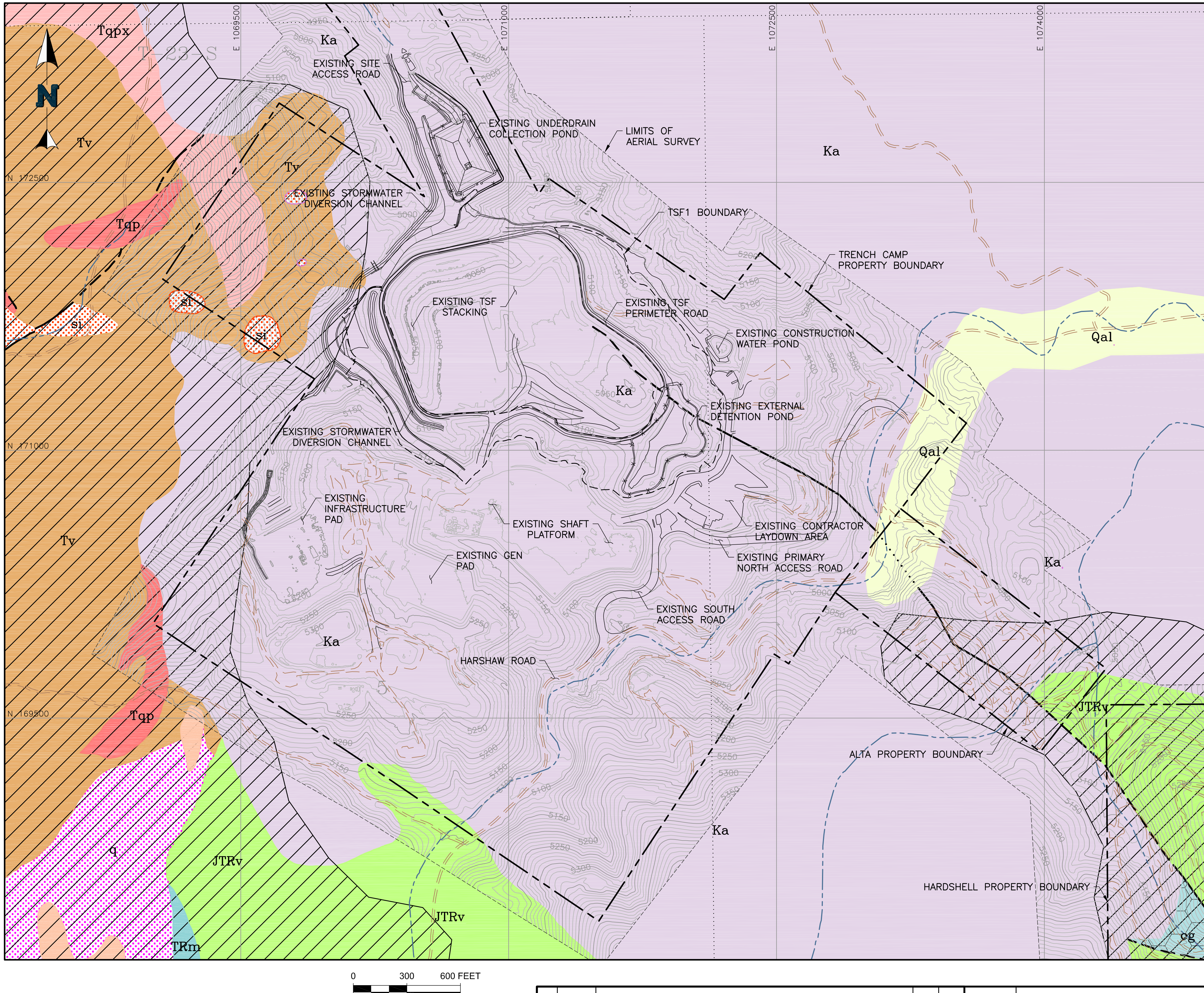

LEGEND:

- EXISTING GROUND CONTOURS
- EXISTING ROADS/TRAILS
- EXISTING DRAINAGES
- PROJECT BOUNDARY
- TSF1 PROPOSED BOUNDARY
- SECTION LINES
- 20 SECTION NUMBER
- EXISTING FENCE
- FAULT LINE (CERTAIN)
- FAULT LINE (APPROX.)
- FAULT LINE (CONCEALED)

UNCONSOLIDATED DEPOSITS

- Qal YOUNGER ALLUVIUM AND TALUS (QUATERNARY)

BEDROCK

- si SILICIFICATION (PALEOCENE)

ROCKS OF MIDDLE ALUM GULCH (PALEOCENE)

- Tv VOLCANICLASTIC ROCKS OF MIDDLE ALUM GULCH (PALEOCENE)
- Tqp QUARTZ FELDSPAR PORPHYRY OF MIDDLE ALUM GULCH (PALEOCENE)
- Tqpx XENOLITHIC QUARTZ FELDSPAR PORPHYRY OF MIDDLE ALUM GULCH (PALEOCENE)

GRANODIORITE OF THE PATAGONIA MOUNTAINS (PALEOCENE)

- Tqmp QUARTZ MONZONITE PORPHYRY

VOLCANIC AND IGNEOUS ROCKS OF RED MOUNTAIN

- Ka TRACHYANDESITE (UPPER CRETACEOUS)

SILICIC VOLCANIC AND SEDIMENTARY ROCKS (JURASSIC OR TRIASSIC)

- JTRv VOLCANIC ROCKS
- cg LIMESTONE CONGLOMERATE

VOLCANIC AND SEDIMENTARY ROCKS

- TRm MOUNT WRIGHTSON FORMATION (TRIASSIC)
- QUARTZITE
- PYRITE ZONE

NOTE:

1. GEOLOGICAL INFORMATION FROM THE USGS "GEOLOGIC MAP OF PATAGONIA MOUNTAINS, SANTA CRUZ COUNTY, ARIZONA", 2015.

Registered Professional Engineer (Civil) CERTIFICATE NO. 63431 CRAIG M. THOMPSON Date Signed 12/8/23 ARIZONA, U.S.A. EXPIRES 3/31/26

REFERENCE:

EXISTING GROUND TOPOGRAPHY DEVELOPED FROM MARCH 2020 AND APRIL 2023 AERIAL SURVEY DATA PROVIDED BY SOUTH32 (AMI). DATA PROJECTED TO STATE PLANE ARIZONA CENTRAL NAD 83 FEET, NAVD88.

REV	DATE	DESCRIPTION	TECH	ENG
0	12/8/23	ISSUED FOR TENDER	JEP	CMT

APPROVED BY: RMS
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DRAWN BY: JEP

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CLIENT: SOUTH32 HERMOSA INC.

PROJECT: HERMOSA PROJECT AQUIFER PROTECTION PERMIT SIGNIFICANT AMENDMENT (TSF1)

TITLE: GEOLOGIC PLAN VIEW

FILENAME: 14.035.004M
DRAWING NO.: A025
REVISION: 0

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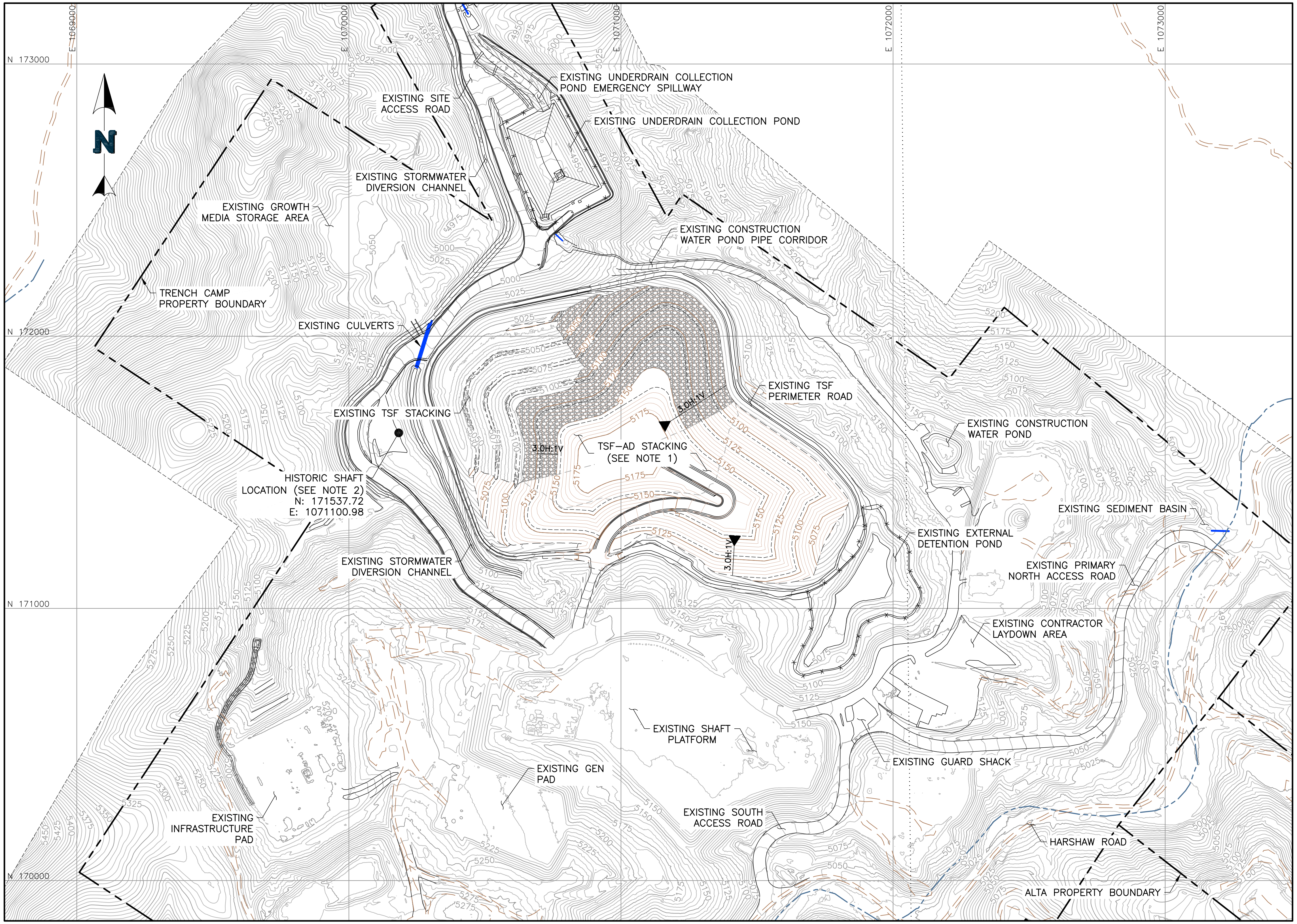

0 200 400 FEET

LEGEND:

- EXISTING GROUND CONTOURS
- TSF-AD STACKING CONTOURS (SEE NOTE 1)
- EXISTING ROADS/TRAILS
- EXISTING DRAINAGES
- PROJECT BOUNDARY
- SECTION LINES
- EXISTING FENCE
- EXISTING CULVERT
- LIMITS OF WASTE ROCK WITHIN TSF-AD STACKING

NOTES:

1. STACKING SHOWN IS THE HERMOSA LINED TSF DESIGN AMENDMENT (TSF-AD) STACKING APPROVED BY ADEQ (2022) FOR PLACEMENT OF FUTURE WASTE ROCK FROM MINE DEVELOPMENT AND MISCELLANEOUS MATERIALS.
2. THE HISTORIC SHAFT (WHICH WAS BACKFILLED) IS LOCATED WITHIN THE EXPANSION FOOTPRINT OF TSF1. SEE DETAIL 3 ON DWG A500 FOR REMEDIATION REQUIREMENTS.

Registered Professional Engineer (Civil) CERTIFICATE NO. 63431 CRAIG M. THOMPSON Date Signed 12/8/23 ARIZONA, U.S.A.

EXPIRES 3/31/26

REFERENCE:

EXISTING GROUND TOPOGRAPHY DEVELOPED FROM MARCH 2020 AND APRIL 2023 AERIAL SURVEY DATA PROVIDED BY SOUTH32 (AMI). DATA PROJECTED TO STATE PLANE ARIZONA CENTRAL NAD 83 FEET, NAVD88.

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DESIGNED BY: CMT
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CLIENT: SOUTH32 HERMOSA INC.

PROJECT: HERMOSA PROJECT AQUIFER PROTECTION PERMIT SIGNIFICANT AMENDMENT (TSF1)

TITLE: EXISTING CONDITIONS (PRIOR TO PRODUCTION)

FILENAME: 14.035.001M
DRAWING NO.: A050
REVISION: 0

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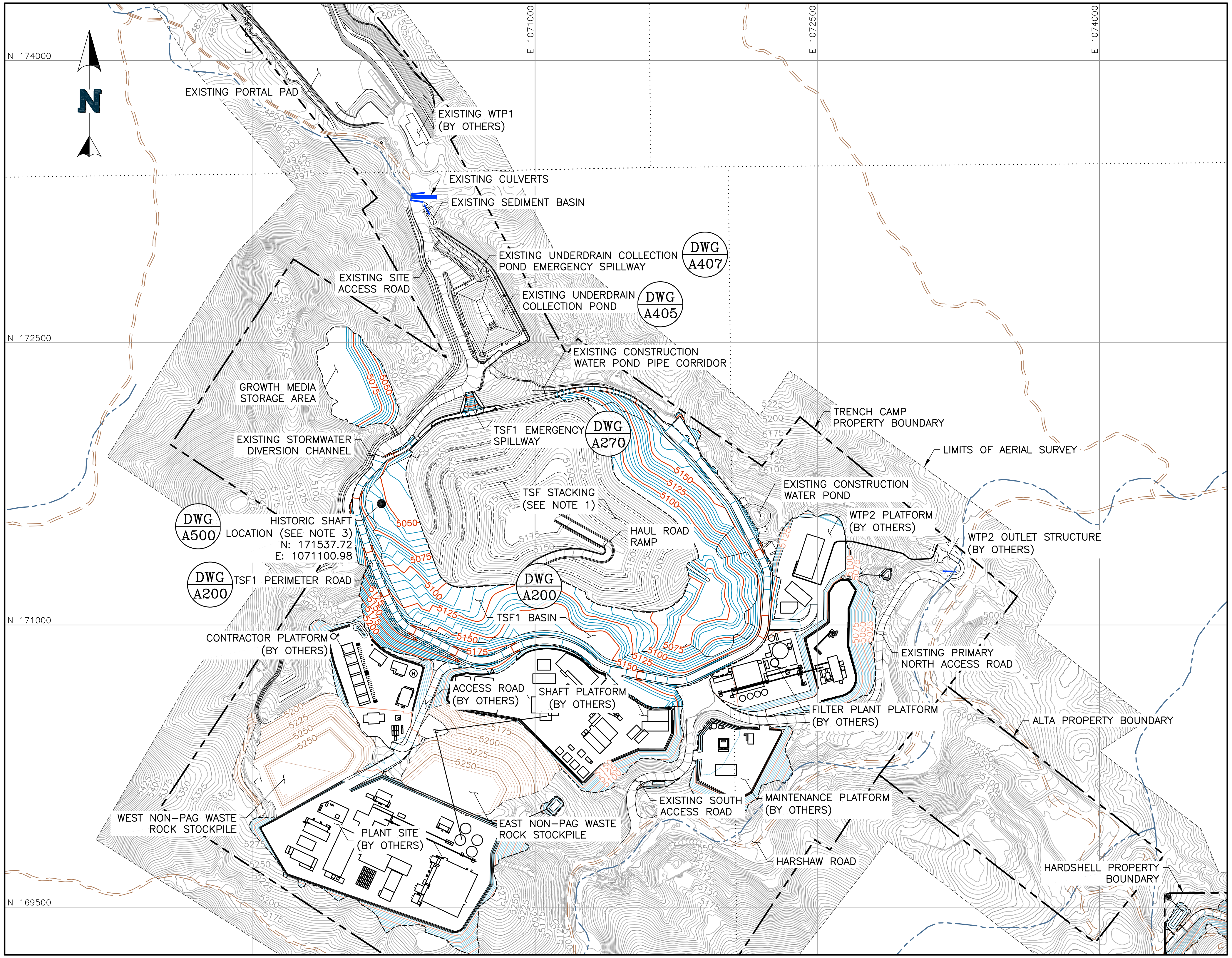

0 300 600 FEET

LEGEND:

- EXISTING GROUND CONTOURS
- PROPOSED GROUND CONTOURS (SEE NOTE 2)
- PROPOSED GROUND CONTOURS (BY OTHERS)
- EXISTING ROADS/TRAILS
- EXISTING DRAINAGES
- PROJECT BOUNDARY
- SECTION LINES
- EXISTING FENCE
- CULVERT (EXISTING OR PROPOSED)

NOTES:

1. STACKING SHOWN IS THE HERMOSA LINED TSF DESIGN AMENDMENT (TSF-AD) STACKING APPROVED BY ADEQ (2022) FOR PLACEMENT OF FUTURE WASTE ROCK FROM MINE DEVELOPMENT AND MISCELLANEOUS MATERIALS.
2. CONTOURS REPRESENT GEOMEMBRANE LINER ELEVATION WITHIN THE LINED TSF BASIN AND FINISHED GRADE EVERYWHERE ELSE.
3. THE HISTORIC SHAFT (WHICH WAS BACKFILLED) IS LOCATED WITHIN THE EXPANSION FOOTPRINT OF TSF1. SEE DETAIL 3 ON DWG A500 FOR REMEDIATION REQUIREMENTS.

Registered Professional Engineer (Civil)
CERTIFICATE NO. 63431
CRAIG M. THOMPSON
Date Signed 12/8/23
ARIZONA, U.S.A.
Expires 3/31/26

REFERENCE:

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CLIENT: SOUTH32 HERMOSA INC.
PROJECT: HERMOSA PROJECT AQUIFER PROTECTION PERMIT SIGNIFICANT AMENDMENT (TSF1)
TITLE: TSF1 GENERAL ARRANGEMENT
FILENAME: 14.035.003M
DRAWING NO.: A100
REVISION: 0

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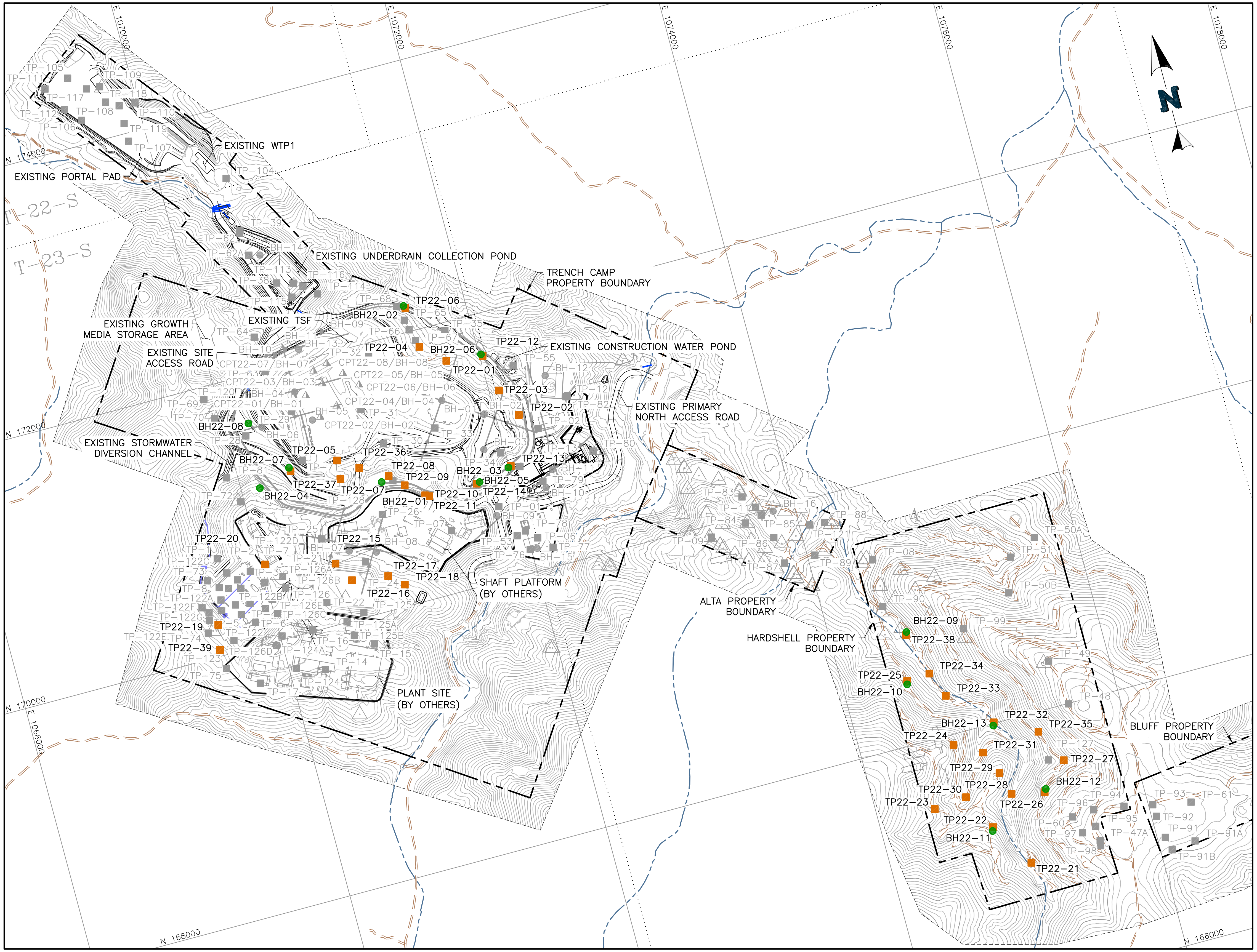

0 400 800 FEET

LEGEND:

	EXISTING GROUND CONTOURS
	EXISTING ROADS/TRAILS
	EXISTING DRAINAGES
	PROJECT BOUNDARY
	SECTION LINES
20	SECTION NUMBER
	EXISTING FENCE
BH22-01	NEWFIELDS BOREHOLE (JUL 2022)
TP22-01	NEWFIELDS TEST PIT (JUL 2022)
CPT22-01 /BH-01	NEWFIELDS BOREHOLE/CPT (FEB 2022)
BH-11	NEWFIELDS BOREHOLE (FEB 2022)
BH-01	NEWFIELDS BOREHOLE (JAN 2017)
TP-01	NEWFIELDS TEST PIT (JAN 2017, JUN 2017, JAN 2018)
	AMI DRILLING LOCATION
	GEOPHYSICAL SURVEY (JAN 2017)
	CULVERT (EXISTING OR PROPOSED)

Registered Professional Engineer (Civil)
CERTIFICATE NO.
63431
CRAIG M. THOMPSON
Date Signed 12/8/23
ARIZONA, U.S.A.
EXPIRES 3/31/26

REFERENCE:

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0	12/8/23	ISSUED FOR TENDER	JEP	CMT

APPROVED BY: RMS
CHECKED BY: CMT
DESIGNED BY: CMT
DRAWN BY: JEP

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CLIENT: SOUTH32 HERMOSA INC.

PROJECT: HERMOSA PROJECT AQUIFER PROTECTION PERMIT SIGNIFICANT AMENDMENT (TSF1)

TITLE: TSF1 GEOTECHNICAL SITE INVESTIGATION PLAN VIEW

FILENAME: 14.035.005M

DRAWING NO.: A150

REVISION: 0

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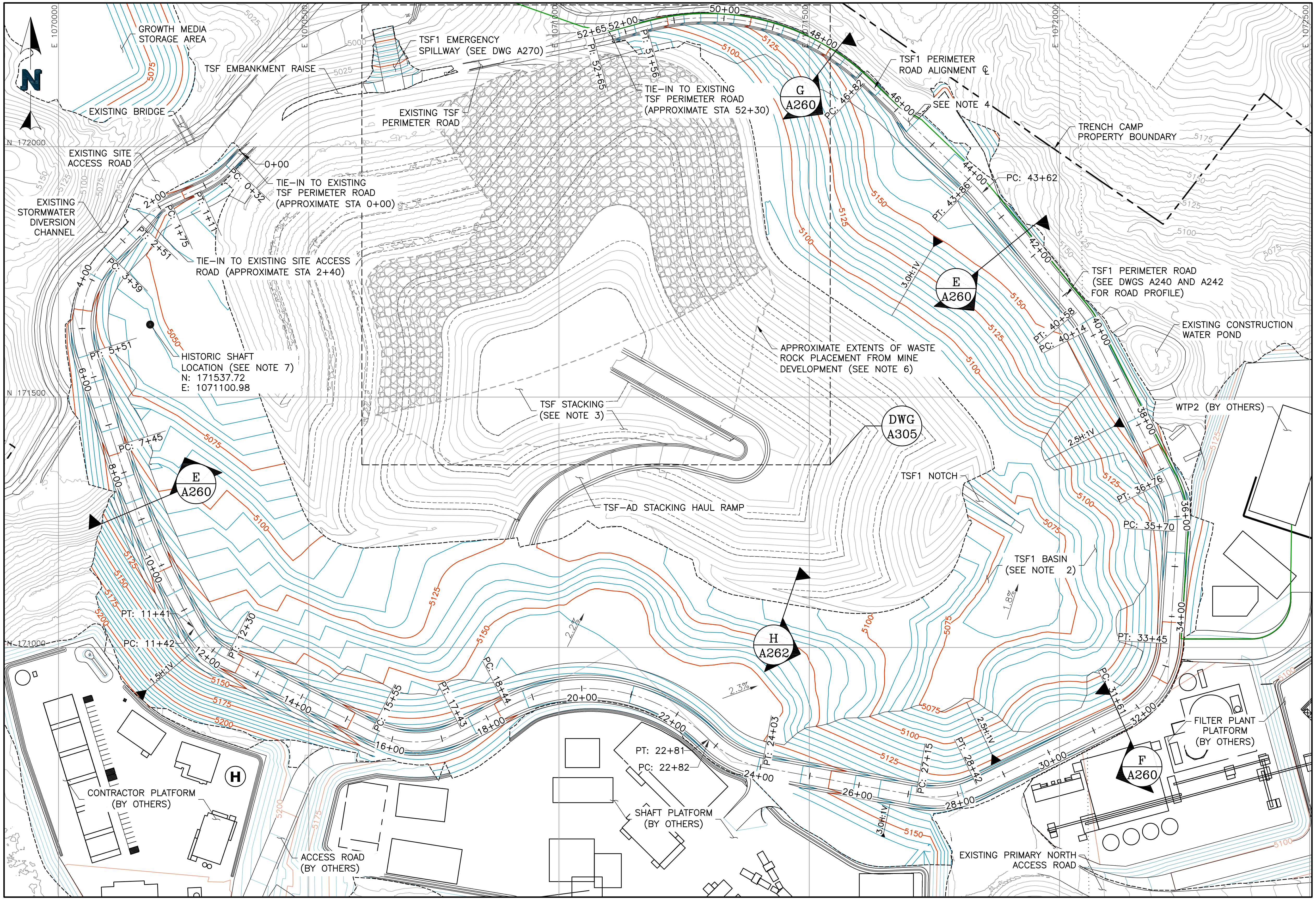

0 100 200 FEET

LEGEND:

- EXISTING GROUND CONTOURS
- PROPOSED GROUND CONTOURS (SEE NOTE 1)
- PROPOSED GROUND CONTOURS (BY OTHERS)
- PROJECT BOUNDARY
- SECTION LINES
- RECLAIM PIPE (SEE NOTE 5)
- PROPOSED CULVERT
- LIMITS OF WASTE ROCK WITHIN TSF-AD STACKING

NOTES:

1. PROPOSED CONTOURS REPRESENT TOP OF LOW PERMEABILITY SOIL LAYER WITHIN THE GEOMEMBRANE LINED AREA, AND FINISHED GRADE EVERYWHERE ELSE.
2. TSF1 BASIN TO BE GRADED AT A MAXIMUM 40% AND MINIMUM 1% GRADE.
3. STACKING SHOWN IS THE HERMOSA LINED TSF DESIGN AMENDMENT (TSF-AD) STACKING APPROVED BY ADEQ (2022) FOR PLACEMENT OF FUTURE WASTE ROCK FROM MINE DEVELOPMENT AND MISCELLANEOUS MATERIALS.
4. ROAD TRANSITIONS FROM SECTION A TO SECTION C BETWEEN STATION 45+50 AND STATION 46+00.
5. RECLAIM PIPE (DESIGNED BY OTHERS) RUNS FROM THE EXISTING UNDERDRAIN COLLECTION POND TO WTP2.
6. INITIAL WASTE ROCK PLACEMENT TO OCCUR AT THE NORTHERN END OF TSF-AD STACKING TO SERVE AS A WASTE ROCK BUTTRESS. REMAINING TSF-AD STACKING VOLUME TO BE UTILIZED FOR WASTE ROCK PAG WASTE GENERATED FROM CONSTRUCTION CUT, MISCELLANEOUS MATERIALS (I.E. FILTER CAKE), AND/OR FILTERED TAILINGS.
7. THE HISTORIC SHAFT (WHICH WAS BACKFILLED) IS LOCATED WITHIN THE EXPANSION FOOTPRINT OF TSF1-3. SEE DETAIL 3 ON DWG A500 FOR REMEDIATION REQUIREMENTS.

Registered Professional Engineer (Civil)
CERTIFICATE NO. 63431
CRAIG M. THOMPSON
Date Signed 12/8/23
ARIZONA, U.S.A.
EXPIRES 3/31/26

REFERENCE:

EXISTING GROUND TOPOGRAPHY DEVELOPED FROM MARCH, 2020 AERIAL SURVEY DATA PROVIDED BY SOUTH32 (AMI). DATA PROJECTED TO STATE PLANE ARIZONA CENTRAL NAD 83 FEET, NAVD88.

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DESIGNED BY: CMT
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CLIENT: SOUTH32 HERMOSA INC.

PROJECT: HERMOSA PROJECT AQUIFER PROTECTION PERMIT SIGNIFICANT AMENDMENT (TSF1)

TITLE: TSF1 PLAN VIEW

FILENAME: 14.035.006M

DRAWING NO.: A200

REVISION: 0

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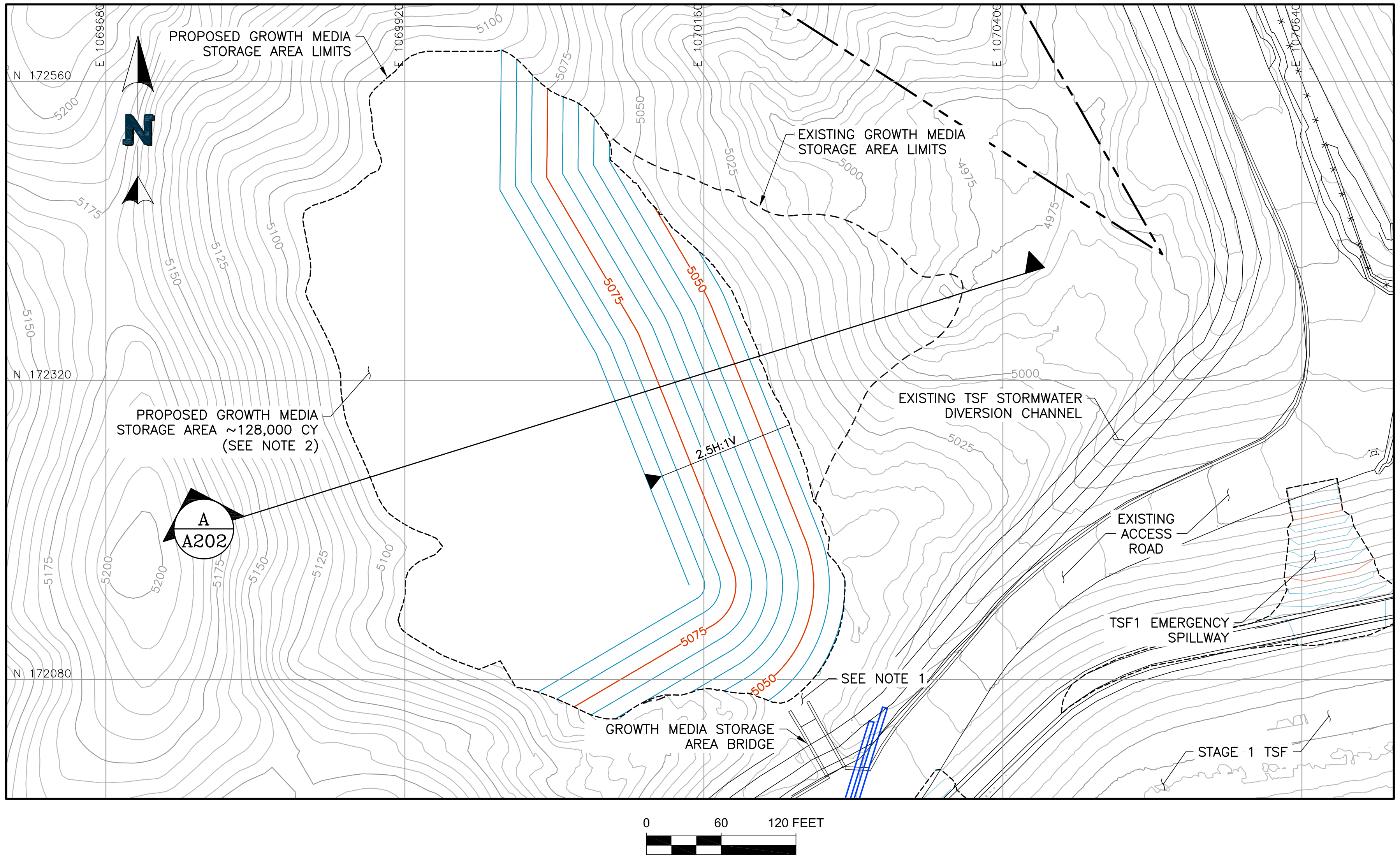


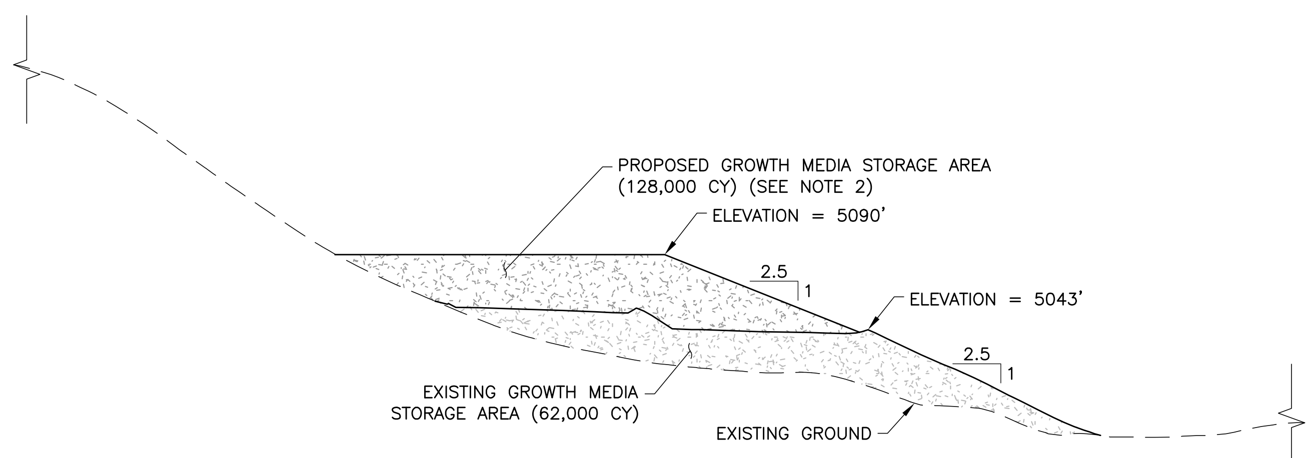
LEGEND:

- EXISTING GROUND CONTOURS
- PROPOSED GROWTH MEDIA STORAGE CONTOURS
- PROPOSED GROUND CONTOURS
- EXISTING ROADS/TRAILS
- EXISTING DRAINAGES
- PROJECT BOUNDARY
- EXISTING FENCE
- CULVERT (EXISTING OR PROPOSED)

STORAGE CAPACITY	
CLOSURE	VOLUME NEEDED FOR CLOSURE (CY)
1' COVER	94,000
2' COVER	188,000

NOTES:

1. HAUL ROAD TO BE CONSTRUCTED WITHIN GROWTH MEDIA STOCKPILE FROM GMSA BRIDGE TO TOP OF STOCKPILE.
2. GROWTH MEDIA GENERATED FROM THE CONSTRUCTION OF TSF1 TO BE PLACED IN THE GROWTH MEDIA STORAGE AREA. THE REMAINDER OF THE GROWTH MEDIA IS TO BE SOURCED FROM THE EXISTING MATERIAL STOCKPILE LOCATED AT THE INFRASTRUCTURE PAD.



A / A202 GROWTH MEDIA STORAGE AREA

Registered Professional Engineer (Civil)
CERTIFICATE NO. 63431
CRAIG M. THOMPSON
Date Signed 12/8/23
ARIZONA, U.S.A.
EXPIRES 3/31/26

REFERENCE:

EXISTING GROUND TOPOGRAPHY DEVELOPED FROM MARCH 2020 AND APRIL 2023 AERIAL SURVEY DATA PROVIDED BY SOUTH32 (AMI). DATA PROJECTED TO STATE PLANE ARIZONA CENTRAL NAD 83 FEET, NAVD88.

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0	12/8/23	ISSUED FOR TENDER	GJF	CMT

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CLIENT: SOUTH32 HERMOSA INC.

PROJECT: HERMOSA PROJECT AQUIFER PROTECTION PERMIT SIGNIFICANT AMENDMENT (TSF1)

TITLE: PROPOSED GROWTH MEDIA STORAGE AREA

FILENAME: 14.035.110M

DRAWING NO.: A202

REVISION: 0

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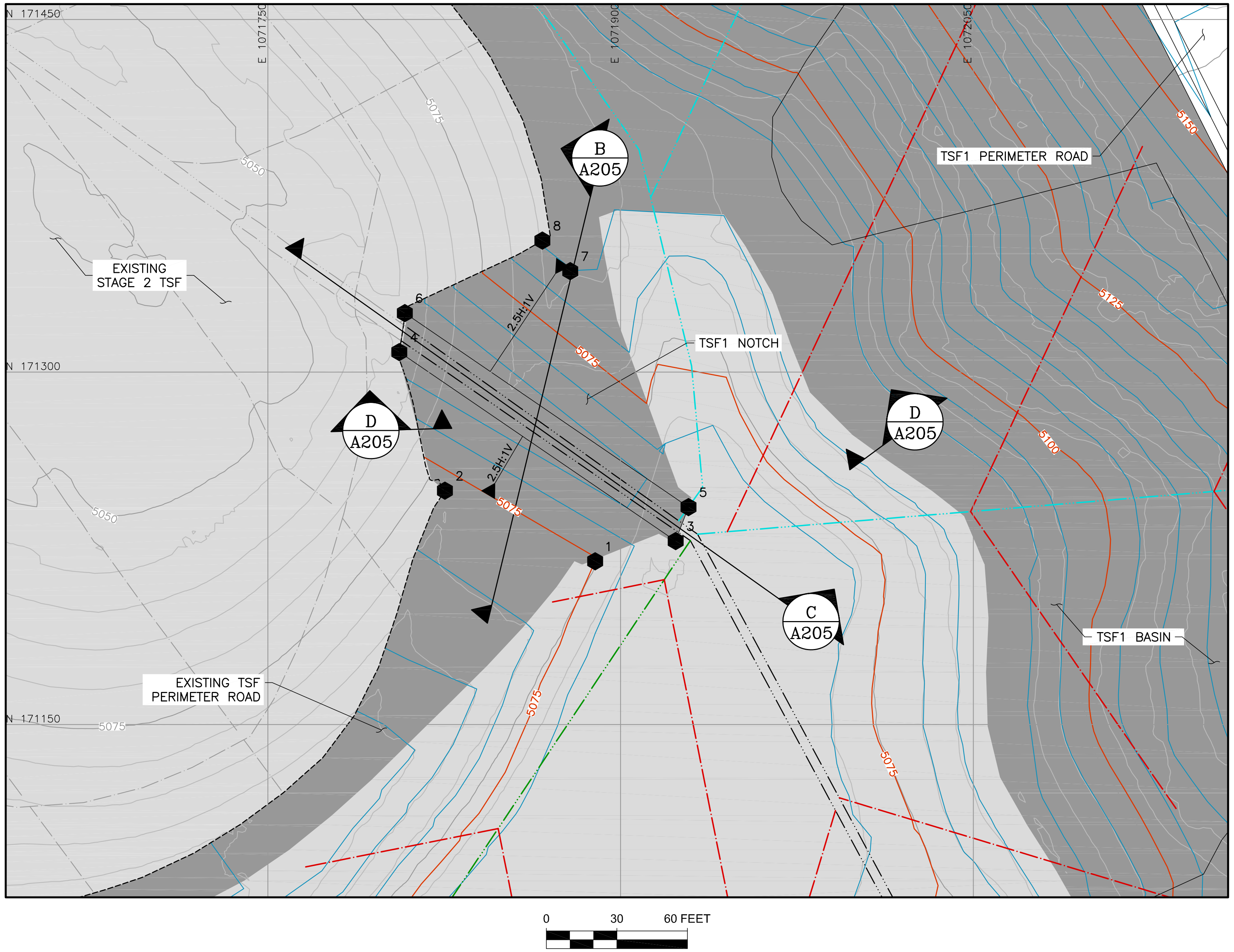


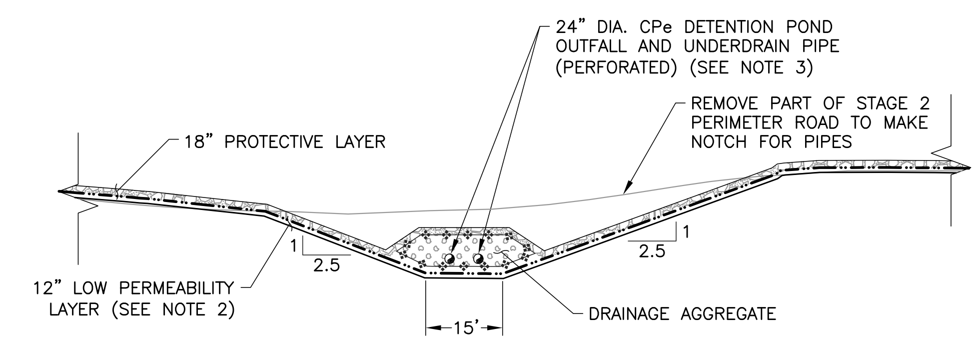
LEGEND:

- EXISTING GROUND CONTOURS
- PROPOSED TSF1 CONTOURS
- 4" DIA. CPe UNDERDRAIN COLLECTION PIPE (PERFORATED)
- 8" DIA. CPe UNDERDRAIN COLLECTION HEADER (PERFORATED)
- 12" DIA. CPe UNDERDRAIN COLLECTION HEADER (PERFORATED)
- 24" DIA. CPe UNDERDRAIN PIPE (PERFORATED)
- EXISTING UNDERDRAIN COLLECTION PIPE
- EXISTING UNDERDRAIN COLLECTION HEADER
- EXISTING GEOMEMBRANE
- TSF1 GEOMEMBRANE

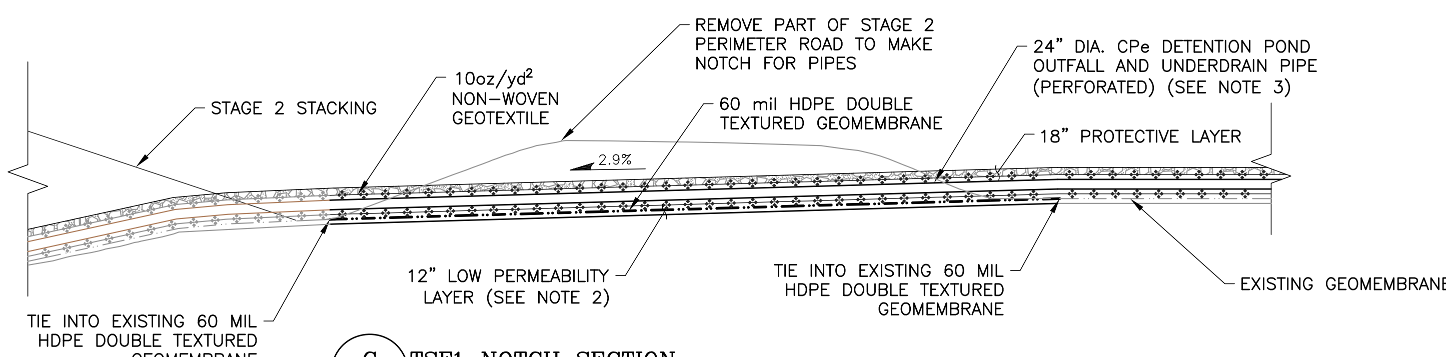
SETTING OUT DATA			
POINT	NORTHING	EASTING	ELEVATION
1	171,219.48	1,071,889.17	5,075.00
2	171,249.53	1,071,825.28	5,077.55
3	171,228.08	1,071,923.44	5,066.00
4	171,308.50	1,071,805.91	5,061.67
5	171,242.55	1,071,928.90	5,065.61
6	171,325.07	1,071,808.26	5,061.67
7	171,342.92	1,071,878.58	5,084.59
8	171,355.92	1,071,866.75	5,085.00

NOTES:

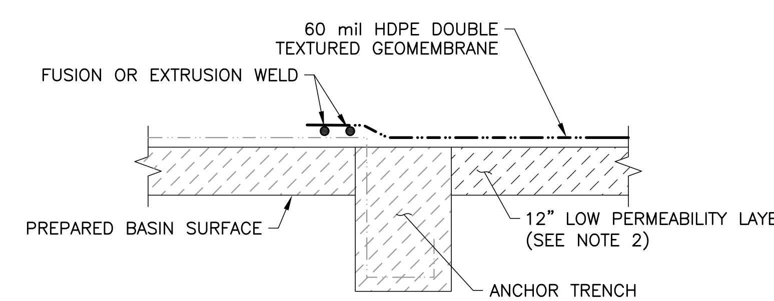
1. PROPOSED CONTOURS REPRESENT TOP OF LOW PERMEABILITY SOIL LAYER WITHIN THE GEOMEMBRANE LINED AREA AND FINISHED GRADE EVERYWHERE ELSE.
2. GCL MAY BE USED AS AN APPROVED EQUIVALENT IN THE SPECIFIED AREAS SHOWN ON DRAWING A220.
3. UNDERDRAIN COLLECTION PIPING TO MAINTAIN POSITIVE DRAINAGE.



B A205 TSF1 NOTCH SECTION



C A205 TSF1 NOTCH SECTION



D A205 TIE INTO EXISTING GEOMEMBRANE DETAIL

Registered Professional Engineer (Civil)
CERTIFICATE NO. 63431
CRAIG M. THOMPSON
Date Signed 12/8/23
ARIZONA, U.S.A.
EXPIRES 3/31/26

REFERENCE:

EXISTING GROUND TOPOGRAPHY DEVELOPED FROM MARCH 2020 AND APRIL 2023 AERIAL SURVEY DATA PROVIDED BY SOUTH32 (AMI). DATA PROJECTED TO STATE PLANE ARIZONA CENTRAL NAD 83 FEET, NAVD88.

REV	DATE	DESCRIPTION	TECH	ENG
0	12/8/23	ISSUED FOR TENDER	JEP	CMT

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CHECKED BY: CMT
DESIGNED BY: CMT
DRAWN BY: JEP

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CLIENT: SOUTH32 HERMOSA INC.

PROJECT: HERMOSA PROJECT AQUIFER PROTECTION PERMIT SIGNIFICANT AMENDMENT (TSF1)

TITLE: TSF1 NOTCH

FILENAME: 14.035.032M

DRAWING NO.: A205

REVISION: 0

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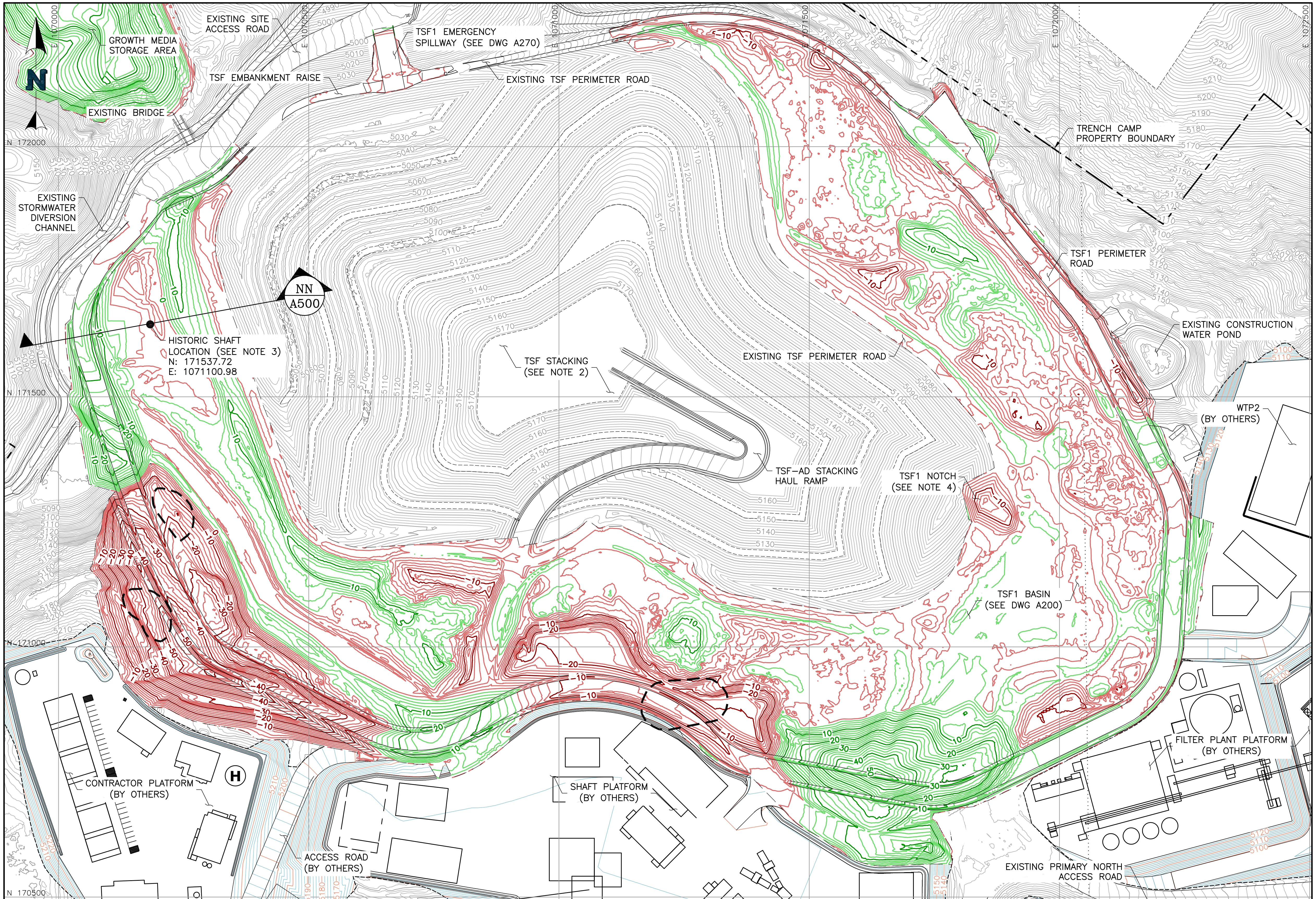

LEGEND:

- EXISTING GROUND CONTOURS
- FILL ISOPACH CONTOURS
- CUT ISOPACH CONTOURS
- PROPOSED GROUND CONTOURS (BY OTHERS)
- PROJECT BOUNDARY
- SECTION LINES
- PROPOSED CULVERT
- PAG EXCAVATION LIMITS (SEE NOTE 6)

NOTES:

1. ISOPACH CUT/FILL SURFACE CREATED FROM A COMPOSITE EXISTING GROUND/EXISTING TAILINGS SURFACE COMPARED TO THE PROPOSED TSF1 BASIN SURFACE.
2. STACKING SHOWN IS THE HERMOSA LINED TSF DESIGN AMENDMENT (TSF-AD) STACKING APPROVED BY ADEQ (2022) FOR PLACEMENT OF FUTURE WASTE ROCK FROM MINE DEVELOPMENT AND MISCELLANEOUS MATERIALS.
3. THE HISTORIC SHAFT (WHICH WAS BACKFILLED) IS LOCATED WITHIN THE EXPANSION FOOTPRINT OF TSF1. SEE DETAIL 3 ON DWG A500 FOR REMEDIATION REQUIREMENTS.
4. THE TSF1 UNDERDRAIN COLLECTION SYSTEM WILL TIE INTO THE EXISTING UNDERDRAIN COLLECTION SYSTEM AT THE TSF1 NOTCH.
5. PAG EXCAVATION LIMITS TO BE VERIFIED BY XRF DURING CONSTRUCTION.

0 100 200 FEET

Registered Professional Engineer (Civil)
CERTIFICATE NO. 63431
CRAIG M. THOMPSON
Date Signed 12/8/23
ARIZONA, U.S.A.
EXPIRES 3/31/26

REFERENCE:

EXISTING GROUND TOPOGRAPHY DEVELOPED FROM MARCH 2020 AND APRIL 2023 AERIAL SURVEY DATA PROVIDED BY SOUTH32 (AMI). DATA PROJECTED TO STATE PLANE ARIZONA CENTRAL NAD 83 FEET, NAVD88.

REV	DATE	DESCRIPTION	TECH	ENG
0	12/8/23	ISSUED FOR TENDER	JEP	CMT

APPROVED BY: RMS
CHECKED BY: CMT
DESIGNED BY: CMT
DRAWN BY: JEP

DISCLAIMER

NEWFIELDS PRODUCED THE INFORMATION PRESENTED ON THIS DRAWING THROUGH THE USE OF AVAILABLE TECHNICAL INFORMATION AND EXPERIENCE. RECEIVING THIS DRAWING DOES NOT GUARANTEE ANY RIGHTS TO EITHER SUCH TECHNICAL INFORMATION OR EXPERIENCE. ANY MODIFICATION OR ADAPTATION OF THE DATA OR DRAWING SHALL BE AT USER'S RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY TO NEWFIELDS.

NewFields

CLIENT: SOUTH32 HERMOSA INC.

PROJECT: HERMOSA PROJECT AQUIFER PROTECTION PERMIT SIGNIFICANT AMENDMENT (TSF1)

TITLE: TSF1 BASIN GRADING ISOPACH

FILENAME: 14.035.008M

DRAWING NO.: A210

REVISION: 0

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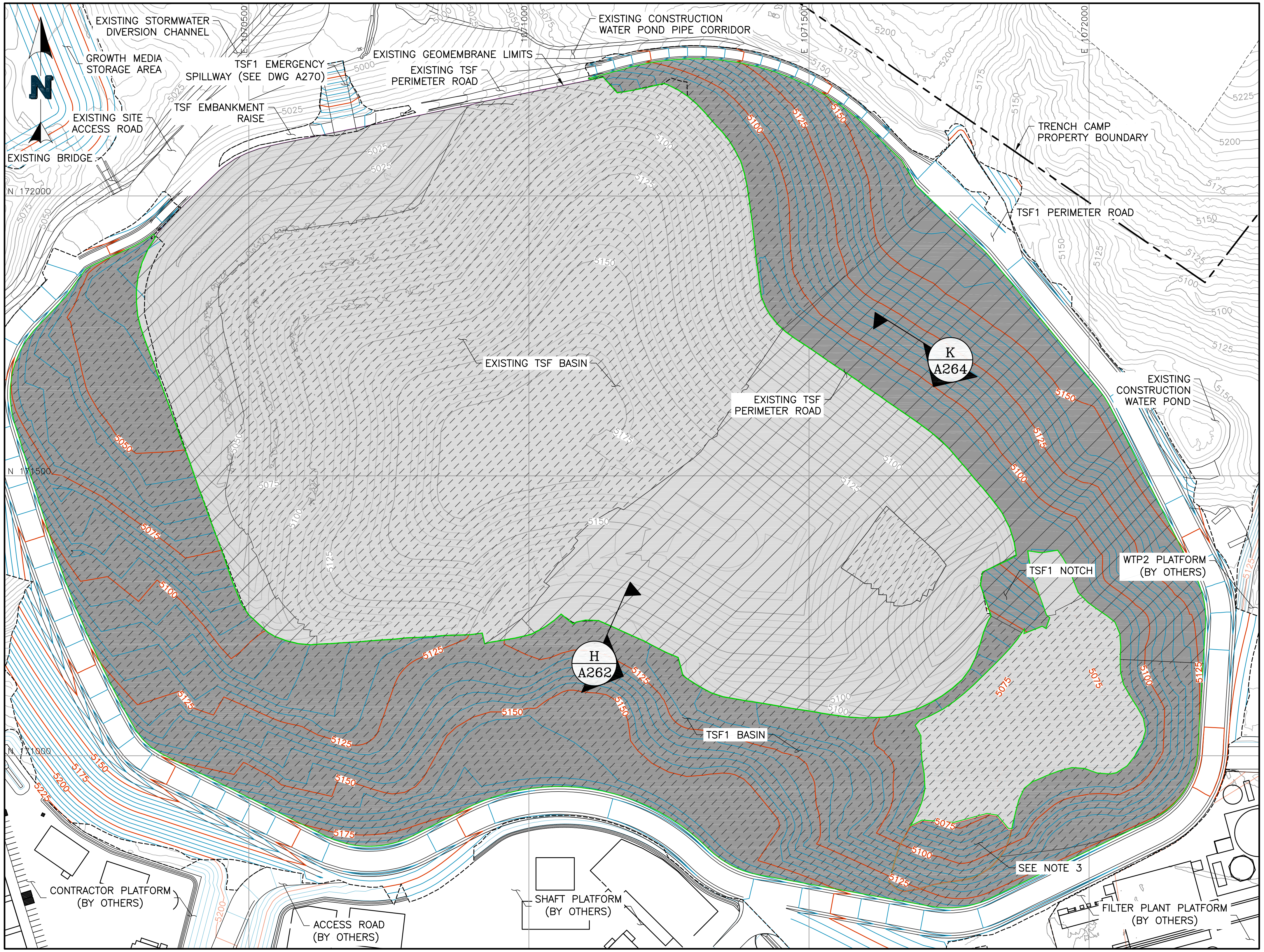

0 100 200 FEET

LEGEND:

- EXISTING GROUND CONTOURS
- PROPOSED GROUND CONTOURS (SEE NOTE 1)
- PROPOSED GROUND CONTOURS (BY OTHERS)
- PROJECT BOUNDARY
- EXISTING GEOMEMBRANE
- TSF1 EXPANSION GEOMEMBRANE LIMITS (SEE NOTE 2)
- LOW PERMEABILITY SOIL LAYER
- LOW PERMEABILITY SOIL LAYER OR GCL
- PROPOSED CULVERT

NOTES:

1. PROPOSED CONTOURS REPRESENT TOP OF LOW PERMEABILITY SOIL LAYER WITHIN THE GEOMEMBRANE LINED AREA AND FINISHED GRADE EVERYWHERE ELSE.
2. TSF1 GEOMEMBRANE TO BE 60 mil HDPE DOUBLE TEXTURED GEOMEMBRANE.
3. APPROXIMATE LIMITS OF EXISTING GEOMEMBRANE LINER AND LOW PERMEABILITY SOIL LAYER TO BE REMOVED DURING CONSTRUCTION OF TSF1. EXISTING GEOMEMBRANE LINER TO BE DISPOSED AND LOW PERMEABILITY SOIL LAYER TO BE SALVAGED. NEW LOW PERMEABILITY SOIL LAYER AND GEOMEMBRANE TO BE INSTALLED AFTER EARTHWORKS (FILL PLACEMENT) IS COMPLETE.

Registered Professional Engineer (Civil)
CERTIFICATE NO. 63431
CRAIG M. THOMPSON
12/8/23
Date Signed
ARIZONA, U.S.A.
EXPIRES 3/31/26

REFERENCE:

EXISTING GROUND TOPOGRAPHY DEVELOPED FROM MARCH 2020 AND APRIL 2023 AERIAL SURVEY DATA PROVIDED BY SOUTH32 (AMI). DATA PROJECTED TO STATE PLANE ARIZONA CENTRAL NAD 83 FEET, NAVD88.

REV	DATE	DESCRIPTION	TECH	ENG
0	12/8/23	ISSUED FOR TENDER	JEP	CMT

APPROVED BY: RMS
CHECKED BY: CMT
DESIGNED BY: CMT
DRAWN BY: JEP

DISCLAIMER

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NewFields

CLIENT: SOUTH32 HERMOSA INC.

PROJECT: HERMOSA PROJECT AQUIFER PROTECTION PERMIT SIGNIFICANT AMENDMENT (TSF1)

TITLE: TSF1 GEOMEMBRANE PLAN VIEW

FILENAME: 14.035.007M

DRAWING NO.: A220

REVISION: 0

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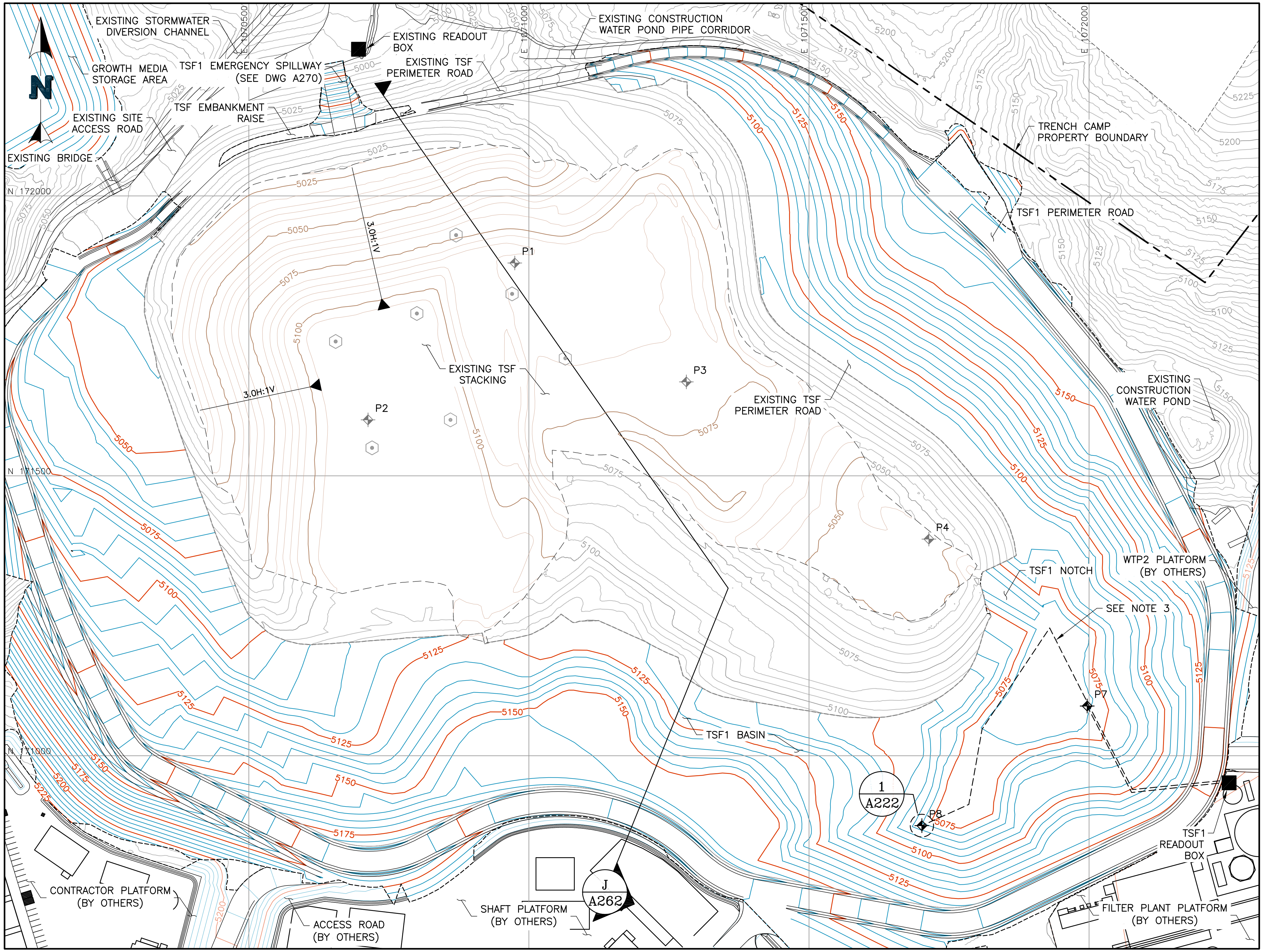


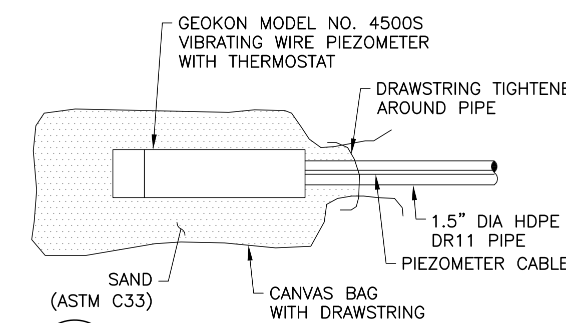
0 100 200 FEET

LEGEND:

- EXISTING GROUND CONTOURS
- PROPOSED GROUND CONTOURS (SEE NOTE 1)
- PROPOSED GROUND CONTOURS (BY OTHERS)
- EXISTING STACKING CONTOURS
- PROJECT BOUNDARY
- P7 — PROPOSED VIBRATING WIRE PIEZOMETER (INSTALLED ON GEOMEMBRANE LINER SURFACE) (SEE NOTE 2)
- P1 — EXISTING VIBRATING WIRE PIEZOMETER (INSTALLED ON GEOMEMBRANE LINER SURFACE WITHIN TSF BASIN)
- EXISTING VIBRATING WIRE PIEZOMETERS (INSTALLED IN FILTERED TAILINGS STACK) (SEE NOTE 4)
- PROPOSED PIEZOMETER CABLE (SEE NOTE 3)
- PROPOSED CULVERT

NOTES:

1. PROPOSED CONTOURS REPRESENT TOP OF LOW PERMEABILITY SOIL LAYER WITHIN THE GEOMEMBRANE LINED AREA AND FINISHED GRADE EVERYWHERE ELSE.
2. VIBRATING WIRE PIEZOMETERS TO BE INSTALLED IMMEDIATELY ADJACENT TO THE GEOMEMBRANE SURFACE WITHIN THE DRAINAGE AGGREGATE NEXT TO AN UNDERDRAIN COLLECTION PIPE.
3. THE PIEZOMETER CABLE AND 1.5" DIA HDPE PIPE CONDUIT TO FOLLOW UNDERDRAIN COLLECTION PIPE ALIGNMENT WITHIN THE DRAINAGE AGGREGATE. THE PIEZOMETER CABLE AND CONDUIT SHALL MAINTAIN A MINIMUM OF 1' OF COVER.
4. VIBRATING WIRE PIEZOMETERS INSTALLED WITHIN THE STACK TO MONITOR ANY POTENTIAL PHREATIC SURFACE. SEE SECTION E ON A262 FOR A CONCEPTUAL PLAN FOR FUTURE VIBRATING WIRE PIEZOMETER LOCATIONS WITHIN THE STACK.



1 A222 VIBRATING WIRE PIEZOMETER

PROPOSED BASIN INSTRUMENTATION LAYOUT DATA			
POINT	NORTHING	EASTING	ELEVATION
P7	171,088.78	1,071,996.73	5,070.00
P8	170,875.23	1,071,701.60	5,080.00
TSF1 READOUT BOX	170,951.73	1,072,250.08	5,110.00

REFERENCE:

EXISTING GROUND TOPOGRAPHY DEVELOPED FROM MARCH 2020 AND APRIL 2023 AERIAL SURVEY DATA PROVIDED BY SOUTH32 (AMI). DATA PROJECTED TO STATE PLANE ARIZONA CENTRAL NAD 83 FEET, NAVD88.

Registered Professional Engineer (Civil)
CERTIFICATE NO. 63431
CRAIG M. THOMPSON
Date Signed 12/8/23
ARIZONA, U.S.A.
EXPIRES 3/31/26

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0	12/8/23	ISSUED FOR TENDER	JEP	CMT

APPROVED BY: RMS
CHECKED BY: CMT
DESIGNED BY: CMT
DRAWN BY: JEP

DISCLAIMER

NewFields

CLIENT: SOUTH32 HERMOSA INC.

PROJECT: HERMOSA PROJECT AQUIFER PROTECTION PERMIT SIGNIFICANT AMENDMENT (TSF1)

TITLE: TSF1 INSTRUMENTATION PLAN VIEW

FILENAME: 14.035.028M

DRAWING NO.: A222

REVISION: 0

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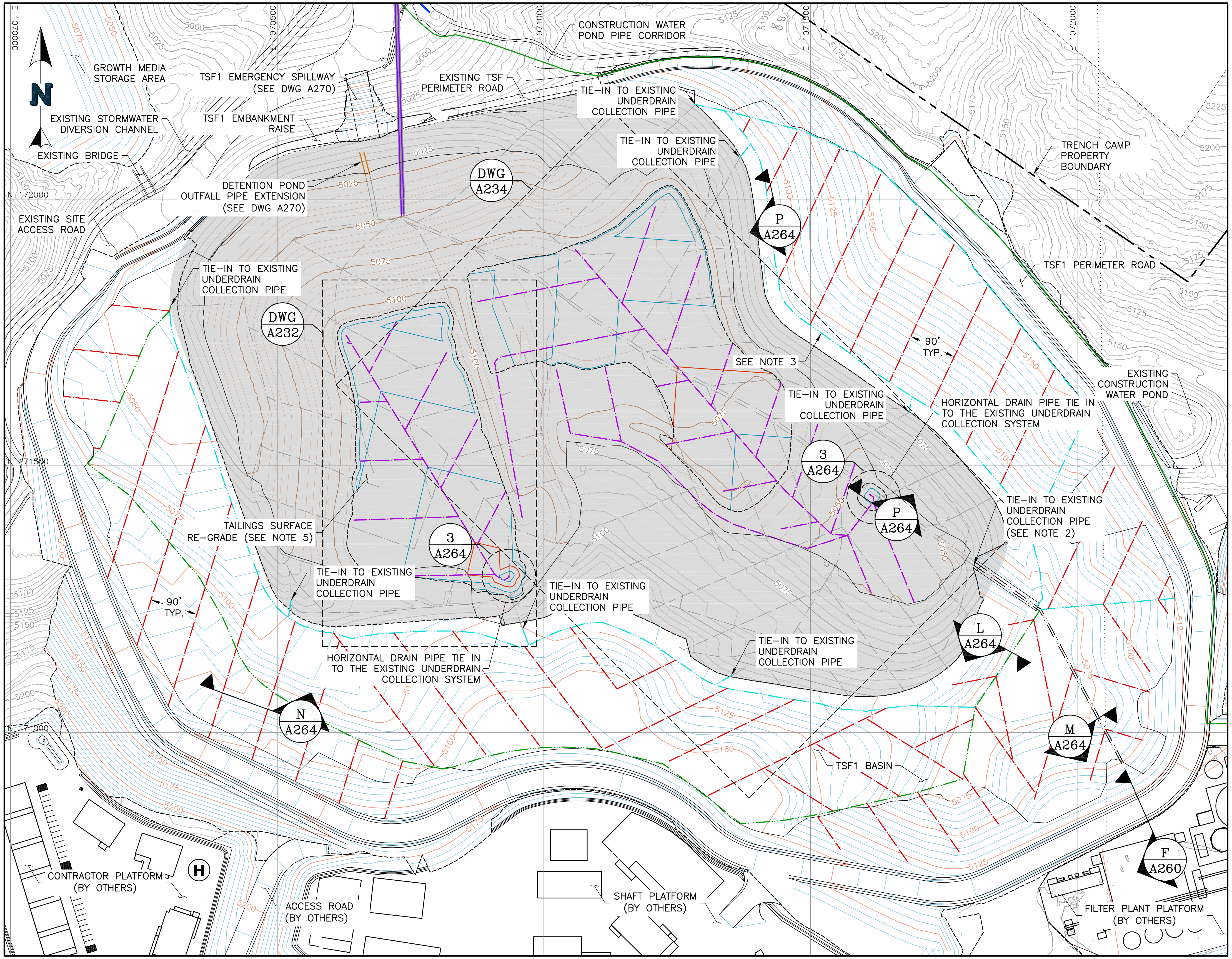

0 100 200 FEET

LEGEND:

- EXISTING GROUND CONTOURS
- PROPOSED GROUND CONTOURS (SEE NOTE 1)
- EXISTING TSF STACKING CONTOURS
- PROPOSED REGRADE CONTOURS
- SECTION LINES
- PROPERTY BOUNDARY
- 4" DIA. CPe UNDERDRAIN COLLECTION PIPE (PERFORATED)
- 8" DIA. CPe UNDERDRAIN COLLECTION HEADER (PERFORATED)
- 12" DIA. CPe UNDERDRAIN COLLECTION HEADER (PERFORATED)
- 18" DIA. CPe DETENTION POND OUTFALL PIPE EXTENSION (SOLID)
- 24" DIA. CPe DETENTION POND OUTFALL AND UNDERDRAIN PIPE (PERFORATED)
- EXISTING UNDERDRAIN COLLECTION PIPE
- EXISTING UNDERDRAIN COLLECTION HEADER
- 36" DIA. HDPE DR11 DETENTION POND OUTFALL AND UNDERDRAIN PIPE (SOLID) EXISTING
- CONCRETE ENCASED UNDERDRAIN EXISTING
- RECLAIM PIPE (SEE NOTE 4)
- PROPOSED CULVERT
- 4" DIA. CPe HORIZONTAL DRAIN PIPE (PERFORATED) (SEE NOTE 5)
- EXISTING TSF BASIN

NOTES:

1. PROPOSED CONTOURS REPRESENT TOP OF LOW PERMEABILITY SOIL LAYER WITHIN THE GEOMEMBRANE LINED AREA AND FINISHED GRADE EVERYWHERE ELSE.
2. TIE IN LOCATION FOR TSF1 UNDERDRAIN COLLECTION HEADER OUTFALL.
3. SOME PIPES IN THE PIPE LAYOUT SHOWN ARE OFFSET FOR CLARITY.
4. RECLAIM PIPE FROM THE EXISTING UNDERDRAIN COLLECTION POND TO WTP2.
5. PIPING LAYOUT ON TOP OF EXISTING TAILINGS SURFACE IS CONCEPTUAL AND MUST TIE INTO EXISTING UNDERDRAIN COLLECTION PIPES. PIPING LAYOUT TO BE UPDATED BASED ON FINAL PAG WASTE ROCK STACKING LIMITS FROM MINE DEVELOPMENT. TAILINGS SURFACE GRADING UNDER HORIZONTAL DRAIN PIPE TO DRAIN AT MINIMUM 3%.

Registered Professional Engineer (Civil)
CERTIFICATE NO. 63431
CRAIG M. THOMPSON
Date Signed 12/8/23
ARIZONA, U.S.A.
EXPIRES 3/31/26

REFERENCE:

EXISTING GROUND TOPOGRAPHY DEVELOPED FROM MARCH 2020 AND APRIL 2023 AERIAL SURVEY DATA PROVIDED BY SOUTH32 (AMI). DATA PROJECTED TO STATE PLANE ARIZONA CENTRAL NAD 83 FEET, NAVD88.

REV	DATE	DESCRIPTION	TECH	ENG
0	12/8/23	ISSUED FOR TENDER	JEP	CMT

APPROVED BY: RMS
CHECKED BY: CMT
DESIGNED BY: CMT
DRAWN BY: JEP

DISCLAIMER

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NewFields

CLIENT: SOUTH32 HERMOSA INC.

PROJECT: HERMOSA PROJECT AQUIFER PROTECTION PERMIT SIGNIFICANT AMENDMENT (TSF1)

TITLE: TSF1 PIPING PLAN VIEW

FILENAME: 14.035.009M

DRAWING NO.: A230

REVISION: 0

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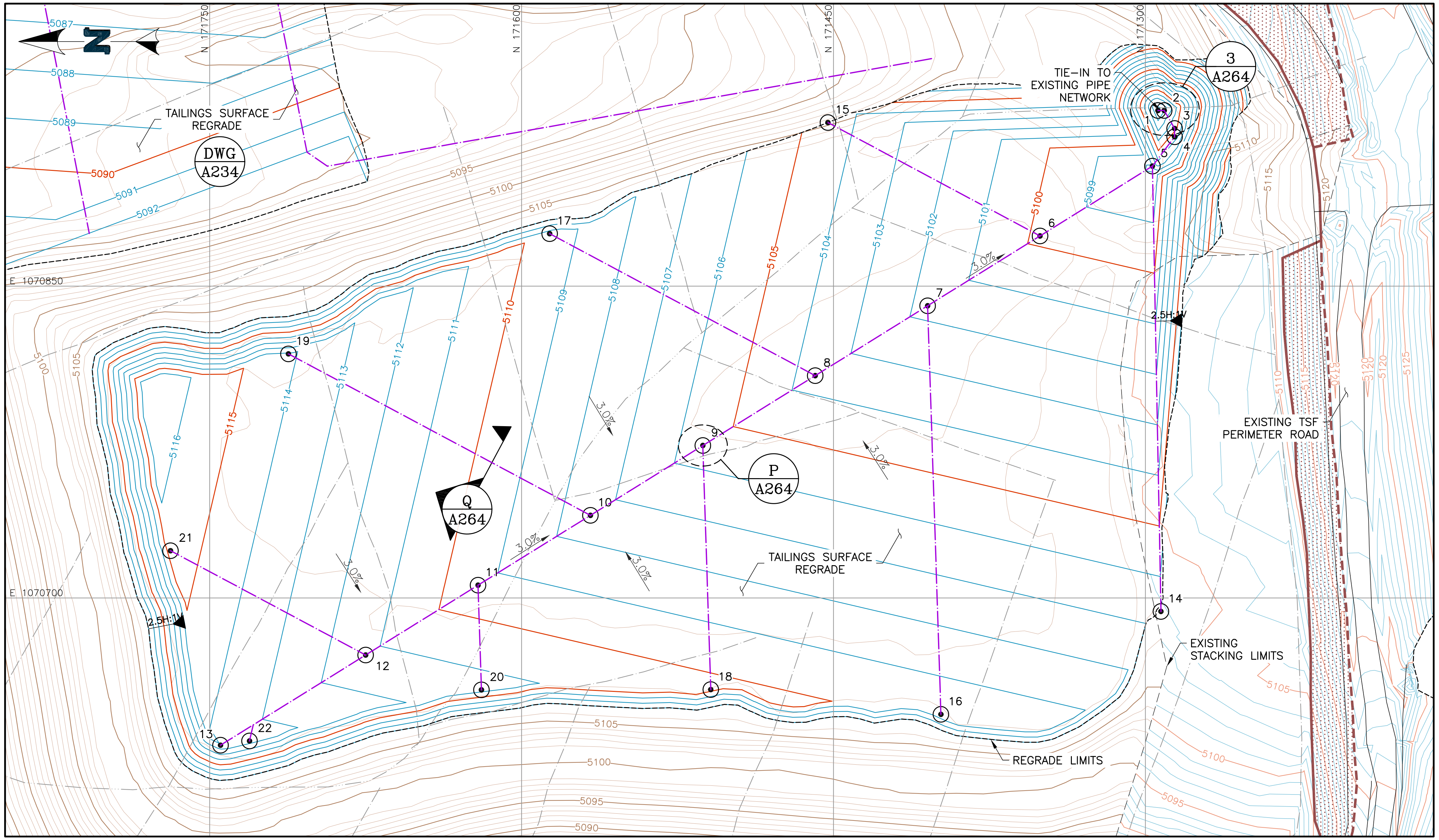

LEGEND:

- AS-BUILT CONTOURS (SEE NOTE 1)
- EXISTING TSF STACKING CONTOURS
- PROPOSED REGRADE CONTOURS (SEE NOTE 4)
- EXISTING 4" DIA. CPe UNDERDRAIN COLLECTION PIPE (PERFORATED) (SEE NOTES 2 AND 6)
- EXISTING CPe UNDERDRAIN COLLECTION HEADER (PERFORATED) (INCLUDES VARIOUS DIAMETER PIPES) (SEE NOTES 2 AND 6)
- 4" DIA. CPe UNDERDRAIN COLLECTION PIPE (PERFORATED) (SEE NOTES 3 AND 5)
- 8" DIA. CPe UNDERDRAIN COLLECTION HEADER (PERFORATED) (SEE NOTES 3 AND 5)
- 4" DIA. CPe HORIZONTAL DRAIN PIPE (PERFORATED) (SEE NOTE 7)
- EXISTING PROTECTIVE LAYER LIMITS
- FINAL PROTECTIVE LAYER LIMITS (SEE NOTES 3 AND 5)
- AREA WHERE PROTECTIVE LAYER AND UNDERDRAIN COLLECTION PIPE TO BE COMPLETED (SEE NOTES 3 AND 5)

NOTES:

1. AS-BUILT CONTOURS REPRESENT TOP OF LOW PERMEABILITY SOIL LAYER WITHIN THE GEOMEMBRANE LINED AREA AND FINISHED GRADE EVERYWHERE ELSE. SEE DRAWING A220 FOR GEOMEMBRANE LIMITS.
2. ALL UPSTREAM OPEN ENDS OF EXISTING PIPES WERE CAPPED.
3. THE UNDERDRAIN COLLECTION PIPING AND PROTECTIVE LAYER INSTALLATION SHOWN HAS ALREADY BEEN APPROVED AND WILL BE INSTALLED IN ACCORDANCE WITH THE STATE OF ARIZONA, AQUIFER PROTECTION PERMIT NO P-512235 APPROVED JANUARY 8TH, 2018.
4. TAILINGS SURFACE GRADING TO DRAIN AT MINIMUM 3%.
5. PROTECTIVE LAYER AND UNDERDRAIN COLLECTION PIPE WORK TO BE COMPLETED INCREMENTALLY IN THIS AREA IMMEDIATELY AHEAD OF STACKING OPERATIONS.
6. UNDERDRAIN COLLECTION PIPES SHOWN IN GRAY SCALE WERE PREVIOUSLY INSTALLED AS PART OF THE VRP TSF CONSTRUCTION.
7. THE INTERLIFT HORIZONTAL DRAIN PIPES ARE TO BE INSTALLED ON THE REGRADED STACKING SURFACE.

SETTING OUT DATA

POINT	NORTHING	EASTING	ELEVATION
1	171,293.94	1,070,934.48	5,090.98
2	171,290.94	1,070,934.48	5,091.88
3	171,285.94	1,070,925.82	5,094.71
4	171,285.94	1,070,921.81	5,095.57
5	171,296.62	1,070,907.72	5,097.88
6	171,350.66	1,070,874.12	5,099.79
7	171,404.71	1,070,840.53	5,101.70
8	171,458.76	1,070,806.93	5,103.61
9	171,512.81	1,070,773.33	5,105.52
10	171,566.86	1,070,739.74	5,107.43

SETTING OUT DATA

POINT	NORTHING	EASTING	ELEVATION
11	171,620.91	1,070,706.14	5,109.33
12	171,674.96	1,070,672.54	5,111.24
13	171,744.75	1,070,629.16	5,113.71
14	171,292.52	1,070,693.51	5,106.69
15	171,452.66	1,070,928.66	5,104.53
16	171,398.32	1,070,644.02	5,109.76
17	171,586.48	1,070,875.22	5,109.54
18	171,508.99	1,070,655.93	5,110.33
19	171,712.10	1,070,817.40	5,114.18
20	171,619.28	1,070,655.79	5,111.40

SETTING OUT DATA

POINT	NORTHING	EASTING	ELEVATION
21	171,768.81	1,070,722.72	5,115.61
22	171,730.82	1,070,631.22	5,113.49

0 30 60 FEET

Registered Professional Engineer (Civil)
CERTIFICATE NO.
63431
CRAIG M. THOMPSON
Date Signed 12/8/23
ARIZONA, U.S.A.
EXPIRES 3/31/26

REFERENCE:

EXISTING GROUND TOPOGRAPHY DEVELOPED FROM MARCH 2020 AND APRIL 2023 AERIAL SURVEY DATA PROVIDED BY SOUTH32 (AMI). DATA PROJECTED TO STATE PLANE ARIZONA CENTRAL NAD 83 FEET, NAVD88.

REV	DATE	DESCRIPTION	TECH	ENG
0	12/8/23	ISSUED FOR TENDER	JEP	CMT

APPROVED BY: RMS
CHECKED BY: CMT
DESIGNED BY: CMT
DRAWN BY: JEP

DISCLAIMER
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NewFields

CLIENT: SOUTH32 HERMOSA INC.

PROJECT: HERMOSA PROJECT AQUIFER PROTECTION PERMIT SIGNIFICANT AMENDMENT (TSF1)

TITLE: WEST RECLAIMED TAILINGS REGRADE AND HORIZONTAL DRAIN PIPE LAYOUT

FILENAME: 14.035.035M
DRAWING NO.: A232
REVISION: 0

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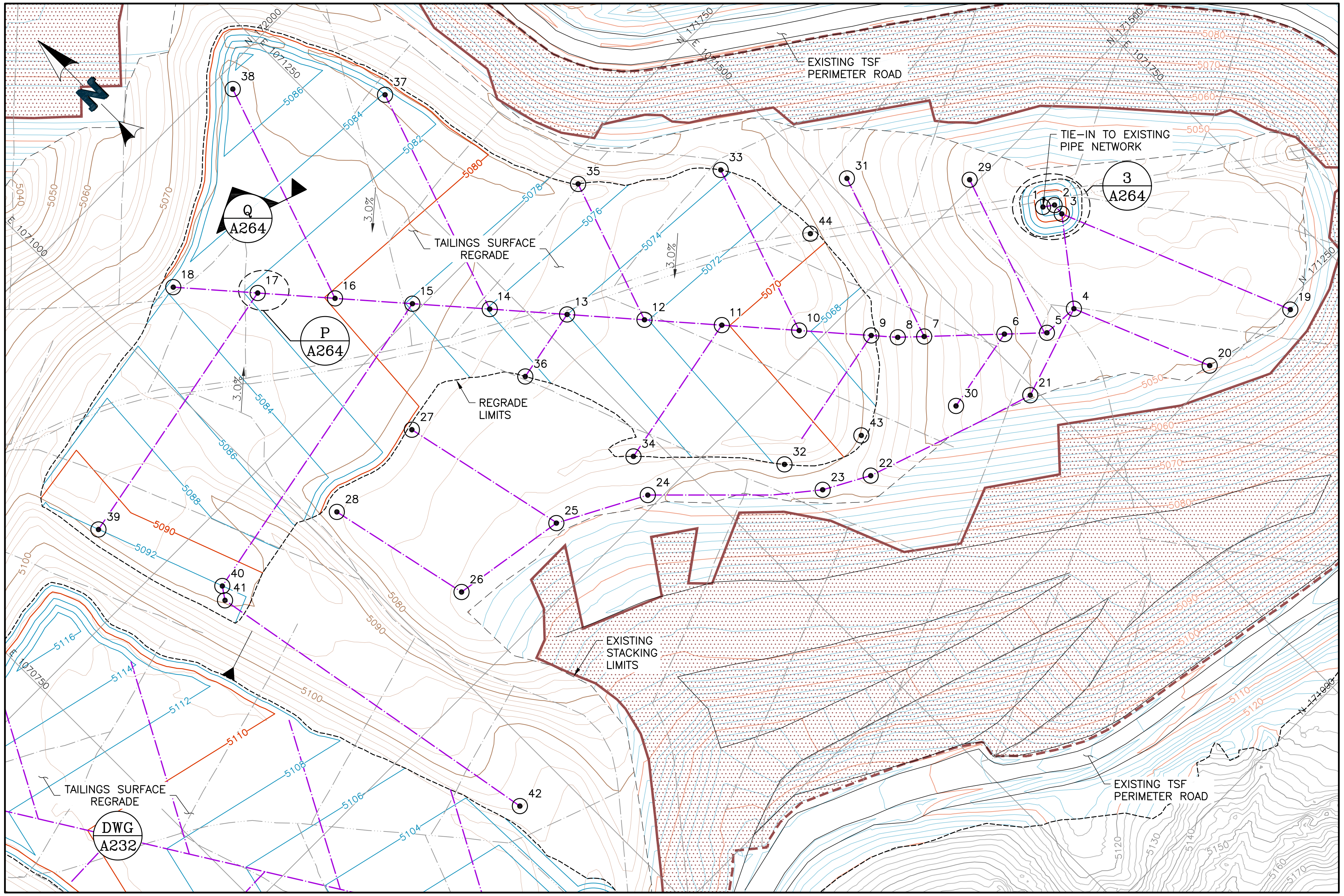

0 50 100 FEET

LEGEND:

AS-BUILT CONTOURS (SEE NOTE 1)

EXISTING TSF STACKING CONTOURS

PROPOSED REGRADE CONTOURS (SEE NOTE 4)

EXISTING 4" DIA. CPe UNDERDRAIN COLLECTION PIPE (PERFORATED) (SEE NOTES 2 AND 6)

EXISTING CPe UNDERDRAIN COLLECTION HEADER (PERFORATED) (INCLUDES VARIOUS DIAMETER PIPE) (SEE NOTES 2 AND 6)

4" DIA. CPe UNDERDRAIN COLLECTION PIPE (PERFORATED) (SEE NOTES 3 AND 5)

8" DIA. CPe UNDERDRAIN COLLECTION HEADER (PERFORATED) (SEE NOTES 3 AND 5)

4" DIA. CPe HORIZONTAL DRAIN PIPE (PERFORATED) (SEE NOTE 7)

EXISTING PROTECTIVE LAYER LIMITS

FINAL PROTECTIVE LAYER LIMITS (SEE NOTES 3 AND 5)

AREA WHERE PROTECTIVE LAYER AND UNDERDRAIN COLLECTION PIPE TO BE COMPLETED (SEES NOTE 3 AND 5)

SETTING OUT DATA			
POINT	NORTHING	EASTING	ELEVATION
1	171,446.87	1,071,610.55	5,037.48
2	171,441.28	1,071,618.39	5,036.95
3	171,431.95	1,071,617.49	5,038.68
4	171,369.88	1,071,569.47	5,047.14
5	171,371.57	1,071,539.85	5,047.89
6	171,395.50	1,071,514.43	5,051.08
7	171,440.64	1,071,466.46	5,060.32
8	171,455.50	1,071,450.67	5,063.63
9	171,471.96	1,071,436.34	5,066.50
10	171,516.67	1,071,397.41	5,068.28
11	171,564.67	1,071,355.63	5,070.19
12	171,612.67	1,071,313.84	5,072.10
13	171,660.67	1,071,272.06	5,074.01
14	171,708.67	1,071,230.27	5,075.92
15	171,756.67	1,071,188.49	5,077.83
16	171,804.67	1,071,146.70	5,079.74
17	171,852.67	1,071,104.91	5,081.64
18	171,905.06	1,071,059.31	5,083.73
19	171,243.76	1,071,694.57	5,049.29
20	171,258.08	1,071,615.26	5,050.32
21	171,345.01	1,071,493.96	5,050.00
22	171,390.95	1,071,354.71	5,067.00

SETTING OUT DATA			
POINT	NORTHING	EASTING	ELEVATION
23	171,410.63	1,071,318.62	5,069.00
24	171,509.07	1,071,214.08	5,071.22
25	171,545.87	1,071,144.74	5,071.99
26	171,560.90	1,071,049.75	5,073.80
27	171,683.88	1,071,115.08	5,078.75
28	171,679.74	1,071,023.88	5,078.34
29	171,505.20	1,071,583.80	5,047.28
30	171,381.88	1,071,444.66	5,056.74
31	171,577.17	1,071,513.36	5,062.08
32	171,447.54	1,071,311.21	5,071.73
33	171,655.34	1,071,445.05	5,074.29
34	171,539.81	1,071,228.20	5,075.51
35	171,729.99	1,071,354.15	5,077.18
36	171,648.91	1,071,211.80	5,076.52
37	171,893.75	1,071,293.85	5,083.94
38	171,985.43	1,071,208.80	5,087.57
39	171,807.87	1,070,875.33	5,092.01
40	171,703.20	1,070,914.43	5,092.01
41	171,693.35	1,070,907.68	5,092.01
42	171,402.86	1,070,959.42	5,103.88
43	171,419.73	1,071,372.59	5,069.05
44	171,566.34	1,071,460.10	5,070.57

NOTES:

1. AS-BUILT CONTOURS REPRESENT TOP OF LOW PERMEABILITY SOIL LAYER WITHIN THE GEOMEMBRANE LINED AREA AND FINISHED GRADE EVERYWHERE ELSE. SEE DRAWING A220 FOR GEOMEMBRANE LIMITS.
2. ALL UPSTREAM OPEN ENDS OF EXISTING PIPES WERE CAPPED.
3. THE UNDERDRAIN COLLECTION PIPING AND PROTECTIVE LAYER INSTALLATION SHOWN HAS ALREADY BEEN APPROVED AND WILL BE INSTALLED IN ACCORDANCE WITH THE STATE OF ARIZONA, AQUIFER PROTECTION PERMIT NO P-512235 APPROVED JANUARY 8TH, 2018.
4. TAILINGS SURFACE GRADING TO DRAIN AT MINIMUM 3%.
5. PROTECTIVE LAYER AND UNDERDRAIN COLLECTION PIPE WORK TO BE COMPLETED INCREMENTALLY IN THIS AREA IMMEDIATELY AHEAD OF STACKING OPERATIONS

NOTES (CONTINUED):

6. UNDERDRAIN COLLECTION PIPES SHOWN IN GRAY SCALE WERE PREVIOUSLY INSTALLED AS PART OF THE VRP TSF CONSTRUCTION.
7. THE INTERLIFT HORIZONTAL DRAIN PIPES ARE TO BE INSTALLED ON THE REGRADED STACKING SURFACE.

REFERENCE:

EXISTING GROUND TOPOGRAPHY DEVELOPED FROM MARCH 2020 AND APRIL 2023 AERIAL SURVEY DATA PROVIDED BY SOUTH32 (AMI). DATA PROJECTED TO STATE PLANE ARIZONA CENTRAL NAD 83 FEET, NAVD88.

Registered Professional Engineer (Civil)
CERTIFICATE NO.
63431
CRAIG M. THOMPSON
Date Signed 12/8/23
ARIZONA, U.S.A.
EXPIRES 3/31/26

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NewFields

CLIENT: SOUTH32 HERMOSA INC.

PROJECT: HERMOSA PROJECT AQUIFER PROTECTION PERMIT SIGNIFICANT AMENDMENT (TSF1)

TITLE: EAST RECLAIMED TAILINGS REGRADE AND HORIZONTAL DRAIN PIPE LAYOUT

FILENAME: 14.035.036M
DRAWING NO.: A234
REVISION: 0

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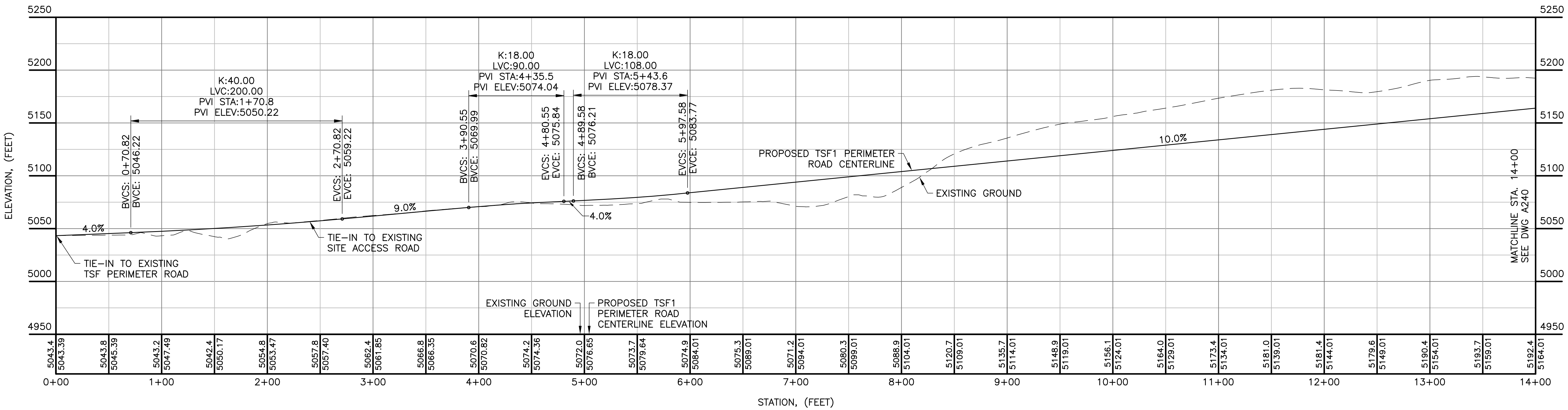

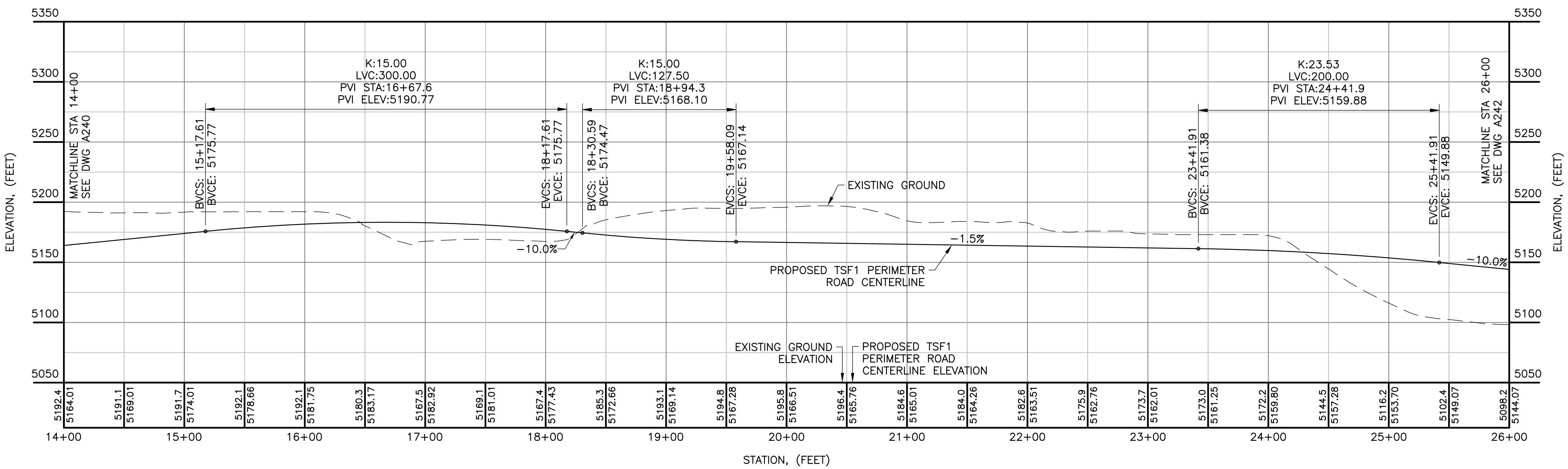

0 50 100 FEET HORIZONTAL
0 50 100 FEET VERTICAL
NO EXAGGERATION

NOTE:

1. SEE DRAWING A200 FOR PERIMETER ROAD PLAN VIEW AND ALIGNMENT.

Registered Professional Engineer (Civil)
CERTIFICATE NO. 63431
CRAIG M. THOMPSON
Date Signed 12/8/23
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DRAWN BY: JEP

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NewFields

CLIENT: SOUTH32 HERMOSA INC.
PROJECT: HERMOSA PROJECT AQUIFER PROTECTION PERMIT SIGNIFICANT AMENDMENT (TSF1)
TITLE: TSF1 PERIMETER ROAD PROFILES (1 OF 2)
FILENAME: 14.035.010P
DRAWING NO.: A240
REVISION: 0

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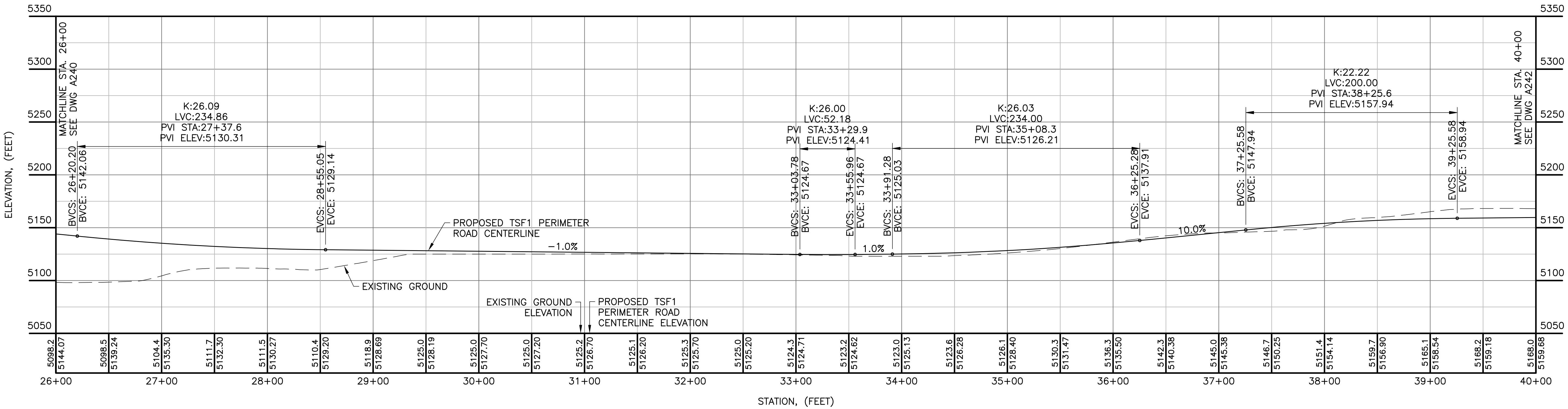

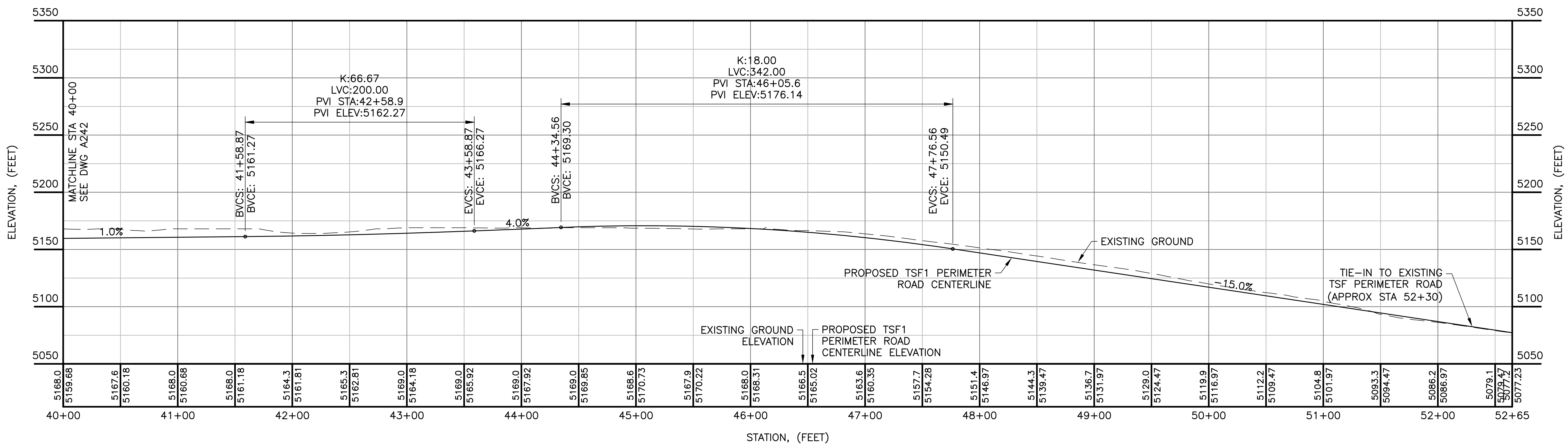

0 50 100 FEET HORIZONTAL
0 50 100 FEET VERTICAL
NO EXAGGERATION

EXPIRES 3/31/26

NOTE:

1. SEE DRAWING A200 FOR PERIMETER ROAD PLAN VIEW AND ALIGNMENT.
2. APPROXIMATE STATION 39+00 TO 50+00 IS LOCATED ALONG THE EXISTING CONSTRUCTION WATER POND PIPE CORRIDOR. MULTIPLE EXISTING BURIED UTILITIES ARE LOCATED IN THIS AREA.

REV	DATE	DESCRIPTION	TECH	ENG
0	12/8/23	ISSUED FOR TENDER	JEP	CMT

APPROVED BY: RMS
CHECKED BY: CMT
DESIGNED BY: CMT
DRAWN BY: JEP

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NewFields

CLIENT: SOUTH32 HERMOSA INC.

PROJECT: HERMOSA PROJECT AQUIFER PROTECTION PERMIT SIGNIFICANT AMENDMENT (TSF1)

TITLE: TSF1 PERIMETER ROAD PROFILES (2 OF 2)

FILENAME: 14.035.011P

DRAWING NO.: A242

REVISION: 0

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TSF1 PERIMETER ROAD ALIGNMENT TABLE						
	STATION	NORTHING	EASTING	DELTA (D-M-S)	LENGTH (FT)	RADIUS (FT)
BP	0+00.00	171,987.12	1,070,367.47			
PC	0+32.15	171,963.59	1,070,345.55	022-32-07	78.66	200.00
PT	1+10.81	171,917.92	1,070,282.13			
PC	1+74.72	171,891.43	1,070,223.98	021-56-10	76.57	200.00
PT	2+51.29	171,847.28	1,070,161.99			
PC	3+38.60	171,784.03	1,070,101.81	060-54-01	212.58	200.00
PT	5+51.18	171,586.60	1,070,055.78			
PC	7+45.27	171,401.32	1,070,113.59	012-14-50	395.44	1850.00
PT	11+40.71	171,039.23	1,070,270.66			
PC	11+41.85	171,038.24	1,070,271.22	033-47-28	88.46	150.00
PT	12+30.31	170,978.19	1,070,334.43			
PC	15+55.29	170,832.51	1,070,624.92	053-54-55	188.20	200.00
PT	17+43.49	170,833.53	1,070,806.25			
PC	18+43.78	170,879.50	1,070,895.39	072-13-09	437.01	346.71
PT	22+80.79	170,816.78	1,071,299.20			
PC	22+82.08	170,815.87	1,071,300.11	034-34-43	120.70	200.00
PT	24+02.78	170,760.70	1,071,405.41			
PC	27+15.21	170,704.52	1,071,712.76	036-17-04	126.66	200.00
PT	28+41.87	170,721.38	1,071,836.16			
PC	31+60.52	170,860.69	1,072,122.75	060-28-54	184.73	175.00
PT	33+45.25	171,007.11	1,072,220.89			
PC	35+69.76	171,231.18	1,072,234.97	030-22-29	106.03	200.00
PT	36+75.79	171,333.83	1,072,213.91			
PC	40+13.63	171,635.43	1,072,061.68	012-37-06	44.05	200.00
PT	40+57.68	171,672.26	1,072,037.68			
PC	43+61.67	171,907.17	1,071,844.73	006-48-36	24.37	205.00
PT	43+86.04	171,925.04	1,071,828.19			
PC	46+81.69	172,129.64	1,071,614.76	059-03-05	474.10	460.00
PT	51+55.79	172,241.36	1,071,175.35			
EP	52+64.93	172,212.63	1,071,070.05			

NOTE:

1. SEE DRAWING A200 FOR PERIMETER ROAD PLAN VIEW AND ALIGNMENT.

Registered Professional Engineer (Civil)
CERTIFICATE NO.
63431
CRAIG M.
THOMPSON
Date Signed 12/8/23
ARIZONA, U.S.A.
EXPIRES 3/31/26

REV	DATE	DESCRIPTION	TECH	ENG
0	12/8/23	ISSUED FOR TENDER	JEP	CMT

APPROVED BY: RMS
CHECKED BY: CMT
DESIGNED BY: CMT
DRAWN BY: JEP

DISCLAIMER

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CLIENT: SOUTH32 HERMOSA INC.

PROJECT: HERMOSA PROJECT AQUIFER PROTECTION PERMIT SIGNIFICANT AMENDMENT (TSF1)

TITLE: TSF1 PERIMETER ROAD ALIGNMENT TABLE

FILENAME: 14.035.012P

DRAWING NO.: A250

REVISION: 0

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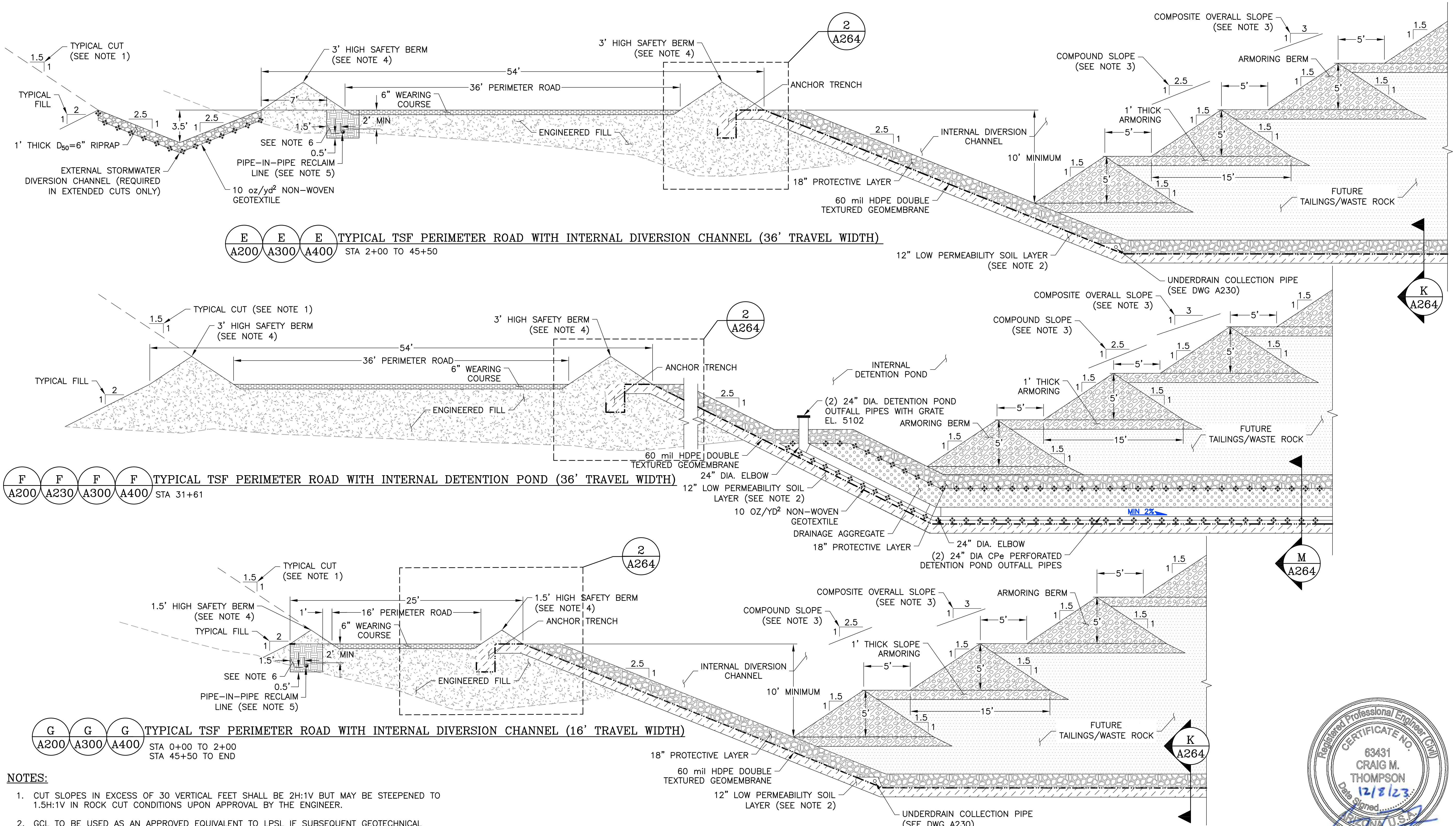

E A200 E A300 E A400 TYPICAL TSF PERIMETER ROAD WITH INTERNAL DIVERSION CHANNEL (36' TRAVEL WIDTH)
STA 2+00 TO 45+50

F A200 F A230 F A300 F A400 TYPICAL TSF PERIMETER ROAD WITH INTERNAL DETENTION POND (36' TRAVEL WIDTH)
STA 31+61

G A200 G A300 G A400 TYPICAL TSF PERIMETER ROAD WITH INTERNAL DIVERSION CHANNEL (16' TRAVEL WIDTH)
STA 0+00 TO 2+00
STA 45+50 TO END

NOTES:

1. CUT SLOPES IN EXCESS OF 30 VERTICAL FEET SHALL BE 2H:1V BUT MAY BE STEEPENED TO 1.5H:1V IN ROCK CUT CONDITIONS UPON APPROVAL BY THE ENGINEER.
2. GCL TO BE USED AS AN APPROVED EQUIVALENT TO LPSL IF SUBSEQUENT GEOTECHNICAL INVESTIGATION RESULTS REVEAL INSUFFICIENT LOW PERMEABILITY SOIL QUANTITY IS AVAILABLE AND SLOPE STABILITY RESULTS SUPPORT ITS USE. SEE DWG A220 FOR POTENTIAL GCL LIMITS.
3. 3H:1V COMPOSITE SLOPE IS COMPRISED OF 25 FT HIGH 2.5H:1V COMPOUND SLOPES IN COMBINATION WITH A 12.5 FT BENCH THAT OCCURS EVER 25 FT IN VERTICAL SLOPE HEIGHT (SEE DWG A300).
4. SAFETY BERM WILL HAVE 1.5H:1V SIDE SLOPES AND WILL BE 3 FT HIGH ALONG HAUL ROADS AND 1.5 FT HIGH ALONG LIGHT VEHICLE ACCESS ROADS.
5. RECLAIM PIPE RUNS FROM THE EXISTING UNDERDRAIN COLLECTION POND TO WTP2 (SEE DWG A200) (APPROXIMATE STA 33+45 TO 52+30).
6. TRENCH SPOILS TO BE USED AS TRENCH BACKFILL.

Registered Professional Engineer (Civil)
CERTIFICATE NO. 63431
CRAIG M. THOMPSON
Date Signed 12/8/23
ARIZONA, U.S.A.
EXPIRES 3/31/26

REV	DATE	DESCRIPTION	TECH	ENG
0	12/8/23	ISSUED FOR TENDER	JEP	CMT

APPROVED BY: RMS
CHECKED BY: CMT
DESIGNED BY: CMT
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NewFields

CLIENT: SOUTH32 HERMOSA INC.
PROJECT: HERMOSA PROJECT AQUIFER PROTECTION PERMIT SIGNIFICANT AMENDMENT (TSF1)
TITLE: TSF1 BASIN SECTIONS AND DETAILS (1 OF 3)
FILENAME: 14.035.013D
DRAWING NO.: A260
REVISION: 0

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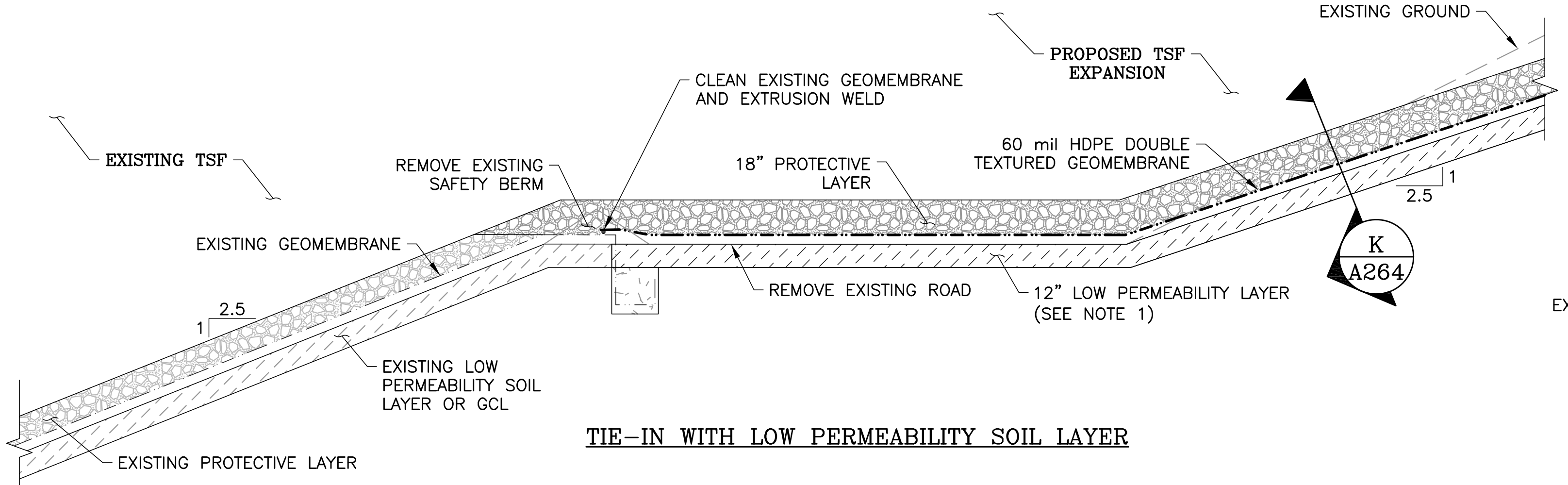
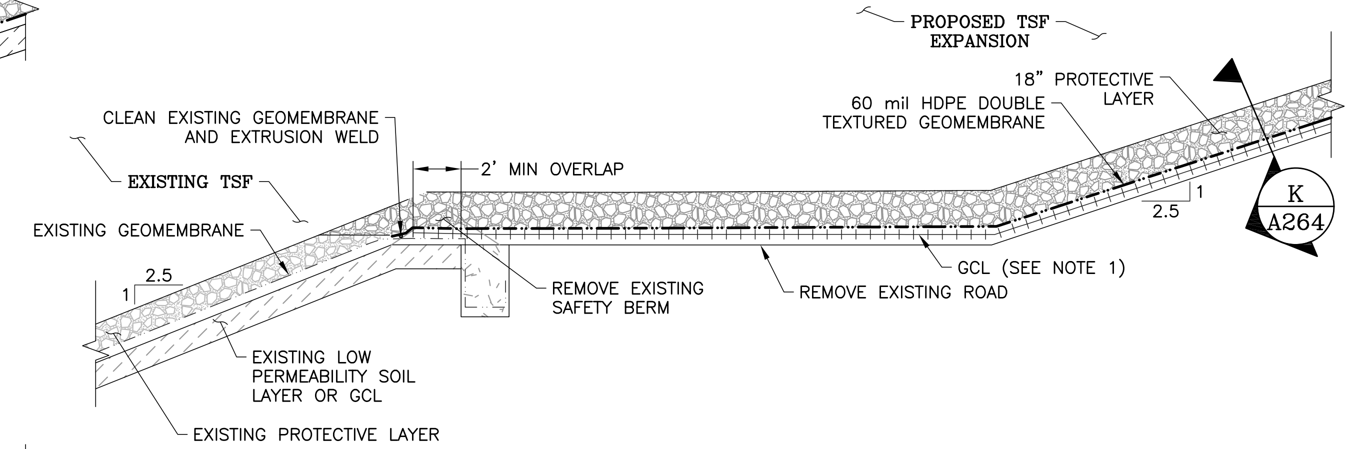
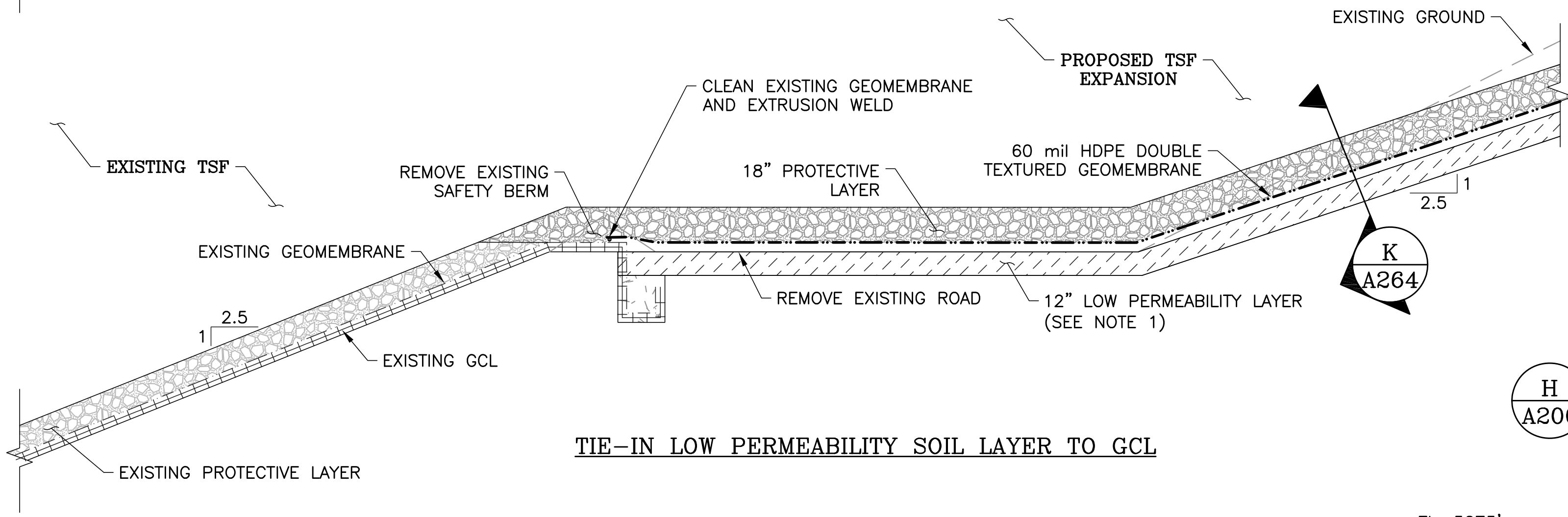


TIE-IN WITH LOW PERMEABILITY SOIL LAYER

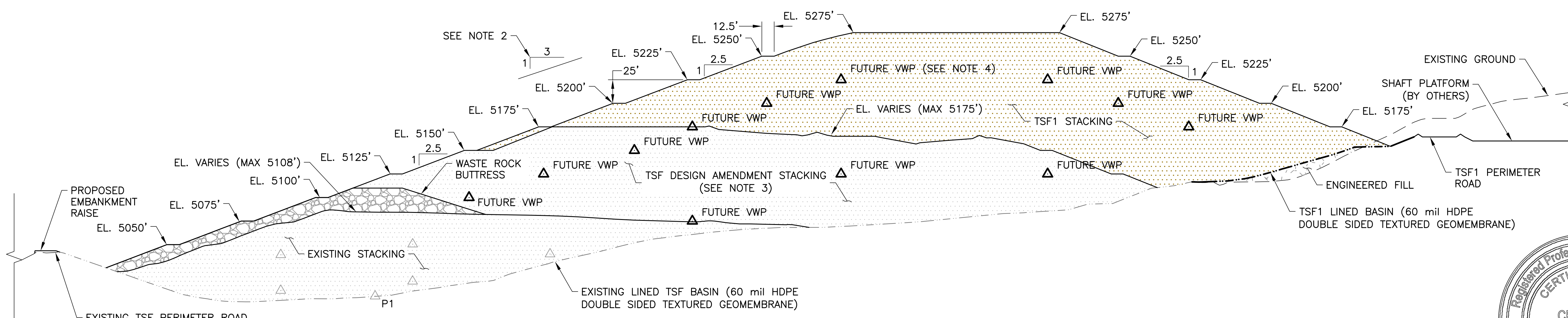


TIE-IN WITH GCL



TIE-IN LOW PERMEABILITY SOIL LAYER TO GCL

H/A200 H/A220 TIE-IN TO EXISTING TSF



J/A222 J/A300 TSF1 STACKING SECTION

NOTES:

1. GCL MAY BE USED AS AN APPROVED EQUIVALENT IF SUBSEQUENT GEOTECHNICAL INVESTIGATION RESULTS REVEAL INSUFFICIENT LOW PERMEABILITY SOIL QUANTITY IS AVAILABLE AND SLOPE STABILITY RESULTS SUPPORT ITS USE. GCL IS ONLY APPROVED FOR PLACEMENT IN AREAS SHOWN ON DWG A220.
2. 3H:1V COMPOSITE SLOPE IS COMPRISED OF 25 FT HIGH 2.5H:1V COMPOUND SLOPES IN COMBINATION WITH A 12.5 FT BENCH THAT OCCURS EVERY 25 FT IN VERTICAL SLOPE HEIGHT (SEE DWG A300).
3. STACKING SHOWN IS THE HERMOSA LINED TSF DESIGN AMENDMENT (TSF-AD) STACKING APPROVED BY ADEQ (2022) FOR PLACEMENT OF FUTURE WASTE ROCK FROM MINE DEVELOPMENT AND MISCELLANEOUS MATERIALS.
4. FUTURE VIBRATING WIRE PIEZOMETERS IN THE STACK ARE ILLUSTRATIVE. FINAL PIEZOMETER LOCATIONS IN THE STACK TO BE DETERMINED IN FINAL DESIGN AND/OR DURING OPERATIONS. VIBRATING WIRE PIEZOMETERS WILL BE USED FOR REAL TIME MONITORING OF THE DRY STACK BY THE OPERATIONS STAFF.

Registered Professional Engineer (Civil) CERTIFICATE NO. 63431 CRAIG M. THOMPSON Date Signed 12/8/23 ARIZONA, U.S.A. EXPIRES 3/31/26

REV	DATE	DESCRIPTION	TECH	ENG
0	12/8/23	ISSUED FOR TENDER	JEP	CMT

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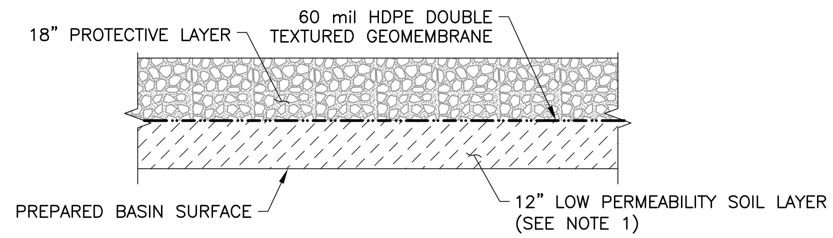
CLIENT: SOUTH32 HERMOSA INC.

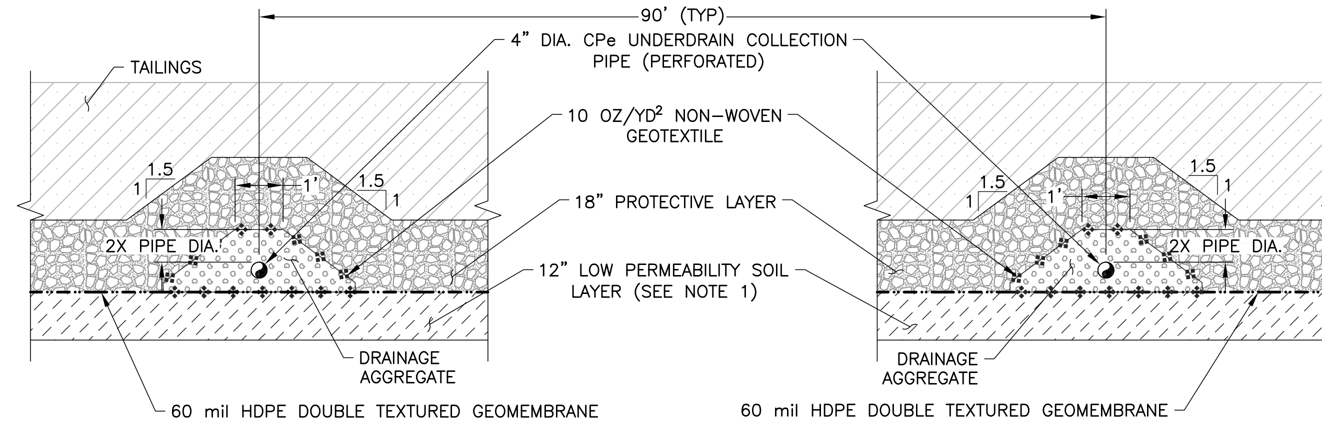
PROJECT: HERMOSA PROJECT AQUIFER PROTECTION PERMIT SIGNIFICANT AMENDMENT (TSF1)

TITLE: TSF1 BASIN SECTIONS AND DETAILS (2 OF 3)

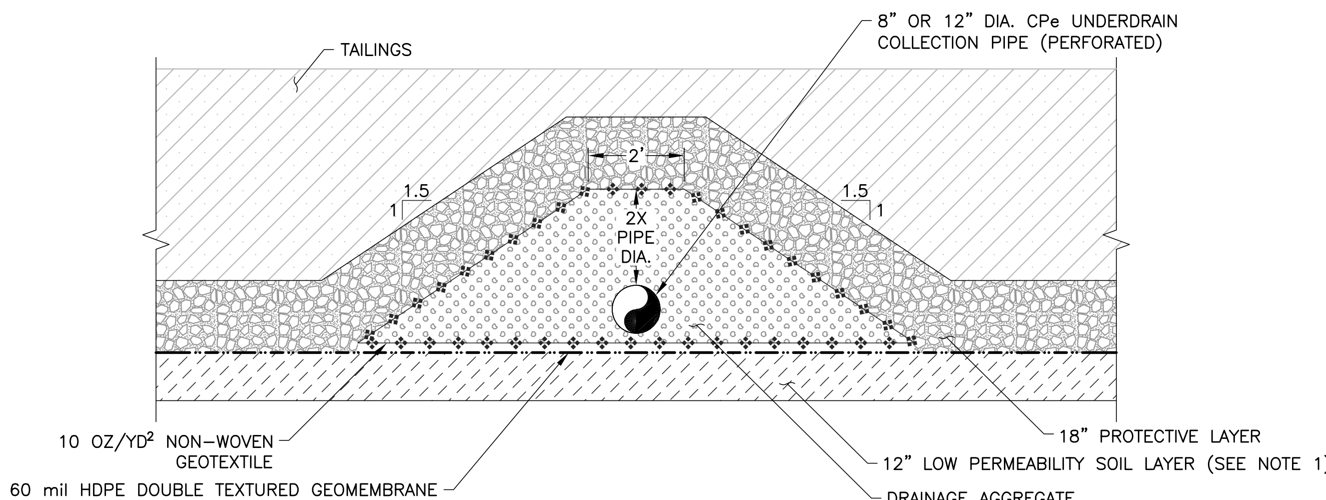
FILENAME: 14.035.014D
DRAWING NO.: A262
REVISION: 0



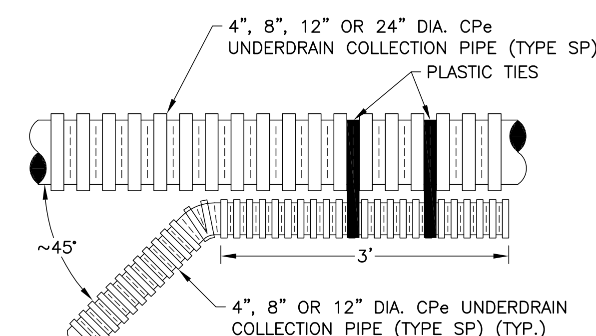
K/A220 K/A260 K/A262 TYPICAL BASIN SECTION (LOW PERMEABILITY LAYER OR GCL)



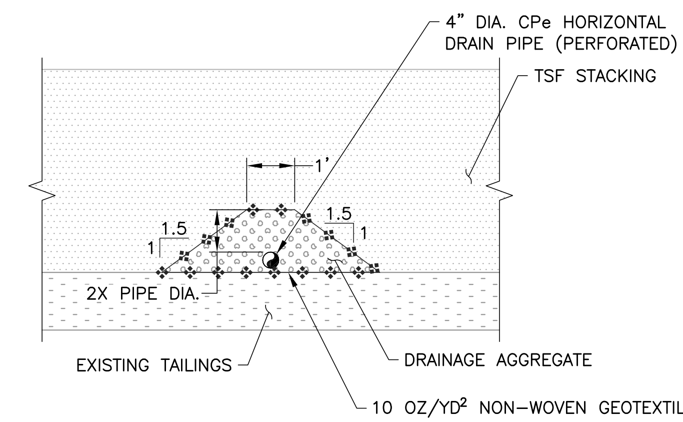
N/A230 UNDERDRAIN BASIN HEADER – 4" PIPE



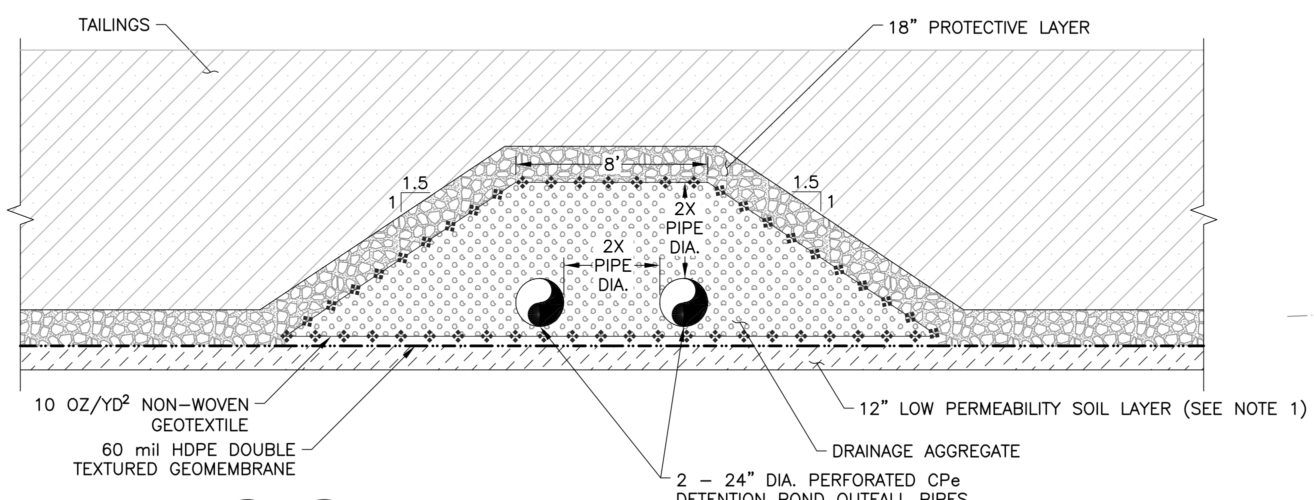
L/A230 UNDERDRAIN BASIN HEADER – 12" OR 8" PIPE



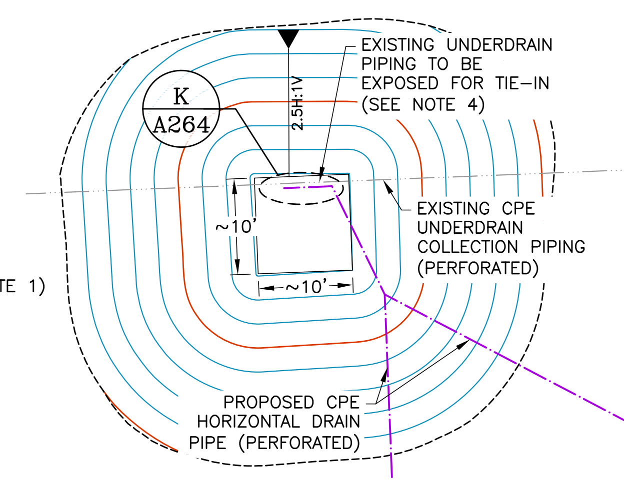
P/A230 P/A232 P/A234 P/A264 UNDERDRAIN COLLECTION PIPE INTERSECTION



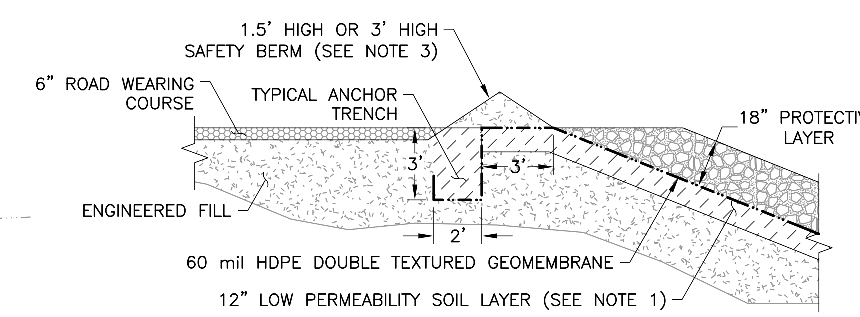
Q/A232 Q/A234 HORIZONTAL DRAIN PIPE – 4" PIPE



M/A230 M/A260 UNDERDRAIN BASIN HEADER – (2) 24" PIPES



3/A230 3/A232 3/A234 HORIZONTAL DRAIN PIPE TIE-IN TO EXISTING UNDERDRAIN



2/A260 TYPICAL ANCHOR TRENCH ON PERIMETER ROAD BERM

Registered Professional Engineer (Civil)
CERTIFICATE NO. 63431
CRAIG M. THOMPSON
Date Signed 12/8/23
ARIZONA, U.S.A.
Expires 3/31/26

NOTES:

1. GCL MAY BE USED AS AN APPROVED EQUIVALENT IF SUBSEQUENT GEOTECHNICAL INVESTIGATION RESULTS REVEAL INSUFFICIENT LOW PERMEABILITY SOIL QUANTITY IS AVAILABLE AND SLOPE STABILITY RESULTS SUPPORT ITS USE. IF GCL IS USED, GCL WILL BE ANCHORED IN LINER TRENCH. SEE DWG A220 FOR POTENTIAL GCL LIMITS.
2. ALL UPSTREAM OPEN ENDS OF PIPES TO BE CAPPED.
3. SAFETY BERMS ALONG HAUL ROADS TO BE 3' HIGH, SAFETY BERMS ALONG LIGHT VEHICLE ACCESS ROADS TO BE 1.5 FT HIGH.
4. TO EXPOSE THE EXISTING UNDERDRAIN PIPE, CUTTING INTO THE EXISTING TAILINGS, PROTECTIVE LAYER, GEOTEXTILE, AND DRAINAGE AGGREGATE WILL BE NECESSARY. WHEN INSTALLING THE PROPOSED HORIZONTAL DRAIN PIPE, CLEAN TIE-INS WITH THE EXISTING PROTECTIVE LAYER, GEOTEXTILE, AND DRAINAGE AGGREGATE IS REQUIRED. IT IS IMPERATIVE THAT CAUTION BE TAKEN WHILE EXCAVATING TO NOT DAMAGE THE BASIN GEOMEMBRANE. ANY DAMAGE TO THE GEOMEMBRANE MUST BE REPAIRED ACCORDING TO THE TECHNICAL SPECIFICATIONS.

REV	DATE	DESCRIPTION	TECH	ENG
0	12/8/23	ISSUED FOR TENDER	JEP	CMT

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CHECKED BY: CMT
DESIGNED BY: CMT
DRAWN BY: JEP

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NewFields
CLIENT: SOUTH32 HERMOSA INC.
PROJECT: HERMOSA PROJECT AQUIFER PROTECTION PERMIT SIGNIFICANT AMENDMENT (TSF1)
TITLE: TSF1 BASIN SECTIONS AND DETAILS (3 OF 3)
FILENAME: 14.035.015D
DRAWING NO.: A264
REVISION: 0

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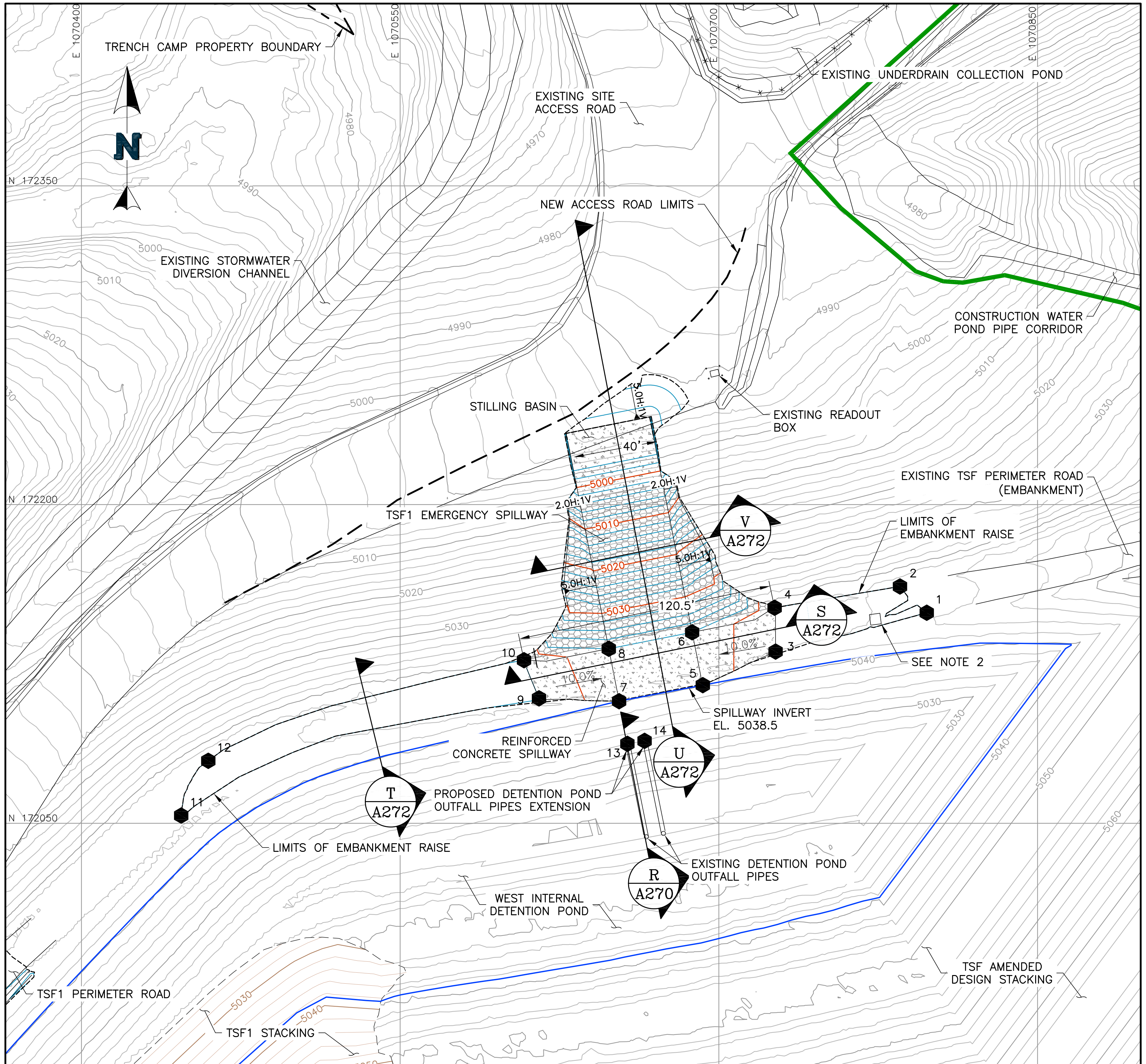


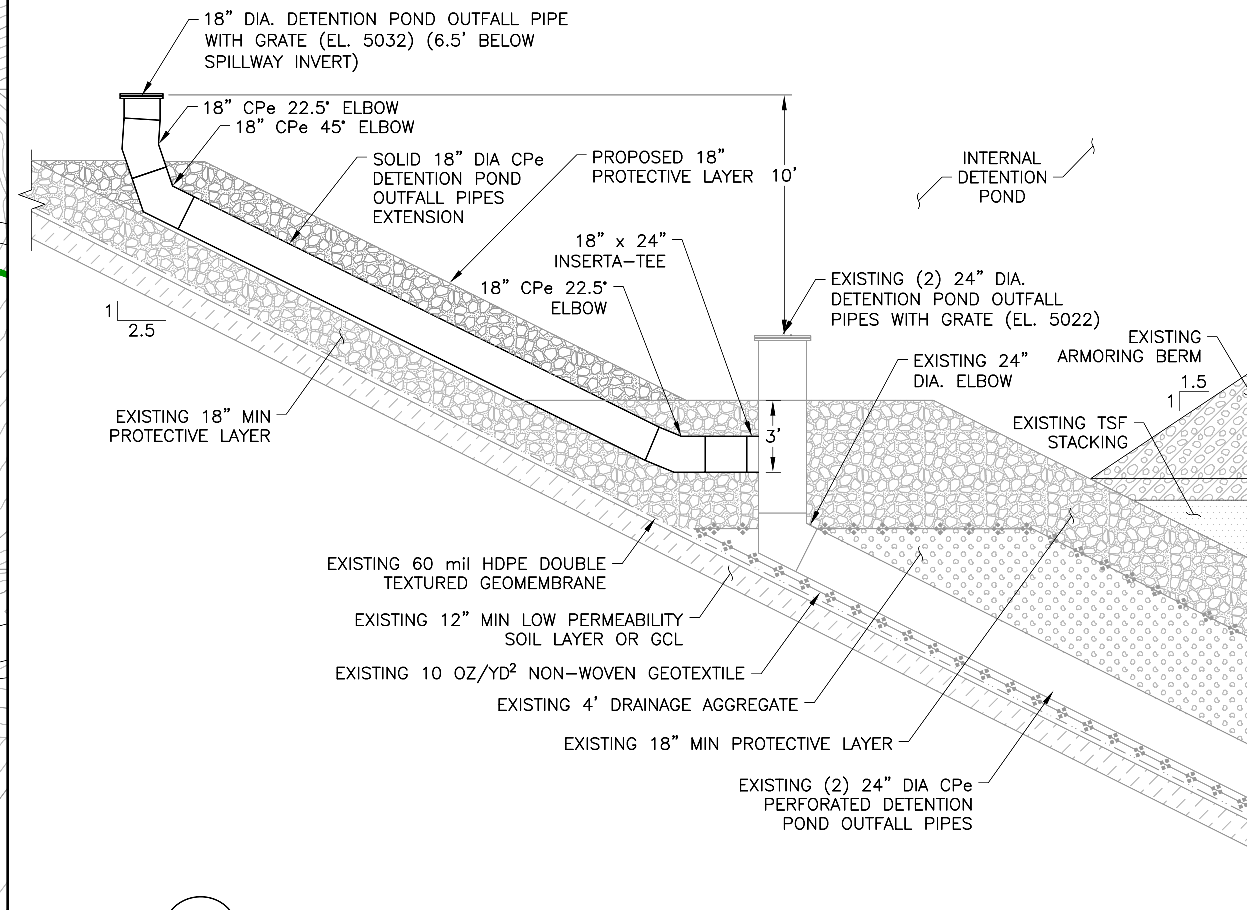
0 30 60 FEET

REFERENCE:

EXISTING GROUND TOPOGRAPHY DEVELOPED FROM MARCH 2020 AND APRIL 2023 AERIAL SURVEY DATA PROVIDED BY SOUTH32 (AMI). DATA PROJECTED TO STATE PLANE ARIZONA CENTRAL NAD 83 FEET, NAVD88.

LEGEND:

- EXISTING GROUND CONTOURS
- PROPOSED GROUND CONTOURS
- PROPOSED STACKING CONTOURS
- RECLAIM PIPE
- INTERNAL DETENTION POND LIMITS
- EXISTING FENCE
- REINFORCED CONCRETE
- PROPOSED GEOWEB



R A270 DETENTION POND OUTFALL PIPE EXTENSION

SPILLWAY SETTING OUT DATA

POINT	NORTHING	EASTING	ELEVATION
1	172,149.11	1,070,797.86	5,042.00
2	172,161.49	1,070,785.23	5,042.00
3	172,130.84	1,070,726.67	5,041.61
4	172,151.46	1,070,726.26	5,042.00
5	172,115.02	1,070,692.45	5,038.50
6	172,139.91	1,070,687.42	5,040.78
7	172,107.50	1,070,653.05	5,038.50
8	172,132.16	1,070,648.18	5,040.68
9	172,108.83	1,070,615.32	5,041.00
10	172,126.79	1,070,608.30	5,041.94
11	172,053.67	1,070,446.95	5,042.00
12	172,079.42	1,070,459.68	5,042.00

OUTFALL PIPES SETTING OUT DATA

POINT	NORTHING	EASTING	ELEVATION
13	172,087.43	1,070,656.93	5,032.00
14	172,088.80	1,070,665.03	5,032.00

Registered Professional Engineer (Civil)
CERTIFICATE NO. 63431
CRAIG M. THOMPSON
Date Signed 12/8/23
ARIZONA, U.S.A.
EXPIRES 3/31/26

NOTES:

1. PROPOSED CONTOURS REPRESENT TOP OF LOW PERMEABILITY SOIL LAYER WITHIN THE GEOMEMBRANE LINED AREA, AND FINISHED GRADE EVERYWHERE ELSE.
2. STANDBY PUMP TO BE LOCATED ON THE TSF PERIMETER ROAD AT THE WEST INTERNAL DETENTION POND. EXISTING PUMP AT THE EXTERNAL DETENTION POND TO BE RELOCATED TO THE TSF PERIMETER ROAD DURING CONSTRUCTION OF TSF1. THE STANDBY PUMP WILL BE UTILIZED IN AN EMERGENCY TO PUMP WATER FROM THE WEST INTERNAL DETENTION POND TO THE UNDERDRAIN COLLECTION POND IN THE EVENT THE UNDERDRAIN COLLECTION SYSTEM IS NOT FUNCTIONAL.

REV	DATE	DESCRIPTION	TECH	ENG
0	12/8/23	ISSUED FOR TENDER	JEP	CMT

APPROVED BY: RMS
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DESIGNED BY: CMT
DRAWN BY: JEP

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NewFields

CLIENT: SOUTH32 HERMOSA INC.

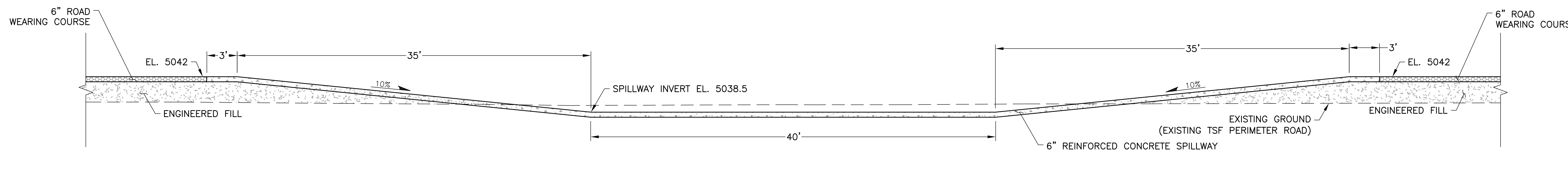
PROJECT: HERMOSA PROJECT AQUIFER PROTECTION PERMIT SIGNIFICANT AMENDMENT (TSF1)

TITLE: TSF1 EMERGENCY SPILLWAY

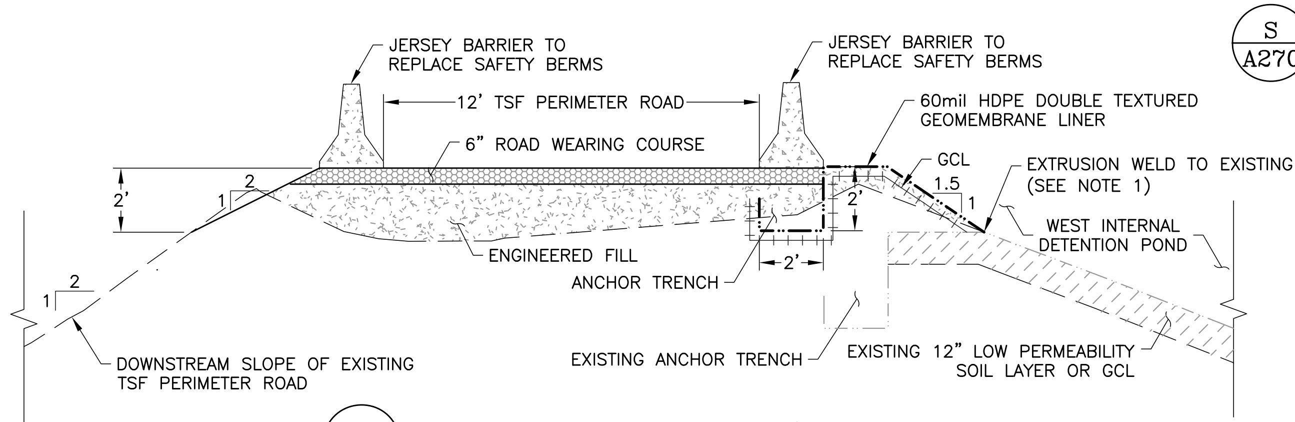
FILENAME: 14.035.016M

DRAWING NO.: A270

REVISION: 0



S
A270
TSF EMERGENCY SPILLWAY SECTION 1 OF 3



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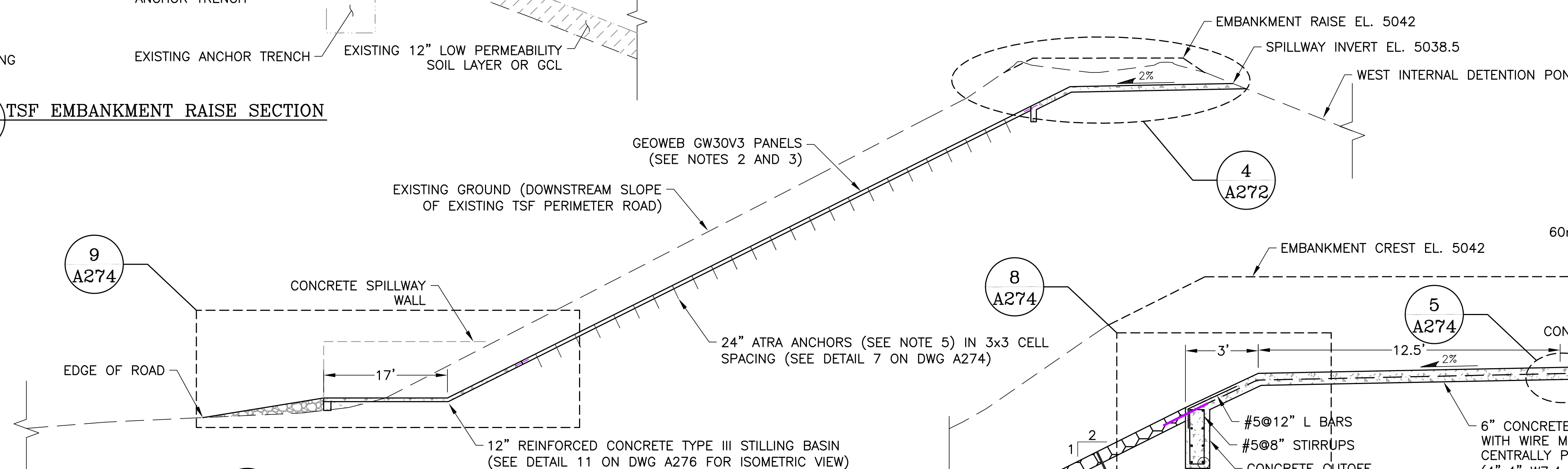
A270
TSF EMBANKMENT RAISE SECTION



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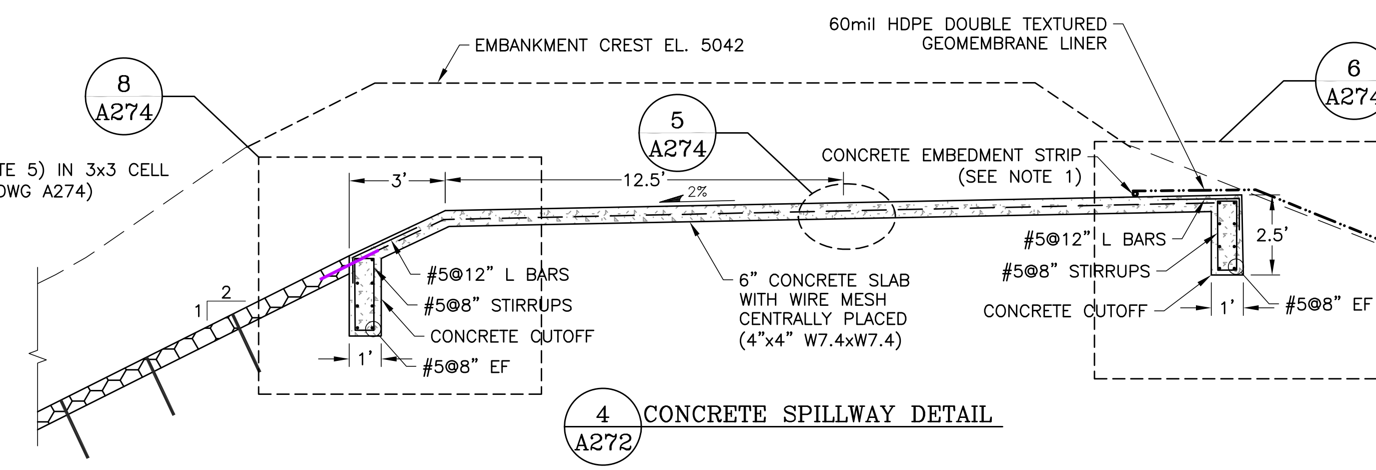
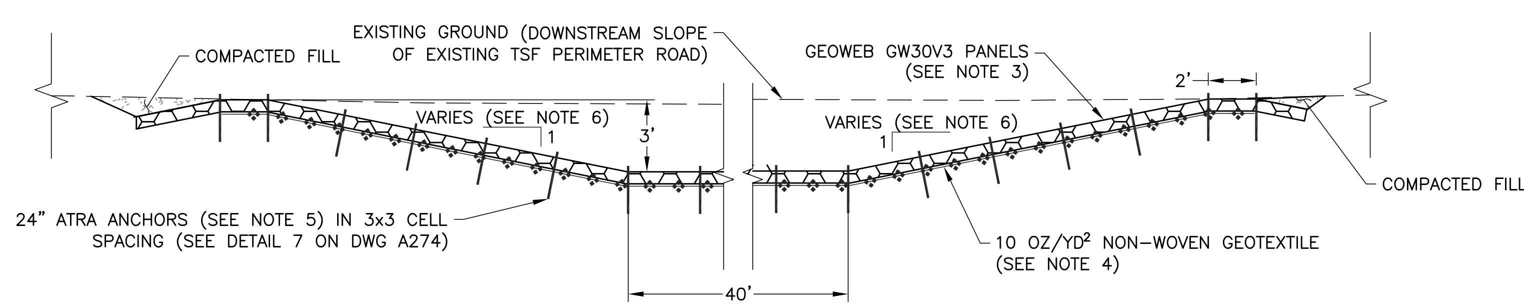
A270
TSF EMERGENCY SPILLWAY SECTION 2 OF 3



4
A272
CONCRETE SPILLWAY DETAIL



V
A270
TSF EMERGENCY SPILLWAY SECTION 3 OF 3

NOTES:

1. EXTRUSION WELD 60mil HDPE DOUBLE TEXTURED GEOMEMBRANE LINER TO EXISTING GEOMEMBRANE LINER AND TO CONCRETE EMBED PLACED IN REINFORCED CONCRETE SPILLWAY.
2. GEOWEB INSTALLATION TO FOLLOW MANUFACTURERS RECOMMENDATIONS.
3. GEOWEB INFILL SHALL BE CONCRETE. ADJUST CONCRETE SLUMP IN THE FIELD AS NECESSARY TO ALLOW FOR INSTALLATION. SCREED THE CONCRETE FLUSH WITH THE TOP OF THE GEOWEB CELL WALLS. DO NOT OVERFILL. ADD ANGULAR CHIP GRAVEL TO THE CONCRETE SURFACE TO INCREASE ROUGHNESS.
4. PROVIDE A NON-WOVEN GEOTEXTILE LAYER AND INSTALL PER MANUFACTURER RECOMMENDATIONS INCLUDING OVERLAPS.
5. ATRA ANCHOR CONSISTS OF A 24" LONG #4 (½") REBAR WITH ATRA STAKE CLIP.
6. SPILLWAY SIDE SLOPES LINED WITH GEOWEB TO TAPER GRADUALLY FROM 10H:1V AT THE TIE IN TO THE CONCRETE SPILLWAY ON THE TSF CREST TO 2H:1V AT THE TIE IN TO THE CONCRETE STILLING BASIN.

Registered Professional Engineer (Civil)
CERTIFICATE NO. 63431
CRAIG M. THOMPSON
Date Signed 12/8/23
ARIZONA, U.S.A.
EXPIRES 3/31/26

REV	DATE	DESCRIPTION	TECH	ENG
0	12/8/23	ISSUED FOR TENDER	JEP	CMT

APPROVED BY: RMS
CHECKED BY: CMT
DESIGNED BY: CMT
DRAWN BY: JEP

DISCLAIMER

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NewFields

CLIENT: SOUTH32 HERMOSA INC.

PROJECT: HERMOSA PROJECT AQUIFER PROTECTION PERMIT SIGNIFICANT AMENDMENT (TSF1)

TITLE: TSF1 EMERGENCY SPILLWAY SECTIONS AND DETAILS (1 OF 2)

FILENAME: 14.035.017D
DRAWING NO.: A272
REVISION: 0

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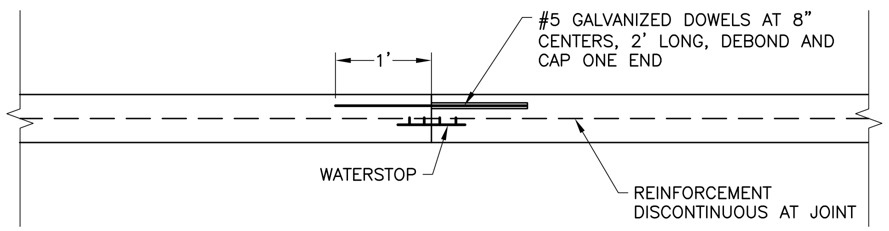
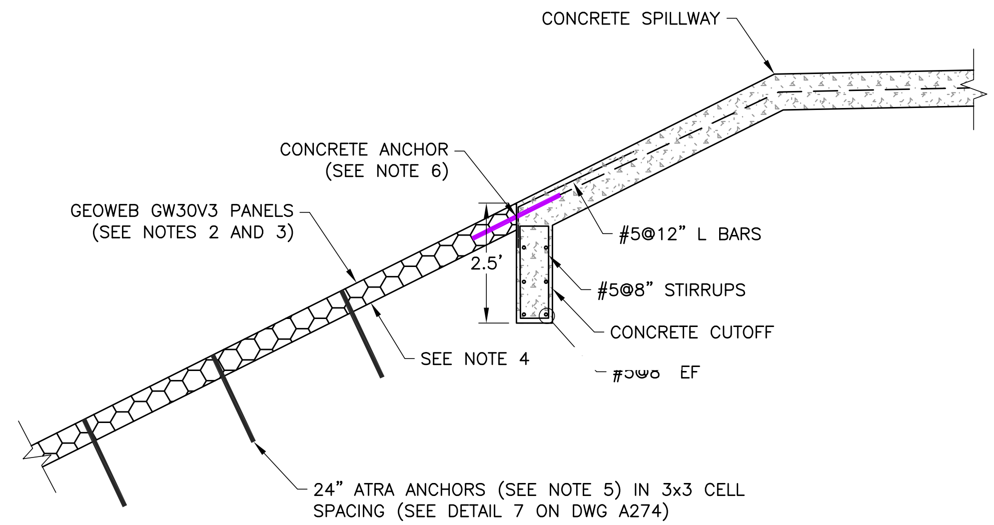
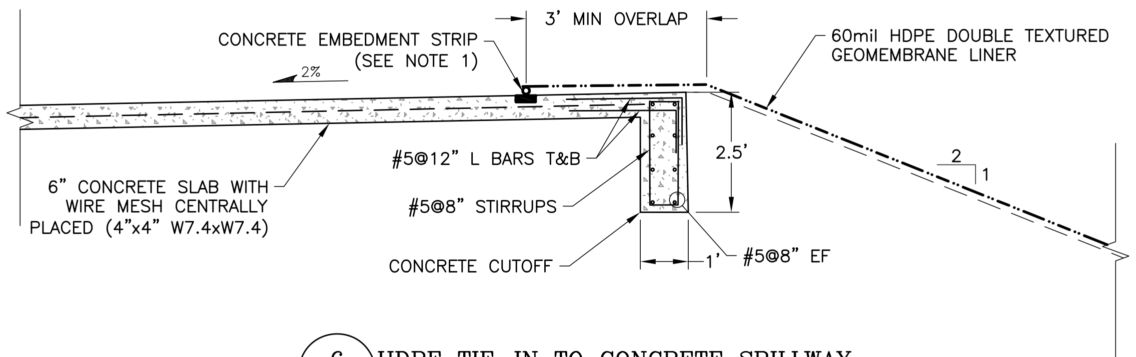


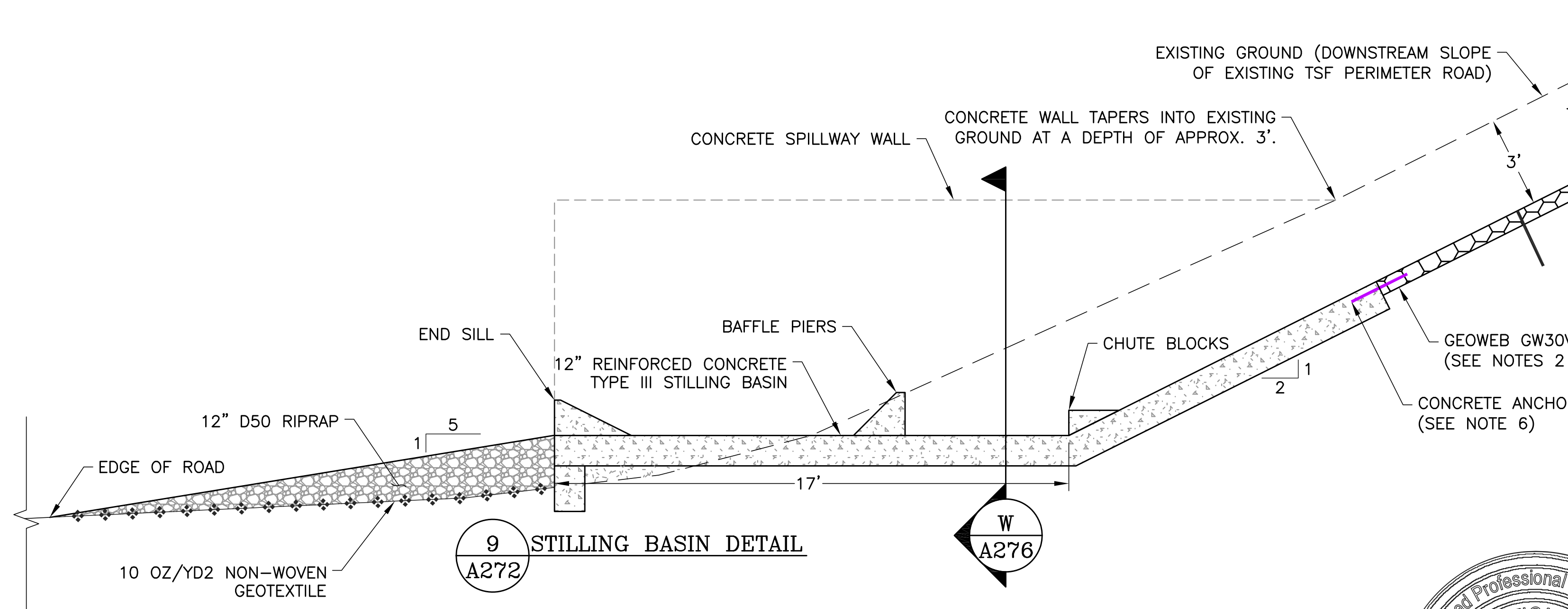
5 A272 CONSTRUCTION JOINT DETAIL



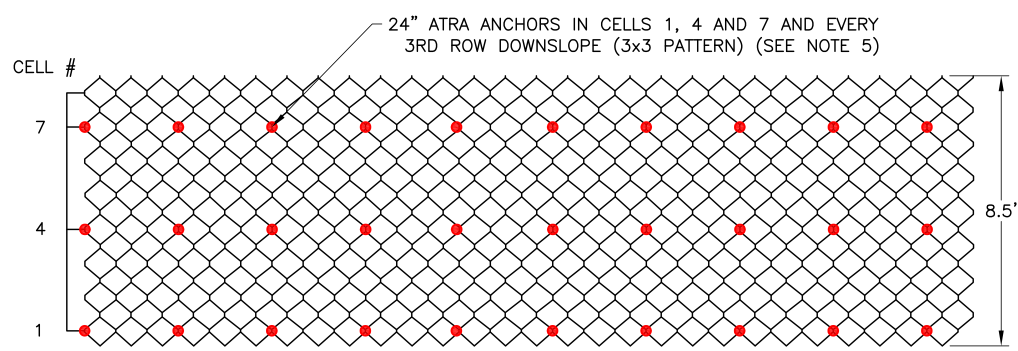
8 A272 GEOWEB TIE-IN TO CONCRETE SPILLWAY



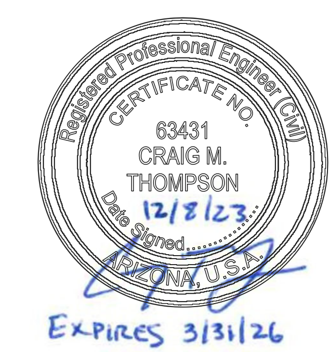
6 A272 HDPE TIE-IN TO CONCRETE SPILLWAY



9 A272 STILLING BASIN DETAIL



7 A274 TYPICAL GEOWEB DETAIL



NOTES:

1. EXTRUSION WELD 60mil HDPE DOUBLE TEXTURED GEOMEMBRANE LINER TO EXISTING GEOMEMBRANE LINER AND TO CONCRETE EMBED PLACED IN REINFORCED CONCRETE SPILLWAY.
2. GEOWEB INSTALLATION TO FOLLOW MANUFACTURERS RECOMMENDATIONS.
3. GEOWEB INFILL SHALL BE CONCRETE. ADJUST CONCRETE SLUMP IN THE FIELD AS NECESSARY TO ALLOW FOR INSTALLATION. SCREED THE CONCRETE FLUSH WITH THE TOP OF THE GEOWEB CELL WALLS. DO NOT OVERFILL. ADD ANGULAR CHIP GRAVEL TO THE CONCRETE SURFACE TO INCREASE ROUGHNESS.
4. PROVIDE A NON-WOVEN GEOTEXTILE LAYER AND INSTALL PER MANUFACTURER RECOMMENDATIONS INCLUDING OVERLAPS.
5. ATRA ANCHOR CONSISTS OF A 24" LONG NO. 4 (½") REBAR WITH ATRA STAKE CLIP.
6. CONCRETE ANCHOR INSTALLED PER MANUFACTURERS RECOMMENDATIONS.

REV	DATE	DESCRIPTION	TECH	ENG
0	12/8/23	ISSUED FOR TENDER	JEP	CMT

APPROVED BY: RMS
CHECKED BY: CMT
DESIGNED BY: JEP
DRAWN BY: JEP

DISCLAIMER

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NewFields

CLIENT: SOUTH32 HERMOSA INC.

PROJECT: HERMOSA PROJECT AQUIFER PROTECTION PERMIT SIGNIFICANT AMENDMENT (TSF1)

TITLE: TSF1 EMERGENCY SPILLWAY SECTIONS AND DETAILS (2 OF 2)

FILENAME: 14.035.109D
DRAWING NO.: A274
REVISION: 0

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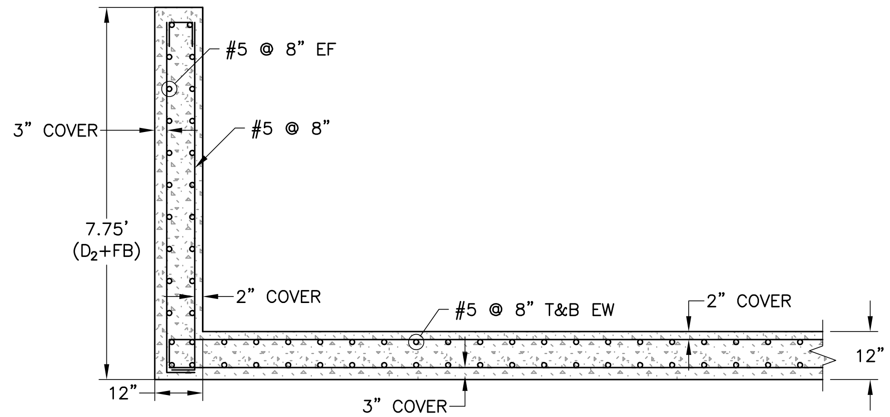
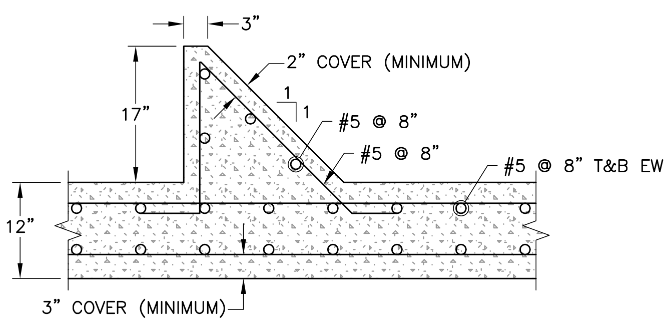
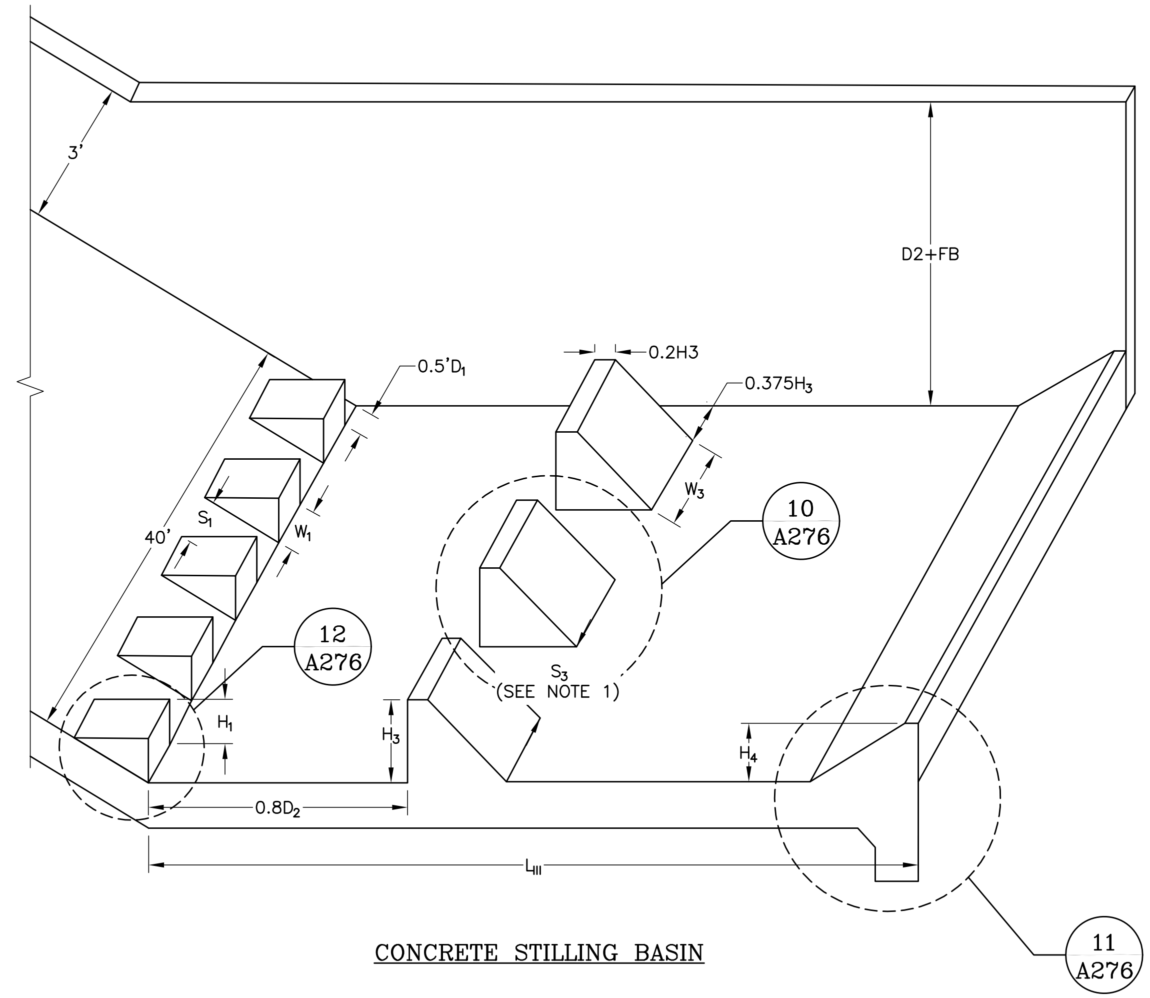


W / A274 CONCRETE SPILLWAY DETAIL



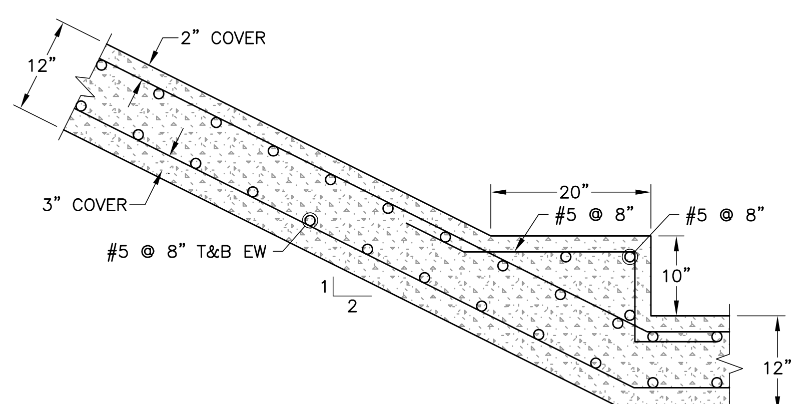
10 / A276 BAFFLE PIER DETAILS



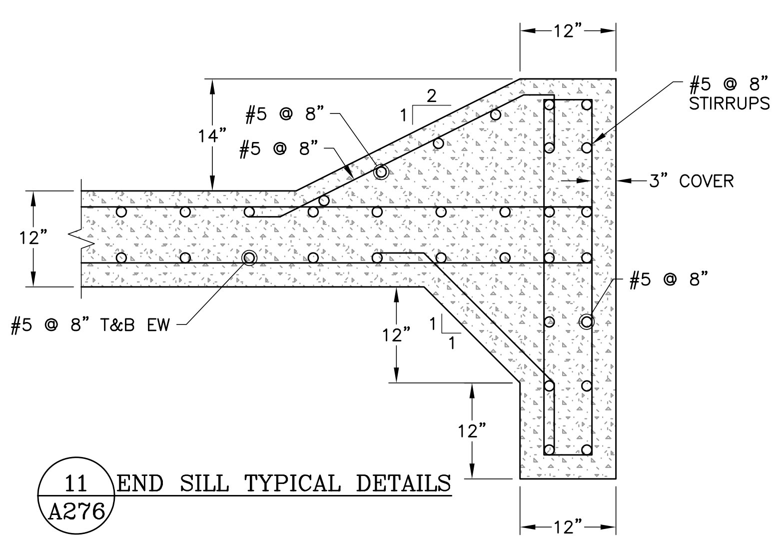
CONCRETE STILLING BASIN

STILLING BASIN DIMENSIONS

DIMENSION	VALUE
L_{III}	17 ft
W_1	10 in
S_1	10 in
H_1	10 in
D_1	10 in
H_3	17 in
W_3	12 in
S_3	12 in
H_4	14 in
D_2	6.75 ft
D_2+FB	7.75 ft



12 / A276 SPILLWAY CHUTE FLOOR LINING DETAILS



11 / A276 END SILL TYPICAL DETAILS

NOTES:

1. CHUTE BLOCK AND BAFFLE PIER DIMENSIONING IS TYPICAL. BOTH ARE PLACED ACROSS ENTIRE WIDTH OF STILLING BASIN.
2. SPECIFIED MINIMUM COMPRESSIVE STRENGTH OF CONCRETE SHALL BE 4500 PSI AT 28 DAYS UNLESS OTHERWISE NOTED.
3. CONCRETE WORK SHALL CONFORM TO ACI 301.
4. ALL CONCRETE IS DESIGNED IN ACCORDANCE WITH AMERICAN CONCRETE INSTITUTE, ACI 350 AND SHALL BE CONSTRUCTED IN ACCORDANCE WITH PROJECT SPECIFICATIONS.
5. REINFORCEMENT STEEL SHALL BE DEFORMED BARS CONFORMING IN QUALITY TO THE REQUIREMENTS OF ASTM A-615 "SPECIFICATIONS FOR DEFORMED AND PLAIN CARBON-STEEL BARS FOR CONCRETE REINFORCEMENT", GRADE 60.
6. CEMENT SHALL BE TYPE I PORTLAND CEMENT OR EQUAL APPROVED BY THE ENGINEER.
7. CONCRETE OVER REBAR IS CONSIDERED TO BE MINIMUM COVER.
8. REBAR DETAILS (SIZE/SPACING/LAYOUT) TO BE CONFIRMED PRIOR TO CONSTRUCTION.

Registered Professional Engineer (Civil)
CERTIFICATE NO. 63431
CRAIG M. THOMPSON
Date Signed 12/8/23
ARIZONA, U.S.A.
Expires 3/31/26

REV	DATE	DESCRIPTION	TECH	ENG
0	12/8/23	ISSUED FOR TENDER	JEP	CMT

APPROVED BY: RMS
CHECKED BY: CMT
DESIGNED BY: CMT
DRAWN BY: JEP

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NewFields

CLIENT: SOUTH32 HERMOSA INC.

PROJECT: HERMOSA PROJECT AQUIFER PROTECTION PERMIT SIGNIFICANT AMENDMENT (TSF1)

TITLE: TSF1 STILLING BASIN CONCRETE DETAILS

FILENAME: 14.035.113D

DRAWING NO.: A276

REVISION: 0

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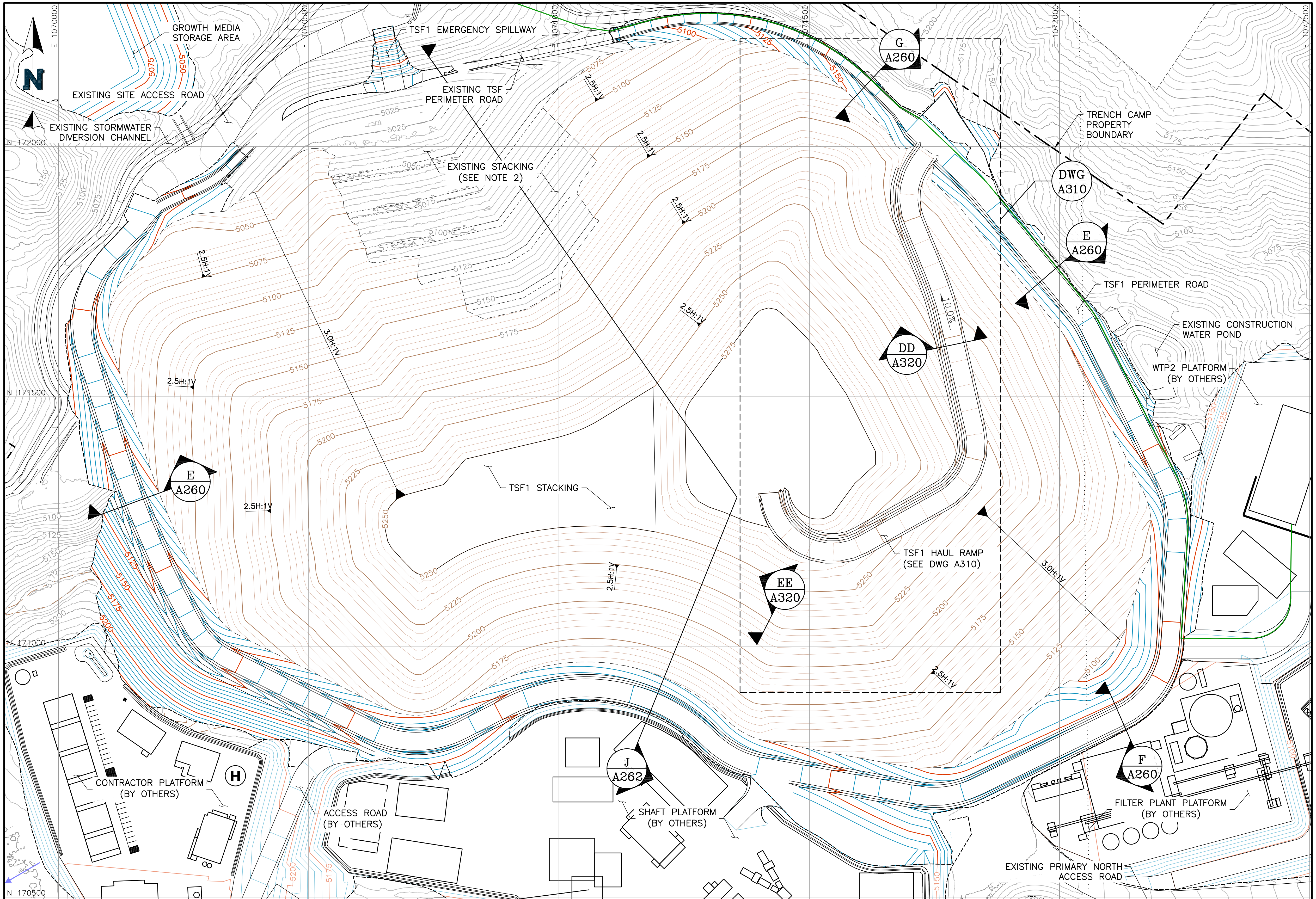

LEGEND:

- EXISTING GROUND CONTOURS
- PROPOSED GROUND CONTOURS (SEE NOTE 1)
- PROPOSED GROUND CONTOURS (BY OTHERS)
- PROPOSED STACKING CONTOURS
- EXISTING ROADS/TRAILS
- PROJECT BOUNDARY
- SECTION LINES
- RECLAIM PIPE
- PROPOSED CULVERT

NOTES:

1. PROPOSED TSF1 FINAL CONTOURS REPRESENT TOP OF LOW PERMEABILITY SOIL LAYER WITHIN THE GEOMEMBRANE LINED AREA, AND FINISHED GRADE EVERYWHERE ELSE.
2. EXISTING STACKING SHOWN IS THE HERMOSA LINED TSF DESIGN AMENDMENT (TSF-AD) STACKING APPROVED BY ADEQ (2022) FOR PLACEMENT OF FUTURE WASTE ROCK FROM MINE DEVELOPMENT AND MISCELLANEOUS MATERIALS.

STORAGE CAPACITY	
	VOLUME (CY)
TSF-AD	1.5 MILLION
TSF1	5.4 MILLION
TOTAL ADDITIONAL	6.9 MILLION

0 100 200 FEET

Registered Professional Engineer (Civil)
CERTIFICATE NO. 63431
CRAIG M. THOMPSON
Date Signed 12/8/23
ARIZONA, U.S.A.
EXPIRES 3/31/26

REFERENCE:

EXISTING GROUND TOPOGRAPHY DEVELOPED FROM MARCH 2020 AND APRIL 2023 AERIAL SURVEY DATA PROVIDED BY SOUTH32 (AMI). DATA PROJECTED TO STATE PLANE ARIZONA CENTRAL NAD 83 FEET, NAVD88.

REV	DATE	DESCRIPTION	TECH	ENG
0	12/8/23	ISSUED FOR TENDER	JEP	CMT

APPROVED BY: RMS
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DESIGNED BY: CMT
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NewFields

CLIENT: SOUTH32 HERMOSA INC.

PROJECT: HERMOSA PROJECT AQUIFER PROTECTION PERMIT SIGNIFICANT AMENDMENT (TSF1)

TITLE: TSF1 STACKING PLAN VIEW

FILENAME: 14.035.018P

DRAWING NO.: A300

REVISION: 0

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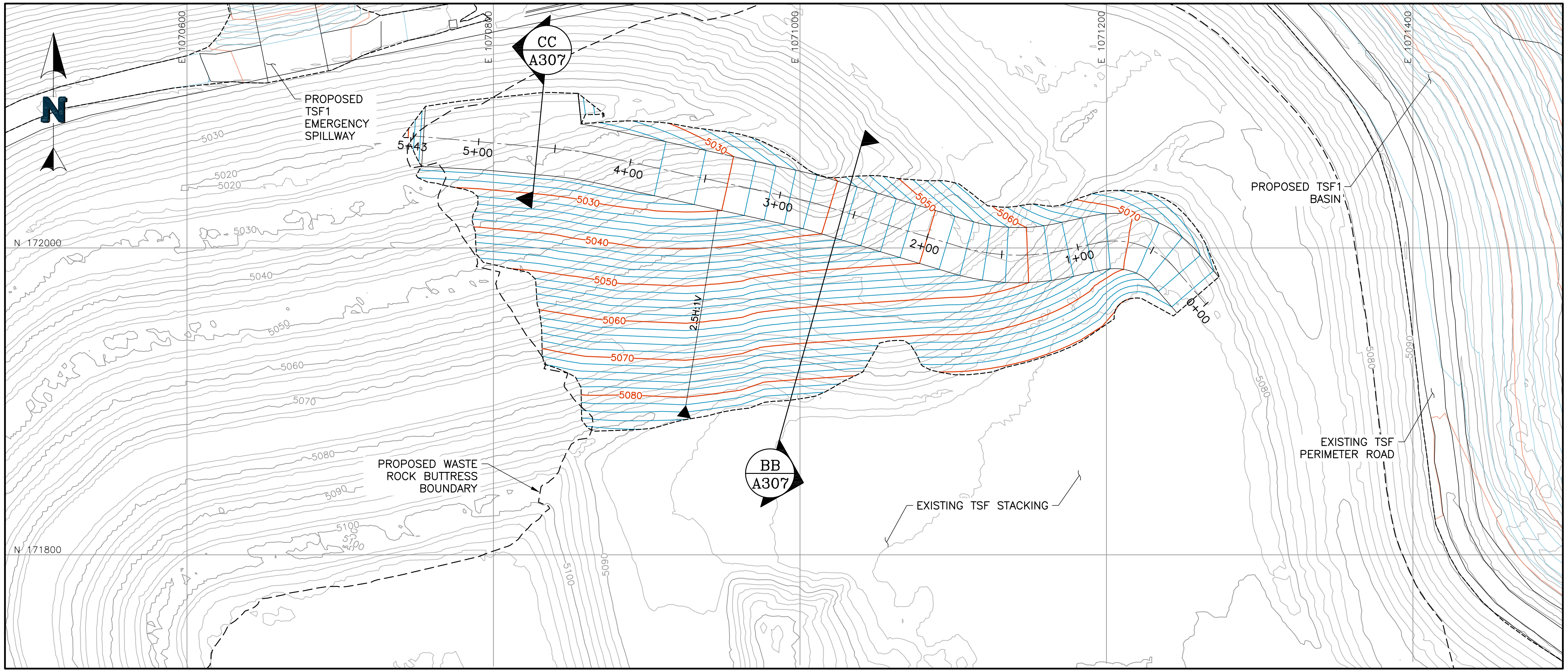
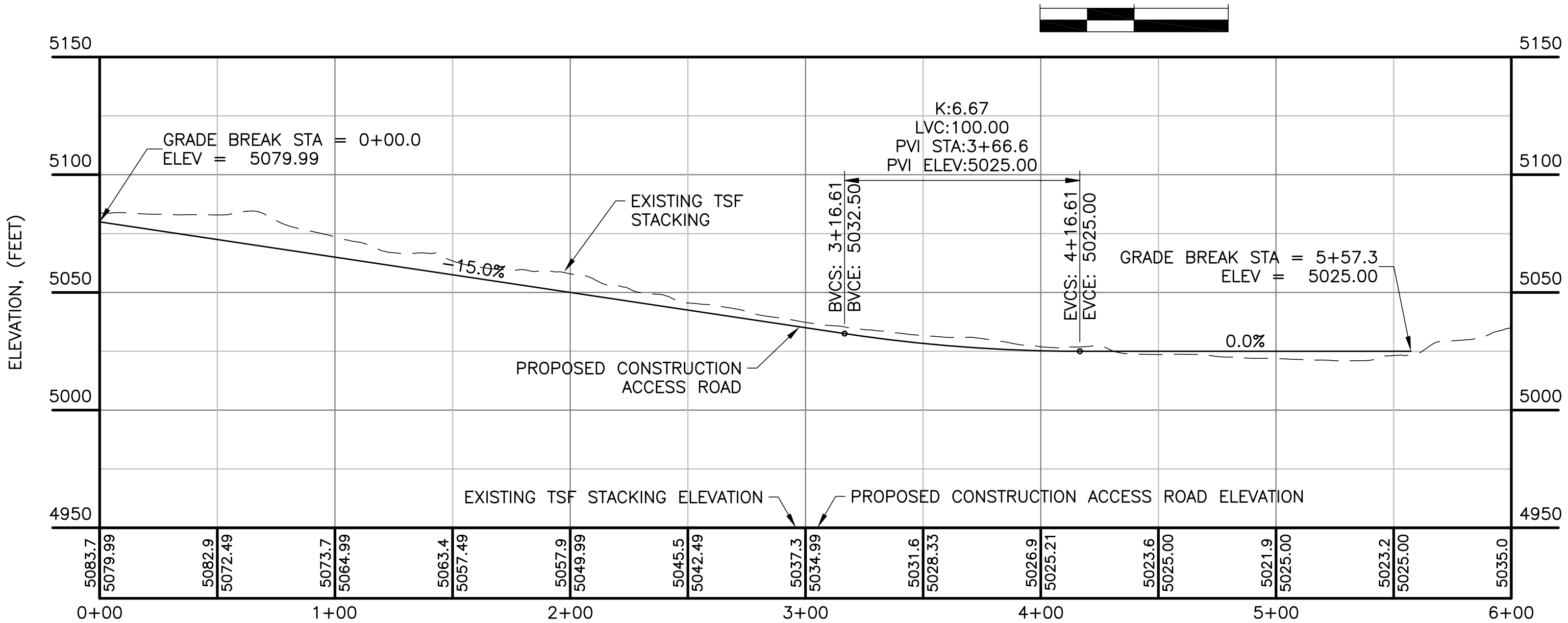


LEGEND:

- EXISTING GROUND CONTOURS
- PROPOSED ROAD CONTOURS
- PROPOSED TSF1 GROUND CONTOURS

0 40 80 FEET



0 40 80 FEET — HORIZONTAL

0 40 80 FEET — VERTICAL

NO EXAGGERATION

REFERENCE:

EXISTING GROUND TOPOGRAPHY DEVELOPED FROM MARCH 2020 AND APRIL 2023 AERIAL SURVEY DATA PROVIDED BY SOUTH32 (AMI). DATA PROJECTED TO STATE PLANE ARIZONA CENTRAL NAD 83 FEET, NAVD88.

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0	12/8/23	ISSUED FOR TENDER	JEP	CMT

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CLIENT: SOUTH32 HERMOSA INC.

PROJECT: HERMOSA PROJECT AQUIFER PROTECTION PERMIT SIGNIFICANT AMENDMENT (TSF1)

TITLE: WASTE ROCK BUTTRESS CONSTRUCTION ACCESS ROAD PLAN AND PROFILE

FILENAME: 14.035.111P

DRAWING NO.: A302

REVISION: 0

Registered Professional Engineer (Civil)
CERTIFICATE NO. 63431
CRAIG M. THOMPSON
Date Signed 12/8/23
ARIZONA, U.S.A.
EXPIRES 3/31/26

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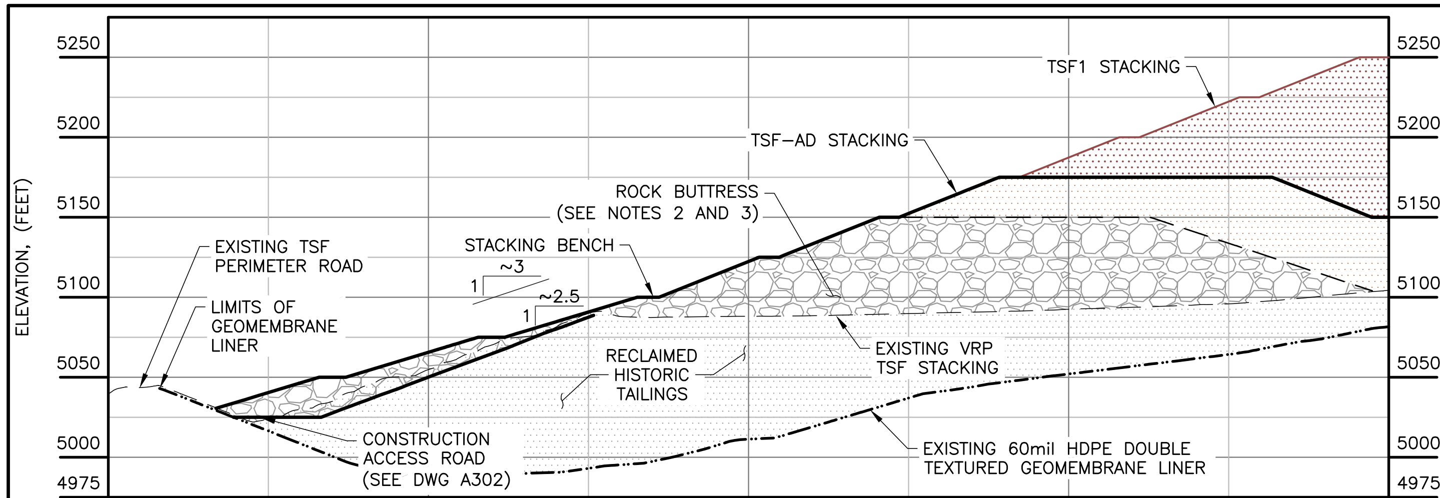
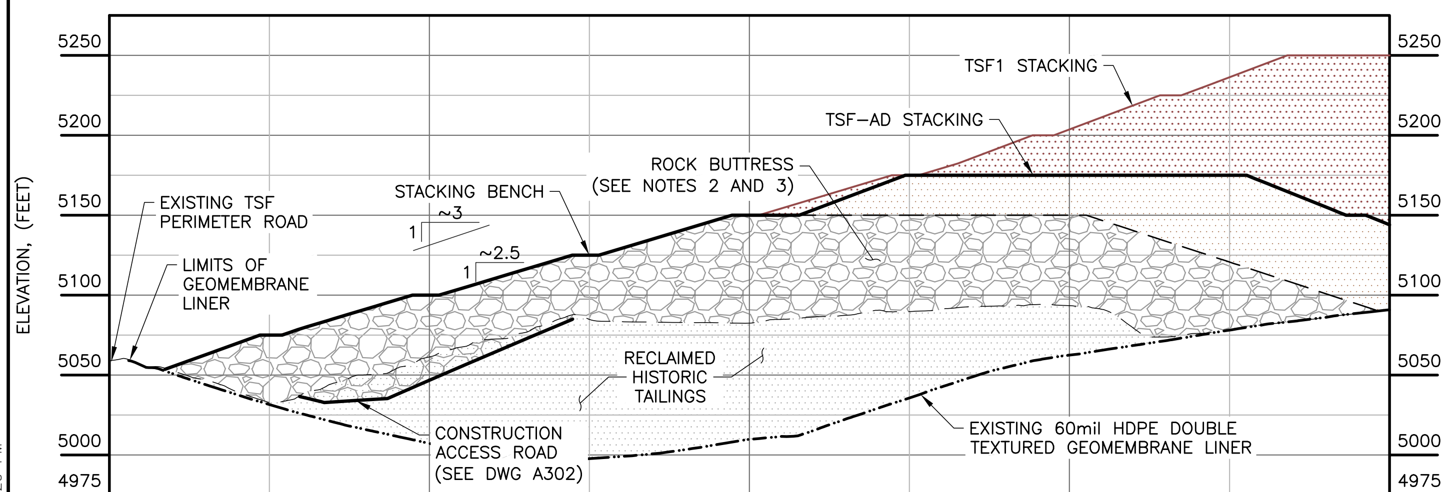
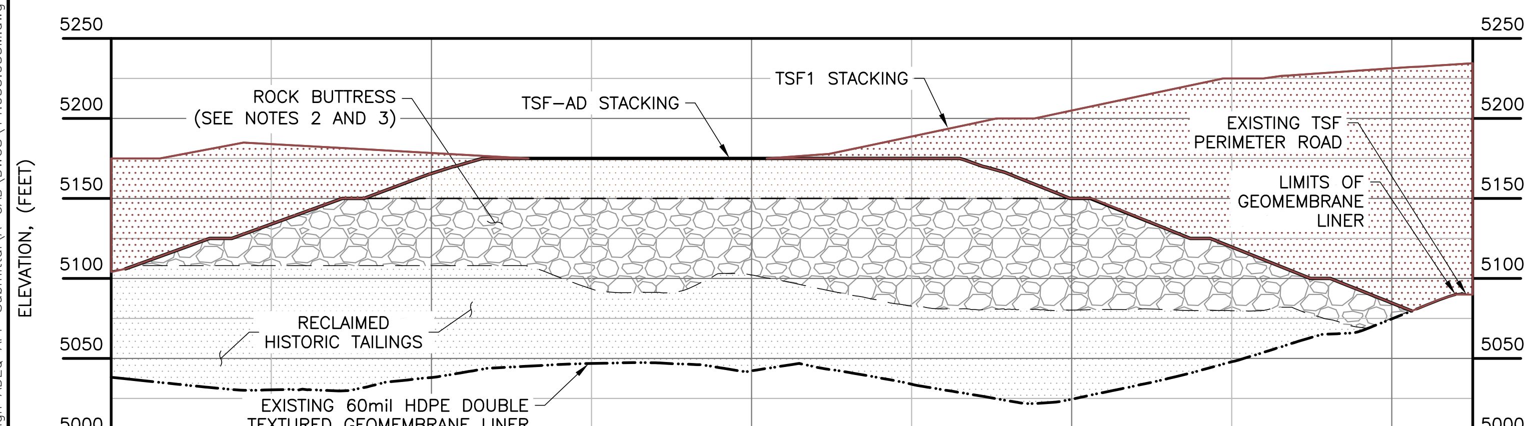


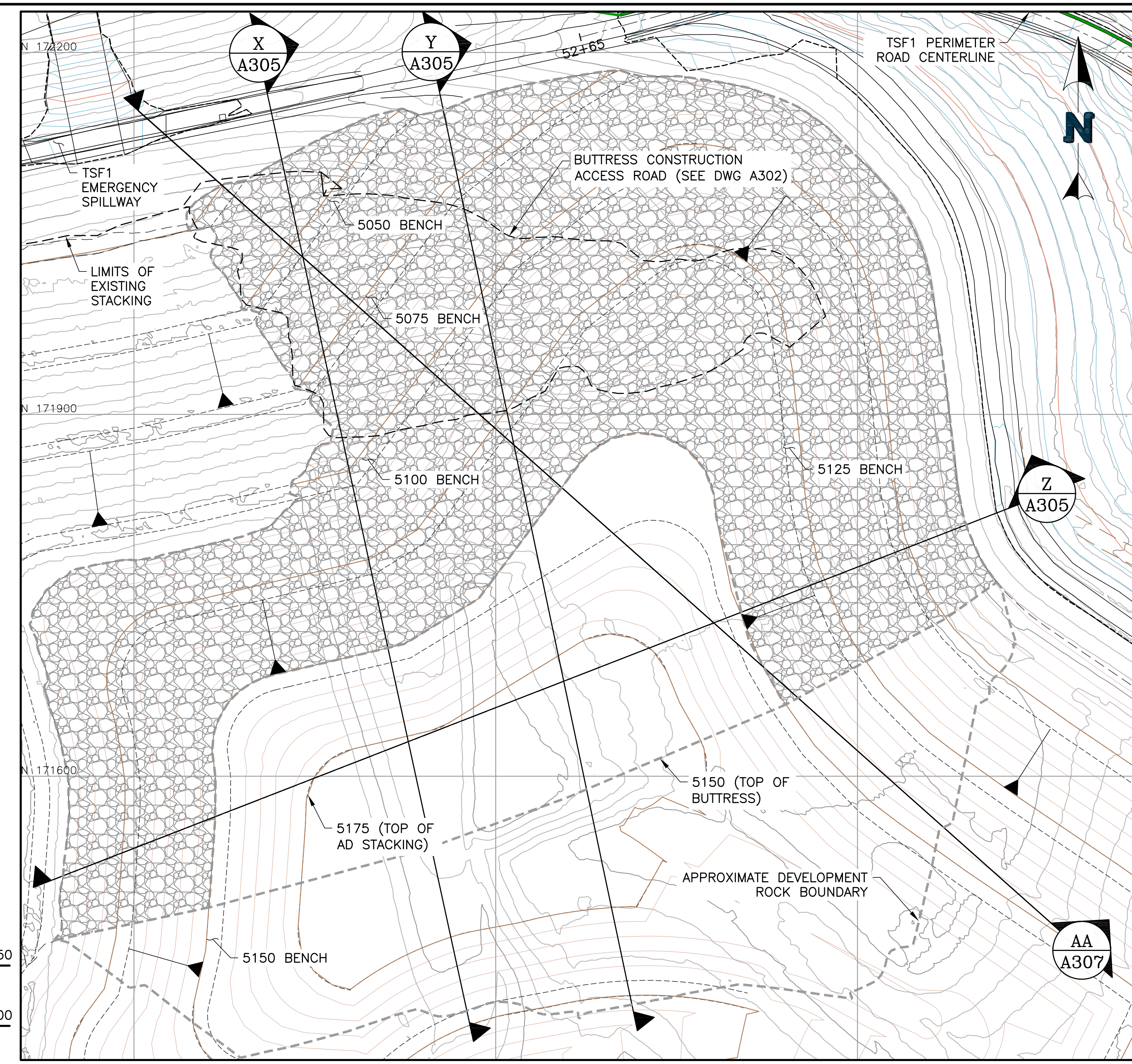
X A305 SECTION X



Y A305 SECTION Y



Z A305 SECTION Z



0 60 120 FEET

LEGEND:

PROPOSED CONTOURS (SEE NOTE 1)

PROPOSED AD STACKING CONTOURS

ROCK BUTTRESS AREA

NOTES:

1. PROPSOED CONTOURS REPRESENT TOP OF LOW PERMEABILITY SOIL LAYER WITHIN THE GEOMEMBRANE LINED AREA, AND FINISHED GRADE EVERYWHERE ELSE.
2. ROCK BUTTRESS AREA SHOWN REQUIRES COMPETENT ROCK MATERIAL. COMPETENT ROCK MATERIAL IS NON-FRIABLE ROCK WITH LESS THAN 25% PASSING THE 1" SIEVE.
3. PAG WASTE ROCK GENERATED DURING INITIAL MINE DEVELOPMENT TO BE PLACED IN THE DESIGNATED BUTTRESS.

Registered Professional Engineer (Civil) CERTIFICATE NO. 63431 CRAIG M. THOMPSON Date Signed 12/8/23 ARIZONA, U.S.A.

EXPIRES 3/31/26

REFERENCE:

EXISTING GROUND TOPOGRAPHY DEVELOPED FROM MARCH 2020 AND APRIL 2023 AERIAL SURVEY DATA PROVIDED BY SOUTH32 (AMI). DATA PROJECTED TO STATE PLANE ARIZONA CENTRAL NAD 83 FEET, NAVD88.

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0	12/8/23	ISSUED FOR TENDER	JEP	CMT

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DESIGNED BY: CMT
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NewFields

CLIENT: SOUTH32 HERMOSA INC.

PROJECT: HERMOSA PROJECT AQUIFER PROTECTION PERMIT SIGNIFICANT AMENDMENT (TSF1)

TITLE: WASTE ROCK BUTTRESS PLAN VIEW

FILENAME: 14.035.033M

DRAWING NO.: A305

REVISION: 0

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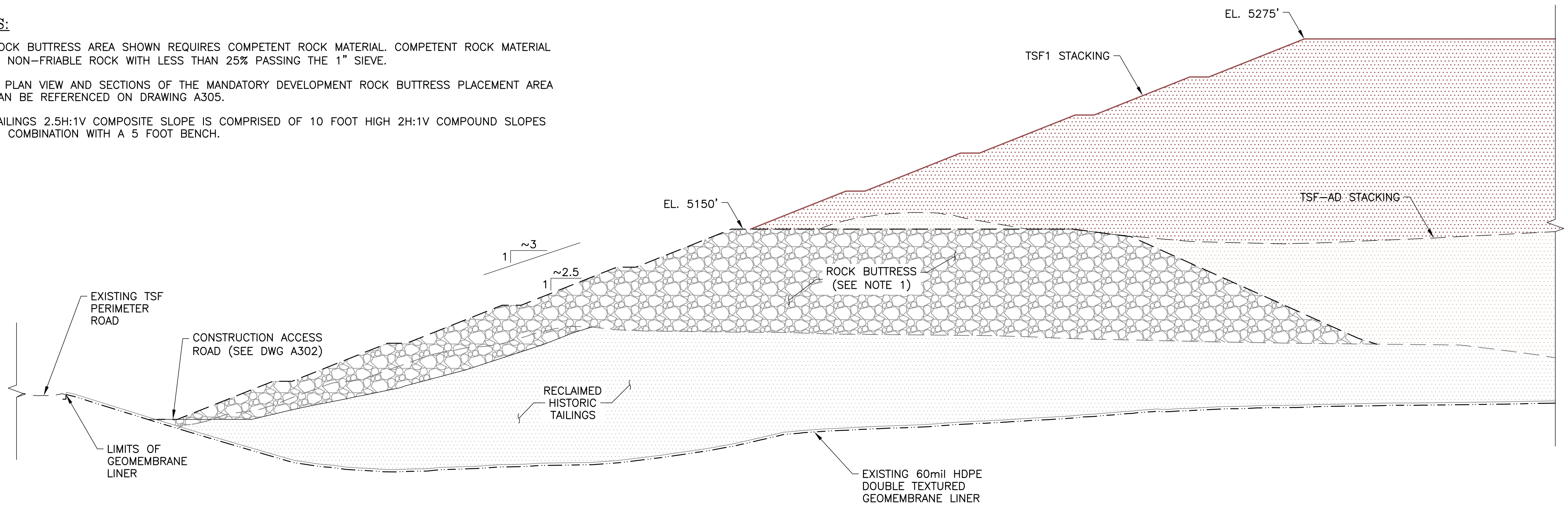
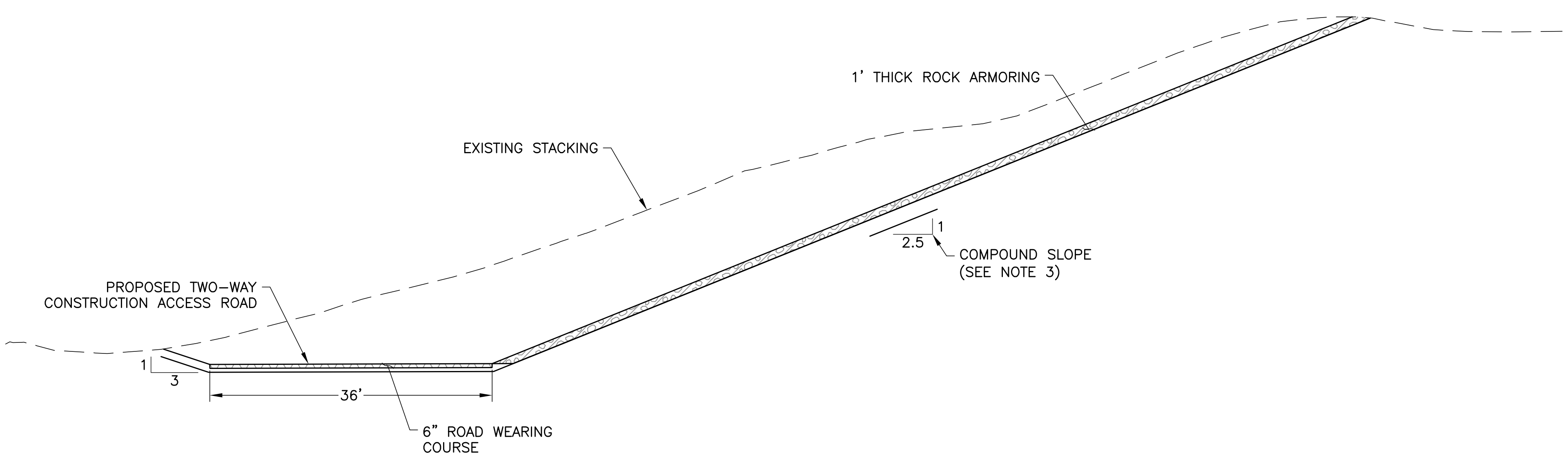
NOTES:

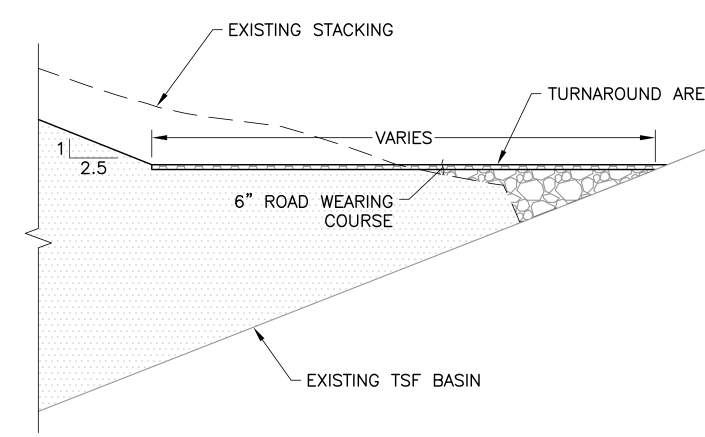
1. ROCK BUTTRESS AREA SHOWN REQUIRES COMPETENT ROCK MATERIAL. COMPETENT ROCK MATERIAL IS NON–FRIABLE ROCK WITH LESS THAN 25% PASSING THE 1" SIEVE.
2. A PLAN VIEW AND SECTIONS OF THE MANDATORY DEVELOPMENT ROCK BUTTRESS PLACEMENT AREA CAN BE REFERENCED ON DRAWING A305.
3. TAILINGS 2.5H:1V COMPOSITE SLOPE IS COMPRISED OF 10 FOOT HIGH 2H:1V COMPOUND SLOPES IN COMBINATION WITH A 5 FOOT BENCH.



AA / A305 TYPICAL WASTE ROCK BUTTRESS SECTION



BB / A302 WASTE ROCK BUTTRESS CONSTRUCTION ACCESS ROAD SECTION



CC / A302 WASTE ROCK BUTTRESS CONSTRUCTION ACCESS ROAD SECTION

Registered Professional Engineer (Civil)
CERTIFICATE NO.
63431
CRAIG M.
THOMPSON
12/8/23
Date Signed
ARIZONA, U.S.A.
Expires 3/31/26

REV	DATE	DESCRIPTION	TECH	ENG
0	12/8/23	ISSUED FOR TENDER	JEP	CMT

APPROVED BY: RMS
CHECKED BY: CMT
DESIGNED BY: CMT
DRAWN BY: JEP

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NewFields

CLIENT: SOUTH32 HERMOSA INC.

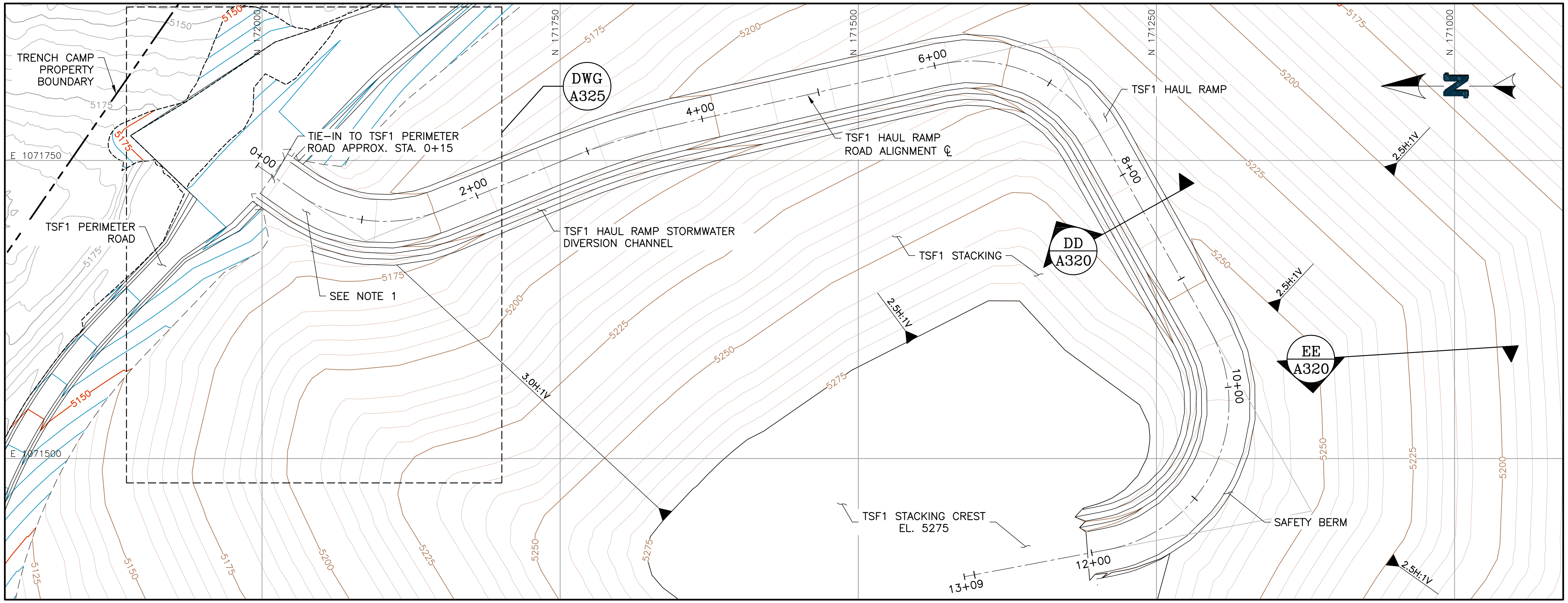
PROJECT: HERMOSA PROJECT AQUIFER PROTECTION PERMIT SIGNIFICANT AMENDMENT (TSF1)

TITLE: WASTE ROCK BUTTRESS SECTIONS

FILENAME: 14.035.034D

DRAWING NO.: A307

REVISION: 0



LEGEND:

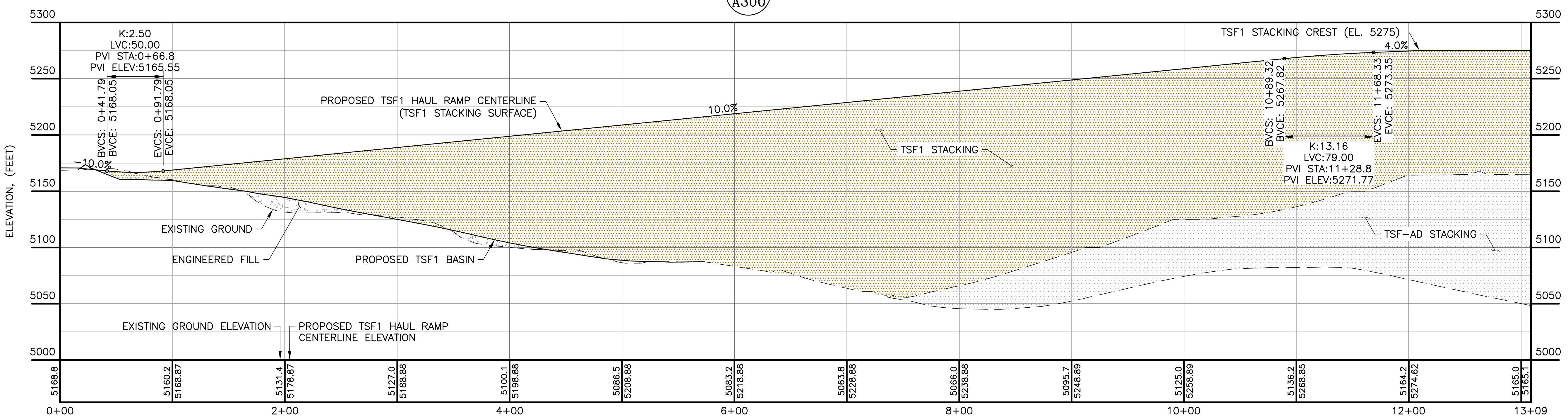
EXISTING GROUND CONTOURS
PROPOSED GROUND CONTOURS
PROPOSED STACKING CONTOURS
PROJECT BOUNDARY

NOTE:

1. DIP IN TSF1 HAUL RAMP AT APPROXIMATE STA 0+43 IS REQUIRED TO MAINTAIN CONTAINMENT OF STORMWATER RUNOFF.

0 50 100 FEET

DWG A300 STACKING HAUL RAMP



0 50 100 FEET
HORIZONTAL

0 50 100 FEET
VERTICAL

NO EXAGGERATION

REFERENCE:

EXISTING GROUND TOPOGRAPHY DEVELOPED FROM MARCH 2020 AND APRIL 2023 AERIAL SURVEY DATA PROVIDED BY SOUTH32 (AMI). DATA PROJECTED TO STATE PLANE ARIZONA CENTRAL NAD 83 FEET, NAVD88.

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NewFields

CLIENT: SOUTH32 HERMOSA INC.

PROJECT: HERMOSA PROJECT AQUIFER PROTECTION PERMIT SIGNIFICANT AMENDMENT (TSF1)

TITLE: TSF1 STACKING HAUL RAMP PLAN AND PROFILE

FILENAME: 14.035.019P
DRAWING NO.: A310
REVISION: 0

Registered Professional Engineer (Civil)
CERTIFICATE NO. 63431
CRAIG M. THOMPSON
Date Signed 12/8/23
ARIZONA, U.S.A.
EXPIRES 3/31/26

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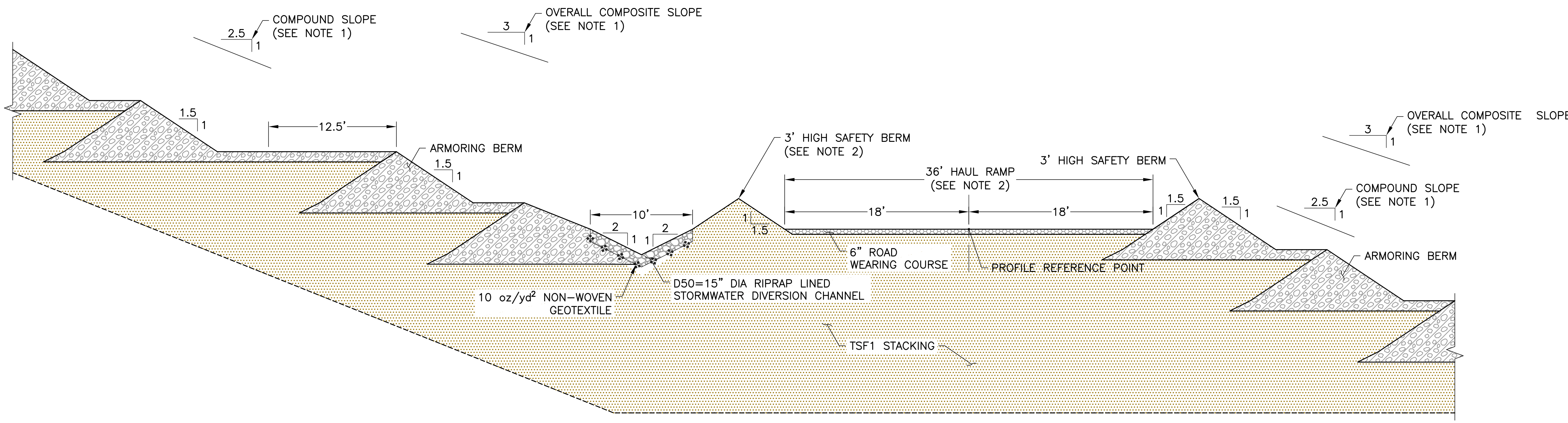
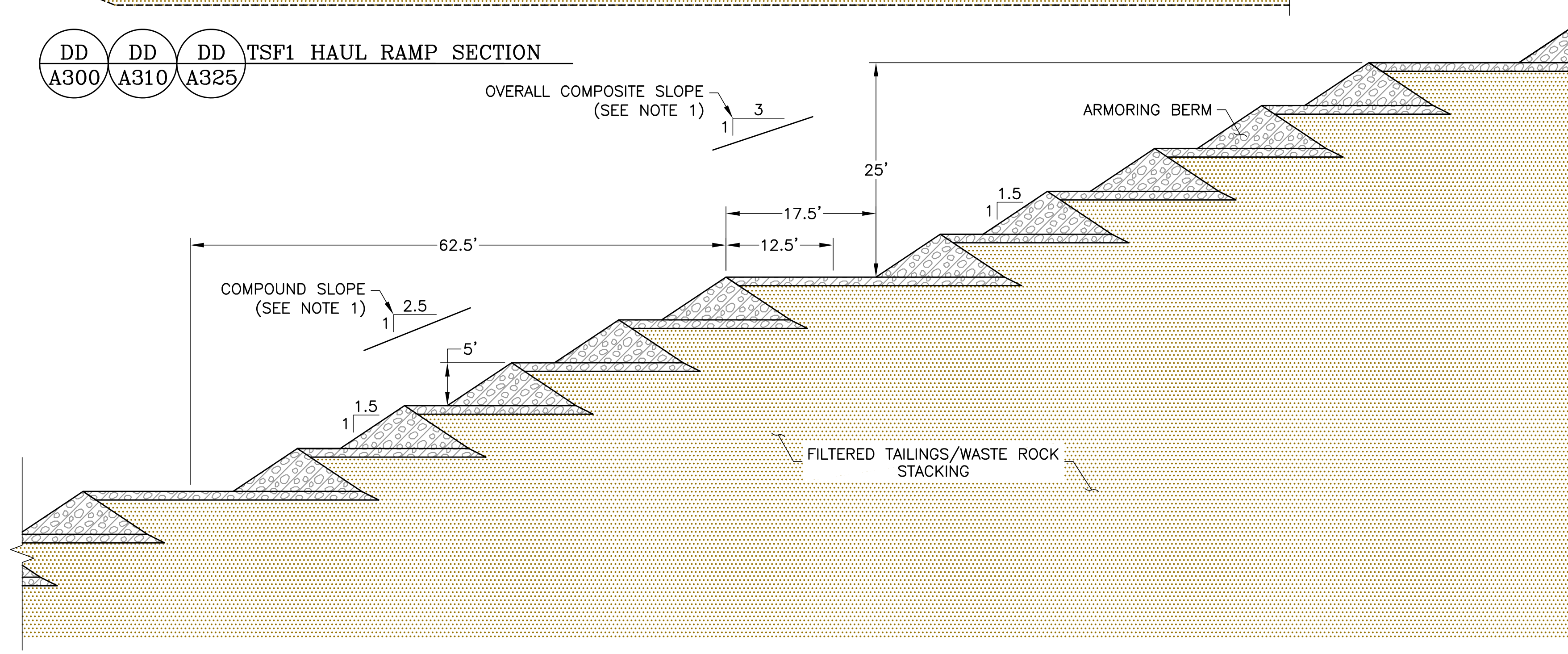


DD A300 DD A310 DD A325 TSF1 HAUL RAMP SECTION

TSF1 STACKING HAUL RAMP ALIGNMENT TABLE							
	STATION	NORTHING	EASTING	DELTA (D-M-S)	LENGTH (FT)	RADIUS (FT)
BP	0+00.00	172,003.91	1,071,745.92			
PC	0+42.89	171,968.73	1,071,721.38	057-04-54	124.53	125.00
PI	1+67.42	171,850.02	1,071,708.14			
PC	2+78.96	171,746.73	1,071,750.25	009-17-03	98.36	606.99
PI	3+77.32	171,653.05	1,071,779.86			
PC	6+03.23	171,432.84	1,071,830.27	073-37-32	160.63	125.00
PI	7+63.85	171,295.90	1,071,769.54			
PC	9+49.51	171,205.13	1,071,607.58	108-34-15	236.86	125.00
PI	11+86.38	171,290.96	1,071,423.64			
EP	13+08.62	171,411.08	1,071,400.95			



EE A300 EE A310 FILTERED TAILINGS STACKING

NOTES:

1. TAILINGS 3H:1V COMPOSITE SLOPE IS COMPRISED OF 25 FOOT HIGH 2.5H:1V COMPOUND SLOPES IN COMBINATIONS WITH A 12.5 FOOT BENCH THAT OCCURS EVERY 25 FEET IN VERTICAL SLOPE HEIGHT.

2. INSERT A SHALLOW SWALE ACROSS THE HAUL RAMP AND BREAK IN THE SAFETY BERM EVERY 100 FT TO PROMOTE HAUL ROAD DRAINAGE INTO STORMWATER DIVERSION CHANNEL.

Registered Professional Engineer (Civil) CERTIFICATE NO. 63431 CRAIG M. THOMPSON Date Signed 12/8/23 ARIZONA, U.S.A.

EXPIRES 3/31/26

REV	DATE	DESCRIPTION	TECH	ENG
0	12/8/23	ISSUED FOR TENDER	JEP	CMT

APPROVED BY: RMS
CHECKED BY: CMT
DESIGNED BY: CMT
DRAWN BY: JEP

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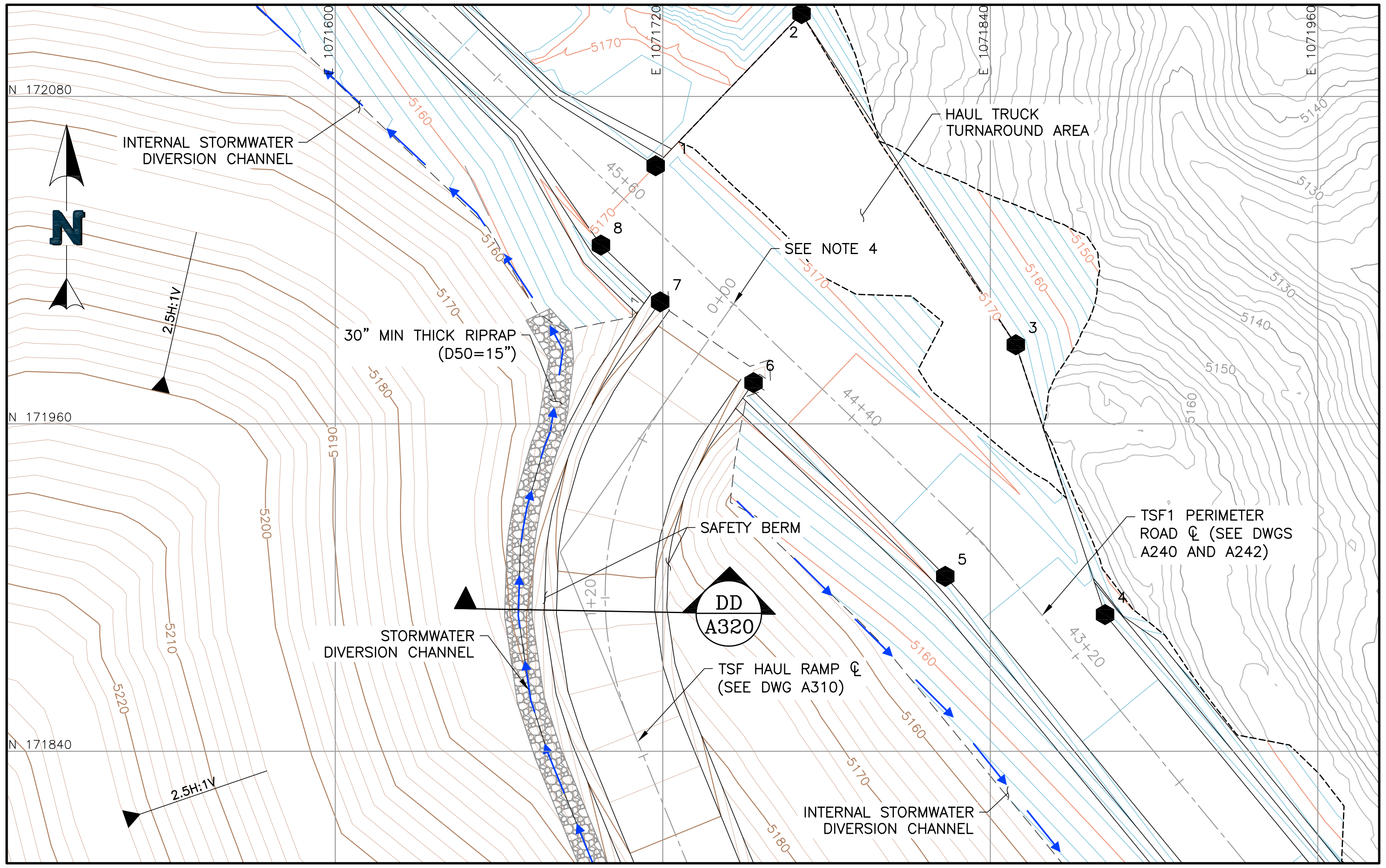
CLIENT: SOUTH32 HERMOSA INC.

PROJECT: HERMOSA PROJECT AQUIFER PROTECTION PERMIT SIGNIFICANT AMENDMENT (TSF1)

TITLE: TSF1 STACKING HAUL RAMP ALIGNMENT TABLE, SECTIONS AND DETAILS

FILENAME: 14.035.020D
DRAWING NO.: A320
REVISION: 0



LEGEND:

- EXISTING GROUND CONTOURS
- PROPOSED CONTOURS (SEE NOTE 1)
- PROPOSED STACKING CONTOURS
- STORMWATER DIVERSION CHANNEL
- RIPRAP

DWG A310 HAUL RAMP ACCESS INTERSECTION

0 30 60 FEET

SETTING OUT DATA			
POINT	NORTHING	EASTING	ELEVATION
1	172,054.60	1,071,717.41	5,170.00
2	172,110.34	1,071,770.84	5,165.00
3	171,989.00	1,071,849.35	5,165.00
4	171,890.10	1,071,882.05	5,165.00
5	171,904.12	1,071,823.52	5,166.87
6	171,975.10	1,071,753.26	5,173.29
7	172,004.72	1,071,719.06	5,174.06
8	172,025.51	1,071,697.37	5,170.22

NOTES:

1. PROPOSED CONTOURS REPRESENT TOP OF LOW PERMEABILITY SOIL LAYER WITHIN THE GEOMEMBRANE LINED AREA AND FINISHED GRADE EVERYWHERE ELSE. SEE DRAWING A220 FOR GEOMEMBRANE LIMITS.
2. THE STORMWATER DIVERSION CHANNEL RIPRAP SHOULD BE GENERATED FROM PLACEMENT OF SELECT NON–PAG WASTE ROCK THAT FITS THE MINIMUM RIPRAP GRADATION. SOME PROCESSING OF RIPRAP MATERIALS SHOULD BE ANTICIPATED.
3. WEARING COURSE MAY BE GENERATED FROM PLACEMENT OF SELECT NON–PAG WASTE ROCK THAT FITS THE WEARING COURSE TECHNICAL SPECIFICATION REQUIREMENTS. SOME PROCESSING OF WEARING COURSE SHOULD BE ANTICIPATED.
4. THE TSF STACKING HAUL RAMP TIES IN TO THE TSF1 PERIMETER ROAD AT APPROXIMATE STATION 45+00.

Registered Professional Engineer (Civil)
CERTIFICATE NO. 63431
CRAIG M. THOMPSON
Date Signed 12/8/23
ARIZONA, U.S.A.
Expires 3/31/26

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REFERENCE:

EXISTING GROUND TOPOGRAPHY DEVELOPED FROM MARCH 2020 AND APRIL 2023 AERIAL SURVEY DATA PROVIDED BY SOUTH32 (AMI). DATA PROJECTED TO STATE PLANE ARIZONA CENTRAL NAD 83 FEET, NAVD88.

REV	DATE	DESCRIPTION	TECH	ENG
0	12/8/23	ISSUED FOR TENDER	JEP	CMT

APPROVED BY: RMS
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DESIGNED BY: CMT
DRAWN BY: JEP

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CLIENT: SOUTH32 HERMOSA INC.

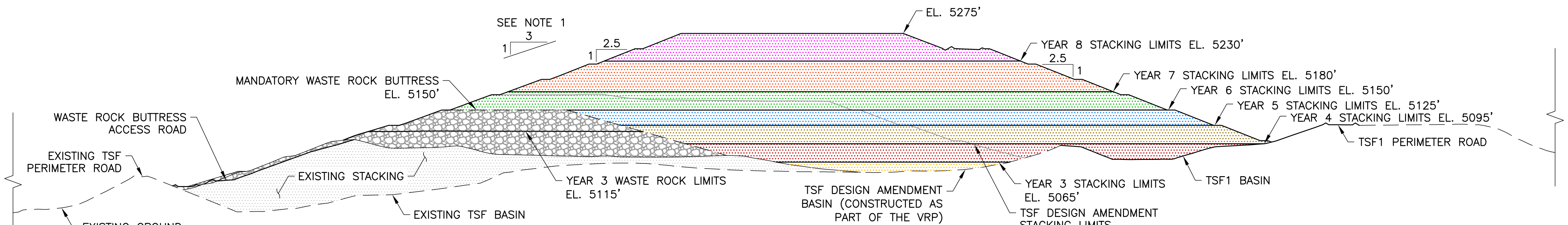
PROJECT: HERMOSA PROJECT AQUIFER PROTECTION PERMIT SIGNIFICANT AMENDMENT (TSF1)

TITLE: TSF1 STACKING HAUL RAMP ACCESS INTERSECTION

FILENAME: 14.035.037M

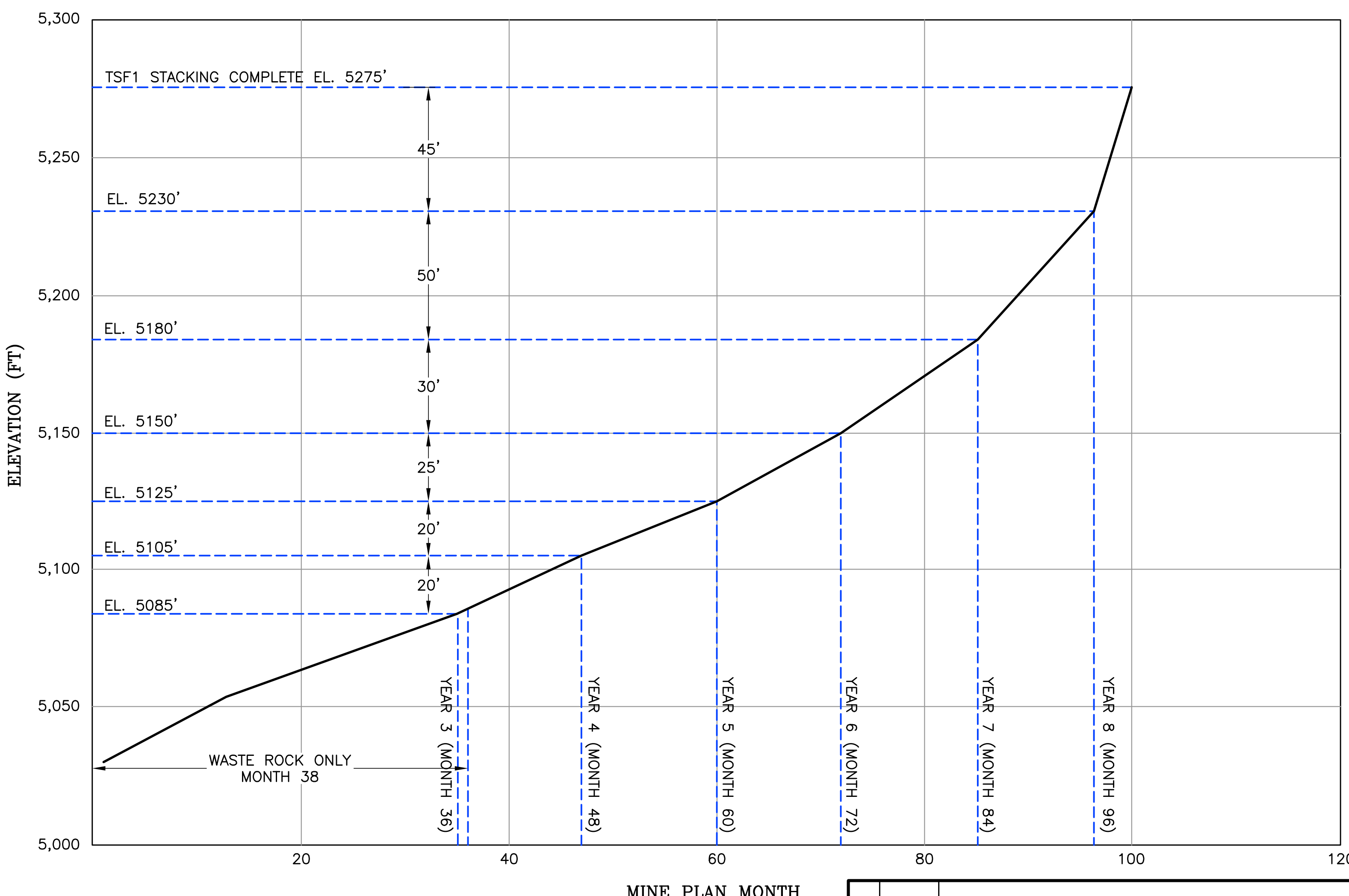
DRAWING NO.: A325

REVISION: 0

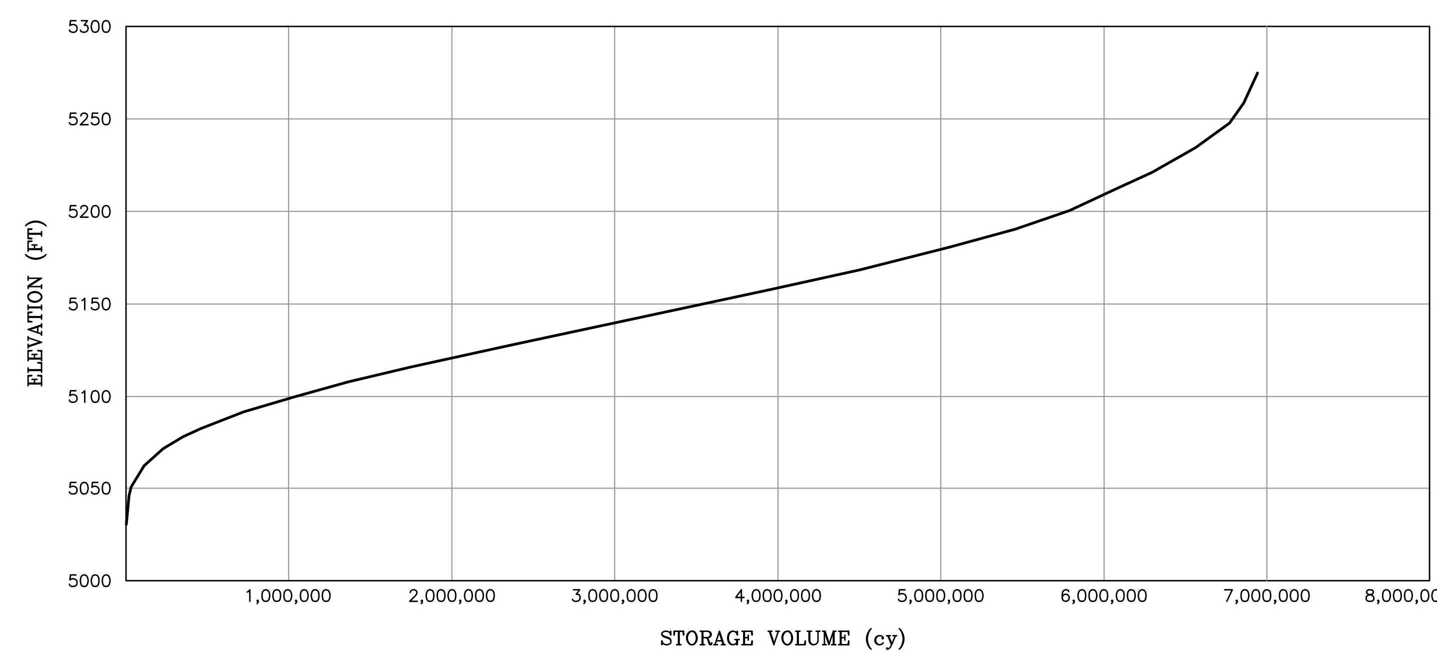


FF
A400
TYPICAL TSF1 STACKING SECTION
(SEE NOTE 2)

TSF FILLING CURVE



STORAGE VOLUME BY ELEVATION



NOTES:

1. 3H:1V COMPOSITE SLOPE IS COMPRISED OF 25' HIGH 2.5H:1V COMPOUND SLOPES IN COMBINATION WITH A 12.5' BENCH THAT OCCURS EVERY 25' IN VERTICAL SLOPE HEIGHT.
2. SEE DRAWING A300 FOR STACKING PLAN VIEW.
3. PRIOR TO YEAR 4, STACKING ELEVATIONS WITHIN THE TSF VARY DUE TO MULTIPLE PLACEMENT SURFACES. ELEVATIONS LISTED ON THE "TSF FILLING CURVE" CHART WERE CALCULATED FROM THE "STORAGE VOLUME BY ELEVATION" FILLING CURVE.
4. STACKING PLAN PLAN TIMING (MONTH/YEAR) MAY CHANGE AS MINE PLAN DEVELOPS.

Registered Professional Engineer (Civil)
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12/8/23
Date Signed
ARIZONA, U.S.A.
Expires 3/31/26

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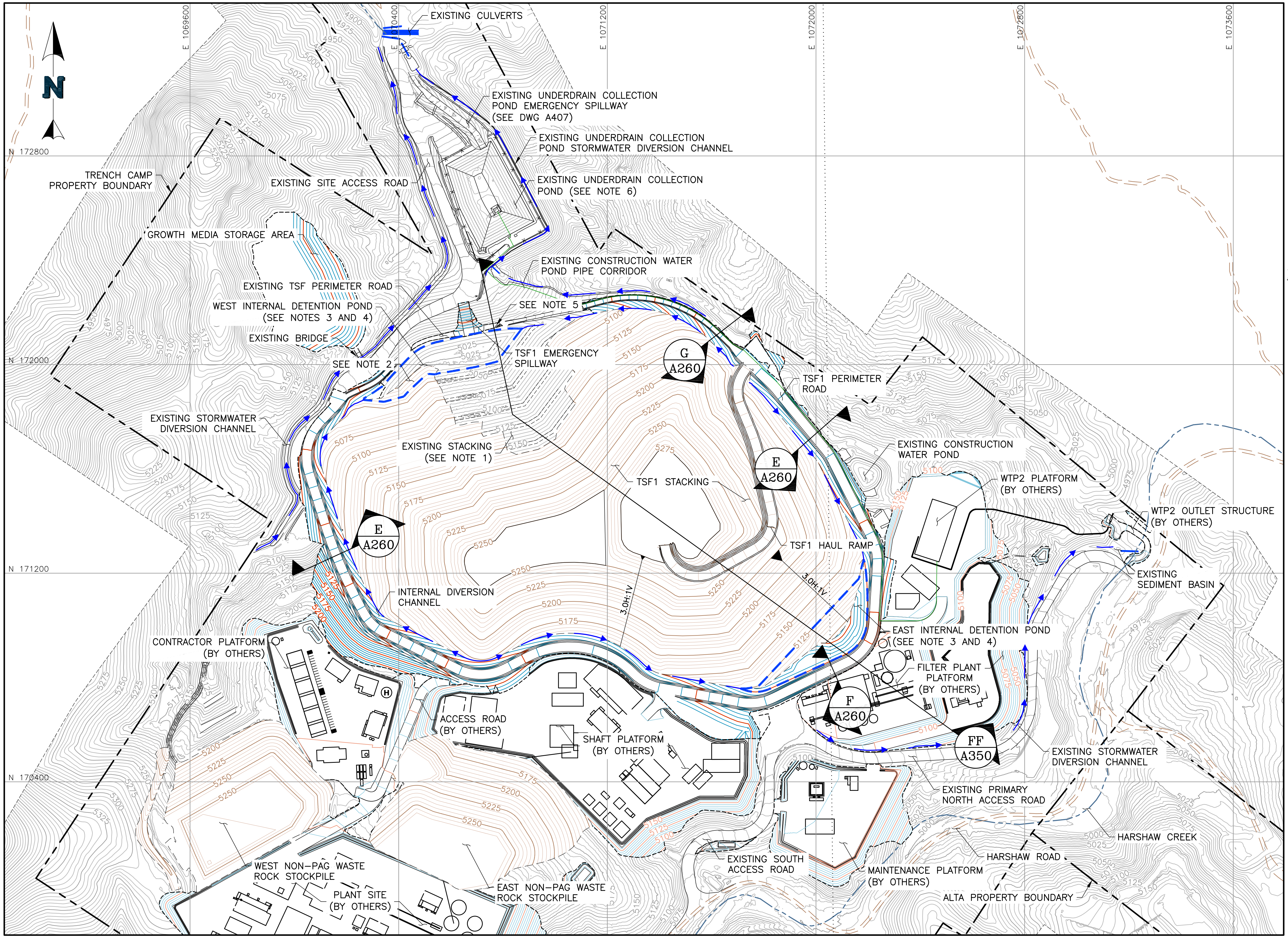
CLIENT: SOUTH32 HERMOSA INC.
PROJECT: HERMOSA PROJECT AQUIFER PROTECTION PERMIT SIGNIFICANT AMENDMENT (TSF1)
TITLE: TSF1 STACKING FILLING CURVES
FILENAME: 14.035.031D
DRAWING NO.: A350
REVISION: 0



LEGEND:

- EXISTING GROUND CONTOURS
- PROPOSED GROUND CONTOURS
- PROPOSED GROUND CONTOURS (BY OTHERS)
- PROPOSED STACKING CONTOURS
- EXISTING ROADS/TRAILS
- EXISTING DRAINAGES
- PROJECT BOUNDARY
- STORMWATER DIVERSION CHANNEL
- INTERNAL DETENTION POND LIMITS
- CULVERT (EXISTING OR PROPOSED)
- EXISTING FENCE

NOTES:

1. EXISTING STACKING SHOWN IS THE HERMOSA LINED TSF DESIGN AMENDMENT (TSF–AD) STACKING APPROVED BY ADEQ (2022) FOR PLACEMENT OF FUTURE WASTE ROCK FROM MINE DEVELOPMENT AND MISCELLANEOUS MATERIALS.
2. EXISTING 48" DIA CPe CULVERTS TO BE REMOVED.
3. STORMWATER RUNOFF REPORTING TO THE WEST AND EAST INTERNAL DETENTION POND IS CONVEYED TO THE UNDERDRAIN COLLECTION POND VIA THE DETENTION OUTFALL PIPES LOCATED AT THE BASE OF EACH INTERNAL DETENTION POND AREA. WATER WILL ONLY COLLECT IN THESE AREAS DURING EXTREME STORM EVENTS (I.E. PMP) FOR A SHORT PERIOD OF TIME. DURING NORMAL OPERATIONS, WATER DOES NOT POND IN THESE AREAS.
4. SEE DWG A405 FOR EAST AND WEST INTERNAL DETENTION POND FILLING CURVES.
5. STANDBY PUMP TO BE LOCATED ON THE TSF PERIMETER ROAD AT THE WEST INTERNAL DETENTION POND. EXISTING PUMP AT THE EXTERNAL DETENTION POND TO BE RELOCATED TO THE TSF PERIMETER ROAD DURING CONSTRUCTION OF TSF1. THE STANDBY PUMP WILL BE UTILIZED IN AN EMERGENCY TO PUMP WATER FROM THE WEST INTERNAL DETENTION POND TO THE UNDERDRAIN COLLECTION POND IN THE EVENT THE UNDERDRAIN COLLECTION SYSTEM IS NOT FUNCTIONAL.
6. ALL STORMWATER RUNOFF AND PERCOLATION THROUGH THE STACK IS TRANSFERRED FROM THE TSF TO THE UNDERDRAIN COLLECTION POND VIA TWO EXISTING 36" DIA HDPE CONCRETE ENCASED PIPES. THE CONCRETE ENCASED PIPES ARE LOCATED AT THE LOW POINT IN THE TSF BASIN, TRAVEL UNDER THE TSF PERIMETER ROAD, AND OUTLET AT THE UNDERDRAIN COLLECTION POND CREST.

Registered Professional Engineer (Civil) CERTIFICATE NO. 63431 CRAIG M. THOMPSON Date Signed 12/8/23 ARIZONA, U.S.A.
EXPIRES 3/31/26

0 200 400 FEET

REFERENCE:

EXISTING GROUND TOPOGRAPHY DEVELOPED FROM MARCH 2020 AND APRIL 2023 AERIAL SURVEY DATA PROVIDED BY SOUTH32 (AMI). DATA PROJECTED TO STATE PLANE ARIZONA CENTRAL NAD 83 FEET, NAVD88.

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NewFields

CLIENT: SOUTH32 HERMOSA INC.

PROJECT: HERMOSA PROJECT AQUIFER PROTECTION PERMIT SIGNIFICANT AMENDMENT (TSF1)

TITLE: SURFACE WATER MANAGEMENT PLAN VIEW

FILENAME: 14.035.022M
DRAWING NO.: A400
REVISION: 0

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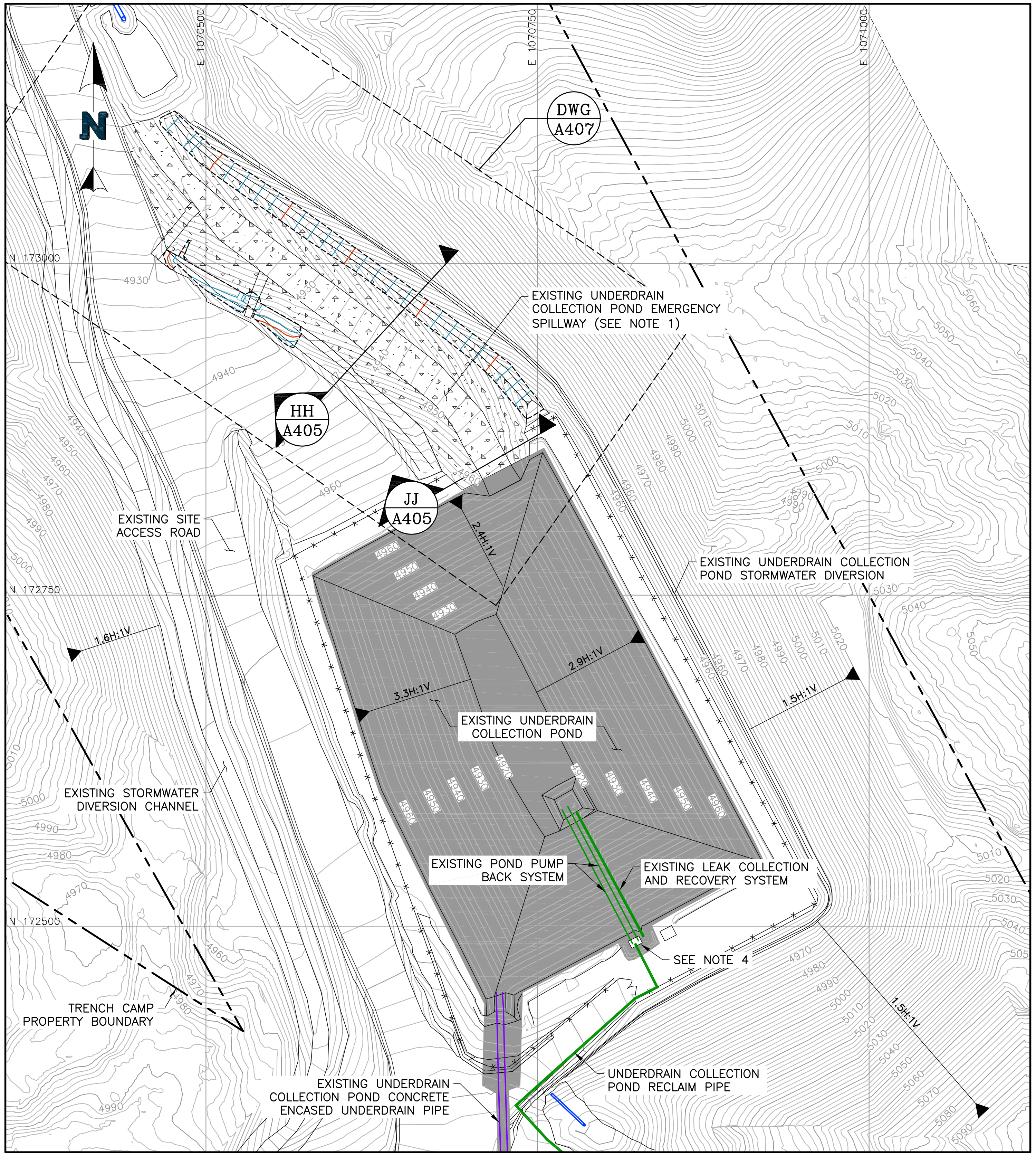
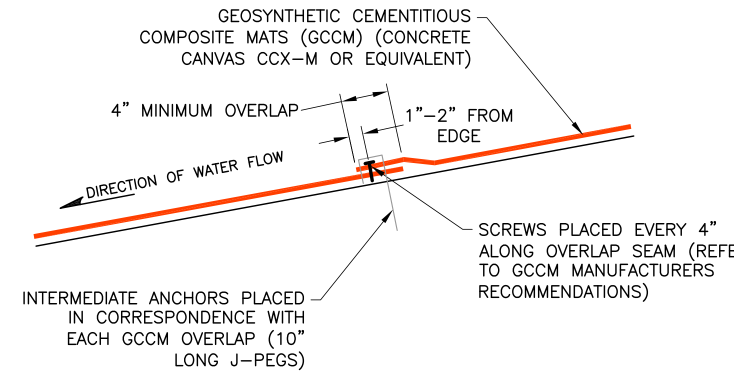


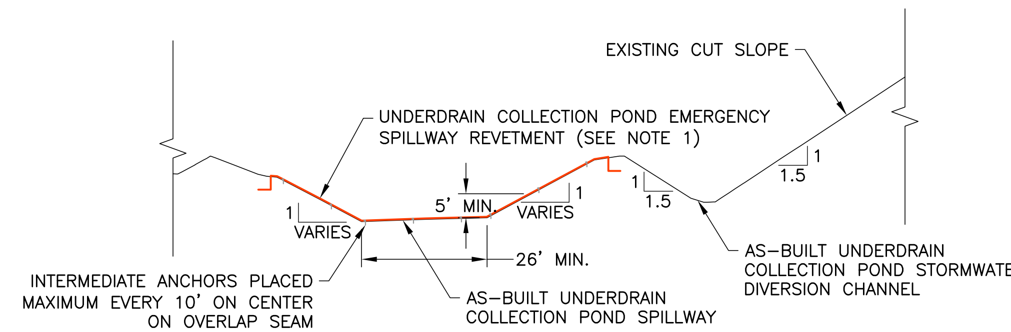
0 50 100 FEET

LEGEND:

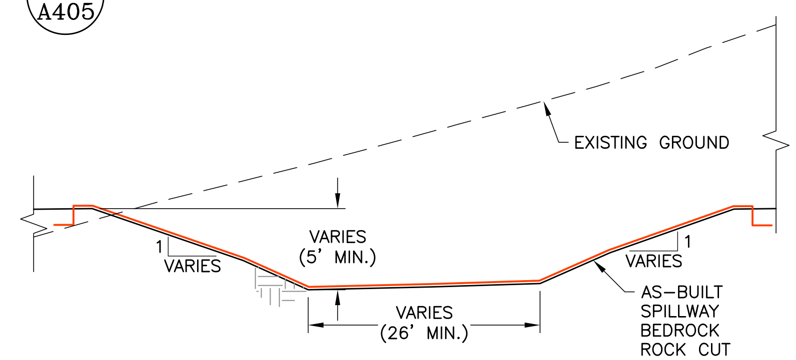
- EXISTING GROUND CONTOURS
- PROPOSED GROUND CONTOURS
- PROJECT BOUNDARY
- EXISTING FENCE
- EXISTING 36" DIA. HDPE DR11 UNDERDRAIN OUTFALL PIPE (SOLID) (SEE NOTE 3)
- EXISTING CONCRETE ENCASED UNDERDRAIN
- UNDERDRAIN COLLECTION POND RECLAIM PIPE TO WATER TREATMENT PLANT (SOLID)
- 12" DIA. LCRS PIPE
- EXISTING GEOMEMBRANE AREA
- PROPOSED REVETMENT AREA



GG / A407 GCCM OVERLAP DETAIL



HH / A405 UNDERDRAIN COLLECTION POND EMERGENCY SPILLWAY SECTION



JJ / A405 UNDERDRAIN COLLECTION POND EMERGENCY SPILLWAY SECTION

NOTES:

1. EXISTING UNDERDRAIN COLLECTION POND EMERGENCY SPILLWAY TO HAVE GEOSYNTHETIC CEMENTITIOUS COMPOSITE MATS (GGCM) (CONCRETE CANVAS CCX OR EQUIVALENT) INSTALLED AS REVETMENT TO PREVENT EROSION IN THE UNLIKELY EVENT OF SPILLWAY ACTIVATION. GEOTEXTILE TO BE INSTALLED BENEATH GCCM TO PREVENT IT FROM BEING PUNCTURED BY ROCK SUBGRADE. INSTALLATION TO FOLLOW MANUFACTURERS RECOMMENDATIONS.
2. EXISTING UNDERDRAIN COLLECTION POND FILLING CURVE IS PRESENTED IN DWG A410.
3. THE EXISTING 36" DIA HDPE DR11 UNDERDRAIN PIPES TRANSFER ALL STORMWATER RUNOFF AND PERCOLATION THROUGH THE BASE OF THE STACK TO THE UNDERDRAIN COLLECTION POND VIA GRAVITY.
4. INSTALL SUBMERSIBLE PUMP CAPABLE OF 660 GPM AT 300 FT OF TOTAL DYNAMIC HEAD.

Registered Professional Engineer (Civil)
CERTIFICATE NO. 63431
CRAIG M. THOMPSON
Date Signed 12/8/23
ARIZONA, U.S.A.
Expires 3/31/26

REFERENCE:

EXISTING GROUND TOPOGRAPHY DEVELOPED FROM MARCH 2020 AND APRIL 2023 AERIAL SURVEY DATA PROVIDED BY SOUTH32 (AMI). DATA PROJECTED TO STATE PLANE ARIZONA CENTRAL NAD 83 FEET, NAVD88.

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REV	DATE	DESCRIPTION	TECH	ENG
0	12/8/23	ISSUED FOR TENDER	JEP	CMT

APPROVED BY: RMS
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DESIGNED BY: CMT
DRAWN BY: JEP

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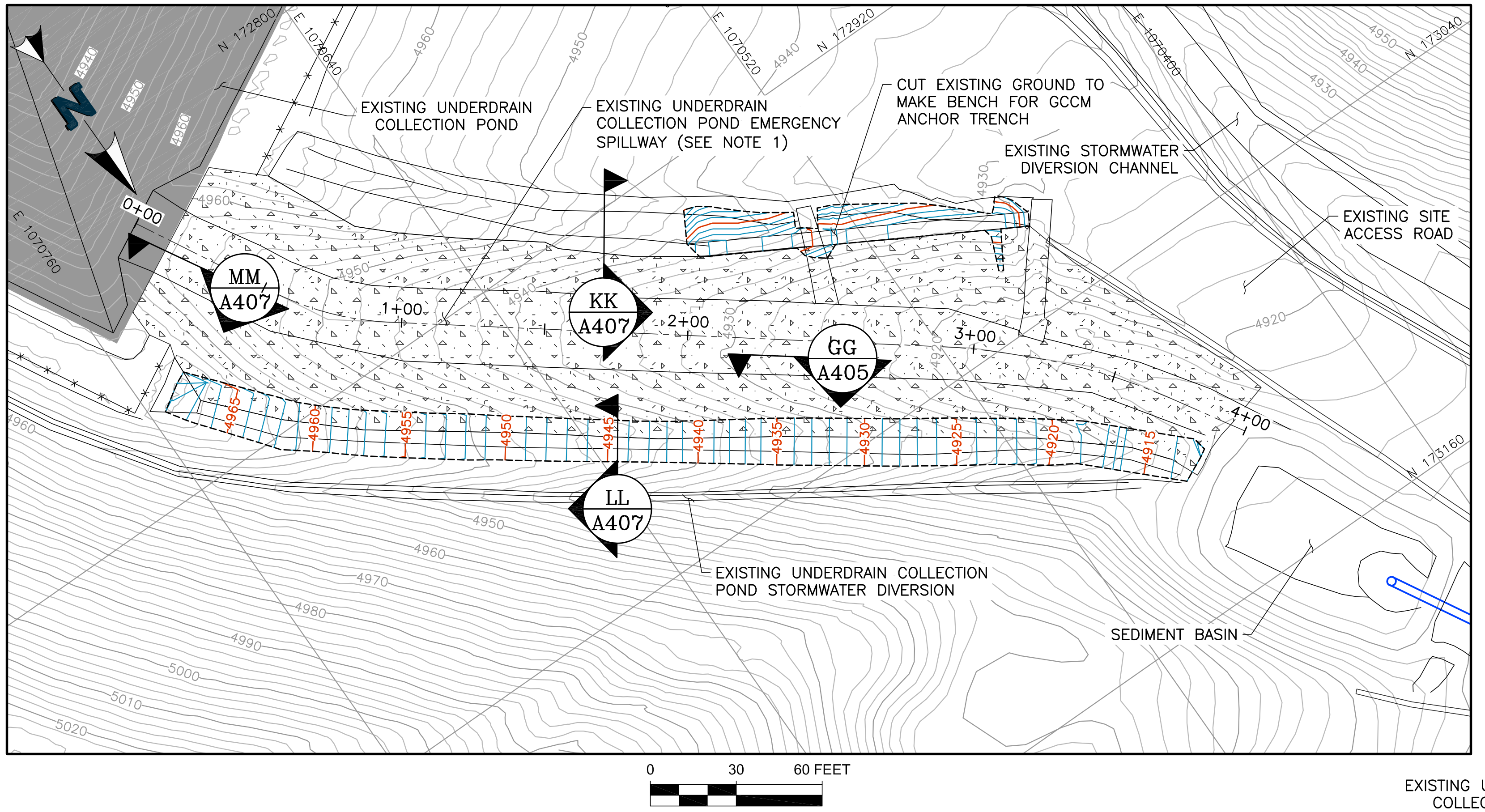
NewFields

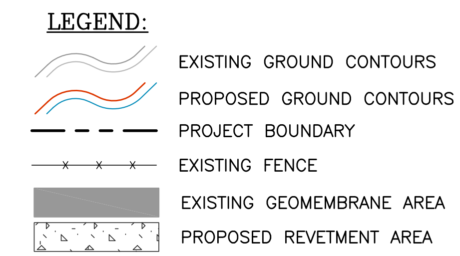
CLIENT: SOUTH32 HERMOSA INC.

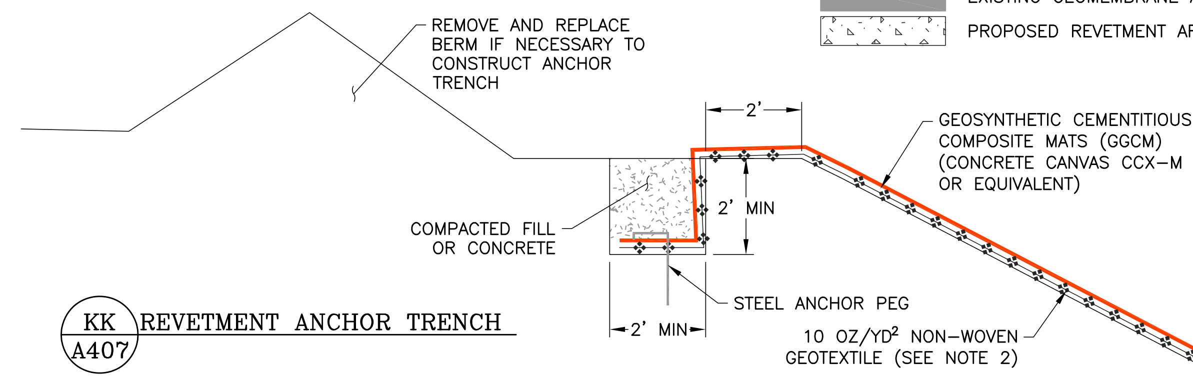
PROJECT: HERMOSA PROJECT AQUIFER PROTECTION PERMIT SIGNIFICANT AMENDMENT (TSF1)

TITLE: EXISTING UNDERDRAIN COLLECTION POND

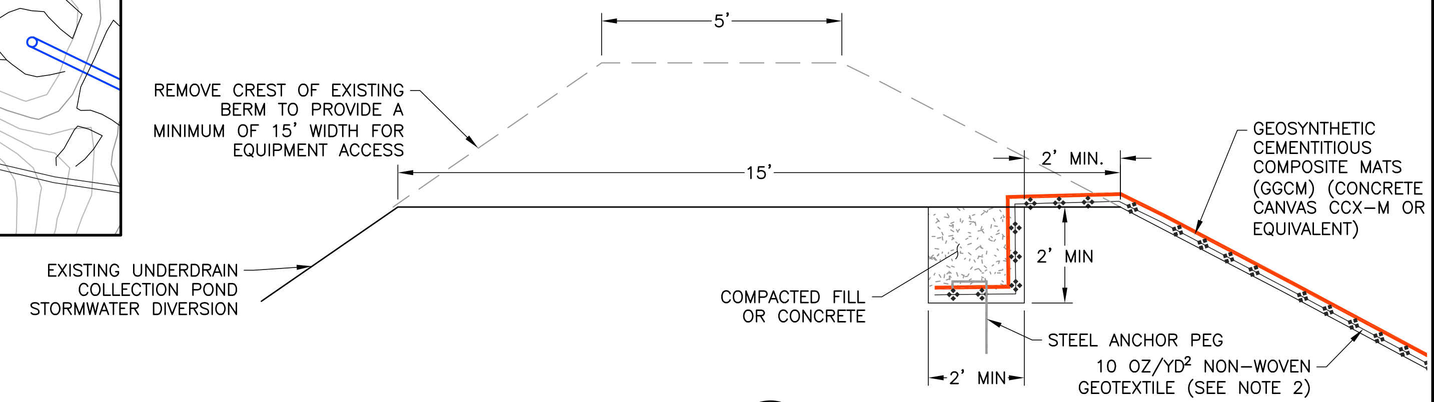
FILENAME: 14.035.026M
DRAWING NO.: A405
REVISION: 0







KK A407 REVETMENT ANCHOR TRENCH



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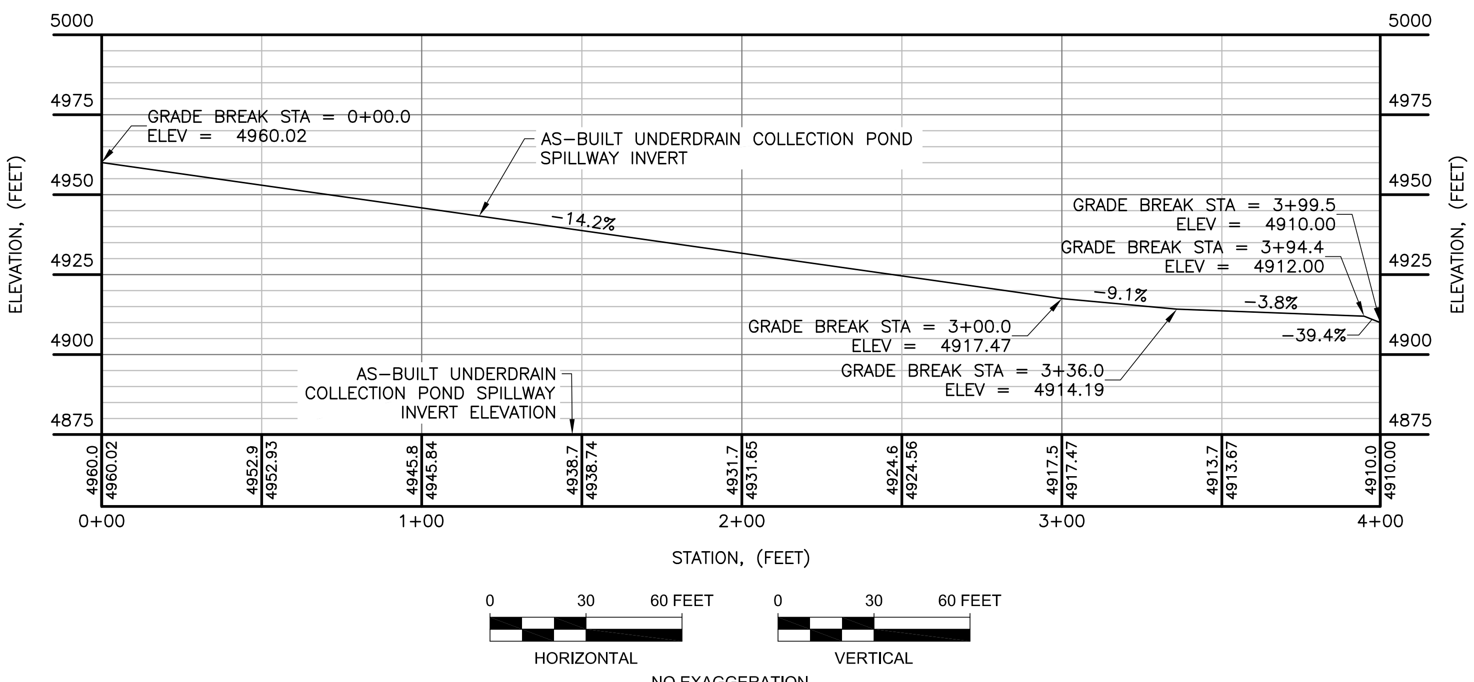

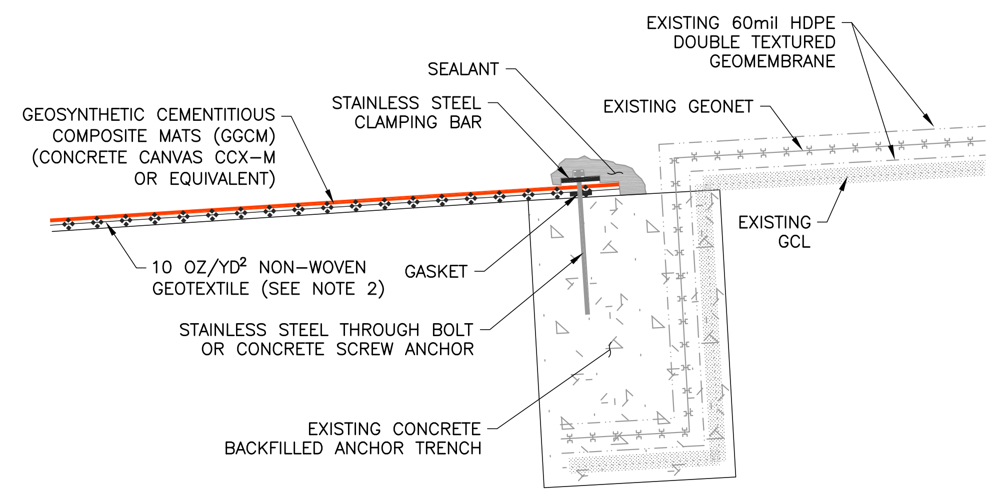

MM A407 REVETMENT ANCHOR TO EXISTING CONCRETE ANCHOR TRENCH

NOTES:

1. EXISTING UNDERDRAIN COLLECTION POND EMERGENCY SPILLWAY TO HAVE GEOSYNTHETIC CEMENTITIOUS COMPOSITE MATS (GCCM) (CONCRETE CANVAS CCX OR EQUIVALENT). INSTALLED AS REVETMENT TO PREVENT EROSION IN THE UNLIKELY EVENT OF SPILLWAY ACTIVATION. INSTALLATION TO FOLLOW MANUFACTURERS RECOMMENDATIONS.
2. GEOTEXTILE TO BE INSTALLED BENEATH GCCM TO PREVENT IT FROM BEING PUNCTURED BY ROCK SUBGRADE.

REFERENCE:

EXISTING GROUND TOPOGRAPHY DEVELOPED FROM MARCH 2020 AND APRIL 2023 AERIAL SURVEY DATA PROVIDED BY SOUTH32 (AMI). DATA PROJECTED TO STATE PLANE ARIZONA CENTRAL NAD 83 FEET, NAVD88.

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NewFields

CLIENT: SOUTH32 HERMOSA INC.

PROJECT: HERMOSA PROJECT AQUIFER PROTECTION PERMIT SIGNIFICANT AMENDMENT (TSF1)

TITLE: EXISTING UNDERDRAIN COLLECTION POND SPILLWAY PLAN AND PROFILE

FILENAME: 14.035.038P
DRAWING NO.: A407
REVISION: 0

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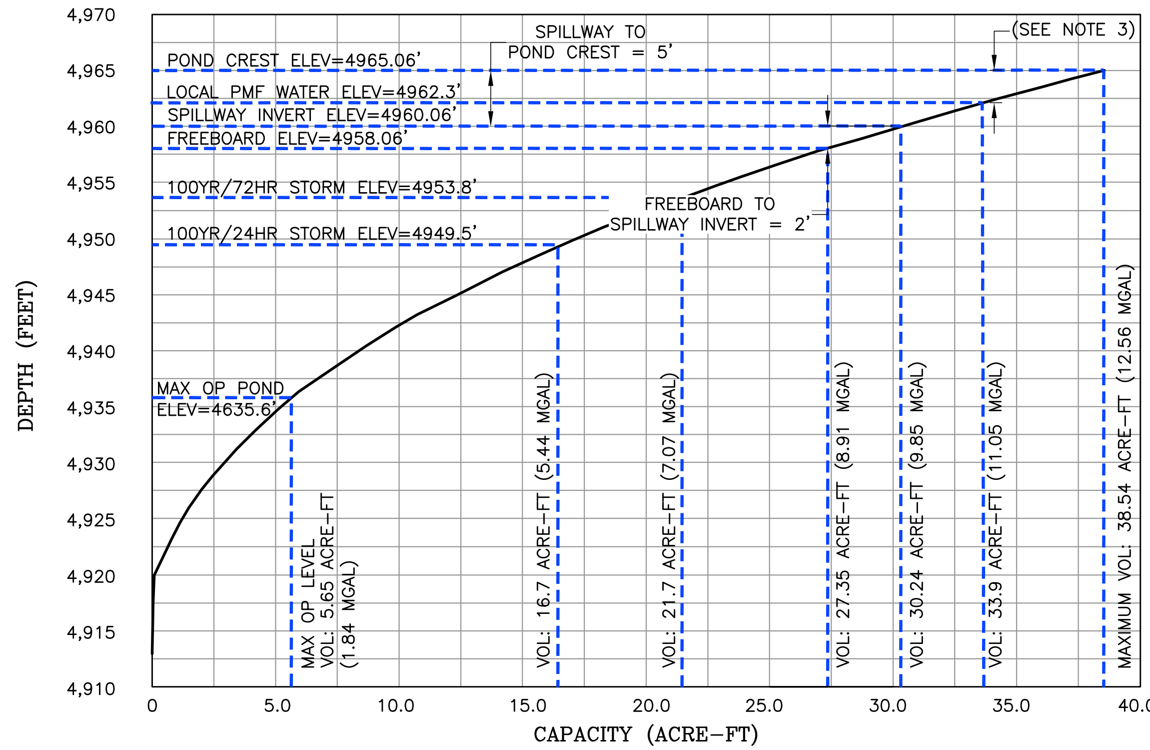
EXISTING UNDERDRAIN COLLECTION POND FILLING CURVE



PRESCRIPTIVE DESIGN CRITERIA

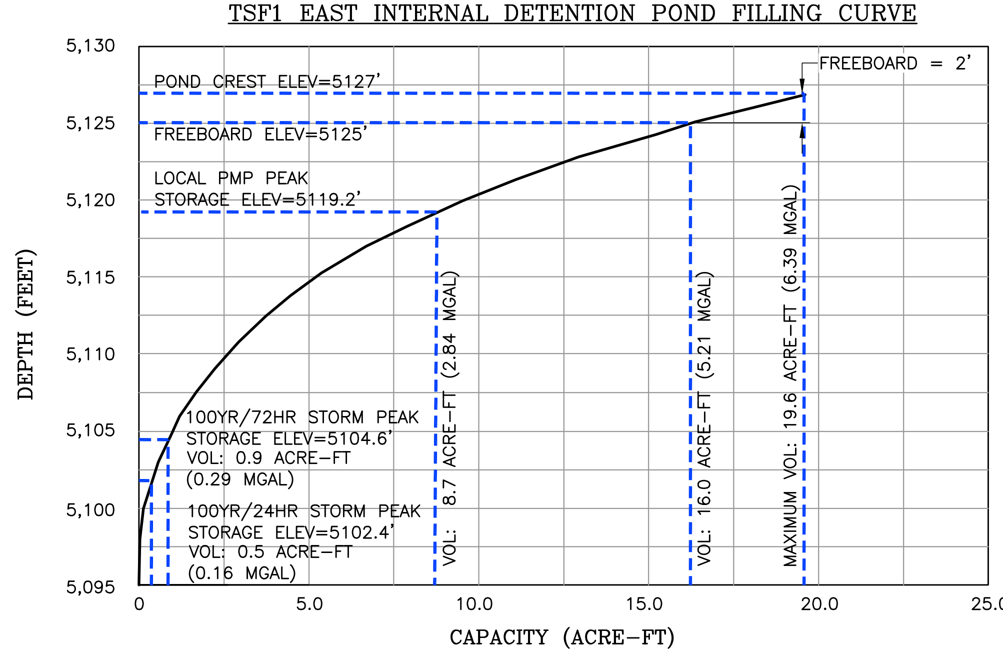
DESIGN CRITERIA	DESIGN STORM	FREEBOARD	COMMENT
BADCT	100-YR/24-HR	2FT	1. CONTAINMENT OF DESIGN STORM.
ADWR DAM SAFETY	1/4 PMF	3FT	1. SAFELY CONVEY 1/4 PMF WITH REQUIRED FREEBOARD THROUGH SPILLWAY.
ANCOLD	100-YR/72-HR	1.64FT* (0.5m)	1. CONTAINMENT OF DESIGN STORM 2. NEWFIELDS USED ANCOLD ENVIRONMENTAL SPILL "HIGH C" CONSEQUENCE CATEGORY.
ANCOLD/GISTM	PMF	0	1. SAFELY CONVEY PMF THROUGH SPILLWAY. 2. NEWFIELDS USED ANCOLD DAM FAILURE "HIGH C" CONSEQUENCE CATEGORY.
GISTM	1/1,000YR	0	1. SAFELY PASS THE 1/1,000 YEAR STORM EVENT. 2. NEWFIELDS USED THE GISTM "SIGNIFICANT" CONSEQUENCE CLASSIFICATION.

* USE 2FT FOR FILLING CURVE FREEBOARD
** SEE NOTE 4

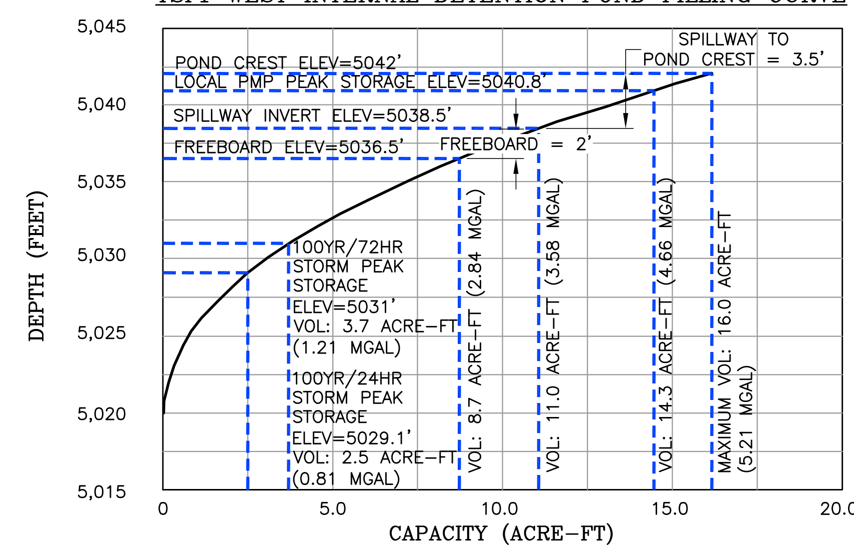
NOTES:

1. EAST AND WEST INTERNAL DETENTION PONDS WERE DESIGNED UTILIZING THE STORAGE GUIDELINES PRESENTED IN BADCT, ANCOLD, AND GISTM.
2. THE EXISTING UNDERDRAIN COLLECTION POND WAS CONSTRUCTED DURING PREVIOUS PROJECT WORK, BUT MEETS THE STORAGE GUIDELINES PRESENTED IN BADCT, ADWR DAM SAFETY, ANCOLD, AND GISTM FOR THE TSF1 EXPANSION.
3. THE INFLOW INTO THE EXISTING UNDERDRAIN COLLECTION POND IS LIMITED BY TWO 36" DIA UNDERDRAIN OUTFALL PIPES BETWEEN THE TSF AND UNDERDRAIN COLLECTION POND. THE MAXIMUM WATER SURFACE ELEVATION FOR THE PMF AND 1/4 PMF ARE 4962.3 FT AND 4961.6 FT RESPECTIVELY. THE 1/4 PMF MAINTAINS ~3.5' OF FREEBOARD FROM THE WATER SURFACE ELEVATION TO THE CREST OF THE POND. THE PMF MAINTAINS ~2.8' OF FREEBOARD FROM THE WATER SURFACE ELEVATION TO THE CREST OF THE POND.
4. DESIGN SATISFIES ALL PRESCRIPTIVE CRITERIA LISTED.

TSF1 EAST INTERNAL DETENTION POND FILLING CURVE



TSF1 WEST INTERNAL DETENTION POND FILLING CURVE



EXPIRES 3/31/26

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APPROVED BY: RMS
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NewFields

CLIENT: SOUTH32 HERMOSA INC.
PROJECT: HERMOSA PROJECT AQUIFER PROTECTION PERMIT SIGNIFICANT AMENDMENT (TSF1)
TITLE: POND FILLING CURVES
FILENAME: 14.035.030D
DRAWING NO.: A410
REVISION: 0

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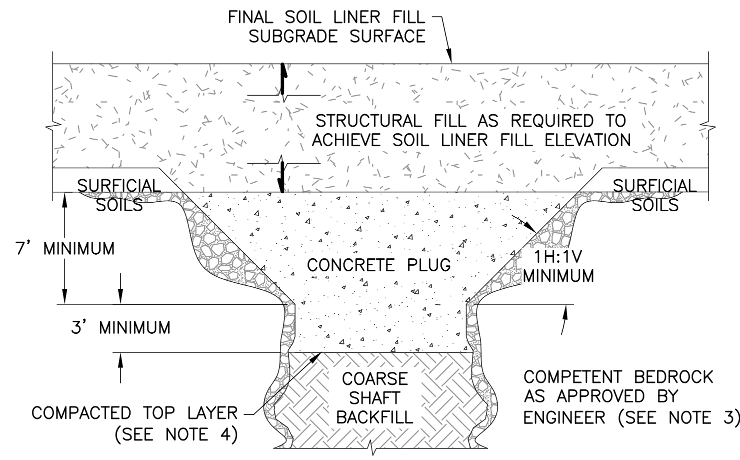
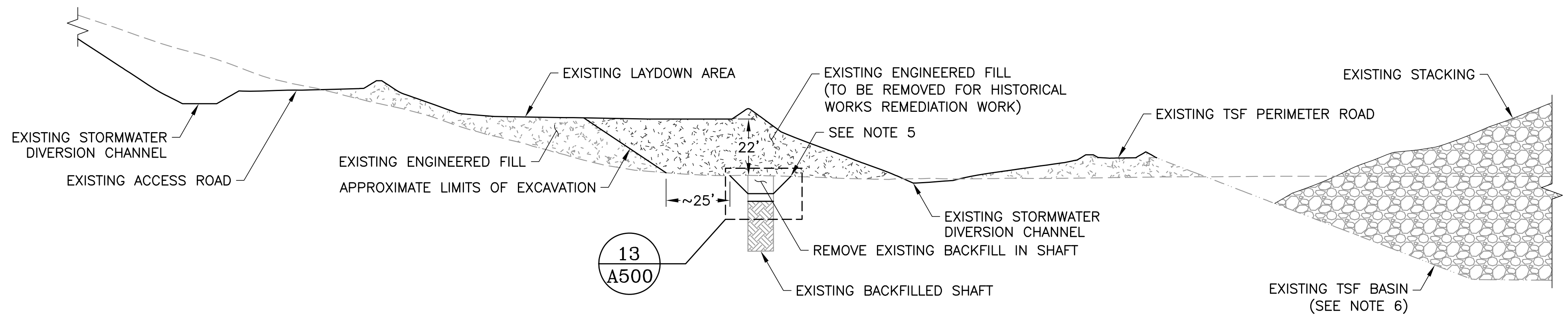


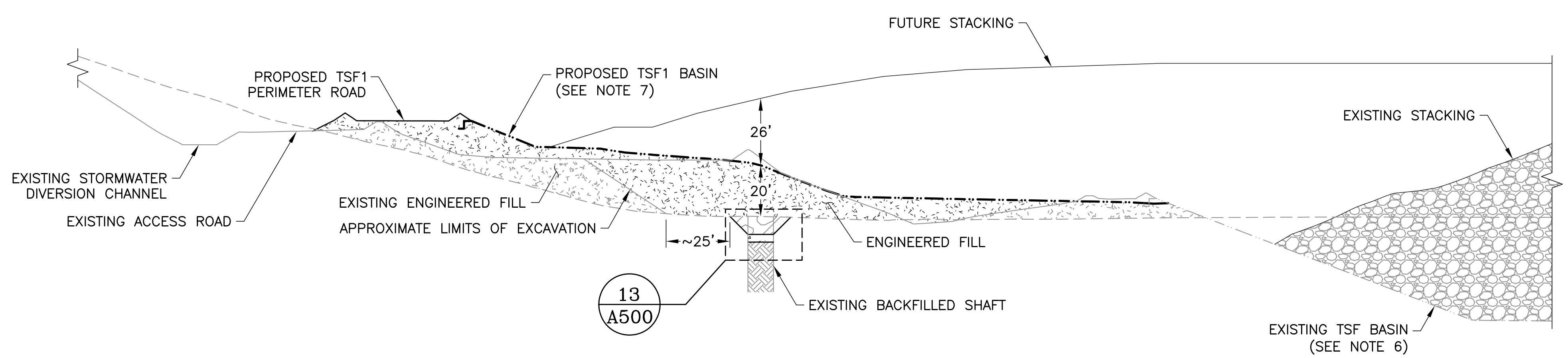
13 A500 SHAFT REMEDIATION DETAIL

NOTES:

1. ANY DEBRIS WITHIN SHAFT, SUCH AS TIMBER SUPPORTS, MUST BE REMOVED.
2. ROCK SURFACE WITHIN SHAFT SHALL BE SCALED TO REMOVE LOOSE MATERIAL PRIOR TO CONCRETE PLUG PLACEMENT.
3. EXCAVATION MUST EXPOSE ALL SIDES OF SHAFT AND BE AT LEAST 3 FT INTO SOUND, HARD ROCK.
4. COMPACTION OF TOP LAYER OF COARSE SHAFT BACKFILL TO BE TAMPED SMOOTH.
5. ASSUMED EXCAVATION LIMIT TO COMPETENT BEDROCK.
6. FROM TOP TO BOTTOM, THE EXISTING TSF BASIN CONSISTS OF AN 18 INCH PROTECTIVE LAYER, 60 MIL DOUBLE TEXTURED HDPE GEOMEMBRANE AND LOW PERMEABILITY SOIL LAYER (OR GEOSYNTHETIC CLAY LINER). ALL EXISTING TSF BASIN LAYERS ARE NOT SHOWN FOR CLARITY.
7. FROM TOP TO BOTTOM, THE PROPOSED TSF1 BASIN CONSISTS OF AN 18 INCH PROTECTIVE LAYER, 60 MIL DOUBLE TEXTURED HDPE GEOMEMBRANE AND LOW PERMEABILITY SOIL LAYER (OR GEOSYNTHETIC CLAY LINER). ALL PROPOSED TSF1 BASIN LAYERS ARE NOT SHOWN FOR CLARITY.



EXCAVATION TO EXISTING SHAFT LIMITS



NN A210 SHAFT REMEDIATION SECTION

Registered Professional Engineer (Civil)
CERTIFICATE NO.
63431
CRAIG M. THOMPSON
Date Signed 12/8/23
ARIZONA, U.S.A.
EXPIRES 3/31/26

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REV	DATE	DESCRIPTION	TECH	ENG
0	12/8/23	ISSUED FOR TENDER	JEP	CMT

APPROVED BY: RMS
CHECKED BY: CMT
DESIGNED BY: CMT
DRAWN BY: JEP

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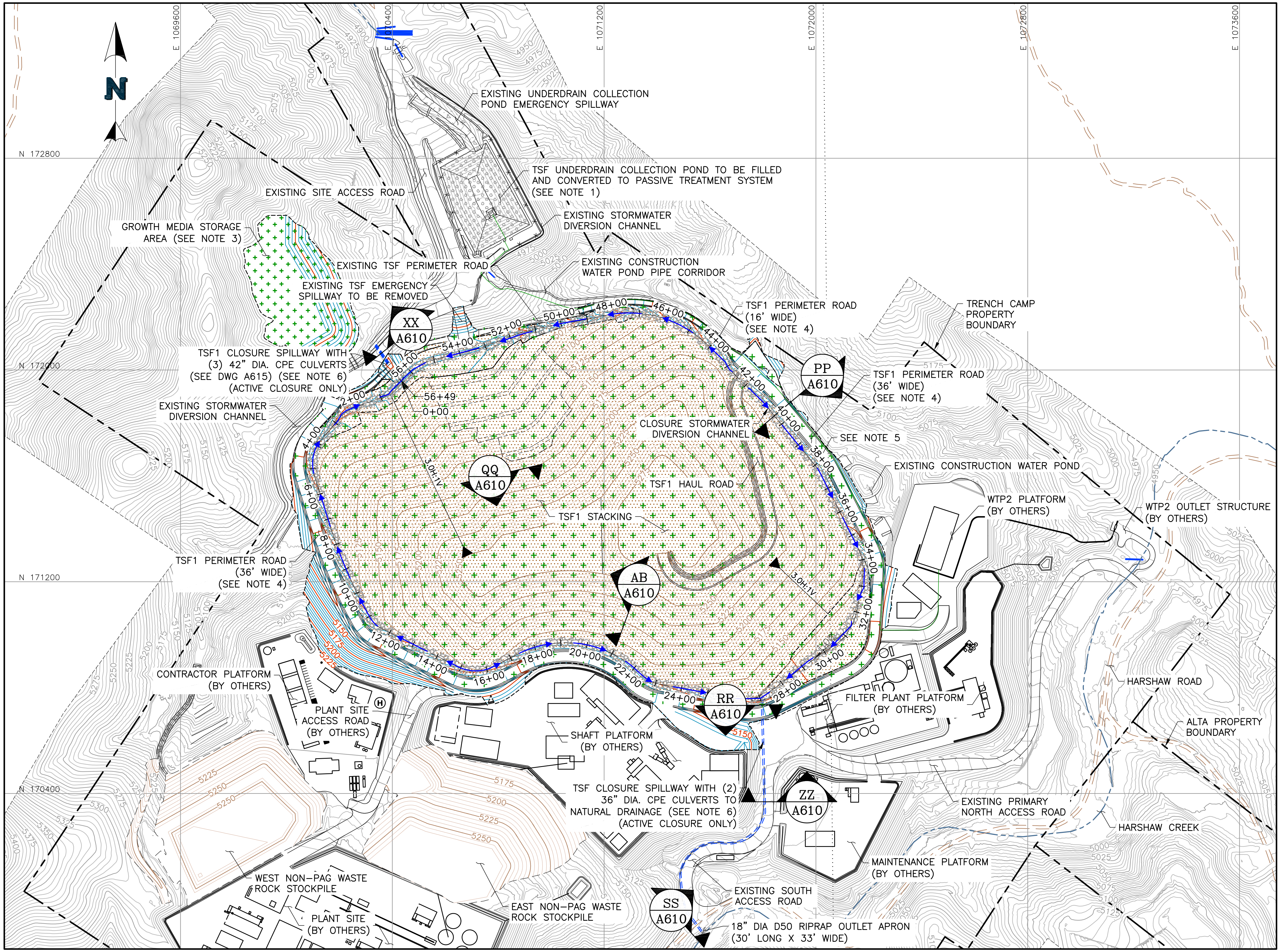
NewFields

CLIENT: SOUTH32 HERMOSA INC.
PROJECT: HERMOSA PROJECT AQUIFER PROTECTION PERMIT SIGNIFICANT AMENDMENT (TSF1)
TITLE: UNDERGROUND WORKING REMEDIATION DETAILS
FILENAME: 14.035.027D
DRAWING NO.: A500
REVISION: 0



LEGEND:

- EXISTING GROUND CONTOURS
- PROPOSED CLOSURE CONTOURS
- PROPOSED STACKING CONTOURS
- EXISTING ROADS/TRAILS
- EXISTING ROADS/TRAILS
- PROJECT BOUNDARY
- STORMWATER DIVERSION CHANNEL
- CULVERT (EXISTING OR PROPOSED)
- RECLAIM PIPE (SEE NOTE 2)
- LIMITS OF GROWTH MEDIA
- LIMITS OF REVEGETATION
- PASSIVE TREATMENT SYSTEM AREA
- LIMITS OF RIPRAP ARMORING
- EXISTING WILDLIFE FENCE

NOTES:

1. THE PASSIVE TREATMENT SYSTEM IS TO BE DESIGNED BASED ON POST CLOSURE WATER CHEMISTRY AND FLOW RATES. ACTIVE TREATMENT OF UNDERDRAIN FLOWS WILL CONTINUE UNTIL AN APPROPRIATE PASSIVE TREATMENT SYSTEM CAN BE ESTABLISHED.
2. RECLAIM PIPE TO BE REMOVED FOLLOWING ESTABLISHMENT OF AN APPROPRIATE PASSIVE TREATMENT SYSTEM.
3. GROWTH MEDIA STORAGE AREA TO BE REVEGETATED AFTER GROWTH MEDIA IS MOVED TO THE TAILINGS STORAGE FACILITY.
4. PERIMETER ROAD TO BE RIPPED AND REVEGETATED AT CLOSURE.
5. A PORTION OF THE TSF1 PERIMETER ROAD WILL REMAIN OPEN AFTER CLOSURE OF THE TSF1 TO MAINTAIN ACCESS AROUND THE SITE AND TO TSF2. THE OPEN PORTION OF THE ROAD WILL BE RIPPED DURING CLOSURE OF TSF2.
6. CULVERTS INSTALLED AS A PART OF TSF1 ACTIVE CLOSURE TO BE UTILIZED TO MAINTAIN ACCESS TO THE SITE DURING OPERATIONS. AT PASSIVE CLOSURE, THE CULVERTS WILL BE REMOVED AND REPLACED WITH AN ARMORED OPEN CHANNEL SPILLWAY CAPABLE OF SAFELY PASSING THE PMF IN CONJUNCTION WITH CLOSURE OF TSF2 (12' BASE, 4' DEEP, 2.5H:1V SIDE SLOPES, D50=12" RIPRAP).
7. ALL CUT AND FILL SLOPES LOCATED ALONG THE EXTERIOR OF THE TSF PERIMETER ROAD WERE HYDROSEEDED AS PART OF THE VRP TSF CONSTRUCTION.
8. A PORTION OF THE TSF1 PERIMETER ROAD WILL REMAIN OPEN AFTER TSF1 CLOSURE TO MAINTAIN ACCESS AROUND THE SITE AND TO TSF2.

0 200 400 FEET

Registered Professional Engineer (Civil)
CERTIFICATE NO. 63431
CRAIG M. THOMPSON
Date Signed 12/8/23
ARIZONA, U.S.A.
Expires 3/31/26

REFERENCE:

EXISTING GROUND TOPOGRAPHY DEVELOPED FROM MARCH 2020 AND APRIL 2023 AERIAL SURVEY DATA PROVIDED BY SOUTH32 (AMI). DATA PROJECTED TO STATE PLANE ARIZONA CENTRAL NAD 83 FEET, NAVD88.

REV	DATE	DESCRIPTION	TECH	ENG
0	12/8/23	ISSUED FOR TENDER	JEP	CMT

APPROVED BY: RMS
CHECKED BY: CMT
DESIGNED BY: CMT
DRAWN BY: JEP

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NewFields

CLIENT: SOUTH32 HERMOSA INC.

PROJECT: HERMOSA PROJECT AQUIFER PROTECTION PERMIT SIGNIFICANT AMENDMENT (TSF1)

TITLE: TSF1 ACTIVE CLOSURE PLAN VIEW

FILENAME: 14.035.023M

DRAWING NO.: A600

REVISION: 0

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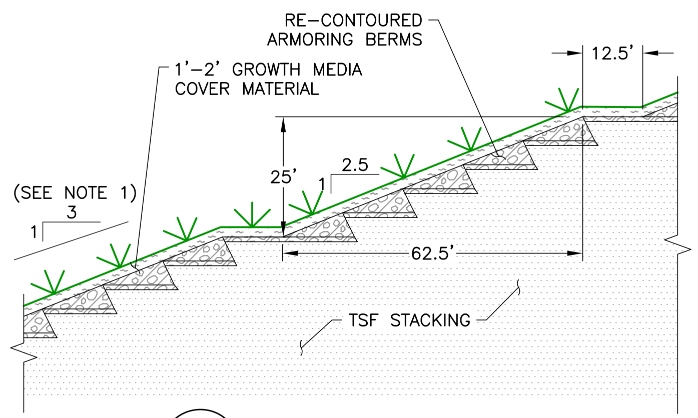
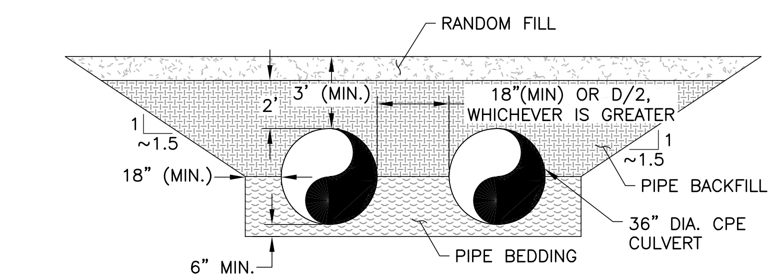
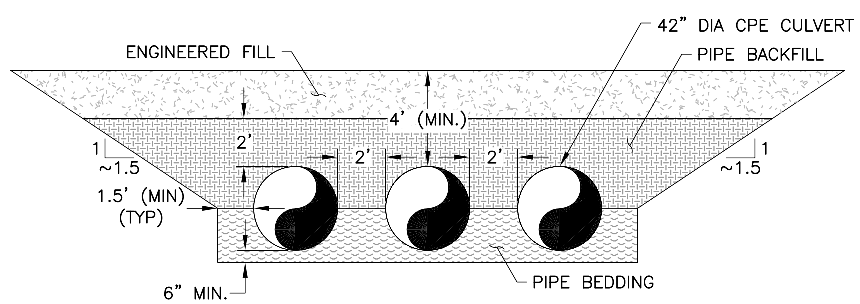


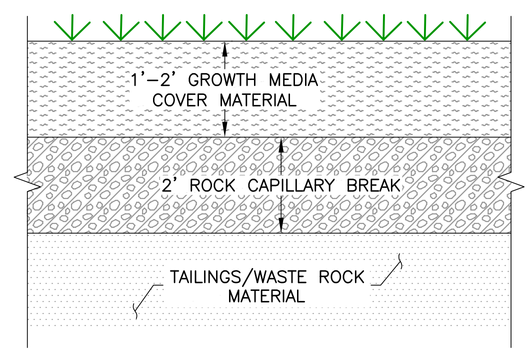
AB A600 CLOSURE STACKING



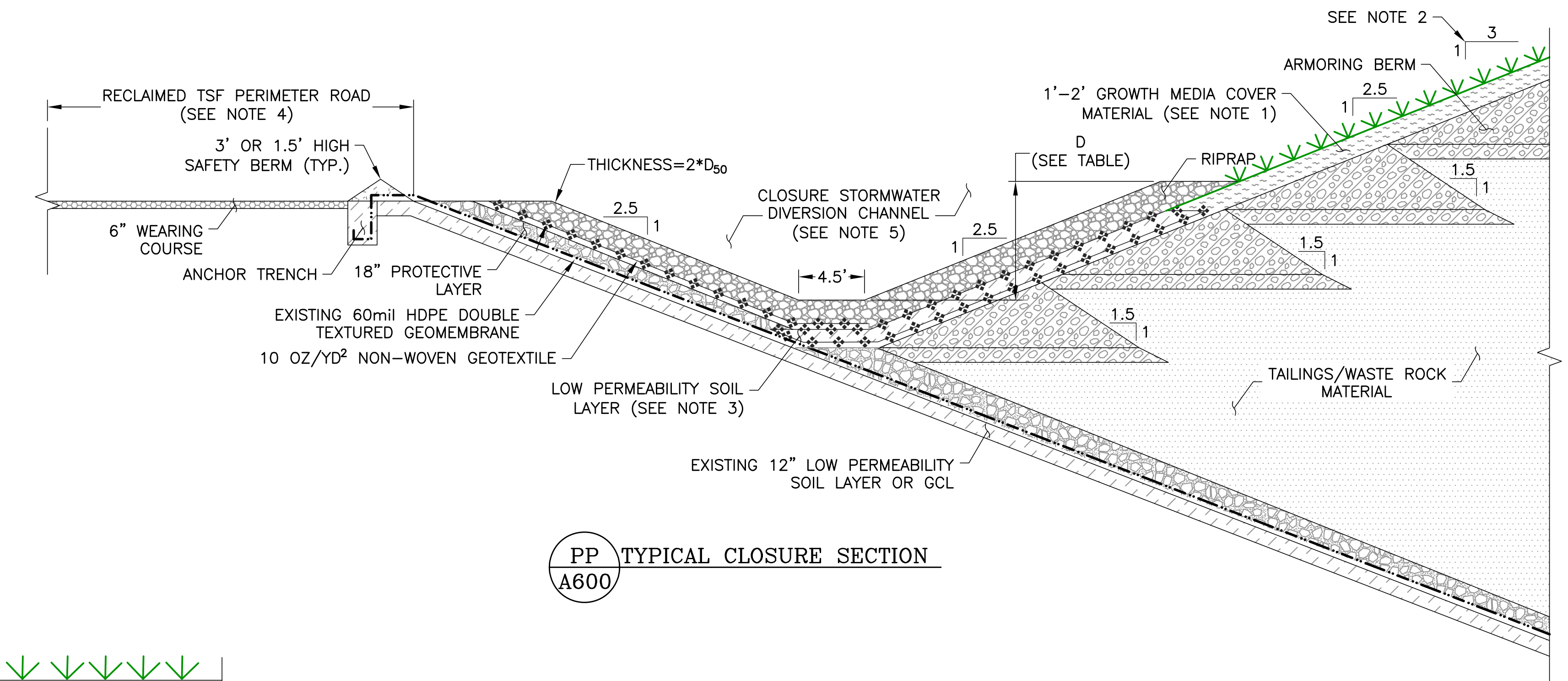
RR A600 TYPICAL SPILLWAY CULVERT SECTION



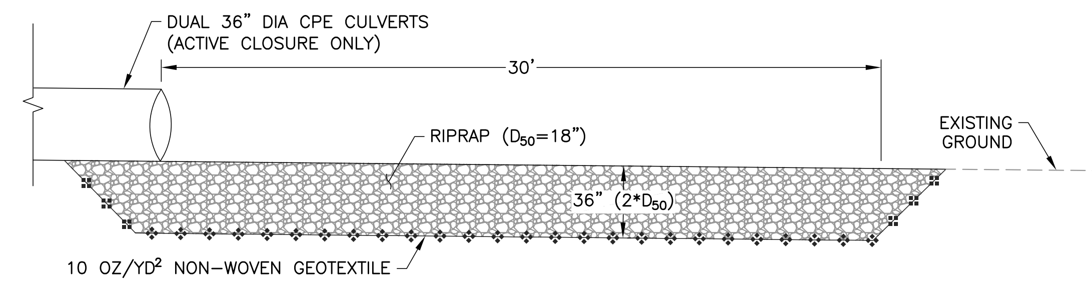
XX A600 TYPICAL SPILLWAY CULVERT SECTION



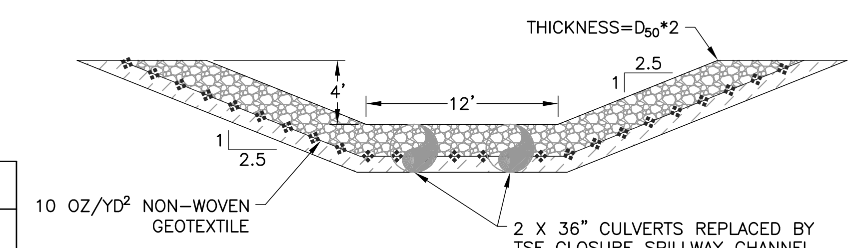
QQ A600 PAD CLOSURE SECTION



PP A600 TYPICAL CLOSURE SECTION



SS A600 CULVERT OUTLET



ZZ A600 TSF CLOSURE SPILLWAY

INTERNAL CLOSURE CHANNEL DIMENSIONS

CHANNEL SLOPE	MINIMUM DEPTH (D)	APPROXIMATE RIPRAP SIZE (D50)	STATION RANGE
<=1%	5.5'	6"	26+50 TO 34+00 35+35 TO 38+00 39+00 TO 43+00
>1% TO <5%	5.5'	12"	0+00 TO 0+50 18+00 TO 23+00 52+20 TO 56+50
5% TO 10%	4'	18"	0+50 TO 11+00 12+00 TO 18+00 23+00 TO 26+50 34+00 TO 35+35 38+00 TO 39+00 43+00 TO 44+25
>10%	3.5'	24"	11+00 TO 12+00 44+25 TO 52+20

NOTES:

1. GROWTH MEDIA COVER MATERIAL TO BE HYDROSEEDED.
2. 3H:1V COMPOUND SLOPE IS COMPRISED OF 25 FT HIGH 2.5H:1V SLOPE IN COMBINATION WITH A 12.5 FT BENCH.
3. LOW PERMEABILITY SOIL LAYER TO BE PLACED AT CHANNEL BOTTOM DURING CLOSURE TO PREVENT POTENTIAL RECHARGE TO THE UNDERDRAIN SYSTEM.
4. PERIMETER ROAD TO BE RIPPED AT CLOSURE.
5. ACTUAL CLOSURE CHANNEL DIMENSIONS AND ARMORING TO BE DETERMINED AT TIME OF CLOSURE BASED ON AS-BUILT STACKING INFORMATION.
6. CULVERTS INSTALLED AS A PART OF THE TSF1 ACTIVE CLOSURE TO BE UTILIZED TO MAINTAIN ACCESS TO THE SITE. DURING PASSIVE CLOSURE, THE CULVERTS WILL BE REMOVED AND REPLACED WITH AN ARMORED OPEN CHANNEL SPILLWAY CAPABLE OF SAFELY PASSING THE PMF.

Registered Professional Engineer (Civil) CERTIFICATE NO. 63431 CRAIG M. THOMPSON Date Signed 12/8/23 ARIZONA, U.S.A.

Expires 3/31/26

REV	DATE	DESCRIPTION	TECH	ENG
0	12/8/23	ISSUED FOR TENDER	JEP	CMT

APPROVED BY: RMS
CHECKED BY: CMT
DESIGNED BY: CMT
DRAWN BY: JEP

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NewFields

CLIENT: SOUTH32 HERMOSA INC.
PROJECT: HERMOSA PROJECT AQUIFER PROTECTION PERMIT SIGNIFICANT AMENDMENT (TSF1)
TITLE: TSF1 CLOSURE SECTIONS AND DETAILS
FILENAME: 14.035.024D
DRAWING NO.: A610
REVISION: 0

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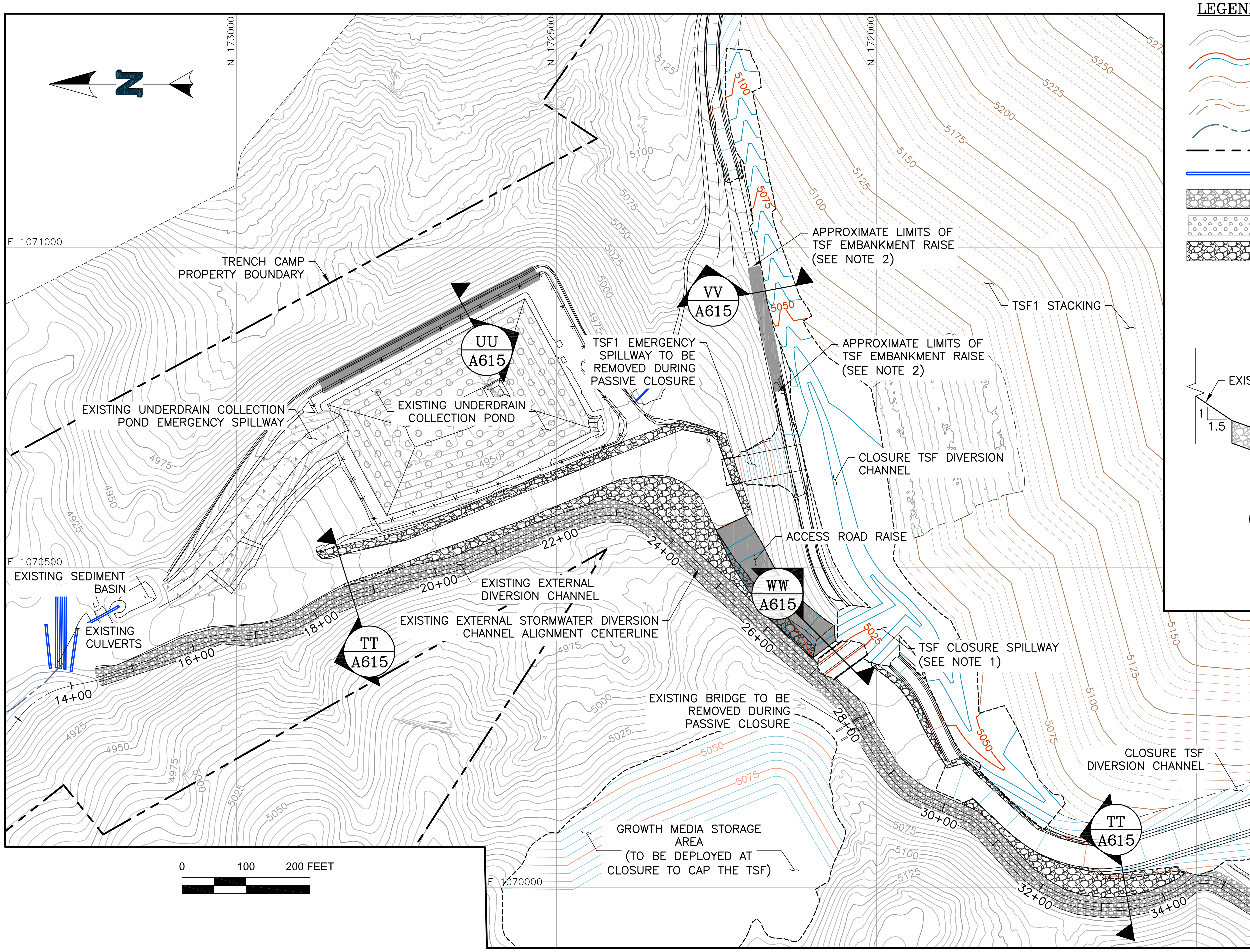
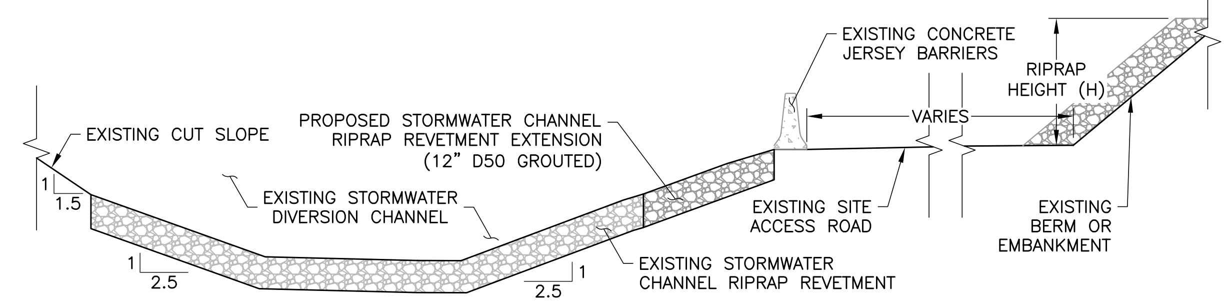


LEGEND:

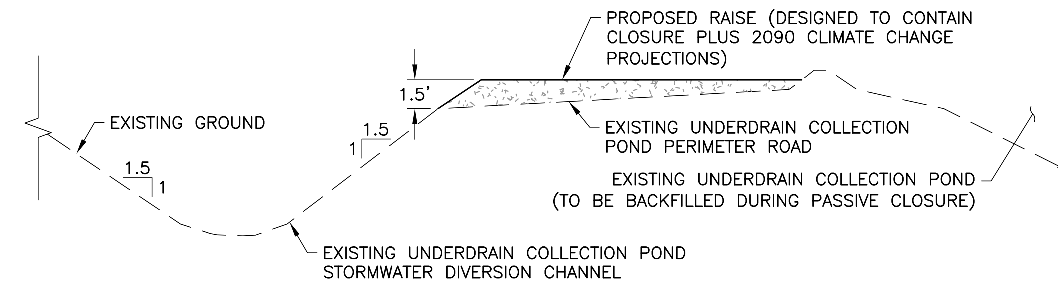
- EXISTING GROUND CONTOURS
- CLOSURE GROUND CONTOURS
- TSF1 AND AD STACKING CONTOURS
- EXISTING ROADS/TRAILS
- EXISTING DRAINAGES
- PROJECT BOUNDARY
- EXISTING CULVERT
- RIPRAP LINED STORMWATER DIVERSION CHANNEL
- PASSIVE TREATMENT SYSTEM AREA
- PROPOSED 12" D50 GROUTED RIPRAP

NOTES:

1. AS PART OF CLOSURE CONSTRUCTION, A TRAPEZOIDAL SPILLWAY WILL BE CUT INTO THE EXISTING TSF PERIMETER ROAD (EMBANKMENT) AND EXISTING ACCESS ROAD. THE TRAPEZOIDAL SPILLWAY WILL OUTLET THE CLOSURE TSF DIVERSION CHANNELS INTO THE EXISTING EXTERNAL STORMWATER DIVERSION CHANNEL. A BRIDGE WILL BE CONSTRUCTED TO SPAN THE SPILLWAY TO MAINTAIN SITE ACCESS.
2. THE TSF PERIMETER ROAD (EMBANKMENT) WILL REQUIRE A 2FT RAISE FOR PASSIVE CLOSURE TO DIRECT STORM FLOWS TO THE TSF SPILLWAY CONSIDERING INCREASED STORM INTENSITY FROM CLIMATE CHANGE. RAISE TO BE CONSTRUCTED PRIOR TO TSF CLOSURE SPILLWAY CONSTRUCTION.
3. PASSIVE CLOSURE DESIGN CONSIDERS 2090 CLIMATE CHANGE PROJECTIONS AS PROVIDED BY SOUTH32 IN THE POTENTIAL IMPACT OF CLIMATE CHANGE (PICC) ASSESSMENT. CLIMATE CHANGE PROJECTIONS TO BE UPDATED DURING FINAL CLOSURE DESIGN.

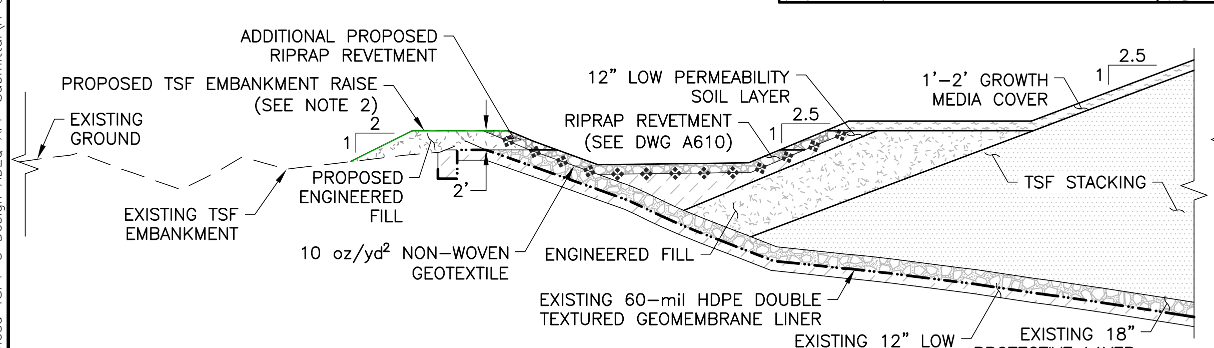


TT A615 EXISTING STORMWATER DIVERSION CHANNEL RIPRAP EXTENSION SECTION (SEE NOTE 3)

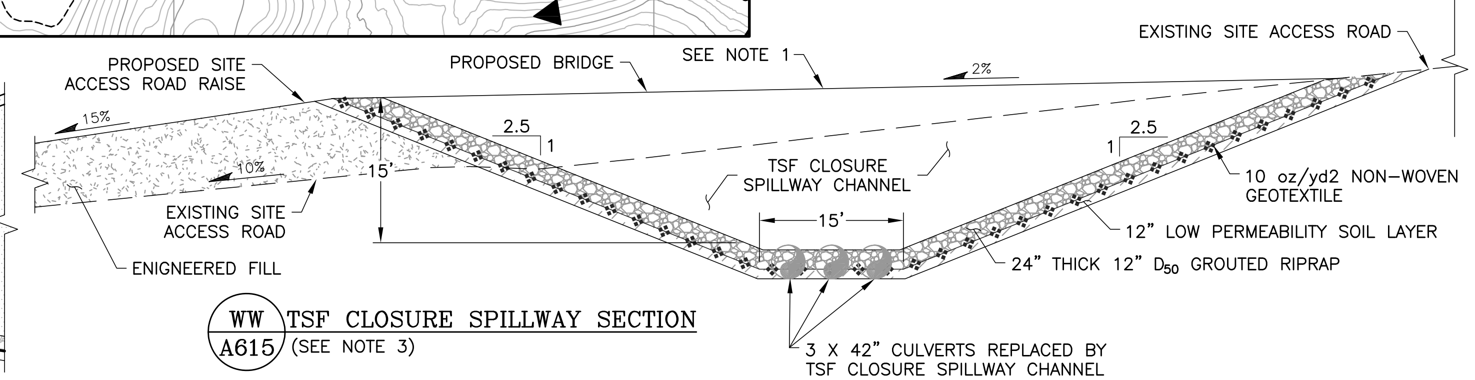


UU A615 UDCP STORMWATER DIVERSION CHANNEL SECTION (SEE NOTE 3)

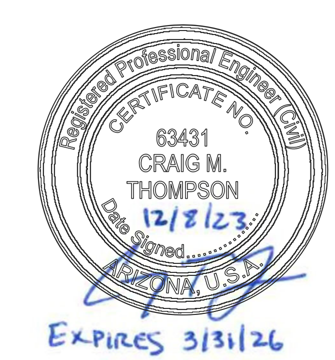
STATION	MINIMUM RIPRAP HEIGHT ABOVE ACCESS ROAD (H) (ft)
18+00 – 27+00	3.0
27+00 – 34+50	2.0



VV A615 TSF PERIMETER ROAD (EMBANKMENT) RAISE SECTION (SEE NOTE 3)



WW A615 TSF CLOSURE SPILLWAY SECTION (SEE NOTE 3)



REFERENCE:

EXISTING GROUND TOPOGRAPHY DEVELOPED FROM MARCH 2020 AND APRIL 2023 AERIAL SURVEY DATA PROVIDED BY SOUTH32 (AMI). DATA PROJECTED TO STATE PLANE ARIZONA CENTRAL NAD 83 FEET, NAVD88.

REV	DATE	DESCRIPTION	TECH	ENG
0	12/8/23	ISSUED FOR TENDER	JEP	CMT

APPROVED BY: RMS
CHECKED BY: CMT
DESIGNED BY: CMT
DRAWN BY: JEP

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NewFields

CLIENT: SOUTH32 HERMOSA INC.

PROJECT: HERMOSA PROJECT AQUIFER PROTECTION PERMIT SIGNIFICANT AMENDMENT (TSF1)

TITLE: TSF1 PASSIVE CLOSURE SPILLWAY AND DIVERSION CHANNEL PLAN VIEW

FILENAME: 14.035.029M

DRAWING NO.: A615

REVISION: 0

FIGURES

INITIAL CONDITIONS

0 200 400 FEET

YEAR 3 STACKING PLAN

0 200 400 FEET

LEGEND:

- EXISTING GROUND CONTOURS
- PROPOSED GROUND CONTOURS
- PROPOSED STACKING CONTOURS
- EXISTING ROADS/TRAILS
- EXISTING DRAINAGES
- PROJECT BOUNDARY
- ROCK BUTTRESS AREA

NOTES:

1. STACKING PLAN TIMING (YEARS) MAY CHANGE AS MINE PLAN DEVELOPS.

NewFields	CLIENT: SOUTH32 HERMOSA INC.
PROJECT	HERMOSA PROJECT TSF1 DESIGN
TITLE: TSF1 STACKING PLAN	FILENAME: 14.035.004F; FIGURE NO.: 1; REVISION: A

YEAR 4 STACKING PLAN

0 200 400 FEET

YEAR 5 STACKING PLAN

0 200 400 FEET

LEGEND:

- EXISTING GROUND CONTOURS
- PROPOSED GROUND CONTOURS
- PROPOSED STACKING CONTOURS
- EXISTING ROADS/TRAILS
- EXISTING DRAINAGES
- PROJECT BOUNDARY
- ROCK BUTTRESS AREA

NOTES:

1. STACKING PLAN TIMING (YEARS) MAY CHANGE AS MINE PLAN DEVELOPS.

NewFields	CLIENT: SOUTH32 HERMOSA INC.
PROJECT	HERMOSA PROJECT TSF1 DESIGN
TITLE	TSF1 STACKING PLAN
FILENAME	14.035.005F
FIGURE NO.	2
REVISION	A

\\nfenglewood\Projects\0014.035 Hermosa TSF1-3 Design ADEQ APP Submittal\A-CAD\FIGS\14.035.005F.dwg-12/8/2023 12:56 PM

YEAR 6 STACKING PLAN

0 200 400 FEET

YEAR 7 STACKING PLAN

0 200 400 FEET

LEGEND:

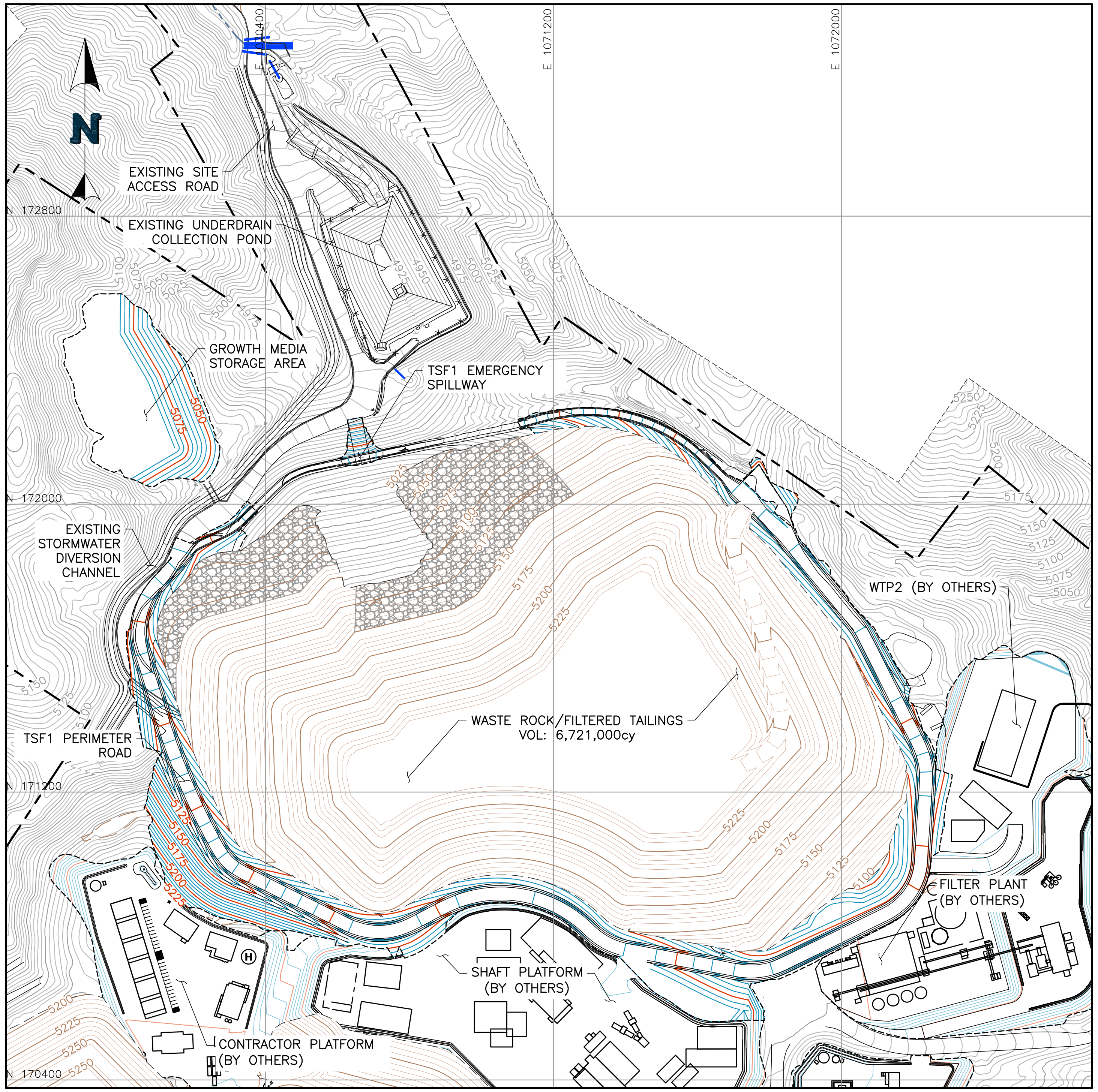
- EXISTING GROUND CONTOURS
- PROPOSED GROUND CONTOURS
- PROPOSED STACKING CONTOURS
- EXISTING ROADS/TRAILS
- EXISTING DRAINAGES
- PROJECT BOUNDARY
- ROCK BUTTRESS AREA

NOTES:

1. STACKING PLAN TIMING (YEARS) MAY CHANGE AS MINE PLAN DEVELOPS.

NewFields	CLIENT: SOUTH32 HERMOSA INC.
PROJECT	HERMOSA PROJECT TSF1 DESIGN
TITLE	TSF1 STACKING PLAN
FILENAME	14.035.006F
FIGURE NO.	3
REVISION	A

\\nfenglewood\Projects\0014.035 Hermosa TSF1-3 Design ADEQ APP Submittal\A-CAD\FIGS\14.035.006F.dwg—12/7/2023 1:21 PM



YEAR 8 STACKING PLAN

0 200 400 FEET

FINAL STACKING PLAN

0 200 400 FEET

LEGEND:

- EXISTING GROUND CONTOURS
- PROPOSED GROUND CONTOURS
- PROPOSED STACKING CONTOURS
- EXISTING ROADS/TRAILS
- EXISTING DRAINAGES
- PROJECT BOUNDARY
- ROCK BUTTRESS AREA

NOTES:

1. STACKING PLAN TIMING (YEARS) MAY CHANGE AS MINE PLAN DEVELOPS.

NewFields	CLIENT: SOUTH32 HERMOSA INC.
PROJECT	HERMOSA PROJECT TSF1 DESIGN
TITLE: TSF1 STACKING PLAN	FILENAME: 14.035.007F; FIGURE NO.: 4; REVISION: A

APPENDIX A

Design Criteria

NewFields	APPENDIX A DESIGN CRITERIA COVER SHEET TAILINGS STORAGE FACILITY 1 (TSF1)
Client	South32 Hermosa Inc
Project	Hermosa Project

	NAME	POSITION	COMPANY
Prepared By:	C. Thompson	Senior Engineer	NewFields
Reviewed By:	R. M. Smith	Principal	NewFields

DATE ISSUED	REVISION	ISSUED FOR	REMARKS
07/31/23	0	Issued for Tender	

SOURCE	SOURCE DESCRIPTION
A	Data Provided by South32
B	NewFields
C	United States Department of Labor Mine Safey and Health Administration (MSHA)
D	Ecological Resources Consultants, Inc., (2017), Technical Memorandum Arizona Mine Site Meteorological Analysis, dated March 13
E	Ecological Resources Consultants, Inc., (2020), Technical Memorandum South32 Mine Site Precipitation Analysis, dated January 2
F	Arizona Mining Guidance Manual (BADCT), Aquifer Protection Program, Arizona Department of Environmental Quality
G	Arizona Department of State, The Arizona Administrative Code, title 12. Natural Resources, Chapter 15. Department of Water Resources (December 31, 2016)
H	Australian National Committee on Large Dams, Guidelines on Tailings Dams, Planning, Design, Construction, Operation and Closure, Revision 1, July.
I	Global Industry Standard on Tailings Management, Global Tailings Review, 2020
J	NewFields Mining Design & Technical Services, (2021c) Hermosa Project Seismic Hazard Assessment, Santa Cruz County, Arizona, dated April 2021
K	NewFields Mining Design & Technical Services, (2022), Geotechnical Laboratory Testing (Main and Ventilation Shaft Boreholes)
L	NewFields Mining Design & Technical Services, (2022), Geotechnical Borrow Source Investigation Summary (Existing Material Stockpiles Located at the Infrastructure Pad and Other Miscellaneous Sources)
M	NewFields Mining Design & Technical Services, (2023), Hermosa Project, Tailings Storage Facility 1 (TSF1), Aquifer Protection Permit (APP) Significant Amendment, Best Available Demonstrated Control Technology (BADCT) Design

South32 Hermsoa Inc
Hermosa Project
Appendix A
Design Criteria

GENERAL INFORMATION

DESCRIPTION	VALUE	COMMENT
SITE LOCATION		
General project location	50 miles southeast of Tucson, Arizona, approximately 8 miles north of the U.S. border with Mexico, in Santa Cruz County	
Site access	Harshaw Road through the town of Patagonia	
Project name	Tailings Storage Facility 1 (TSF1)	
BASE MAPPING		
Projection system	NAD 83, Arizona State Plane Central Zone International Feet	Veritical datum is NAVD88
Units	English	
Topographic files	Various	Document Register in the Site Characterization Report for comprehensive list of topographic files
CODES AND STANDARDS		
ADEQ	Arizona Department of Environmental Quality	
ADWR Dam Safety	Arizona Department of Water Resources Dam Safety	
ANCOLD	Austrailian National Committee On Large Dams	
ASTM	American Society for Testing and Materials	
AZPDES	Arizona Pollutant Discharge Elimination System	
BADCT	Best Available Demonstrated Control Technology	Arizona Mining BADCT Guidance Manual (Auquifer Protection Program)
GISTM	Global Industry Standard on Tailings Management	
GRI	Geosynthetic Research Institute	
ICMM	International Council on Mining & Metals	
MSHA	Mine Safety and Health Administration	
LIST OF ABBREVIATIONS		
AEP	annual exceedance probability	
AMSL	above mean sea level	
FoS	factor of safety	
H:V	Horizontal:Vertical	
HDPE	high density polyethylene	
MCE	maximum credible earthquake	
Non-PAG	non-potentially acid generating	
PAG	potentially acid generating	
PGA	peak ground acceleration	
PMF	probable maximum flood	
PMP	probable maximum precipitation	
TBD	to be determined	
TSF	tailings storage facility	
WTP	water treatment plant	
UNITS		
cy	cubic yards	
°F	degree fahrenheit	
ft	feet/foot	
gpm	gallons per minute	
hr	hour	
in	inch/inches	
M	million	
mil	one-thousand of an inch	
pcf	pounds per cubic foot	
st	short tons	
yr	year	

METEOROLOGICAL/CLIMATOLOGICAL DATA

DESCRIPTION	VALUE	SOURCE
CLIMATOLOGICAL FACTORS		
Average annual precipitation	25.18 in	D
Average annual pond evaporation	47.30 in	D
Average winter minimum temperature	28 °F	D
Average daily maximum temperature	96 °F	D
STORM EVENTS		
2-yr/24-hr	2.31 in	D
5-yr/24-hr	2.87 in	D
10-yr/24-hr	3.32 in	D
25-yr/24-hr	3.93 in	D
50-yr/24-hr	4.40 in	D
100-yr/24-hr	4.88 in	D
100-yr/72-hr	6.07 in	E
500-yr/24-hr	6.02 in	D
Local PMP (6-hr)	14.63 in	D
General PMP (72-hr)	20.81 in	D
AVERAGE MONTHLY PRECIPITATION		
January	1.66 in	D
February	0.88 in	D
March	2.51 in	D
April	0.35 in	D
May	0.38 in	D
June	0.87 in	D
July	5.66 in	D
August	5.59 in	D
September	4.38 in	D
October	0.63 in	D
November	0.63 in	D
December	1.64 in	D
AVERAGE MONTHLY PAN EVAPORATION		
January	3.13 in	D
February	3.76 in	D
March	5.47 in	D
April	6.22 in	D
May	8.94 in	D
June	10.41 in	D
July	5.16 in	D
August	4.72 in	D
September	4.63 in	D
October	5.93 in	D
November	4.35 in	D
December	2.98 in	D
AVERAGE MONTHLY POND EVAPORATION		
January	2.26 in	D
February	2.71 in	D
March	3.94 in	D
April	4.48 in	D
May	6.44 in	D
June	7.50 in	D
July	3.72 in	D
August	3.40 in	D
September	3.33 in	D
October	4.27 in	D
November	3.13 in	D
December	2.14 in	D
CLIMATE CHANGE		
Climate Change Impacts (RCP4.5 and RCP8.5 for 2030, 2050, 2090)	Reference Design Report for a Table with temperature, rainfall, atmosphere, solar radiation, and wind speed data.	A

South32 Hermsoa Inc
Hermosa Project
Appendix A
Design Criteria

NewFields

TAILINGS STORAGE FACILITY

DESCRIPTION	VALUE	COMMENT	SOURCE
FILTERED TAILINGS, WASTE ROCK, CONSTRUCTION CUT, AND MISCELLANEOUS MATERIALS TO TSF			
Production (filtered) tailings (reporting to TSF)	8.0 Mst (5.5 Mcy)	Value provided by South32	A
Waste rock (reporting to TSF)	PAG: 1.9 Mst (PAG: 1.1 Mcy)	Value provided by South32	A
PAG Construction Cut	~20,000 cy	Value provided by South32	A
Miscellaneous Materials	Approximately 100,000 cy (12,000 cy/yr for 8 years)	Includes solids from water treatment including filter cake from WTP1 and WTP2, core cutting material, construction PAG cut, drill cuttings, sediments from stormwater BMPs, assay rejects, and sediments from vehicle and equipment wash sumps. Values provided by South32.	A
FILTERED TAILINGS PROPERTIES			
Minimum (placed) dry density	108 pcf	Data from laboratory test results (standard proctor), minimum 93% relative compaction	M
Material properties	~42% - 48% passing the no. 200 sieve and non-plastic	Laboratory testing results	M
Optimum moisture content	14.4%	Optimum moisture content associated with maximum dry density	M
WASTE ROCK PROPERTIES			
Minimum (placed) dry density	125 pcf	Value estimated by NewFields/South32	A, B
CONSTRUCTION CUT (PAG) PROPERTIES			
Minimum (placed) dry density	125 pcf	Value estimated by NewFields/South32	B
MISCELLANEOUS MATERIAL PROPERTIES (WTP1 FILTER CAKE, CORE CUTTINGS MATERTIAL, ETC)			
Minimum (placed) dry density	108 pcf	Assume to be same as filtered tailings after placement.	B
FACILITY FEATURES			
Embankment type	Rockfill/earthfill		B
Embankment construction method	Engineered fill	Contractor placed	B
Final embankment crest width	25 ft	Minimum	B
Downstream embankment slope	2.0H:1V (Fill)	Maximum (Benching to be considered for slopes greater than 30 vertical ft)	B
Upstream embankment slope	2.5H:1V	Maximum	B
Lining requirement	Composite liner (60 mil HDPE geomembrane placed over 12 inches of low permeability soil material or a geosynthetic clay liner)	Prescriptive BADCT	F
Maximum basin slope	2.5H:1V		B
Minimum basin slope	1%		B
Basin underdrain system	Protective/drainage layer with a minimum thickness of 18 inches, underdrain collection system consisting of perforated drain pipe encapsulated in a drainage aggregate and placed within topographic lows (drainages)		F
Stacking slope	3.0H:1V compound slope		B
Required storm event containment	100-yr/24-hr storm (2 ft freeboard) 100-yr/72-hr storm (1.64 ft freeboard)	BADCT: 100-yr/24-hr ANCOLD (High C): 100-yr/72-hr	F, H
TSF emergency spillway	Safely pass the PMF (no freeboard requirement)	ANCOLD (High C) - PMF GISTM (Significant) - 1,000-yr (active care), 10,000-yr (passive care)	H, I

UNDERDRAIN COLLECTION POND

DESCRIPTION	VALUE	COMMENT	SOURCE
GENERAL			
Required storm event volume (containment)	100-yr/24-hr storm (2 ft freeboard) 100-yr/72-hr storm (1.64 ft freeboard)	BADCT: 100-yr/24-hr ANCOLD (High C): 100-yr/72-hr	F, H
Emergency spillway sizing	0.25 PMF (3 ft freeboard[1]) PMF (no freeboard requirement)	ADWR Dam Safety: 0.25 PMF ANCOLD (High C): PMF	G, H
Embankment type	Rockfill/earthfill	Contractor placed	B
Final embankment crest width	25 ft minimum	50' minimum width for access to LCRS/pumpback system	B
Downstream embankment slope	2.0H:1V	Maximum (Benching to be considered for slopes greater than 30 vertical ft)	B
Upstream embankment slope	2.0H:1V	Maximum	B
Minimum basin slope	1%	Minimum	B
Lining system	Double liner system with an LCRS sited between the two 60 mil HDPE geomembranes. Secondary liner shall be a composite liner consisting of a 60 mil HDPE geomembrane placed over 6 in low permeability soil material or GCL.	Geonet sited between the primary and secondary geomembranes	F

Notes: [1] Vertical distance between the emergency spillway crest and top of dam must also be a minimum of 5 ft.

WATER BALANCE

DESCRIPTION	VALUE	COMMENT	SOURCE
WATER BALANCE SIMULATION			
Method of simulation	Excel Model		-
Model time-step	Daily		-
Design storm	See Underdrain Collection Pond design criteria		F, G, H
Underdrain collection pond freeboard to spillway invert (residual freeboard)	2 ft (See Underdrain Collection Pond design criteria)	Freeboard to Underdrain Collection Pond crest is 7 ft Freeboard to Underdrain Collection Pond spillway invert is 2 ft (residual freeboard)	F, G
Minimum pond operating depth	Depth sufficient for pump actuation		-
Maximum pond operating depth	To be determined based on maintaining available storage for the design storm events plus freeboard		-
Water treatment plant capacity	120 gpm (WTP1) WTP2 treatment rate to be provided by South32		-

BORROW SOURCES

DESCRIPTION	VALUE	COMMENT	SOURCE
Materials			
	Source		
Engineered fill	Local soils and rock	As required	B
Wearing course	Local soils and rock (processed on site) or import	As required	B
Protective layer	Local soils and rock (processed on site) or import	Mine development waste rock to be considered primary source	K
Armoring berm	Local soils and rock (potentially requiring processing on site) or mine waste rock	Mine development waste rock to be considered primary source	B, K
Drainage aggregate	Local soils and rock (processed on site) or import	Mine development waste rock to be considered primary source	K
Low permeability soil liner	Local soils and rock (processed on site) or import	Existing stockpile located on the Infrastructure Pad to be considered primary source	L

ROADS

DESCRIPTION	VALUE	COMMENT	SOURCE
HAUL/CONSTRUCTION ROAD (PERMANENT)			
Maximum road grade	10%		A
Minimum road width	38.5 ft	Clear distance between berms	A
Minimum road turning radius	125 ft	Measured from centerline	B
Safety berm height	Equal to the axle height of the largest piece of equipment on the road	MSHA	C
Design vehicle	745 articulated haul truck		A
Traffic pattern	Right hand traffic		A
TSF PERIMETER ROAD			
Maximum road grade	15%		A
Minimum road width	16 ft	Clear distance between berms	A
Safety berm height	Equal to the axle height of the largest piece of equipment on the road	MSHA	C
Design vehicle	Light vehicle		A
Traffic pattern	Right hand traffic	One way (limited traffic on facility perimeter roads)	A

NewFields

STORMWATER DIVERSION CHANNELS AND CULVERTS

DESCRIPTION	VALUE	COMMENT	SOURCE
Permanent External Diversion Channels			
Storm event for depth sizing	100-yr/24-hr storm (1 ft freeboard) 1,000-yr (active care) 10,000-yr (passive care)	ADEQ minimum requirement GISTM (active care) GISTM (passive care)	F, I
Storm event for erosion control design	100-yr/24-hr storm (minimum)	If cut into bedrock, erosion control may not be necessary	B
Erosion protection	Riprap, bedrock or vegetated		F
Permanent TSF Internal Diversion Channels (Containment)			
Storm event for sizing	100-yr/24-hr storm (2 ft freeboard) 100-yr/72-hr storm (1.64 ft freeboard)	BADCT minimum requirement ANCOLD minimum requirement	F, H
Emergency Spillway			
Storm event for sizing	See TSF and Underdrain Collection Design Criteria	ADWR Dam Safety (UDCP only), ANCOLD and GISTM requirements	G, H, I
Culverts			
Storm event for size requirements	Match channel size		B
Diameter requirement	As required		B
Material type	CPeP or HDPE		B
Maximum headwater	1.5:1 HW/D		B
Runoff Collection Ponds			
Impacted construction runoff	Employ best management practices		B
Sediment basin sizing	Sized per acre of distrubed area	Based on NRCS conservation practice standard Arizona	B

STABILITY ANALYSIS

DESCRIPTION	VALUE	COMMENT	SOURCE
Stability Analysis			
Static factor of safety (minimum)	1.5 (permanent slope)	ANCOLD: Long term drained (FoS≥1.5), short term undrained with potential loss of containment (FoS≥1.5), short term undrained with no potential loss of containment (FoS≥1.3) ADEQ BADCT: Site specific material testing data (FoS≥1.3)	F, H
Psuedostatic factor of safety (minimum)	≥ 1.0 or acceptable deformation	BADCT requirement	F
Post seismic factor of safety	1.0 - 1.2	ANCOLD minimum requirement	H
Maximum design earthquake	Greater of MCE or 10,000-yr (design to passive closure value)	BADCT: 450-yr ANCOLD (High C): 2,000-yr (active), 10,000-yr (passive) GISTM (Significant): 1,000-yr (active), 10,000-yr (passive)	F, H, I
Seismic Hazard Assessment	MCE for deterministic and 10,000-yr probabilistic assessments are 0.13 gravity (g) and 0.22 g, respectively	Seismic Hazard Assessment updated by NewFields April 2021	J

APPENDIX B

Seismic Hazard Report

HERMOSA PROJECT
SEISMIC HAZARD ASSESSMENT
SANTA CRUZ COUNTY, ARIZONA

Prepared for:

South32 (Arizona Minerals Inc.)
2210 East Fort Lowell Road
Tucson, AZ 85719

Prepared by:

NewFields Mining Design & Technical Services
9400 Station Street, Suite 300
Lone Tree, Colorado 80124

NewFields Project No. 475.0014.024
April 2021

April 23, 2021
NewFields Project No. 475.0014.024

South32 (Arizona Minerals Inc)
2210 East Fort Lowell Road
Tucson, Arizona 85719

Attention: **Garner Lea (South32)**

Re: **Hermosa Project**
Seismic Hazard Assessment
Santa Cruz County, Arizona

Mr. Lea,

We are pleased to submit the updated seismic hazard assessment report for the Hermosa Project. Historical seismicity and regional seismic sources are presented, and design-level ground motions were developed. This report is a revision to the original seismic hazard report completed in 2017 and considers development of additional prescriptive criteria referenced in international guidance documents.

We appreciate the opportunity to work with Arizona Minerals Inc. on this project. If you have any questions or require additional information, please contact the undersigned.

Sincerely,
NewFields Mining Design & Technical Services

Nicholas Rocco, Ph.D., P.E.
Principal Geotechnical Engineer

Craig Thompson, P.E.
Senior Engineer

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1. INTRODUCTION

This report presents the seismic hazard assessment (SHA) for the Hermosa Project and includes a summary of regional seismicity and the development of design level ground motions. This report is a revision to the original seismic hazard report completed (NewFields, 2017a) and considers development of additional prescriptive criteria referenced in international guidance documents. The Project site is located in the northern end of the Patagonia Mountains, in Santa Cruz County, Arizona. The approximate latitude and longitude of the site are 31.47°N and 110.73°W, respectively.

The primary objective of this SHA was to characterize the site-specific ground motion hazard for potential future earthquakes in the region. The ground motions developed and summarized herein consider prescriptive design criteria referenced in the Arizona Best Available Demonstrated Control Technology (BADCT) Manual. BADCT references the Maximum Probable Earthquake (MPE) as an event with a 20 percent chance of exceedance in 100 years (450 year return period) and the Maximum Credible Earthquake (MCE).

Additional international standards for the design of tailings storage facilities have been reviewed to ensure all potential seismic design criteria are available for design. The recommendations presented in the Global International Standard for Tailings Management (GISTM) and the Australian National Committee on Large Dams (ANCOLD) were reviewed and considered for this revision. The ground motions presented are sufficient for seismic design of all engineered structures at the Project, but seismic design criteria will change for the various structures. The scope of work completed included:

- Review of available literature and project specific reports related to regional geology and tectonics, particularly during the Quaternary Period (last 2.6 million years);
- Review of earthquake catalogues to identify historical earthquake activity within approximately 124 miles (200 km) of the Project;
- Identification of seismogenic fault sources within 124 miles of the Project;
- Completion of a deterministic seismic hazard analysis (DSHA) to identify the median (50^{th} percentile) and 84^{th} percentile peak ground acceleration (PGA) and spectral acceleration values;
- Utilization of probabilistic SHA tools from the United States Geological Survey (USGS) to identify PGA and spectral acceleration values for 200-year, 475-year, 1,000-year, 2,475-year, 5,000-year, and 10,000-year return periods;
- Identification of the site classification and code-based seismic ordinates for structural design; and
- Preparation of this technical report describing the data, methods, and results.

2. REGIONAL GEOLOGY AND TECTONIC SETTING

The Project lies within the Patagonia Mountains in the southern Basin and Range Physiographic Province of the Western United States and northern Mexico. The province is an actively deforming region of crustal extension over the last 65 million years.

The Project is located northeast of the highly seismic area of the Gulf of California, which is a 1,300 kilometer (km) active rift zone between the East Pacific Rise at the southern margin of the Gulf and the San Andreas Fault in southern California, and south of the seismically active area of north-northwest Arizona near Flagstaff and the Grand Canyon. The regional seismic hazard has been categorized as moderate to low (Pearthree, 1998).

Surficial colluvial and alluvial sediments are thinly spread across the project site, and in general competent rock conditions are found at or near the existing ground surface.

2.1. Historical Seismicity

Historical seismicity in the region was reviewed to identify earthquake events with a moment magnitude (M_w) of 4.0 or greater utilizing the earthquake catalogs developed by the International Seismological Centre (ISC), Southern California Earthquake Data Center (SCEDC), México Servicio Sismológico Nacional (SSN) – Universidad Nacional Autónoma de Mexico, and the Advanced National Seismic System (ANSS) Comprehensive Catalog. All identified historical events were reviewed, and duplicate events, foreshocks and aftershocks were removed.

Figure 1 presents regional historical earthquake epicenters. Historical records from 1850 to 2020 indicate that at least 32 earthquakes with a magnitude greater than 4 have been recorded within 124 miles of the project site, but few sizeable seismic events have been recorded. The historic events greater than M 5.0 are listed in Table 2.1**.** The largest historic event was the 1887 Sonora earthquake along the Pitaycachi Fault in northeastern Sonora, a magnitude 7.6 event occurring at a distance of approximately 100 miles from the Project.

Table 2.1 - Historic Seismic Events with M_w 5.0 or Greater within 124 miles of the Site

Date	Name	Magnitude		Distance to Site (miles)
		Scale	Value	
5/3/1887	Sonora Earthquake	M_w	7.6	98.8
6/29/2014	Unnamed	M_w	5.3	119.5
5/26/1907	Unnamed	M_w	5.2	98.8

2.2. Seismogenic Fault Sources

Regional faults within a 124 mile (200 km) radius from the project site were identified using the USGS Fault and Fold database. Sixteen mapped faults were identified with Quaternary activity. Approximately 25 percent of the faults indicate displacement has occurred during the Holocene (past 15,000 years), 30 percent indicate displacement in the late Quaternary (past 130,000 years), 30 percent indicate displacement in the mid Quaternary (past 750,000 years), and the remainder of the faults indicate older fault activity. Parameters for the Quaternary faults are documented in Table 2.2, and traces of all the active faults in relation to the project site are presented in **Figure 1**.

Table 2.2 - Fault Parameters for Regional Faults

Fault Name	Sense of Slip[1]	Dip Direction[1]	Length[1] (mi)	Rupture Width[2] (mi)	Age of Activity	Maximum EQ Magnitude[3]	Distance[4] (mi)
Santa Rita Fault Zone (FZ)	Normal	NW	32	9	< 130ka	6.7	18.6
Huachuca Fault Zone	Normal	East	16	6	< 750ka	6.4	29.8
California Wash Fold/Fault	Normal	East	4	3	< 1.6Ma	5.5	37.3
Little Rincon Mtns Fault	Normal	East	11	6	< 1.6Ma	6.3	59.0
Pitaycachi Fault	Normal	West	65	9	< 130ka	7.6[5]	93.2
Pedrogosa Fault	Normal	East	16	6	< 750ka	6.3	80.8
Chiricahua Fault Zone	Normal	East	17	6	< 750ka	6.3	97.6
Gray Ranch Fault Zone	Normal	East	12	6	< 130ka	6.3	110.6
Gillespie Mountain Fault	Normal	West	14	6	< 130ka	6.4	119.9
Washburn Ranch FZ	Normal	East	7	3	< 15ka	5.8	113.7
Animas Valley Faults	Normal	West	12	6	< 15ka	6.3	121.2
Unnamed Faults West of Pyramid Mountain	Normal	West	10	6	< 130ka	6.2	121.2
Safford FZ – S. Section	Normal	NE	10	6	< 15ka	6.2	98.2
Safford FZ – N. Section	Normal	NE	9	6	< 15ka	6.2	101.3
Cactus Flats Faults	Normal	NE/SW	6	3	< 750ka	5.7	106.9
Buena Vista Fault	Normal	NW	3	3	< 750ka	5.3	114.3

Notes:

1 From USGS Quaternary fault and fold database.
2 Rupture width estimated.
3 Maximum EQ magnitude estimated with Wells and Coppersmith (1994) relationship. Rupture length was assumed to be half the total fault length for faults greater than 31 miles, two-thirds of the fault length for fault lengths between 15.5 and 31 miles, and the total fault length for faults less than 15.5 miles in length.
4 Closest distance estimated based on fault rupture to the ground surface.
5 Earthquake magnitude estimated from Wells and Coppersmith (1994) relationship was less than the historic earthquake event along the Pitaycachi Fault, and thus an increased magnitude was considered in the deterministic assessment.

3. DETERMINISTIC SEISMIC HAZARD

Ground motions associated with the MCE were assessed using deterministic methods. The MCE is the largest deterministic event considered possible under the current tectonic regime. PGA values were estimated for potential seismogenic fault sources within 62 miles (100 km) of the site. The energy associated with rupture of fault sources further than this distance would be significantly attenuated and generally not capable of damaging ground motions at the Project.

3.1. Ground Motion Prediction Equations

Ground motion prediction equations (GMPE), also referred to as attenuation relationships, relate PGA or response spectral acceleration to earthquake magnitude, source-to-site distance, and local site conditions. Spectral acceleration values are considered 5 percent damped for this evaluation, which is typical.

The GMPE used in this analysis were selected based on the similarity between the tectonic and geologic conditions surrounding the Project and those where the earthquake motions were recorded and used to derive the empirical GMPE.

Four of the Pacific Earthquake Engineering Center Next Generation of Ground Motion Attenuation Phase 2 Project (PEER NGA-West2) GMPE were used for the deterministic evaluation. The four NGA-West2 GMPE, Abrahamson et al. (2014), Boore et al. (2014), Campbell and Bozorgnia (2014), and Chiou and Youngs (2014), were used and weighted equally. The NGA-West2 GMPE were developed for active tectonic regions based mostly on earthquake strong ground motion data recorded at seismically active, present-day plate boundaries, primarily from the western United States and around the world, making them well suited for this study.

For seismic hazard evaluations, the averaged shear wave velocity in the upper 100-feet below the ground surface (V_{s30}) is a typical proxy for the site ground conditions. A number of the GMPE scale to the V_{s30} value, so it is an important parameter. The GMPE considered an average shear wave velocity of 2,800 feet per second (854 meters per second) in the upper 100-feet of the subsurface materials, based on geophysical data from the site. The estimated V_{s30} results in site class B, rock ground conditions, per ASCE7-16 (American Society of Civil Engineers).

The GMPE rely on estimation of the various site-to-source distance parameters, including the closest horizontal distance to the surface projection of the rupture, often called the Joyner-Boore distance, and the closest direct distance to the rupture plane. The distance parameters were estimated following the recommendations of Kaklamanos et al. (2011).

For the dip angle, angles of 35 degrees, 50 degrees, and 65 degrees were considered, and the angles were weighted at 0.2, 0.6, and 0.2, respectively, for the deterministic evaluation.

3.2. Maximum Credible Earthquake

The calculated accelerations for the seismogenic faults are presented in Table 3.1 for both median and 84th percentile values. Some of the fault sources previously presented in Table 2.2 were omitted, since the estimated PGA were nonconsequential. As previously mentioned, the listed PGA values were equally weighted between the four NGA-West2 GMPE, and the values also include weighting for variable dip angles. The data indicates the deterministic MCE ground motions are controlled by a M6.7 rupture of the Santa Rita Fault Zone at a distance of approximately 19 miles.

Table 3.1 - Horizontal Peak Ground Accelerations

Fault	Approx. Distance (mile)	Peak Ground Acceleration (g)	
		Median	84th Percentile
Santa Rita Fault Zone	19	0.07	0.13
Huachuca Fault Zone	30	0.03	0.06
California Wash Fold/Fault	37	0.01	0.02
Little Rincon Mountains Fault	59	0.01	0.02
Pedrogosa Fault	81	0.01	0.02
Pitaycachi Fault	93	0.02	0.04
Chiricahua Fault Zone	98	0.01	0.01

Table 3.2 summarizes the MCE median and 84th percentile horizontal spectral accelerations (5 percent damped) at discrete spectral periods for the Project. These values represent the most conservative estimate of the PGA at the site from the MCE event.

Table 3.2 – MCE Horizontal Spectral Accelerations

Spectral Period (sec)	Spectral Acceleration (g)		Spectral Period (sec)	Spectral Acceleration (g)	
	Median	84th Percentile		Median	84th Percentile
PGA	0.071	0.128	0.4	0.105	0.200
0.01	0.071	0.129	0.5	0.088	0.168
0.02	0.073	0.132	0.75	0.060	0.119
0.03	0.081	0.148	1	0.044	0.087
0.05	0.102	0.193	1.5	0.027	0.055
0.075	0.127	0.246	2	0.019	0.039
0.1	0.143	0.277	3	0.008	0.024
0.15	0.158	0.301	4	0.005	0.016
0.2	0.156	0.294	5	0.004	0.012
0.25	0.143	0.268	7.5	0.002	0.006
0.3	0.129	0.243	10	0.001	0.003

4. PROBABILISTIC SEISMIC HAZARD ANALYSIS

Probabilistic PGA values for return periods ranging from 200-years to 10,000-years were obtained using the online USGS Unified Hazard Tool. The current Unified Hazard Tool uses the 2014 edition of the USGS probabilistic ground motions. The online calculator allows for a Site Class B/C (V_{s30} = 2,500 ft/s), which is similar to the measured velocity in the subsurface at the Project. The various return periods along with corresponding PGA (g) values are presented in Table 4.1. Hazard curves and uniform hazard response spectra are presented in **Appendix A**.

Table 4.1 - Probabilistic Design Accelerations

Return Period	PGA (g)
200-Year	0.02
475-Year	0.03
1,000-Year	0.06
2,500-Year	0.10
5,000-Year	0.15
10,000-Year	0.22

4.1. Deaggregation Analysis

Deaggregation analysis of the seismic hazard is used to identify magnitude and source locations that contribute to the mean hazard at a given return period for a given spectral acceleration. In general, hazard sources are either associated with known faults or from background earthquakes not associated with known faults (generally referred to as gridded area or areal sources). Deaggregation is used to confirm the dominant earthquake magnitude and distance that contributes most to the site hazard. The USGS Unified Hazard Tool provides the results of the PGA deaggregation analysis, and results are presented in **Appendix A**. The color bars in the deaggregation plots indicate how much of the hazard contribution is above the median PGA; referred to as the epsilon parameter. An epsilon of 0 indicates a median value. Negative epsilon numbers indicate standard deviations below the median and positive numbers indicate standard deviations above the median.

Review of the deaggregation plots indicate only gridded, background sources contribute to the earthquake hazard at all return periods. Background events within 10 miles of the site are dominant. For example, for the 10,000-year return event approximately 40 percent of the hazard is for modest sized earthquake magnitudes within 6 miles of the project location.

Based on the magnitude and distance pairs, the controlling earthquakes are defined by the mean and modal magnitudes and distances. Mean magnitudes and distances are computed from hazards within 124 miles of the Project. Modal magnitude and distance are based on full hazard results for all magnitudes and distances. Mean magnitudes are between M6.0 and M6.2 and modal magnitudes are between M5.1 and M5.5 for all return periods. Mean and modal distances generally decrease with increasing return period.

5. SITE CLASSIFICATION

Based on the results of the recent geotechnical subsurface investigation program, and in accordance with the 2018 IBC and ASCE 7-16, the site classifies as rock, Site Class B, with the upper 100-feet dominated by andesite. The site classification is based on natural rock and overburden, and does not consider existing or future mine deposits and engineered landforms.

The code based maximum earthquake response accelerations at short and long periods, S_S and S_1, respectively, were determined and relevant seismic design values for structures are listed in Table 5.1.

Table 5.1 - Code Based Seismic Parameters

Site Soil Class	B
Mapped MCE_R, five (5) percent damped, spectral response acceleration parameter at short periods (Site Class B), S_S	0.233g
Mapped MCE_R, five (5) percent damped, spectral response acceleration parameter at a period of one (1) second (Site Class B), S_1	0.074g

6. CONCLUSIONS

Ground motions associated with the maximum credible earthquake and various risk levels were assessed using both deterministic and probabilistic methods to estimate potential earthquake ground motions at the Hermosa project site. Deterministic calculations were completed after identification of seismogenic faults near the Project using four of the NGA-West2 GMPE. Probabilistic ground motions were estimated using the USGS Unified Hazard Tool. The results of the SHA indicate:

- The regional seismic hazard has been categorized as moderate to low (Pearthree, 1998).
- The historic earthquake search indicates few sizeable seismic events have been recorded within the vicinity of the Project since 1850.
- Sixteen mapped faults were identified with Quaternary activity within 124 miles of the Project. Approximately 25 percent of the faults indicate displacement has occurred during the Holocene (past 15,000 years), 30 percent indicate displacement in the late Quaternary (past 130,000 years), 30 percent indicate displacement in the mid Quaternary (past 750,000 years), and the remainder of the faults indicate older activity.
- Deterministic MCE ground motions are controlled by a M6.7 rupture (the maximum magnitude expected for this fault system) of the Santa Rita Fault Zone at a distance of approximately 20 miles. The MCE median and 84th percentile PGA values are 0.07g and 0.13g, respectively. Calculated PGA values significantly decrease for fault sources exceeding 20 miles from the Project.
- Deterministic ground motions for regional faults that have potential earthquakes with larger magnitudes or higher earthquake frequency, such as the Pitaycachi Fault or Safford Fault, are at distances that they do not control the deterministic MCE event for the Project.
- Probabilistic PGA ground motions were estimated as 0.02g, 0.03g, 0.06g, 0.10g, 0.15g, and 0.22g for return periods of 200-year, 475-year, 1,000-year, 2,500-year, 5,000-year, and 10,000-year, respectively. Hazard deaggregation of the probabilistic events indicates a dominant contribution from the shallow crustal gridded area sources with earthquake magnitudes from approximately M5.0 to M6.0. Contributions from the regional fault systems do not contribute significantly to the hazard.

7. REFERENCES

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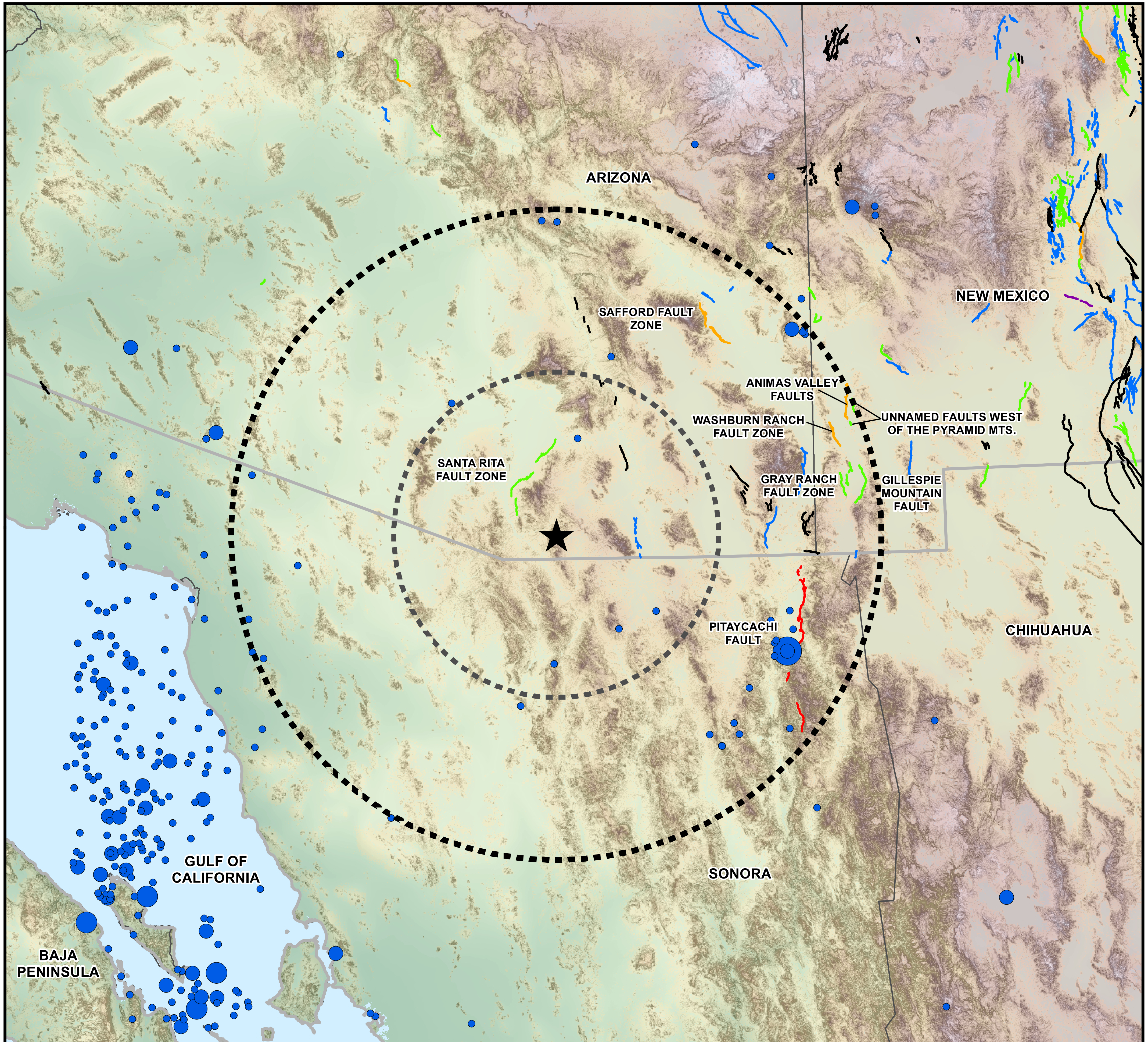
FIGURE



LEGEND

★ HERMOSA PROJECT

124 MILE (200 km) RADIUS

62 MILE (100 km) RADIUS

ACTIVE FAULTS

- HISTORICAL (<150 YEARS)
- LATEST QUATERNARY (<15,000 YEARS)
- LATE QUATERNARY (<130,000 YEARS)
- MIDDLE AND LATE QUATERNARY (<750,000 YEARS)
- UNDIFFERENTIATED QUATERNARY (<1.6 MILLION YEARS)
- CLASS B (VARIOUS AGE)

HISTORICAL EARTHQUAKE MAGNITUDE

- 4.0 - 4.9
- 5.0 - 5.9
- 6.0 - 6.9
- >7

ELEVATION (feet)

4400

2200

0

0 20 40 60

Miles

References:

1. Historic earthquakes from ISC, ANSS, SSN and SCEDC catalogs.
2. Quaternary Faults from USGS Fault and Fold Database.

NewFields	CLIENT	SOUTH32 (AMI)	
PROJECT	HERMOSA PROJECT		
TITLE	HISTORIC SEISMICITY AND ACTIVE FAULTS	FILENAME GIS-0014.008.002F.mxd	
		FIGURE NO. 1	REV 1

F:\Drive_P_Projects\Hermosa\DATA\GIS-0014.008.002F.mxd

APPENDIX A

U.S. Geological Survey - Earthquake Hazards Program

Unified Hazard Tool

Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the U.S. Seismic Design Maps web tools (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Input

Edition
Dynamic: Conterminous U.S. 2014 (u…

Latitude
Decimal degrees
31.47

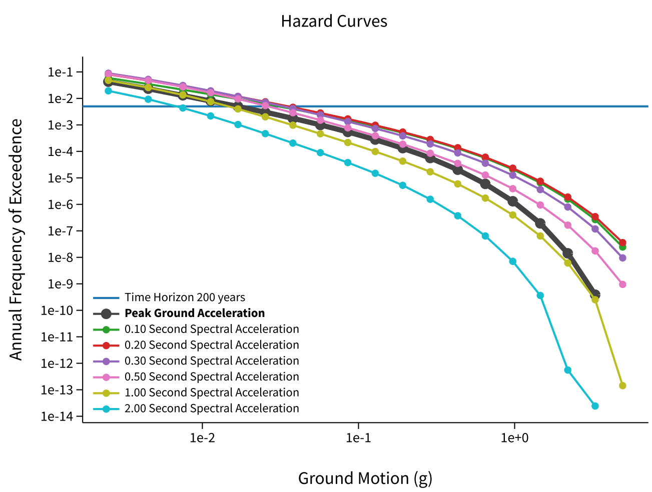
Longitude
Decimal degrees, negative values for western longitudes
-110.73

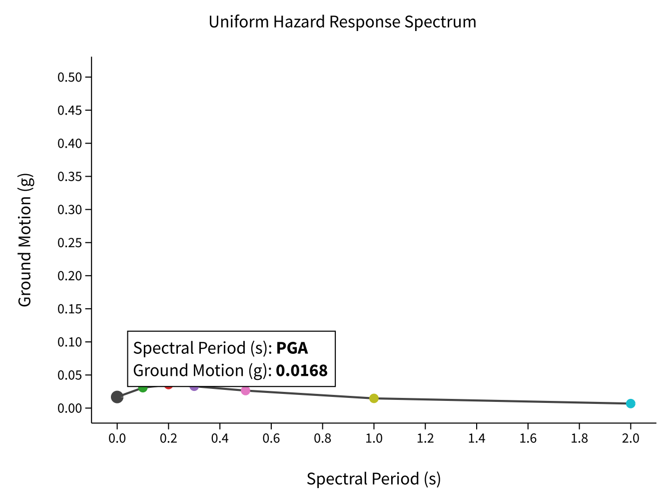
Site Class
760 m/s (B/C boundary)

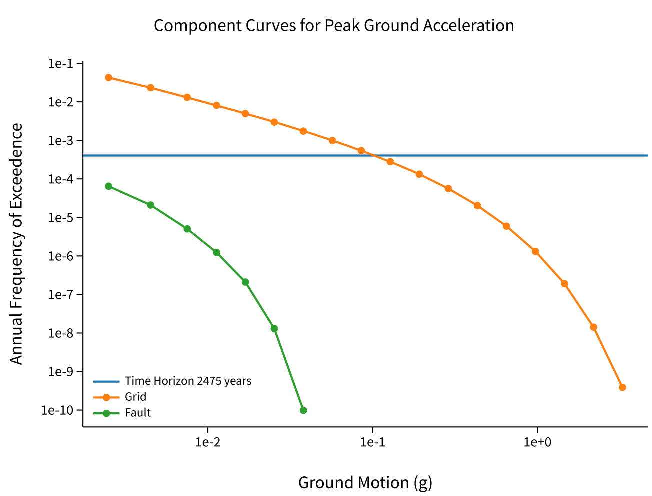
Spectral Period
Peak Ground Acceleration

Time Horizon
Return period in years
200

Hazard Curve





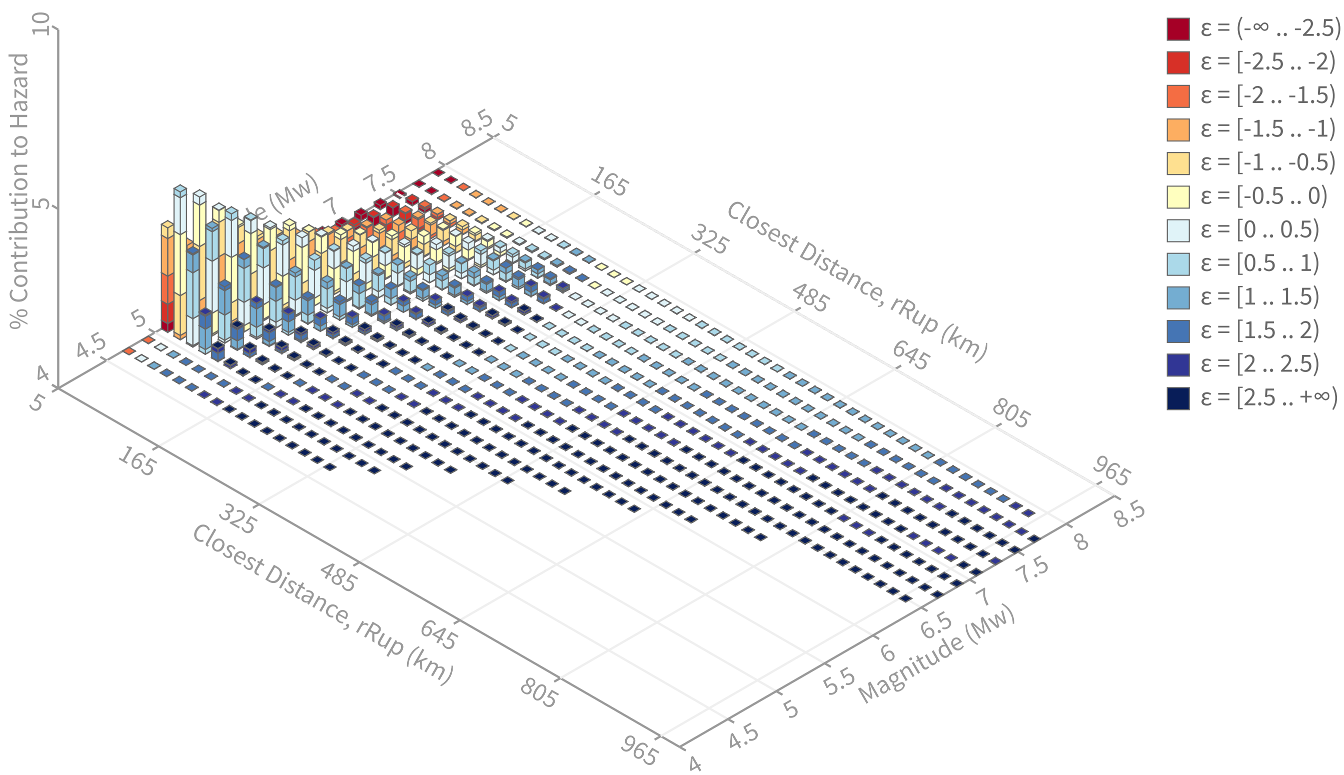


View Raw Data

Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 200 yrs
Exceedance rate: 0.005 yr^{-1}
PGA ground motion: 0.016781766 g

Recovered targets

Return period: 203.01889 yrs
Exceedance rate: 0.00492565 yr^{-1}

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.91 %

Mean (over all sources)

m: 6.04
r: 75.93 km
ε_0: -0.39 σ

Mode (largest m-r bin)

m: 5.1
r: 29.9 km
ε_0: -0.24 σ
Contribution: 4.11 %

Mode (largest m-r-ε_0 bin)

m: 5.1
r: 29.96 km
ε_0: -0.24 σ
Contribution: 1.7 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

Deaggregation Contributors

Source Set ↳ Source	Type	r	m	ε_0	lon	lat	az	%
EXTmap_2014_fixSm.ch.in (opt)	Grid							36.07
EXTmap_2014_adSm.ch.in (opt)	Grid							23.10
EXTmap_2014_fixSm.gr.in (opt)	Grid							18.01
EXTmap_2014_adSm.gr.in (opt)	Grid							11.54
EXTmap_2014_fixSm_M8.in (opt)	Grid							6.56
EXTmap_2014_adSm_M8.in (opt)	Grid							4.19

U.S. Geological Survey - Earthquake Hazards Program

Unified Hazard Tool

Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the U.S. Seismic Design Maps web tools (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Input

Edition

Dynamic: Conterminous U.S. 2014 (u…

Latitude

Decimal degrees

31.47

Longitude

Decimal degrees, negative values for western longitudes

-110.73

Site Class

760 m/s (B/C boundary)

Spectral Period

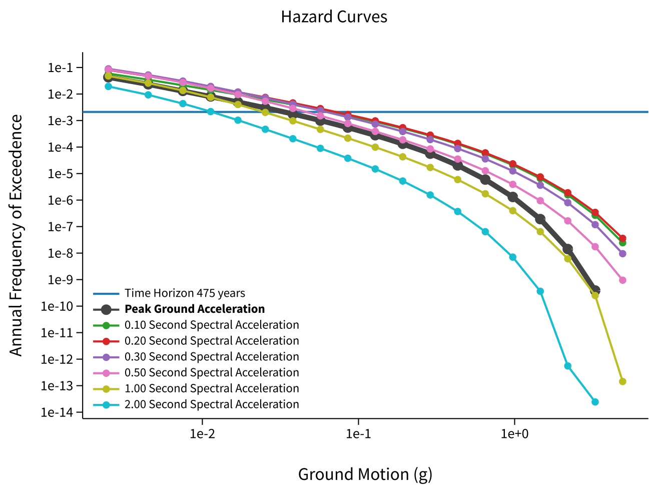
Peak Ground Acceleration

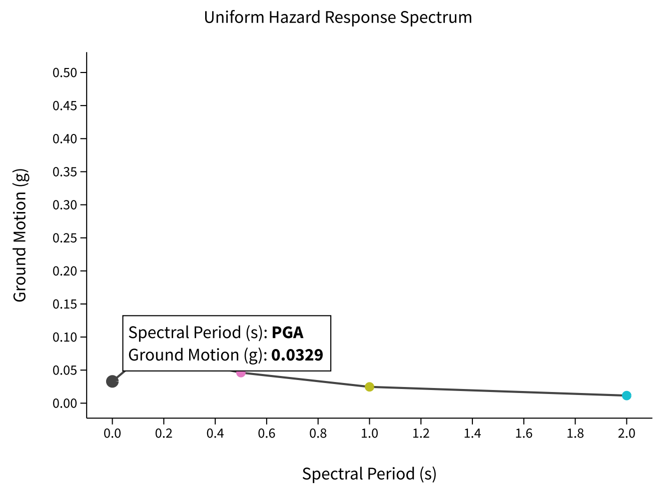
Time Horizon

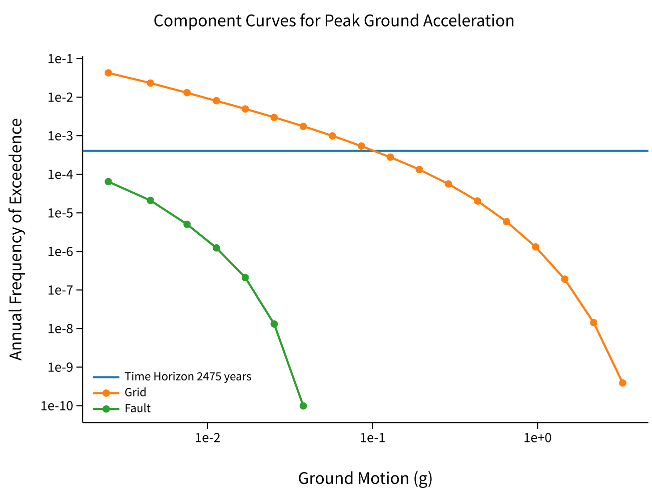
Return period in years

475

Hazard Curve





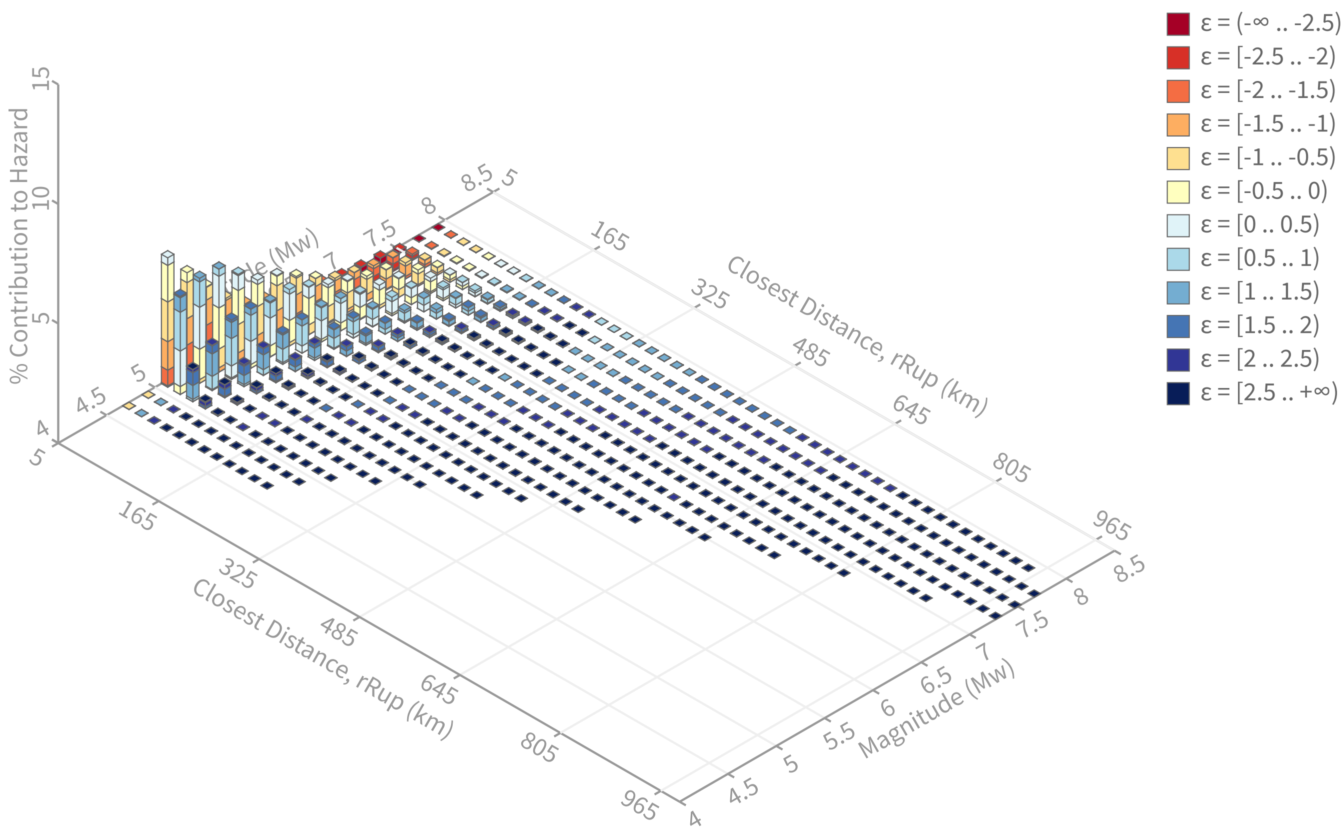


View Raw Data

Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 475 yrs
Exceedance rate: 0.0021052632 yr^{-1}
PGA ground motion: 0.032925496 g

Recovered targets

Return period: 481.6713 yrs
Exceedance rate: 0.0020761046 yr^{-1}

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.67 %

Mean (over all sources)

m: 6.04
r: 49.23 km
ε_0: -0.24 σ

Mode (largest m-r bin)

m: 5.1
r: 13.23 km
ε_0: -0.8 σ
Contribution: 5.41 %

Mode (largest m-r-ε_0 bin)

m: 5.3
r: 29.39 km
ε_0: 0.25 σ
Contribution: 1.75 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

Deaggregation Contributors

Source Set ↳ Source	Type	r	m	ε_0	lon	lat	az	%
EXTmap_2014_fixSm.ch.in (opt)	Grid							35.71
PointSourceFinite: -110.730, 31.600		15.00	5.58	-1.36	110.730°W	31.600°N	0.00	1.29
PointSourceFinite: -110.730, 31.708		25.87	5.72	-0.59	110.730°W	31.708°N	0.00	1.24
EXTmap_2014_adSm.ch.in (opt)	Grid							23.63
EXTmap_2014_fixSm.gr.in (opt)	Grid							17.83
EXTmap_2014_adSm.gr.in (opt)	Grid							11.80
EXTmap_2014_fixSm_M8.in (opt)	Grid							6.49
EXTmap_2014_adSm_M8.in (opt)	Grid							4.27

U.S. Geological Survey - Earthquake Hazards Program

Unified Hazard Tool

Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the U.S. Seismic Design Maps web tools (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Input

Edition

Dynamic: Conterminous U.S. 2014 (u…

Latitude

Decimal degrees

31.47

Longitude

Decimal degrees, negative values for western longitudes

-110.73

Site Class

760 m/s (B/C boundary)

Spectral Period

Peak Ground Acceleration

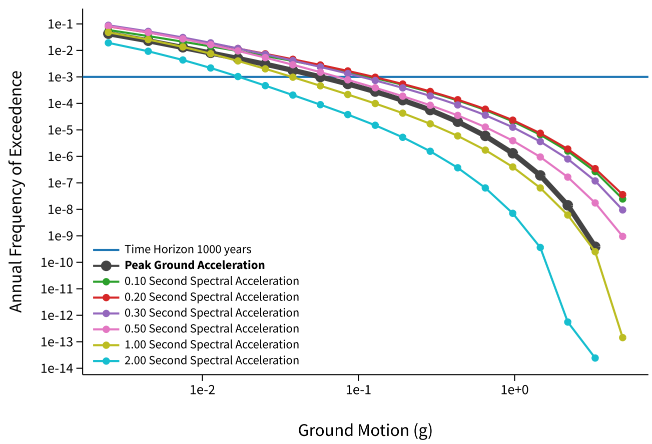
Time Horizon

Return period in years

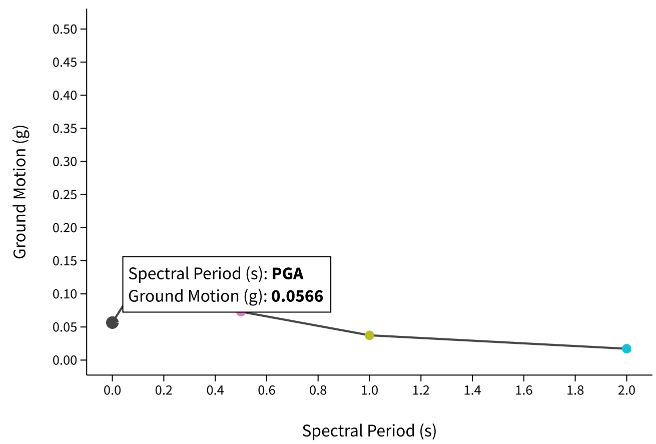
1000

Hazard Curve

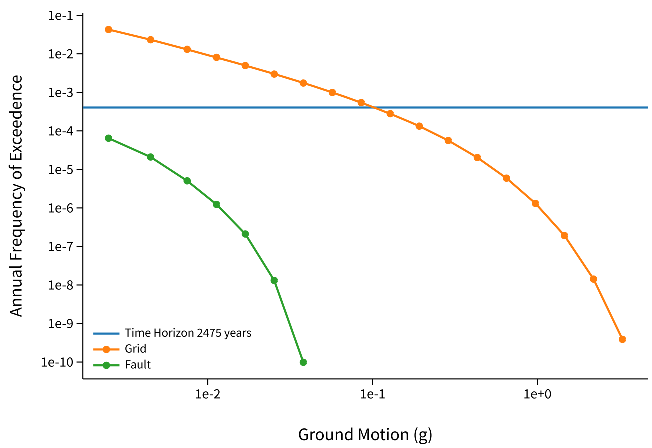
Hazard Curves



Uniform Hazard Response Spectrum



Component Curves for Peak Ground Acceleration

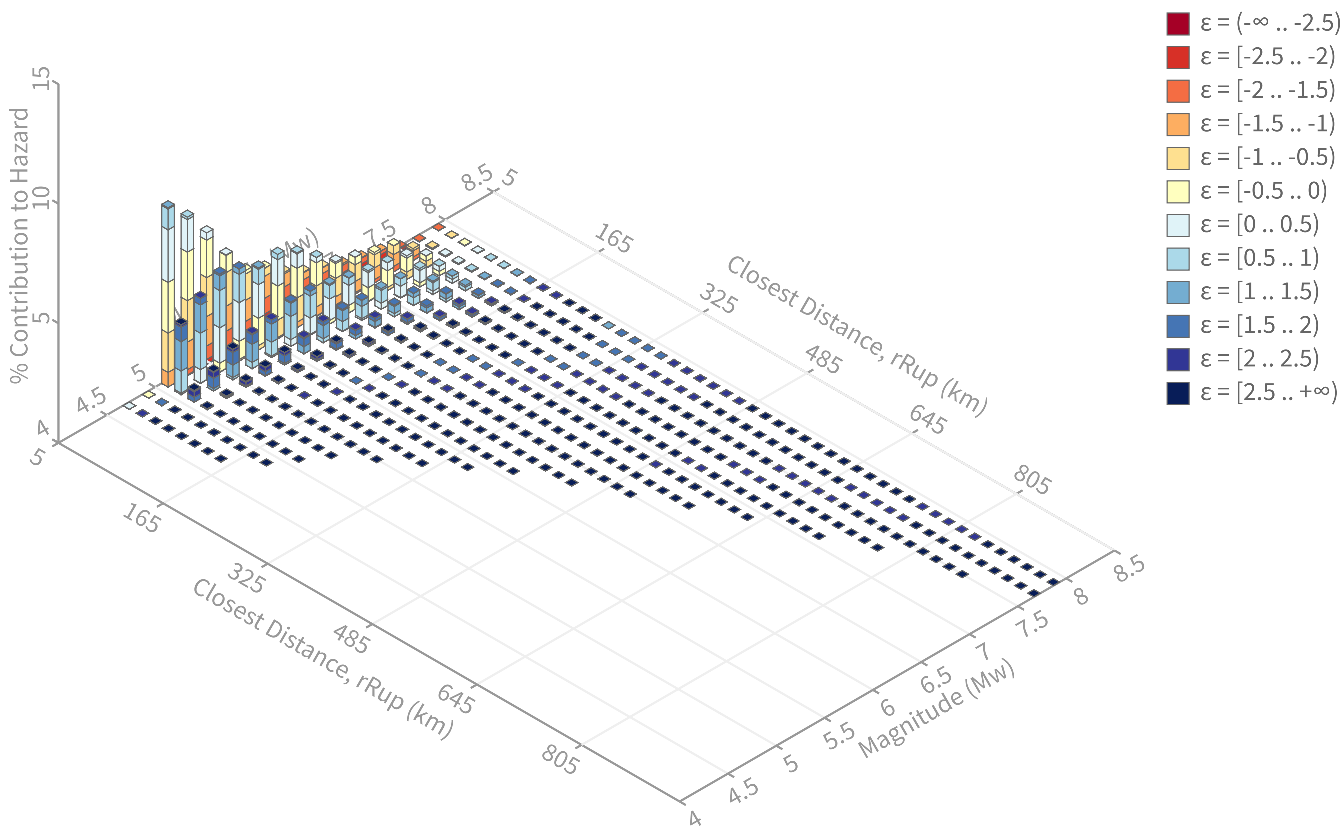


View Raw Data

Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 1000 yrs
Exceedance rate: 0.001 yr^{-1}
PGA ground motion: 0.056636038 g

Recovered targets

Return period: 1018.2911 yrs
Exceedance rate: 0.00098203742 yr^{-1}

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.5 %

Mean (over all sources)

m: 6.05
r: 34.34 km
ε_0: -0.07 σ

Mode (largest m-r bin)

m: 5.1
r: 12.51 km
ε_0: -0.17 σ
Contribution: 7.49 %

Mode (largest m-r-ε_0 bin)

m: 5.1
r: 15.65 km
ε_0: 0.23 σ
Contribution: 2.2 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

Deaggregation Contributors

Source Set ↳ Source	Type	r	m	ε_0	lon	lat	az	%
EXTmap_2014_fixSm.ch.in (opt)	Grid							35.42
PointSourceFinite: -110.730, 31.600		14.83	5.67	-0.69	110.730°W	31.600°N	0.00	2.02
PointSourceFinite: -110.730, 31.510		6.93	5.55	-1.68	110.730°W	31.510°N	0.00	1.48
PointSourceFinite: -110.730, 31.708		25.19	5.89	-0.04	110.730°W	31.708°N	0.00	1.47
PointSourceFinite: -110.730, 31.546		9.84	5.58	-1.24	110.730°W	31.546°N	0.00	1.38
PointSourceFinite: -110.730, 31.537		9.07	5.57	-1.35	110.730°W	31.537°N	0.00	1.37
PointSourceFinite: -110.730, 31.564		11.46	5.61	-1.04	110.730°W	31.564°N	0.00	1.27
PointSourceFinite: -110.730, 31.582		13.13	5.64	-0.86	110.730°W	31.582°N	0.00	1.11
PointSourceFinite: -110.730, 31.699		24.33	5.87	-0.08	110.730°W	31.699°N	0.00	1.04
EXTmap_2014_adSm.ch.in (opt)	Grid							23.97
PointSourceFinite: -110.730, 31.600		14.83	5.67	-0.69	110.730°W	31.600°N	0.00	1.41
PointSourceFinite: -110.730, 31.510		6.93	5.55	-1.68	110.730°W	31.510°N	0.00	1.03
PointSourceFinite: -110.730, 31.708		25.19	5.89	-0.04	110.730°W	31.708°N	0.00	1.03
EXTmap_2014_fixSm.gr.in (opt)	Grid							17.69
PointSourceFinite: -110.730, 31.600		14.83	5.67	-0.69	110.730°W	31.600°N	0.00	1.01
EXTmap_2014_adSm.gr.in (opt)	Grid							11.97
EXTmap_2014_fixSm_M8.in (opt)	Grid							6.43
EXTmap_2014_adSm_M8.in (opt)	Grid							4.32

U.S. Geological Survey - Earthquake Hazards Program

Unified Hazard Tool

Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the U.S. Seismic Design Maps web tools (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Input

Edition

Dynamic: Conterminous U.S. 2014 (u…

Latitude

Decimal degrees

31.47

Longitude

Decimal degrees, negative values for western longitudes

-110.73

Site Class

760 m/s (B/C boundary)

Spectral Period

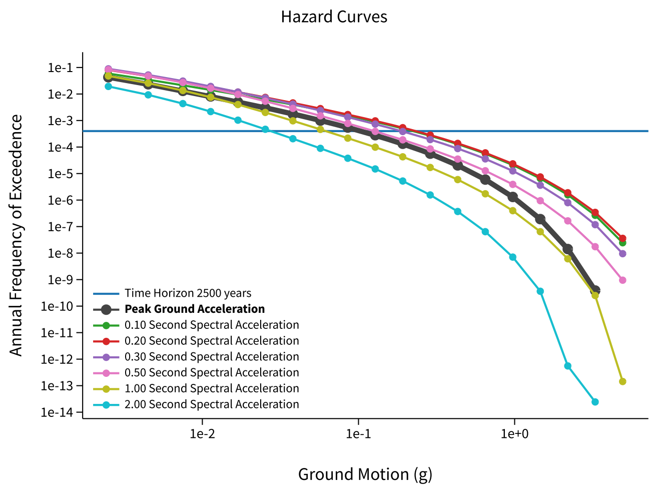
Peak Ground Acceleration

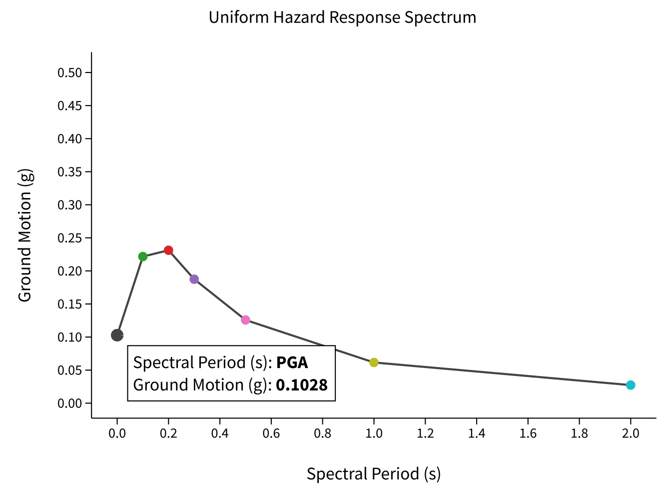
Time Horizon

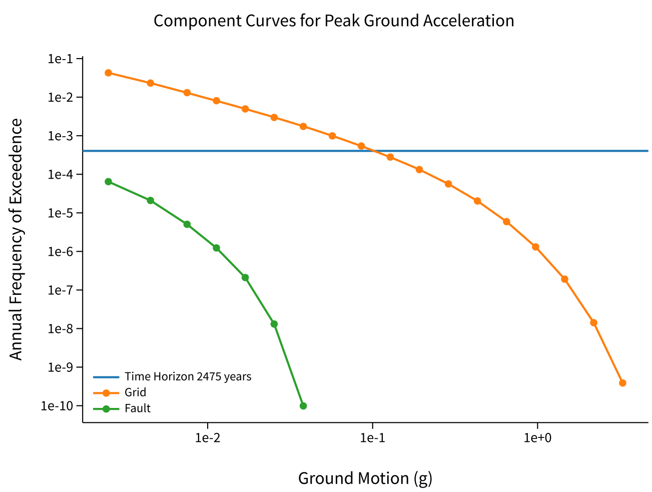
Return period in years

2500

Hazard Curve





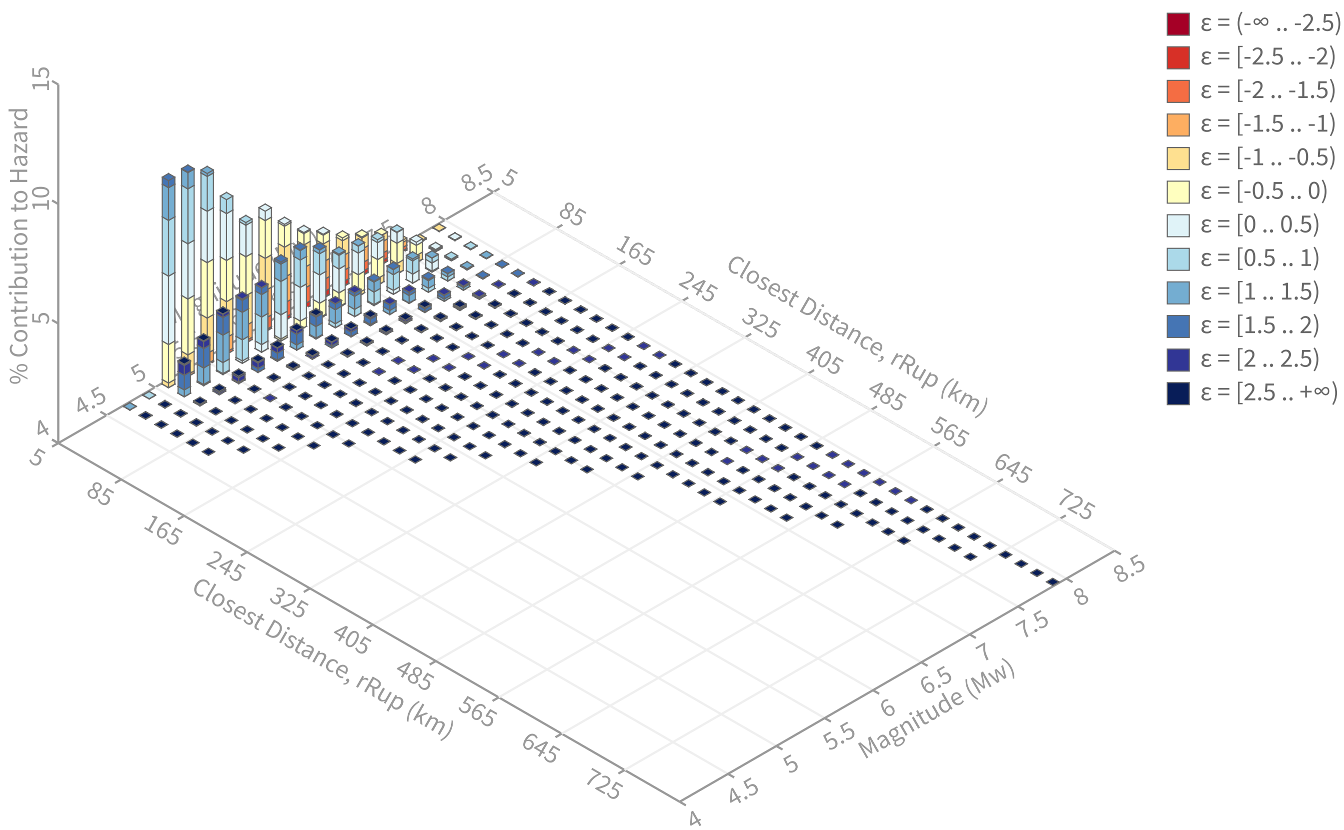


[View Raw Data]

Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 2500 yrs
Exceedance rate: 0.0004 yr^{-1}
PGA ground motion: 0.10279859 g

Recovered targets

Return period: 2536.3539 yrs
Exceedance rate: 0.00039426674 yr^{-1}

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.34 %

Mean (over all sources)

m: 6.08
r: 23.08 km
ε_0: 0.18 σ

Mode (largest m-r bin)

m: 5.1
r: 11.48 km
ε_0: 0.47 σ
Contribution: 8.65 %

Mode (largest m-r-ε_0 bin)

m: 5.1
r: 9.58 km
ε_0: 0.24 σ
Contribution: 2.86 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

Deaggregation Contributors

Source Set ↳ Source	Type	r	m	ε_0	lon	lat	az	%
EXTmap_2014_fixSm.ch.in (opt)	Grid							35.21
PointSourceFinite: -110.730, 31.510		6.90	5.61	-0.88	110.730°W	31.510°N	0.00	2.94
PointSourceFinite: -110.730, 31.600		14.40	5.83	-0.04	110.730°W	31.600°N	0.00	2.77
PointSourceFinite: -110.730, 31.537		8.97	5.66	-0.59	110.730°W	31.537°N	0.00	2.46
PointSourceFinite: -110.730, 31.546		9.71	5.68	-0.50	110.730°W	31.546°N	0.00	2.37
PointSourceFinite: -110.730, 31.564		11.24	5.73	-0.32	110.730°W	31.564°N	0.00	2.02
PointSourceFinite: -110.730, 31.582		12.81	5.78	-0.17	110.730°W	31.582°N	0.00	1.63
PointSourceFinite: -110.730, 31.708		23.88	6.16	0.48	110.730°W	31.708°N	0.00	1.43
PointSourceFinite: -110.730, 31.609		15.20	5.86	0.02	110.730°W	31.609°N	0.00	1.25
PointSourceFinite: -110.730, 31.618		16.00	5.89	0.07	110.730°W	31.618°N	0.00	1.16
PointSourceFinite: -110.730, 31.627		16.79	5.91	0.13	110.730°W	31.627°N	0.00	1.09
PointSourceFinite: -110.730, 31.699		23.10	6.13	0.45	110.730°W	31.699°N	0.00	1.03
EXTmap_2014_adSm.ch.in (opt)	Grid							24.19
PointSourceFinite: -110.730, 31.510		6.90	5.61	-0.88	110.730°W	31.510°N	0.00	2.05
PointSourceFinite: -110.730, 31.600		14.40	5.83	-0.04	110.730°W	31.600°N	0.00	1.93
PointSourceFinite: -110.730, 31.537		8.97	5.66	-0.59	110.730°W	31.537°N	0.00	1.70
PointSourceFinite: -110.730, 31.546		9.71	5.68	-0.50	110.730°W	31.546°N	0.00	1.60
PointSourceFinite: -110.730, 31.564		11.24	5.73	-0.32	110.730°W	31.564°N	0.00	1.36
PointSourceFinite: -110.730, 31.582		12.81	5.78	-0.17	110.730°W	31.582°N	0.00	1.15
EXTmap_2014_fixSm.gr.in (opt)	Grid							17.58
PointSourceFinite: -110.730, 31.510		6.90	5.61	-0.88	110.730°W	31.510°N	0.00	1.47
PointSourceFinite: -110.730, 31.600		14.40	5.83	-0.04	110.730°W	31.600°N	0.00	1.39
PointSourceFinite: -110.730, 31.537		8.97	5.66	-0.59	110.730°W	31.537°N	0.00	1.23
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PointSourceFinite: -110.730, 31.564		11.24	5.73	-0.32	110.730°W	31.564°N	0.00	1.01
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EXTmap_2014_fixSm_M8.in (opt)	Grid							6.40
EXTmap_2014_adSm_M8.in (opt)	Grid							4.38

U.S. Geological Survey - Earthquake Hazards Program

Unified Hazard Tool

Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the U.S. Seismic Design Maps web tools (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Input

Edition

Dynamic: Conterminous U.S. 2014 (u…

Latitude

Decimal degrees

31.47

Longitude

Decimal degrees, negative values for western longitudes

-110.73

Site Class

760 m/s (B/C boundary)

Spectral Period

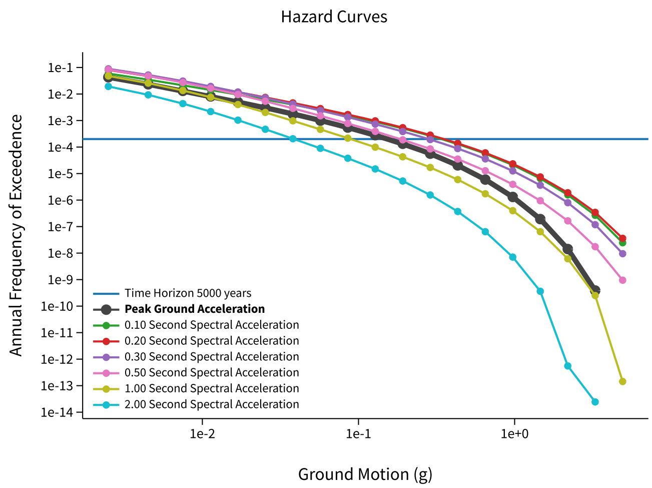
Peak Ground Acceleration

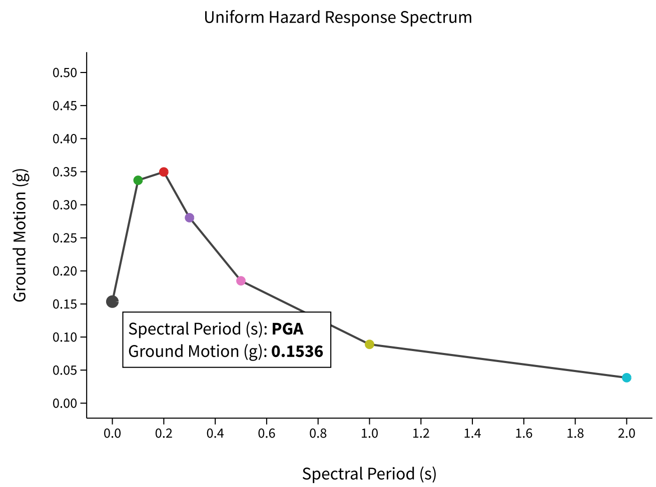
Time Horizon

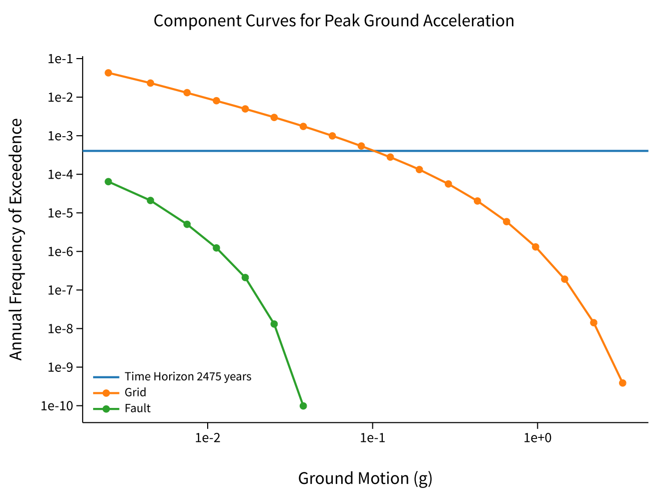
Return period in years

5000

Hazard Curve





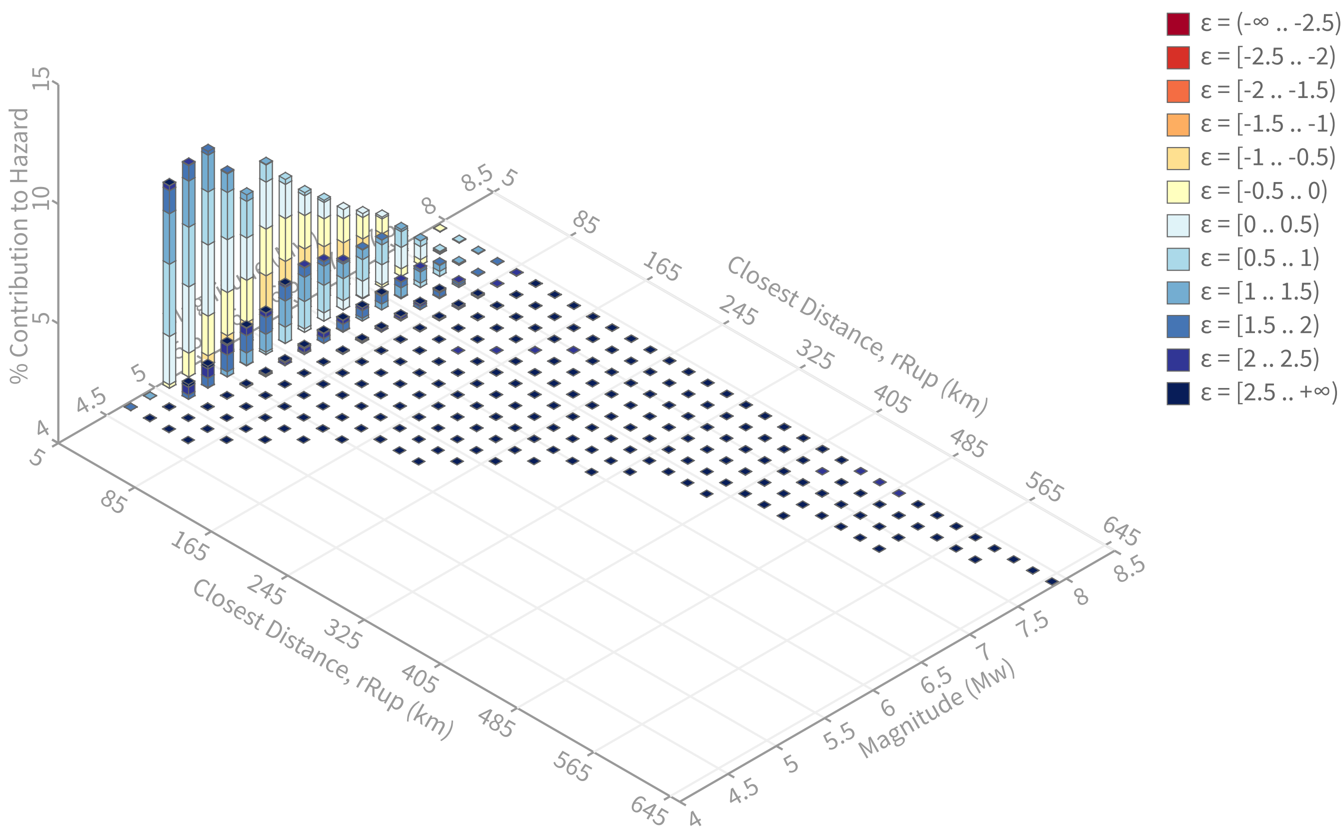


View Raw Data

Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 5000 yrs
Exceedance rate: 0.0002 yr^{-1}
PGA ground motion: 0.15356268 g

Recovered targets

Return period: 5095.8721 yrs
Exceedance rate: 0.00019623726 yr^{-1}

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.22 %

Mean (over all sources)

m: 6.11
r: 17.88 km
ε_0: 0.4 σ

Mode (largest m-r bin)

m: 5.5
r: 11.64 km
ε_0: 0.42 σ
Contribution: 8.96 %

Mode (largest m-r-ε_0 bin)

m: 5.09
r: 9.42 km
ε_0: 0.74 σ
Contribution: 3.02 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

Deaggregation Contributors

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PointSourceFinite: -110.730, 31.627		16.13	6.09	0.50	110.730°W	31.627°N	0.00	1.12
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PointSourceFinite: -110.730, 31.600		13.91	5.98	0.36	110.730°W	31.600°N	0.00	2.14
PointSourceFinite: -110.730, 31.546		9.52	5.79	-0.03	110.730°W	31.546°N	0.00	2.10
PointSourceFinite: -110.730, 31.564		10.96	5.85	0.12	110.730°W	31.564°N	0.00	1.68
PointSourceFinite: -110.730, 31.582		12.43	5.92	0.25	110.730°W	31.582°N	0.00	1.35
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PointSourceFinite: -110.730, 31.600		13.91	5.98	0.36	110.730°W	31.600°N	0.00	1.53
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PointSourceFinite: -110.730, 31.537		8.82	5.76	-0.11	110.730°W	31.537°N	0.00	1.15
PointSourceFinite: -110.730, 31.600		13.91	5.98	0.36	110.730°W	31.600°N	0.00	1.07
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EXTmap_2014_adSm_M8.in (opt)	Grid							4.40

U.S. Geological Survey - Earthquake Hazards Program

Unified Hazard Tool

Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the U.S. Seismic Design Maps web tools (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Input

Edition

Dynamic: Conterminous U.S. 2014 (u…

Latitude

Decimal degrees

31.47

Longitude

Decimal degrees, negative values for western longitudes

-110.73

Site Class

760 m/s (B/C boundary)

Spectral Period

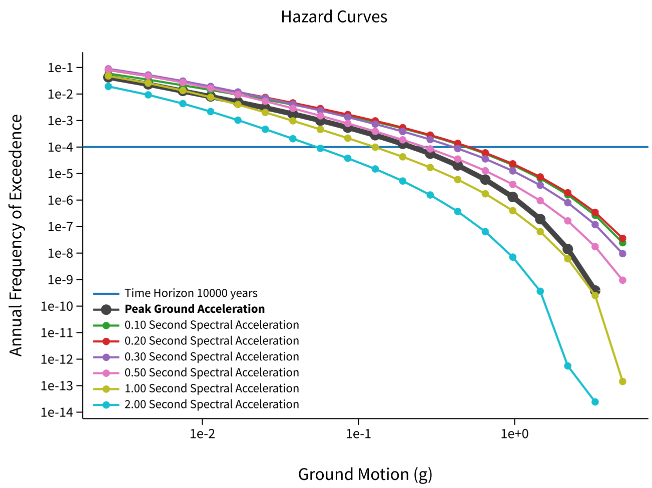
Peak Ground Acceleration

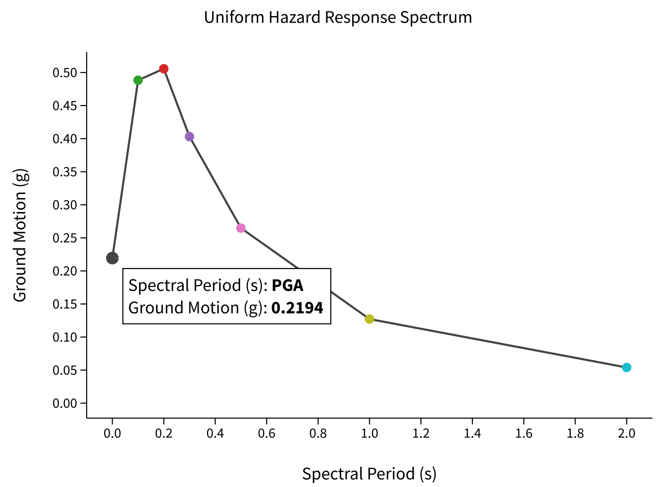
Time Horizon

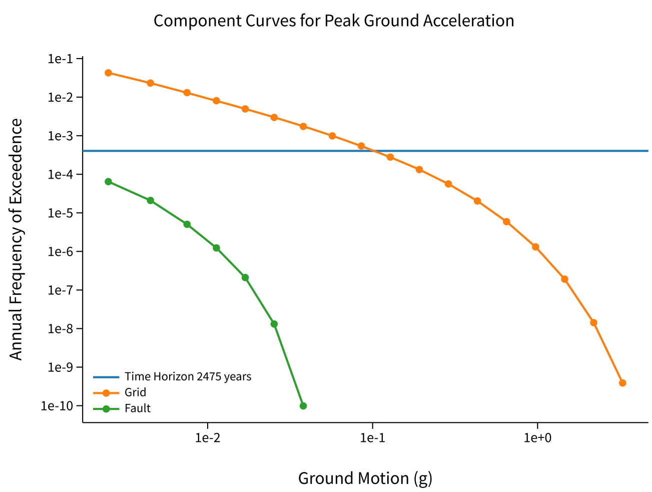
Return period in years

10000

Hazard Curve





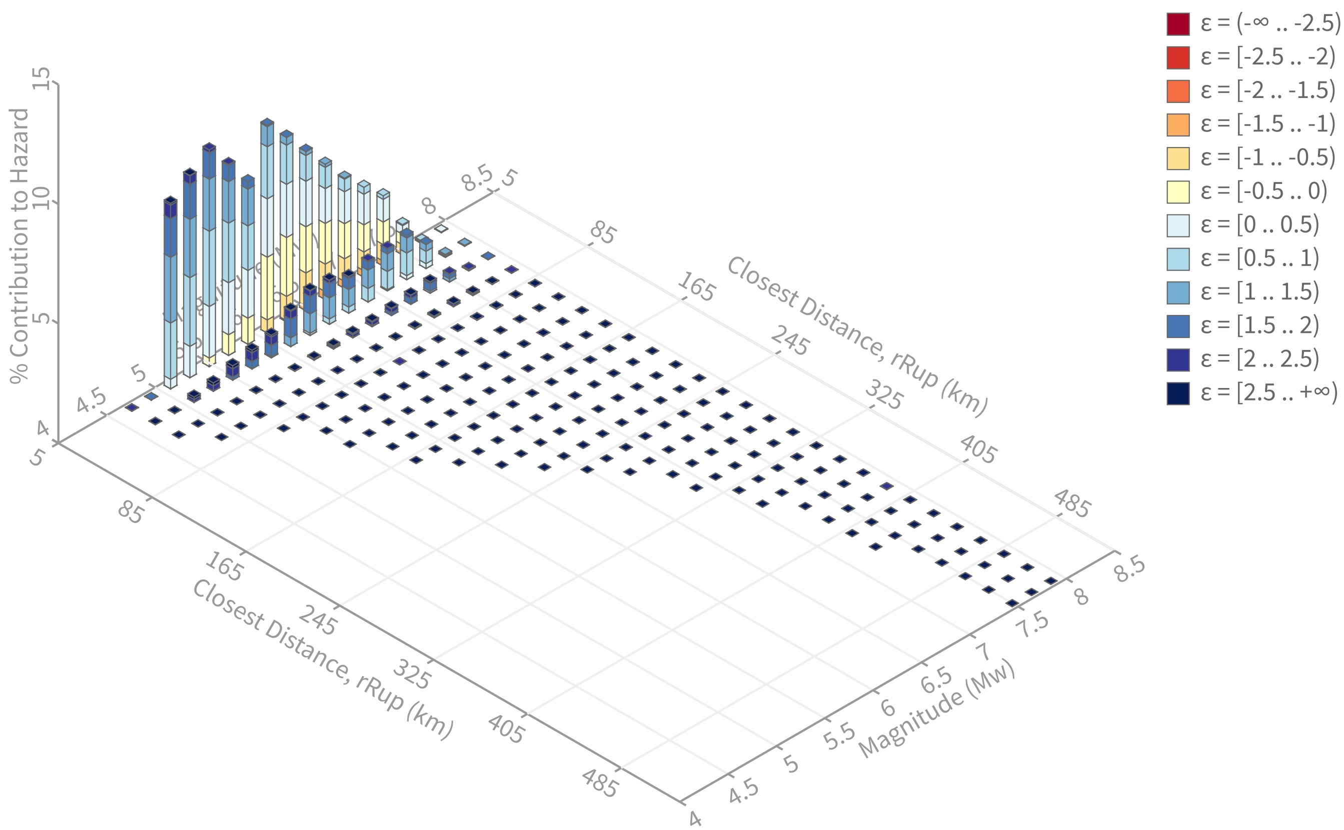


View Raw Data

Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 10000 yrs
Exceedance rate: 0.0001 yr^{-1}
PGA ground motion: 0.21941383 g

Recovered targets

Return period: 10309.757 yrs
Exceedance rate: 0.000096995501 yr^{-1}

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.19 %

Mean (over all sources)

m: 6.16
r: 14.5 km
ε_0: 0.64 σ

Mode (largest m-r bin)

m: 5.5
r: 10.86 km
ε_0: 0.83 σ
Contribution: 9.05 %

Mode (largest m-r-ε_0 bin)

m: 5.5
r: 9.63 km
ε_0: 0.73 σ
Contribution: 3.15 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

Deaggregation Contributors

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PointSourceFinite: -110.730, 31.618		14.72	6.22	0.79	110.730°W	31.618°N	0.00	1.20
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PointSourceFinite: -110.730, 31.510		6.75	5.76	0.07	110.730°W	31.510°N	0.00	2.07
PointSourceFinite: -110.730, 31.537		8.61	5.86	0.30	110.730°W	31.537°N	0.00	1.43
PointSourceFinite: -110.730, 31.546		9.27	5.90	0.37	110.730°W	31.546°N	0.00	1.26
PointSourceFinite: -110.730, 31.600		13.34	6.14	0.70	110.730°W	31.600°N	0.00	1.10
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EXTmap_2014_adSm_M8.in (opt)	Grid							4.42

APPENDIX C

Climate Memo

Ecological Resource Consultants, Inc.
35715 US Hwy. 40, Suite D204 ~ Evergreen, CO ~ 80439 ~ (303) 679-4820

Technical Memorandum

Date: March 13, 2017

To: Johnny Pappas, Arizona Minerals

From: Troy Thompson

Re: Arizona Mine Site Meteorological Analysis

1.0 Introduction

Ecological Resource Consultants Inc. (ERC) has evaluated available climate data for Arizona Minerals' proposed Mine Site located in Santa Cruz County, Arizona. The evaluation was conducted to determine precipitation and evaporation values that should be used to define climate related design criteria for mine planning and design. The proposed mine is located at roughly Latitude 31o 27' 20" N, Longitude 110o 42' 47" W at an elevation of approximately 5,200 feet.

A previous climatological analysis was completed by ERC in March of 2013 (ERC 2013). This new evaluation utilized information presented in ERC's 2013 technical memo along with updated site specific information to derive more refined parameters that we recommend be used for future design and permitting work.

2.0 Available Precipitation and Evaporation Data

Precipitation and evaporation data used for this analysis were determined based on review of data from three regional meteorological stations as well as data recorded at the mine site. Regional data was collected from the Western Regional Climate Center (WRCC) which maintains an online database (http://www.wrcc.dri.edu/summary/Climsmaz.html) of climate date from monitoring stations throughout the western United States. A list of regional stations considered as part of this analysis is presented in Table 1. A location map showing the different sites relative to the proposed mine is presented in **Figure 1**.

Table 1 – Regional/Local Meteorological Stations

Site	Distance from Mine	Station Elevation (ft)	Precipitation Data Available	Pan Evaporation Data Available
Nogales 6N (ID:25924)	15 miles (W)	3,460	October 1952 - December 2016	1952-2005
Patagonia (ID:26280)	7 miles (NW)	4,189	June 1922 – December 2016	NA
Canelo 1 (ID:21231)	13 miles (NE)	5,009	January 1910 - December 2012	NA
Site Station	NA	5,436	Oct 2007 – Dec 2016	2015

Figure 1 – Station Locations (from Google Earth)

3.0 Monthly Precipitation Data

3.1 Site Data

Since there is a reasonably long period-of-record of available site data (over 9 years), this data was used as the primary source for estimating monthly precipitation values. A summary of available monthly site data along with pertinent statistics are presented in **Table 2**. Site data for 2016 was derived based on data recorded at the meteorological station as well as the Trench and Alta sites. Given that each of the three sources provided partial data, the maximum precipitation recorded during each month at an individual site was used as estimate the total at the mine for that month.

Table 2 – Recorded Monthly Site Precipitation (inches)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2007										0.00	1.18	1.8	NA
2008	0.87	0.90	3.44	0.00	0.89	0.49	7.19	4.66	2.63	0.33	0.60	1.03	23.03
2009	0.25	0.71	2.42	0.18	0.45	0.90	2.53	3.26	3.92	0.85	0.04	1.00	16.51
2010	4.78	2.82	3.44	0.63	0.00	0.00	6.51	5.47	3.6	0.72	0.05	1.08	29.1
2011	0.27	0.40	2.01	0.48	0.00	0.00	6.34	4.09	5.00	0.09	1.37	2.96	23.01
2012	0.17	0.04	2.92	0.13	0.48	0.53	4.61	7.13	1.64	0.00	0.19	1.71	19.55
2013	1.54	0.72	0.35	0.00	1.00	0.35	4.1	2.7	2.95	0.00	1.09	0.65	15.45
2014	0.01	0.12	4.02	0.03	0.00	0.01	5.74	5.82	6.96	1.90	0.00	1.17	25.78
2015	2.79	0.17	0.94	0.63	0.19	3.44	4.44	4.95	2.97	1.62	0.77	0.84	23.75
2016	2.30	1.00	0.10	0.62	0.00	1.05	2.85	5.65	4.60	0.01	0.20	2.05	20.43
Average	1.44	0.76	2.18	0.30	0.33	0.75	4.92	4.86	3.81	0.55	0.55	1.43	21.90
St. Dev.	1.60	0.85	1.43	0.28	0.40	1.08	1.63	1.37	1.56	0.71	0.52	0.70	4.35
Correlation	-0.267	0.786	0.146	-0.359	-0.709	-0.048	-0.378	0.192	-0.028	0.474	-0.414	0.343	NA

Data indicates that from October 2007 through the end of 2016, average annual precipitation has been approximately 21.9 inches. The site experiences defined wet and dry seasons with an average of over 60% of the annual precipitation occurring during the summer monsoon period of July through September. July and August are the wettest months while April is the driest, averaging only about 0.3 inches of rainfall. A great majority of precipitation falls in the form of rain; however, minor amounts of snow does occur.

While the site data provides a good indication of precipitation, the area is known to have been drier during the past decade than is typical. To account for this, ERC utilized data from the regional sites to determine the long-term mean precipitation that should be expected at the site.

3.2 Regional Data

When considering the three regional sites, ERC first evaluated available data for completeness. All three regional stations were found to have incomplete data (> 5 days per month with missing data) in various months throughout their respective periods of record. ERC also looked at which stations have a period of record that overlap with the period of record at the site. This is important as an overlapping period of record is helpful when comparing data from different sites. The completeness and overlapping period of record for the three regional sites are summarized in **Table 3**.

Table 3 – Overlapping Period of Record and Evaluation of Incomplete Data

Site	Overlapping Period of Record with Mine?	# of Months Data is Incomplete in Overlapping POR	# of Months Data is Incomplete in Full Dataset
Nogales 6N	Yes	7 months (6% incomplete)	18 months (2% incomplete)
Patagonia	Yes	13 months (15% incomplete)	35 months (3% incomplete)
Canelo 1	No No Data for 2013 - 2014	55 months (63% incomplete)	92 months (7% incomplete)

Since Canelo 1 does not have data after 2012 and the available dataset is largely incomplete from October 2007 through the end 2014, it was not used for further evaluation.

Of the remaining two regional sites, the Nogales 6N site is favorable for use given the completeness of its dataset while the Patagonia site is favorable given its proximity to the site and similarities in elevation between it and the site. Given that there are advantages of both sites, additional analysis was performed on data from both locations.

In order to complete further evaluations of Nogales 6N and Patagonia precipitation data, the months with missing or incomplete data were first filled. The greater of the mean monthly precipitation for the given missing month or the amount of precipitation recorded at the site during the partial month when precipitation was measured was assumed. This is not a rigorous method for filling missing data, however, since the data from these two sites was only being used to evaluate long-term annual average precipitation versus averages from October 2007 through 2016, this method is believed to be adequate.

Once this data filling was complete, the average annual precipitation at each of the two stations was determined over different periods. Average annual precipitation values from both sites was determined from October 2007 through December 2016 to facilitate a direct comparison to site data. Average annual precipitation values from both sites was also determined from 1953 through 2016 as this is the longest concurrent period of record for the Nogales 6N and the Patagonia stations and represents the full period of record at the Nogales 6N site. Lastly the average annual precipitation at the Patagonia station was determined over its full period of record. Results of this evaluation are given in **Table 4**. For the October 2007 through December 2016 period, the values listed below are based on the sum of the mean monthly values due to the use of partial years.

Table 4 – Average Annual Precipitation Over Different Periods of Record (inches)

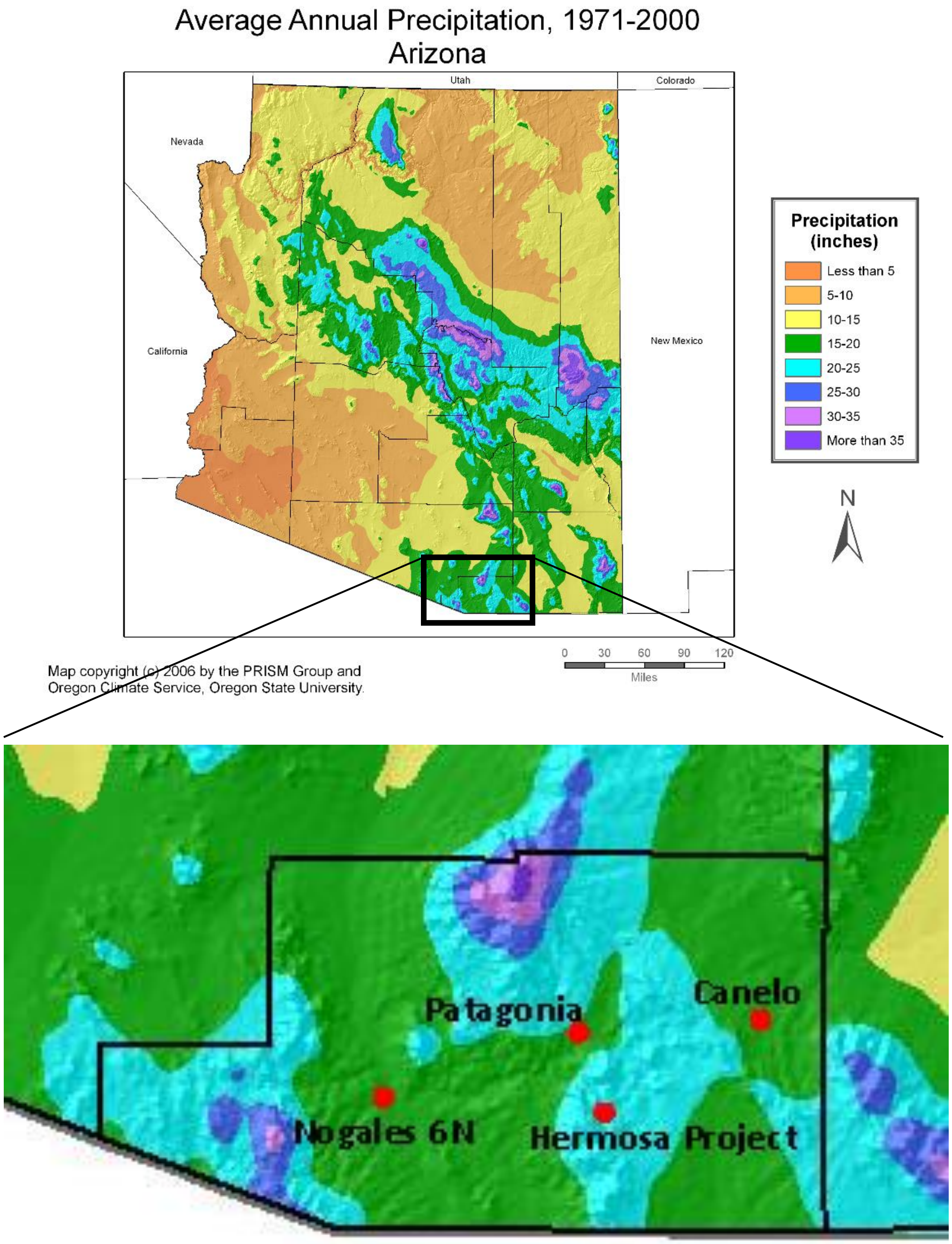
Period	Site Data	Nogales 6N	Patagonia
October 2007 – December 2016	21.90	13.98 (64% of site)	16.05 (73% of site)
1953 - 2016	NA	16.88 (21% greater than 2008 - 2014)	17.92 (12% greater than 2008 - 2014)
1923 - 2016	NA	NA	17.84 (11% greater than 2008 - 2014)

Based on the evaluation of historic records at the Nogales 6N and Patagonia sites, it is likely that site precipitation recorded from late 2007 through 2016 underestimates long-term precipitation. Given that the amount of precipitation at Nogales 6N was about 20% greater from 1953 through 2016 than from late 2007 through 2016 and precipitation at Patagonia over extended periods was roughly 10% greater than from late 2007 through 2016, long-term precipitation at the site is expected to be on the order of 15% greater than has been recorded since 2007. The would equate to a long-term annual precipitation of approximately 25.2 inches at the site.

3.3 PRISM Model

The final step for verifying estimates of site precipitation data was the review of annual estimates from other sources. A precipitation map for Arizona based on average annual precipitation from a period of 1971-2000 was created using the Parameter-elevation Regressions on Independent Slope Model (PRISM) developed by Utah State University. PRISM utilizes observed precipitation values, elevation, orographic effects and aspect to estimate precipitation at unknown site. The PRISM model for Arizona was obtained and expanded in the region of the site to show computer model estimates of long-term average annual precipitation. **Figure 2** shows PRISM results for the State and the mine area including the regional precipitation sites used in our analysis. PRISM results generally confirm conclusions based on the raw data and show that the site is expected to receive more precipitation than any of the regional sites. Effects of elevation on precipitation can be clearly seen from this map. While not matching the exact values recorded at the different stations, PRISM results support the overall estimates above.

Figure 2 – Estimates of Annual Precipitation (from PRISM)



The PRISM map suggests that average annual precipitation at Nogales 6N is between 15” and 18” (ERC’s estimate from data is about 17”), annual precipitation at Patagonia is between 18” and 19” (ERC’s estimate from data is about 18”) and precipitation at the site is between 20” and 25” (ERC’s estimate is about 25”). The PRISM data generally fits with ERC’s estimates, therefore ERC’s estimate including a 15% increase over values recorded at site from late 2007 – 2016 appear to be reasonable. We suggest that the mine continue to monitor precipitation data on site. In the future, as additional site and regional data is collected estimates of long-term precipitation averages can be updated.

Based on the evaluations above, ERC has developed the following recommendations for monthly precipitation values to be used in analysis. As the site continues to collect additional data, these values can be further refined.

Table 5 – Recommended Precipitation Statistics Site Evaluations

Month	Average Precip (in)	Standard Deviation (in)	Monthly Correlation
January	1.66	1.84	-0.267
February	0.88	0.97	0.786
March	2.51	1.65	0.146
April	0.35	0.33	-0.359
May	0.38	0.46	-0.709
June	0.87	1.24	-0.048
July	5.66	1.88	-0.378
August	5.59	1.57	0.192
September	4.38	1.80	-0.028
October	0.63	0.82	0.474
November	0.63	0.60	-0.414
December	1.64	0.81	0.343
Annual	25.18	5.00	NA

4.0 24-Hour Storm Depths

Determination of precipitation associated with the various frequency storm events was obtained from the National Oceanic and Atmospheric Administration (NOAA) Precipitation Frequency Data Server. Short-duration storm depths are determined from NOAA by entering site location. Reported precipitation values are for Latitude 31o 27’ 20” N, Longitude 110o 42’ 47” W. The resultant 1 – through 500-year 24-hour storm events are presented on **Table 6**.

Table 6 – Point Precipitation Frequency Estimates

Frequency (yr.)	Duration (hr)	Precipitation Depth (in)
1	24	1.86
2	24	2.31
5	24	2.87
10	24	3.32
25	24	3.93
50	24	4.40
100	24	4.88
500	24	6.02

5.0 Probable Maximum Precipitation

5.1 Methodology

ERC followed the methodology outlined in Hydrometeorological Report No. 49 (HMR 49), Probable Maximum Precipitation – Colorado River and Great Basin Drainages. Note that the procedures and inputs for the PMP have not changed since ERC completed the analysis in 2013, so all results presented herein are taken from the 2013 report.

5.2 Assumptions

The following assumptions were incorporated into the PMP calculations based on satellite imaging.

- Site Location: 31o 27’ 20” N, 110o 42’ 47” W
- Drainage Basin Area: 2.0 square miles
- Lowest Basin Elevation: 5,200 feet above mean sea level (AMSL)

5.3 General Storm Calculations

General storms derived from HMR 49 are 72-hour duration events. General Storms are calculated as the combination of two types of storm drivers: convergence storms and orographic storms. Research into historical precipitation data indicates that the magnitude of the General Storm within this region is dependent upon the month in which it occurs. PMP estimates were therefore calculated independently for every month following procedures outlined in HMR 49.

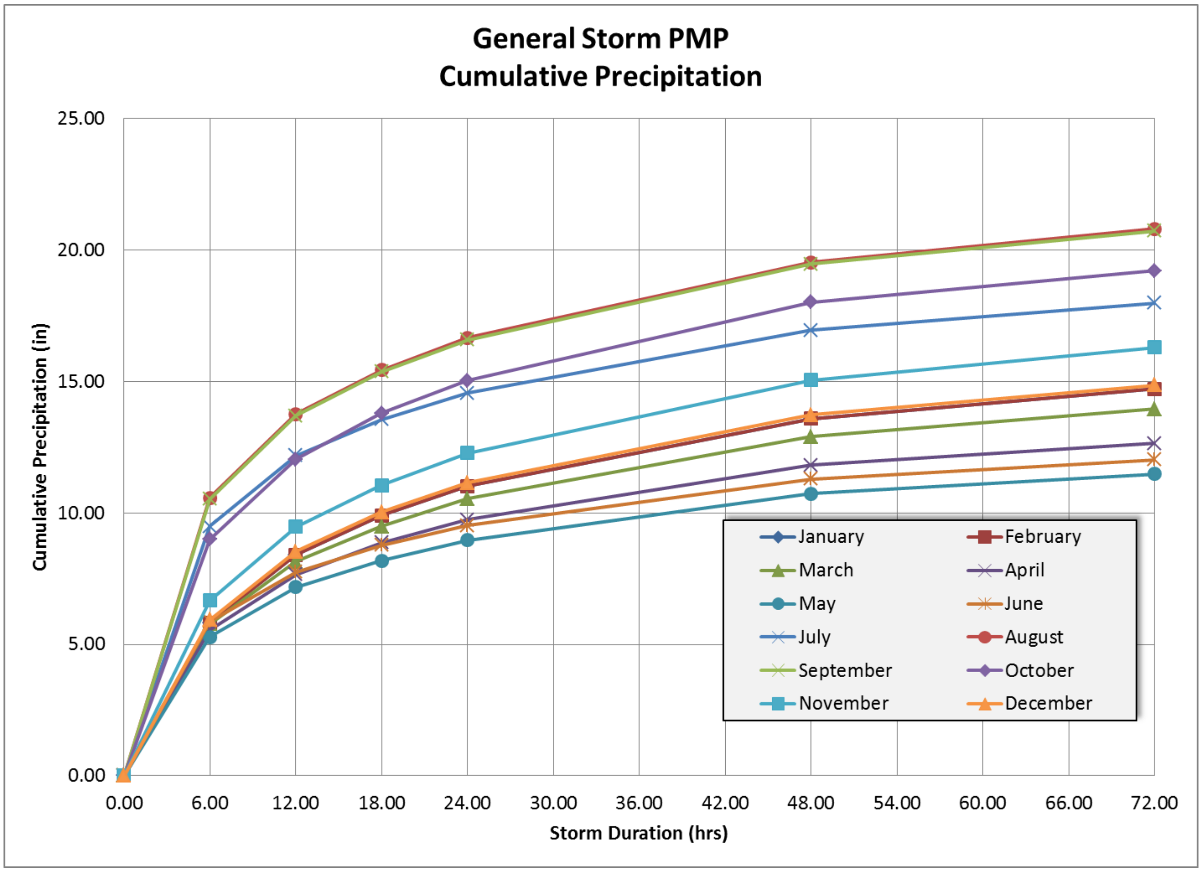
Graphical and tabular data from HMR 49 used in the calculation of the General Storm are presented in **Appendix A**. Calculations are given in **Appendix B**.

Results of the General Storm PMP calculation produce cumulative precipitation distributions for each month. **Figure 3** presents these results. Cumulative precipitation estimated for the General Storm PMP ranges from a low of 11.48 inches in the month of May to a high of 20.81 inches in August. In general, the temporal distribution of each monthly PMP is similar. General Storm PMP values calculated by month are provided in **Table 7**.

Table 7 – Monthly General Storm PMP Estimates (inches)

Month	PMP Estimates (inches)
January	14.71
February	14.71
March	13.95
April	12.66
May	11.48
June	12.02
July	18.00
August	20.81
September	20.73
October	19.22
November	16.30
December	14.87

Figure 3 – General Storm PMP Cumulative Precipitation

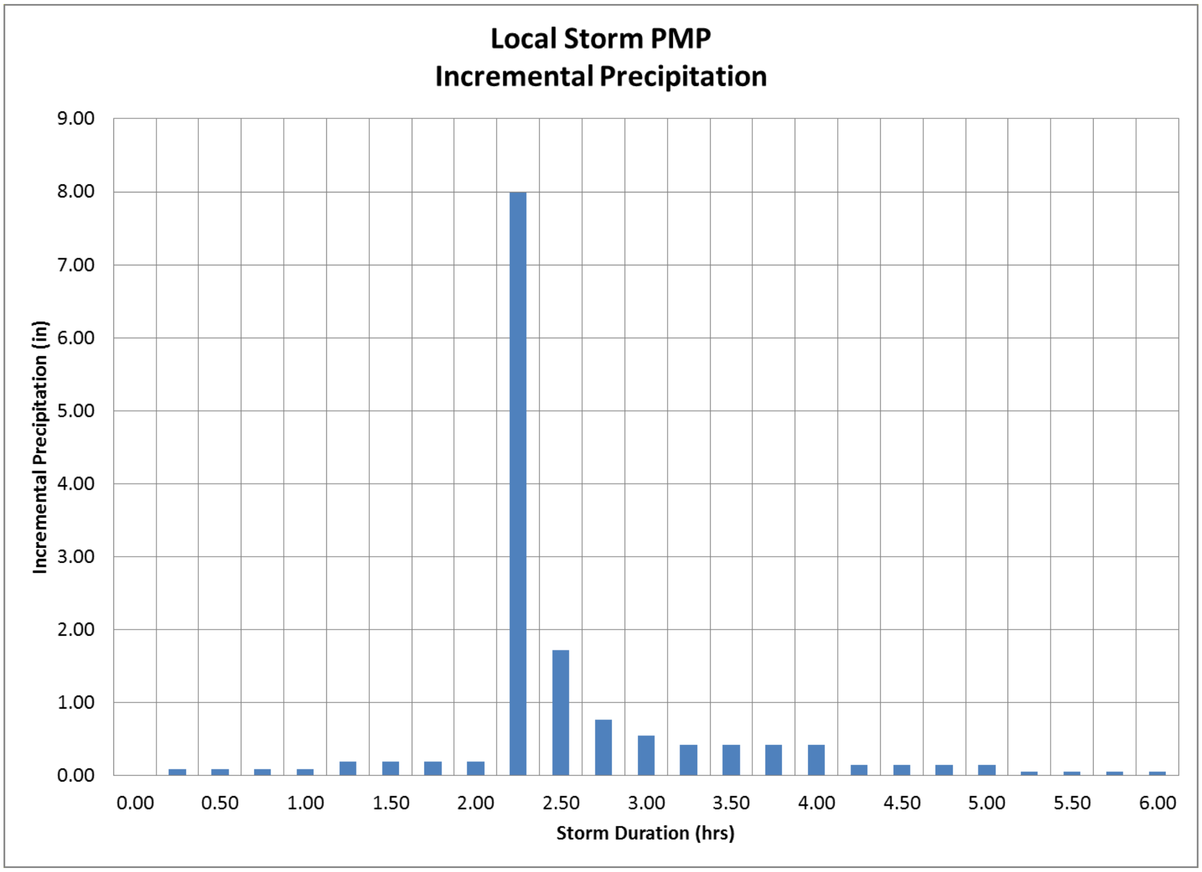


5.4 Local Storm Calculations

Local storms derived in HMR 49 are 6-hour duration events typical of isolated thunderstorms. Unlike General Storms, a single value is generated for the Local Storm to be used for all months. Graphical and tabular data from HMR 49 used in the calculation of the Local Storm are presented in **Appendix C**. Calculations are given in **Appendix D**.

Results of the Local Storm PMP calculation produce incremental precipitation values for time intervals down to 15-minutes during the storm peak. Figure 4 presents these results. The estimated total rainfall produced by the Local Storm is 14.63 inches in a six-hour period. The greatest 15-minute incremental rainfall predicted by the Local Storm is 7.99 inches which equates to a peak rainfall intensity of approximately 31.96 inches per hour for 15 minutes.

Figure 4 – Local Storm PMP Incremental Precipitation

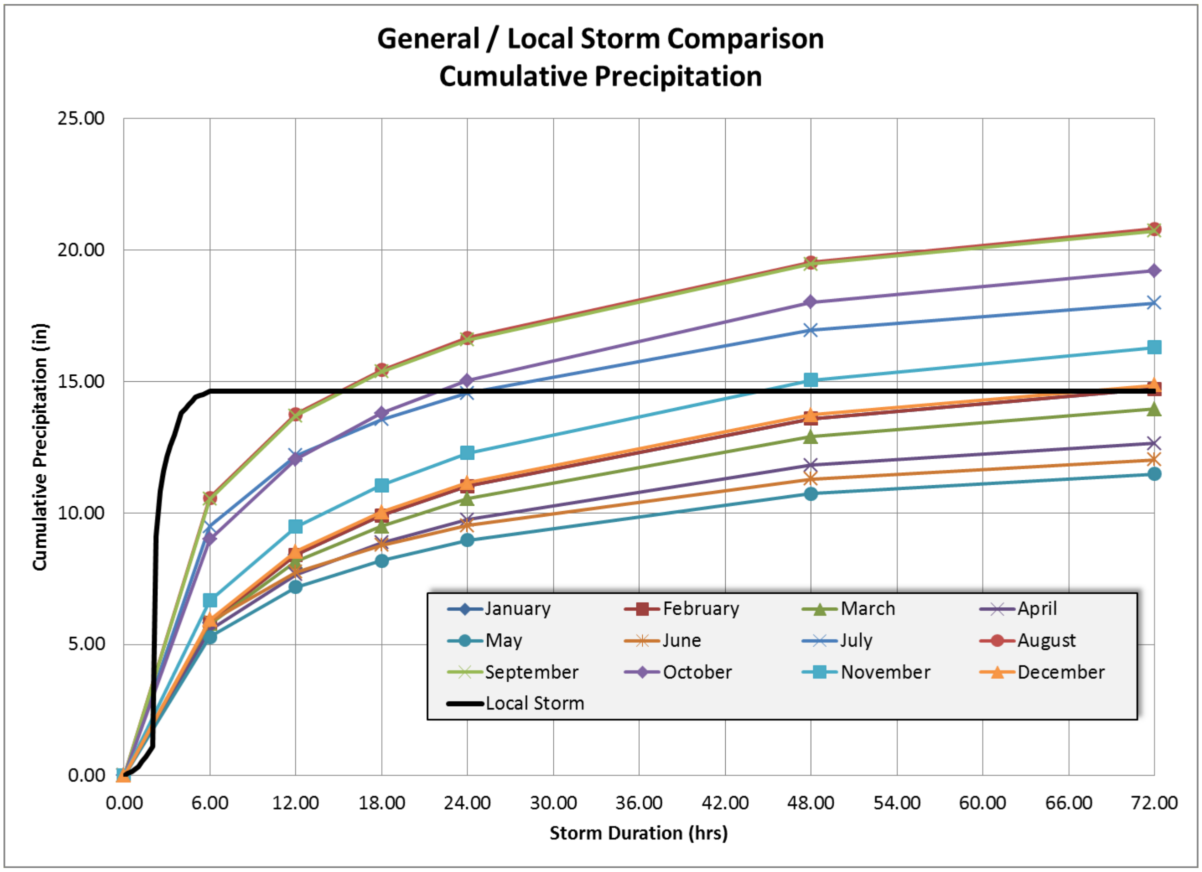


5.5 Comparison of General and Local Storm PMPs

ERC converted incremental precipitation predicted for the Local Storm PMP to a cumulative distribution to compare General and Local Storm PMPs. To do so, ERC assumed that no precipitation occurred in the 66 hours following the 6-hour Local Storm PMP. In the comparison, both storms were assumed to begin at the same time. **Figure 5** presents the comparison between the different PMPs. Results show the local storm produces less rainfall than the general storm during initial 2 hours. Between hours 2 and 4 the Local Storm PMP produces significantly greater rainfall. Between hours 4 and 6 the Local Storm rainfall intensities are lower than General Storm intensities. After hour 6 no additional precipitation is predicted for the Local Storm whereas precipitation is assumed to continue through hour 72 for the General Storm.

Total precipitation produced by the General Storm PMP is approximately 40% greater than precipitation produced by the Local Storm. In general, the Local Storm will produce higher peak flows due to higher rainfall intensities and the General Storm will produce higher rainfall volumes due to a greater amount of total precipitation. In general, the Local Storm would be more critical when sizing facilities that convey water and the General Storm would be more critical when sizing facilities that store water.

Figure 5 – Comparison between Local and General Storm PMPs



6.0 Evaporation Data

Pan evaporation data has been collected at the site starting in late 2007. ERC compiled monthly evaporation data from quarterly meteorological reports prepared by various consultants. Raw reported monthly total site pan evaporation data is presented in **Table 8**. Review of the monthly summary reports show that evaporation data has not been recovered for all periods. The percentage of time that pan evaporation data has been collected at the site is included in the quarterly reports and is summarized in Table 9. To account for this missing data, ERC estimated the site pan evaporation rates by dividing the measured evaporation rates in **Table 8** by the data completeness in **Table 9**. The results, shown in **Table 10**, represent adjusted estimates of site pan evaporation.

Table 8 – Pan Evaporation Recorded at the Site (inches)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2008	2.91	3.79	5.50	7.93	8.99	9.89	5.31	3.96	5.38	5.12	3.92	2.92	65.60
2009	1.38	1.68	2.85	4.50	3.55	4.85	4.11	2.84	4.08	3.33	3.12	1.57	37.86
2010	1.81	2.92	4.50	4.00	5.78	4.81	3.19	4.90	4.96	2.45	1.75	1.44	42.50
2011	2.36	2.46	4.26	3.93	5.39	7.30	4.20	4.38	4.18	6.02	4.07	2.35	50.89
2012	3.08	2.80	5.52	5.72	8.08	7.89	5.21	5.58	3.94	5.24	3.21	2.92	59.18
2013	2.03	2.75	2.87	0.78	7.73	8.06	5.30	2.76	4.87	6.40	3.76	2.65	49.96
2014	3.75	4.32	6.41	7.91	10.92	13.29	5.69	4.94	4.06	4.28	3.48	2.50	71.55
2015	2.42	3.73	4.30	4.87	2.26	3.04	1.82	2.45	2.54	3.24	3.53	2.70	36.90
Average	2.47	3.05	4.53	4.95	6.59	7.39	4.35	3.98	4.25	4.51	3.35	2.38	51.80
St. Dev	0.76	0.85	1.26	2.32	2.88	3.25	1.32	1.17	0.87	1.42	0.72	0.57	12.77

Table 9 – Completeness of Pan Evaporation Recorded at the Site

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2008	95.4%	95.0%	92.5%	90.1%	89.1%	90.4%	92.6%	91.3%	95.3%	90.9%	93.5%	93.0%	92.4%
2009	97.4%	91.7%	93.0%	97.8%	94.6%	91.9%	95.7%	97.4%	95.7%	93.5%	96.3%	98.2%	95.3%
2010	98.8%	99.1%	99.1%	98.0%	98.8%	98.3%	100.0%	100.0%	99.7%	98.1%	98.2%	99.6%	99.0%
2011	99.2%	98.9%	99.6%	100.0%	98.9%	97.5%	99.2%	91.8%	94.2%	96.4%	84.9%	90.2%	95.9%
2012	85.3%	77.4%	85.9%	76.7%	77.6%	77.6%	88.7%	88.4%	85.4%	80.8%	80.4%	93.4%	83.1%
2013	89.1%	90.6%	83.3%	69.4%	67.9%	61.0%	87.9%	77.3%	87.5%	83.1%	85.0%	88.6%	80.9%
2014	82.8%	80.8%	87.0%	81.7%	83.9%	82.9%	88.0%	87.8%	91.9%	83.3%	80.1%	87.5%	84.8%
2015	81.6%	90.6%	80.0%	76.7%	68.8%	65.6%	68.8%	66.6%	82.6%	74.0%	81.4%	85.3%	76.8%

Table 10 – Adjusted Site Pan Evaporation Estimates based on Data Completeness (inches)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2008	3.05	3.99	5.94	8.80	10.09	10.94	5.74	4.33	5.65	5.63	4.19	3.14	71.48
2009	1.42	1.83	3.07	4.60	3.75	5.28	4.29	2.91	4.26	3.56	3.24	1.60	39.81
2010	1.83	2.95	4.54	4.08	5.85	4.89	3.19	4.90	4.98	2.50	1.79	1.44	42.92
2011	2.38	2.49	4.27	3.93	5.45	7.49	4.23	4.77	4.43	6.25	4.79	2.60	53.08
2012	3.61	3.62	6.42	7.45	10.41	10.16	5.87	6.32	4.62	6.48	3.99	3.12	72.08
2013	2.28	3.03	3.45	1.12	11.39	13.22	6.02	3.58	5.57	7.70	4.43	2.99	64.76
2014	4.53	5.34	7.37	9.69	13.01	16.03	6.47	5.63	4.42	5.14	4.34	2.85	84.82
2015	2.97	4.12	5.38	6.35	3.28	4.63	2.65	3.68	3.08	4.38	4.34	3.17	48.01
Average	2.76	3.42	5.05	5.75	7.90	9.08	4.81	4.51	4.63	5.20	3.89	2.61	59.62
St. Dev	1.00	1.09	1.49	2.85	3.74	4.22	1.42	1.13	0.82	1.68	0.96	0.70	16.06

Adjusted values suggest that the average annual precipitation at the mine site is approximately 60 inches. May and June are the months with the greatest pan evaporation while the least amount of evaporation is expected to occur in December and January.

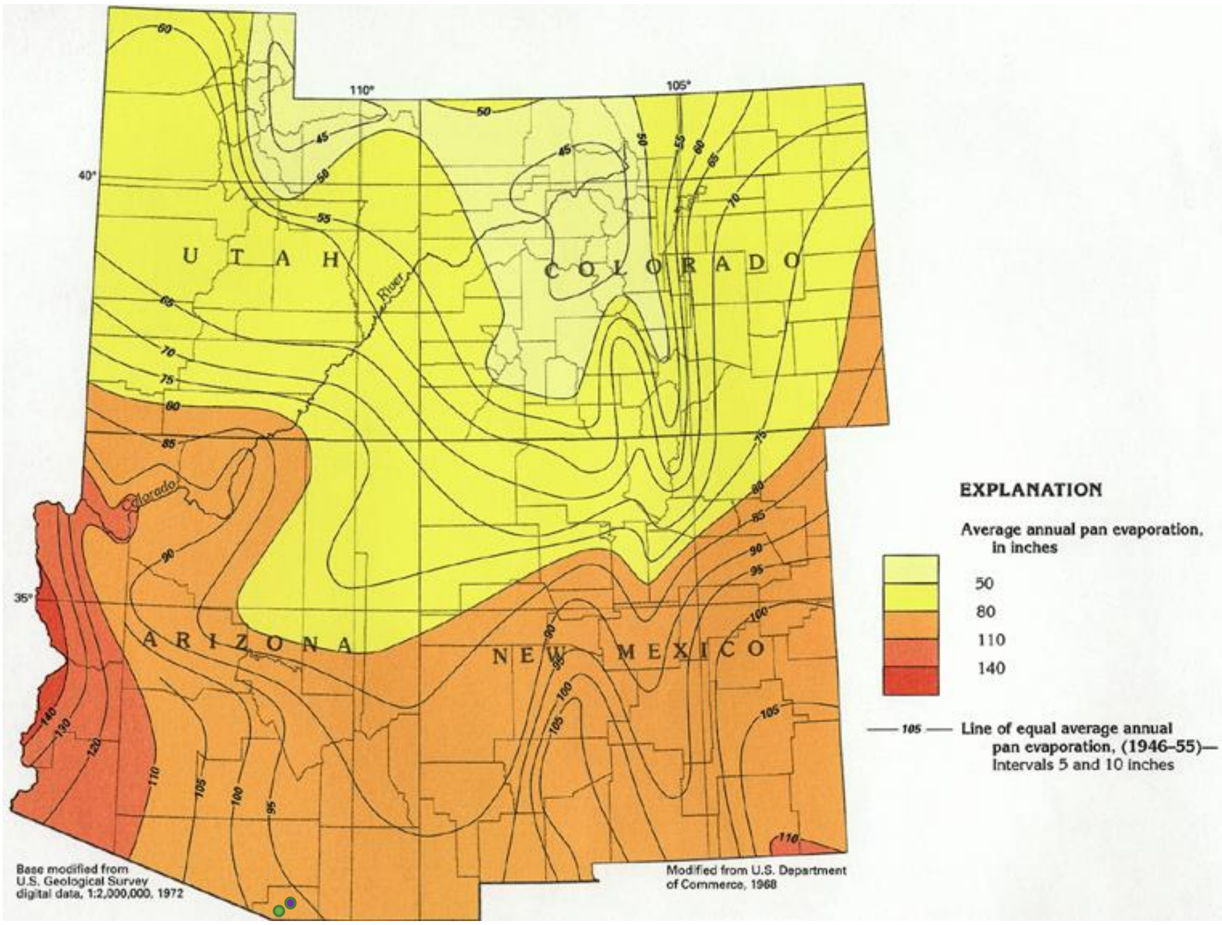
In an attempt to verify site data, ERC considered available regional pan evaporation data. From a regional basis, evaporation data is not available from the Canelo or Patagonia stations. The nearest meteorological station with available evaporation data is the Nogales 6N Station located in Nogales, AZ, approximately 15 miles west of the proposed mine site. The period of record for the Nogales 6N Station evaporation data is 1952 to 2005. The annual total pan evaporation is approximately 92 inches with nearly 40% of the annual evaporation total occurring over the three-month period of May through July. The average monthly and annual pan evaporation rates based on data recorded at the Nogales 6N site are provided in **Table 11**.

Table 11 – Pan Evaporation Based on Data from the Nogales 6N Site

Month	Pan Evaporation (inches)
January	3.6
February	4.7
March	7.0
April	9.4
May	11.9
June	13.3
July	10.0
August	8.3
September	8.1
October	7.2
November	4.5
December	3.6
Annual	91.6

To verify the Nogales 6N data, ERC evaluated regional evaporation estimates for comparison. The United States Geologic Service (USGS) publishes maps showing average annual evaporation. The approximate location of the Nogales 6N station and the site were plotted on a USGS evaporation of Arizona and surrounding areas, shown in Figure 6. Nogales 6N is identified by the green circle while the site is shown by the purple circle. The USGS figure suggests that annual evaporation at Nogales 6N is likely on the order of 97-98 inches while annual evaporation at the site is approximately 96 inches.

Figure 6 – Estimates of Annual Pan Evaporation Rates (from USGS)



The regional data suggests that pan evaporation on site would be significantly (roughly 50%) higher than estimated based on site data. Inspection of the site pan evaporation data suggests that evaporation is highly variable from year to year. As an example, evaporation in 2009 and 2010 were recorded to be approximately 40 inches per year while evaporation in 2015 was under 50 inches. These extreme low values raised concern in the integrity of the site collected data. Due to this highly variable site data and the discrepancy between site and regional data, ERC completed additional analysis in an attempt to verify the site pan evaporation data.

Given all of the meteorological data collected on site, it is possible to calculate evaporation estimates using other measured parameters. One simple method is the Energy Balance Method, which calculates daily evaporation based on net solar radiation (Chow 1988). The standard Energy Balance equation is:

$$Er = 0.0353Rn$$

where Er is evaporation measured in millimeters per day and Rn is solar radiation in Watts per square meter. This simple equation assumes that air temperature is 20^{o}C, which is not the case for the site. Given this temperature issue, the standard Energy Balance equation is not expected to provide absolute evaporation rates for the site. It can, however, be used to compare the relative amount of evaporation from year-to-year and highlight potential anomalies in the data set.

Site measured mean monthly solar radiation is provided in **Table 12** while the corresponding calculated monthly and annual evaporation rates at site are given in **Table 13**.

Table 12 – Site Recorded Solar Radiation (W/m2)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2008	320.7	384.8	492.9	518.6	515.7	477.6	342.7	354.8	376.5	409.9	294.5	217.2
2009	272.3	370.7	464.4	512.8	450.2	428	374.4	402	387.9	389.8	267.1	238.3
2010	231.4	297.5	468.7	456	544.7	520.4	326.2	377.8	412.3	365	296.4	204.5
2011	264.6	341.7	495.4	493.7	540.2	530.3	328.3	343.2	396.9	369.2	248.3	198.3
2012	273.6	404.5	474.9	554.5	621.4	474.6	328	446.5	365.8	419.3	250.6	222.8
2013	236.4	374.1	454.4	580.4	508	502.9	316.8	363.5	401.6	427.4	254.7	221
2014	265.3	379.1	449.2	622.3	665	655.5	395.5	420.9	338.5	417.4	321	219.8
2015	98.4	169.9	207.8	285.5	291.7	254.7	193.6	209.5	181	157.5	123.5	98.1

Table 13 – Site Evaporation Calculates Based on Recorded Solar Radiation (inches)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2008	13.82	16.58	21.24	22.34	22.22	20.58	14.76	15.29	16.22	17.66	12.69	9.36	202.74
2009	11.73	15.97	20.01	22.09	19.40	18.44	16.13	17.32	16.71	16.79	11.51	10.27	196.37
2010	9.97	12.82	20.19	19.65	23.47	22.42	14.05	16.28	17.76	15.73	12.77	8.81	193.91
2011	11.40	14.72	21.34	21.27	23.27	22.85	14.14	14.79	17.10	15.91	10.70	8.54	196.03
2012	11.79	17.43	20.46	23.89	26.77	20.45	14.13	19.24	15.76	18.06	10.80	9.60	208.37
2013	10.18	16.12	19.58	25.01	21.89	21.67	13.65	15.66	17.30	18.41	10.97	9.52	199.96
2014	11.43	16.33	19.35	26.81	28.65	28.24	17.04	18.13	14.58	17.98	13.83	9.47	221.85
2015	4.24	7.32	8.95	12.30	12.57	10.97	8.34	9.03	7.80	6.79	5.32	4.23	97.85
Average	10.57	14.66	18.89	21.67	22.28	20.70	14.03	15.72	15.40	15.92	11.07	8.72	189.63
St. Dev	2.81	3.28	4.08	4.39	4.87	4.86	2.58	3.09	3.23	3.82	2.58	1.89	38.17

Site evaporation calculated by the Energy Balance Method produces monthly and annual values that greatly exceed recorded pan evaporation and regional evaporation estimates. ERC does not recommend using these calculated values. Calculated evaporation rates are, however, helpful in evaluating data recorded at the site. Review of the calculated data suggest that in 2009 and 2010, solar radiation at the site was approximately average whereas in 2015 it was only about 50% of average. This suggests that evaporation in 2009 and 2010 should have been near the average annual evaporation whereas evaporation in 2015 is expected to below average. Pan evaporation data recorded at the site (see **Table 10**), however, show that recorded evaporation in 2009 and 2010 are the two lowest years of record. Given how much the 2009 and 2010 data are lower than other years and even lower than regional data, ERC suggests that these values not be used at this time. Low pan evaporation rates from 2015 are supported by low solar radiation and ERC feels that this data should be considered. Based on this information, ERC recommends that monthly site pan evaporation be based on values recorded at site in 2008 and from 2011-2015. When estimating evaporation from a pond surface, ERC recommended that a pan coefficient of 0.72 be applied to pan evaporation. Recommended pan and pond monthly evaporation rates are presented in **Table 14**. We feel that moving forward additional evaluations of evaporation data is warranted given the significant differences in site and regional data.

Table 14 – Recommended Pan and Pond Evaporation for Use at Site

Month	Pan Evaporation (inches)	Pond Evaporation (inches)
January	3.13	2.26
February	3.76	2.71
March	5.47	3.94
April	6.22	4.48
May	8.94	6.44
June	10.41	7.50
July	5.16	3.72
August	4.72	3.40
September	4.63	3.33
October	5.93	4.27
November	4.35	3.13
December	2.98	2.14
Annual	65.70	47.31

7.0 References

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Hansen, et al., Hydrometeorological Report No. 49 (HMR 49), Probable Maximum Precipitation – Colorado River and Great Basin Drainages, National Weather Service, Silver Spring, MD, reprinted 1984.

NOAA's National Weather Service Hydrometeorological Design Studies Center Precipitation Frequency Data Server, hdsc.nws.noaa.gov/hdsc.pfds

PRISM Climate Data, prism.oregonstate.edu

Western Regional Climate Center, wrcc.dri.edu

Appendices

Appendix A – Graphical and Tabular Data for General Storm PMP

Appendix B –General Storm PMP Calculations

Appendix C – Graphical and Tabular Data for Local Storm PMP

Appendix D – Local Storm PMP Calculations

Appendix A

Graphical and Tabular Data for General Storm PMP

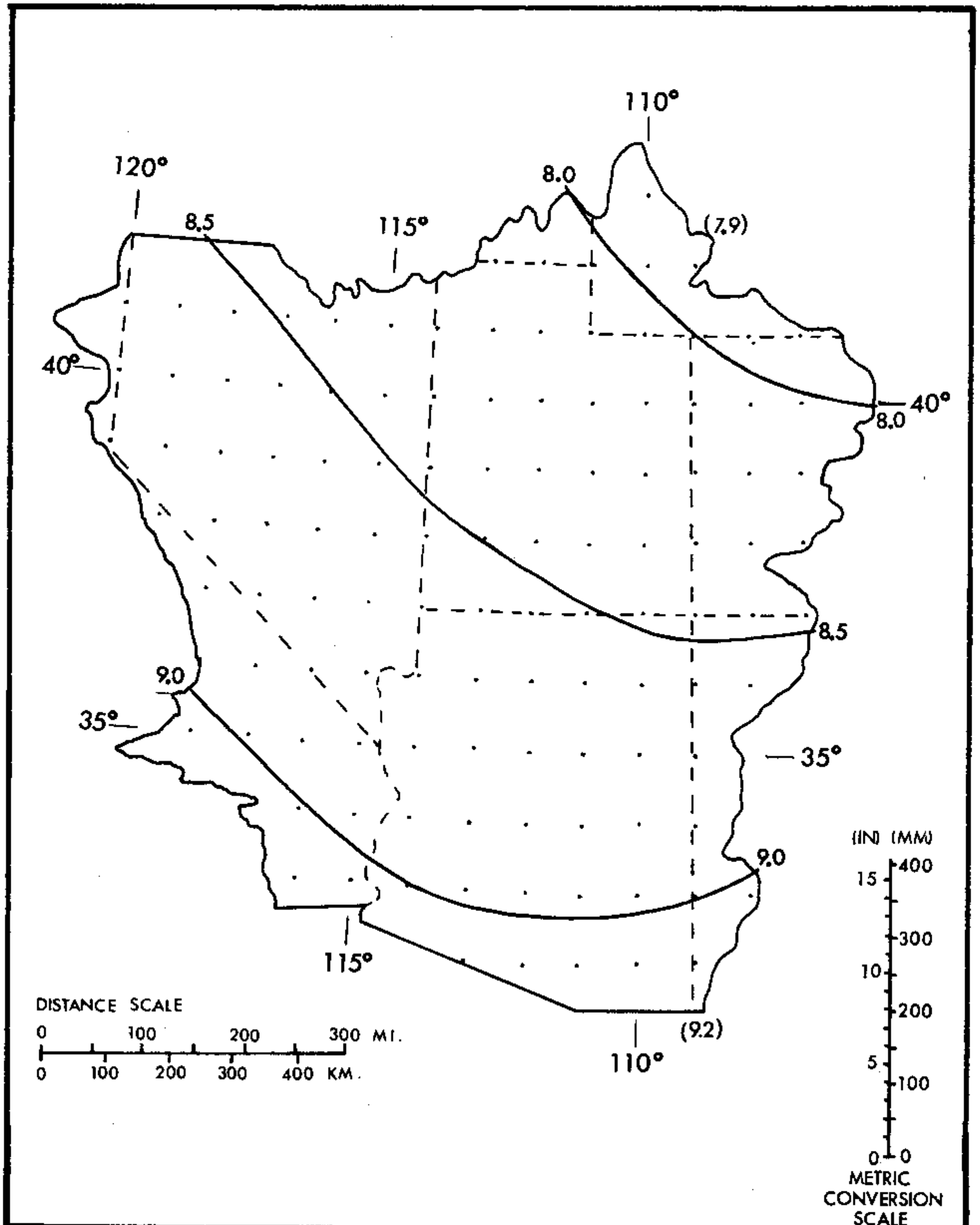


Figure 2.5.--1000-mb (100-kPa) 24-hr convergence PMP (inches) for 10 mi^2 (26 km^2) for January. Values in parentheses are limiting values and are to facilitate extrapolation beyond the indicated gradient.

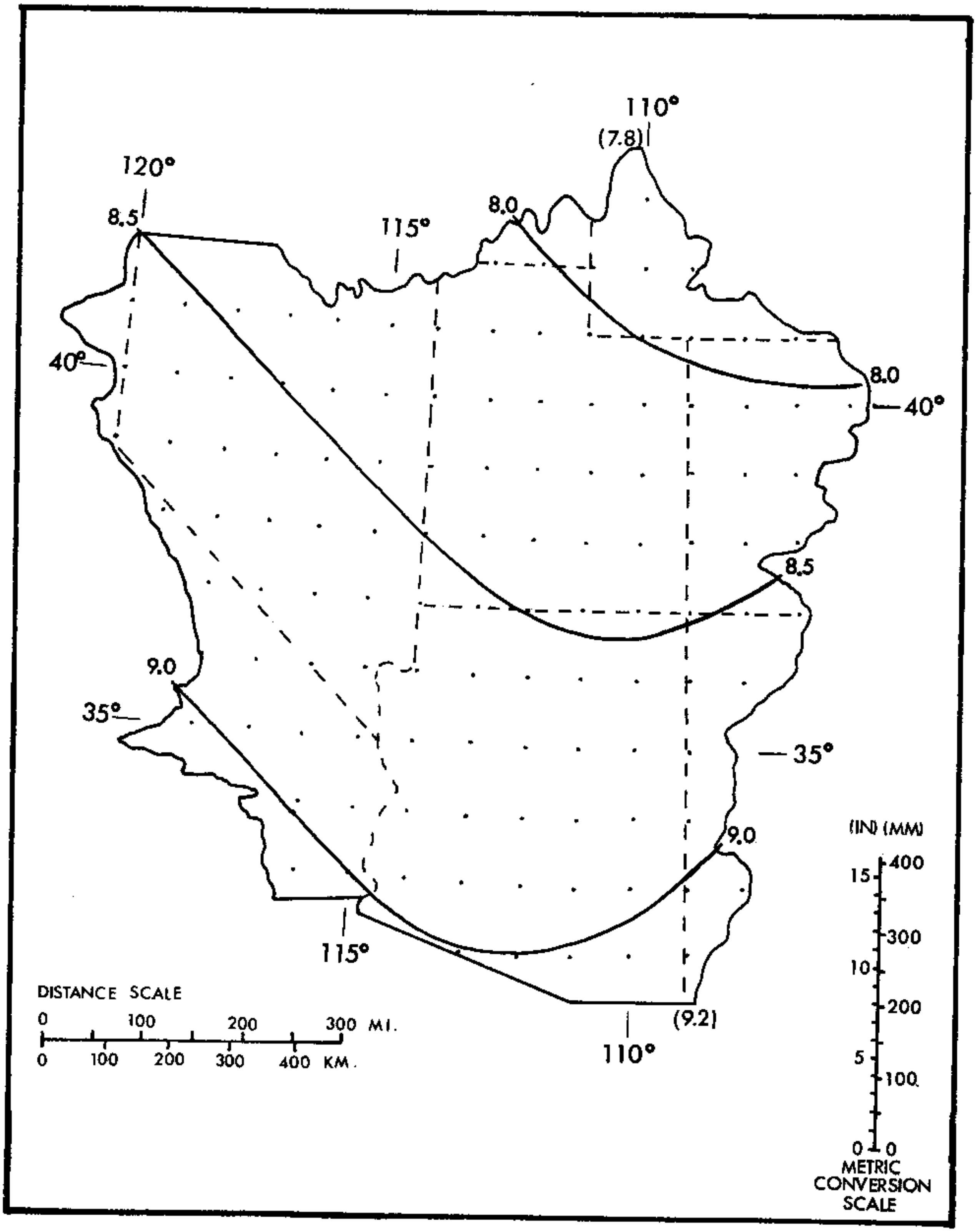


Figure 2.6.--1000-mb (100-kPa) 24-hr convergence PMP (inches) for 10 mi² (26 km²) for February. Values in parentheses are limiting values and are to facilitate extrapolation beyond the indicated gradient.

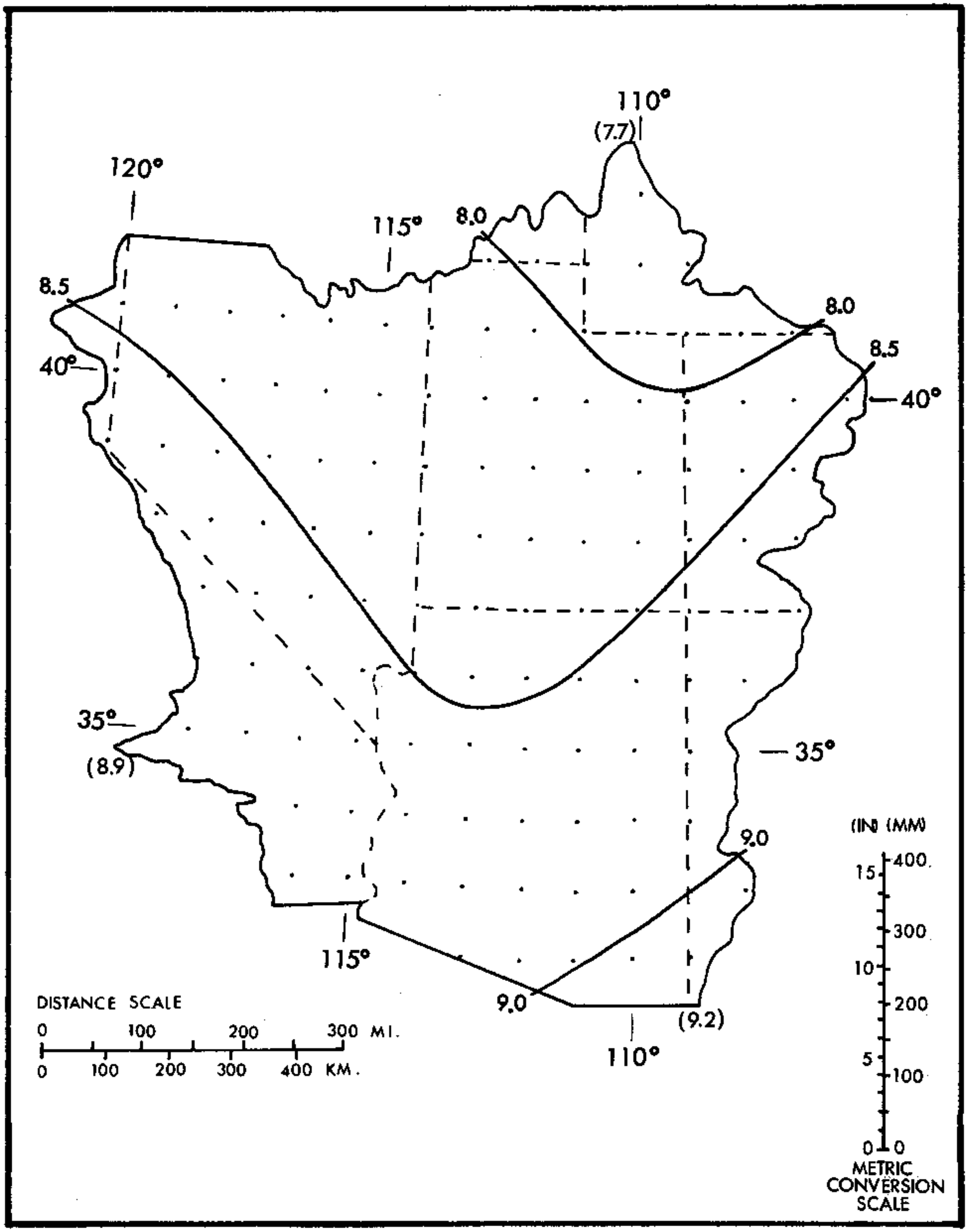


Figure 2.7.--1000-mb (100-kPa) 24-hr convergence PMP (inches) for 10 mi^2 (26 km^2) for March. Values in parentheses are limiting values and are to facilitate extrapolation beyond the indicated gradient.

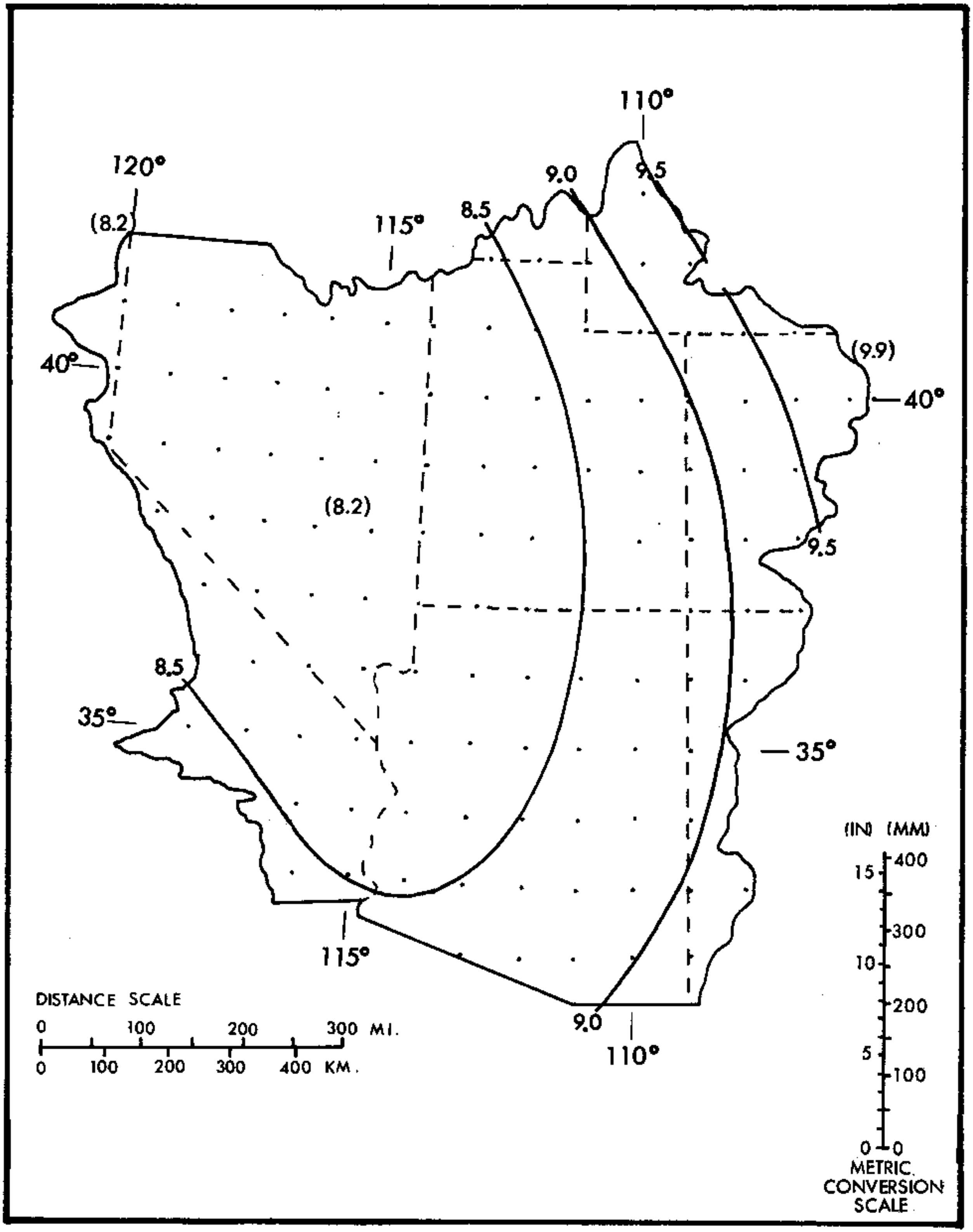


Figure 2.8.--1000-mb (100-kPa) 24-hr convergence PMP (inches) for 10 mi^2 (26 km^2) for April. Values in parentheses are limiting values and are to facilitate extrapolation beyond the indicated gradient.

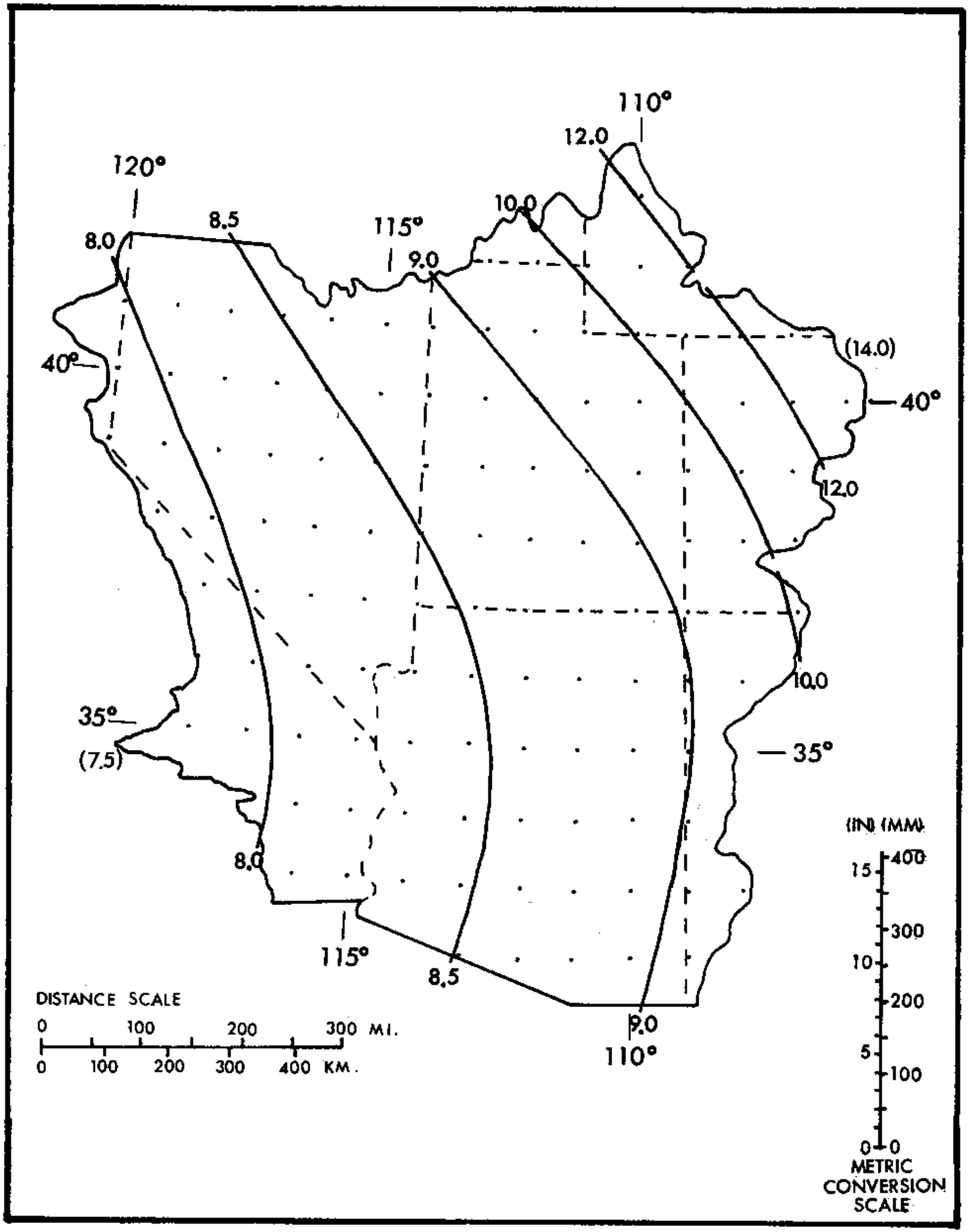


Figure 2.9.--1000-mb (100-kPa) 24-hr convergence PMP (inches) for 10 mi^2 (26 km^2) for May. Values in parentheses are limiting values and are to facilitate extrapolation beyond the indicated gradient.

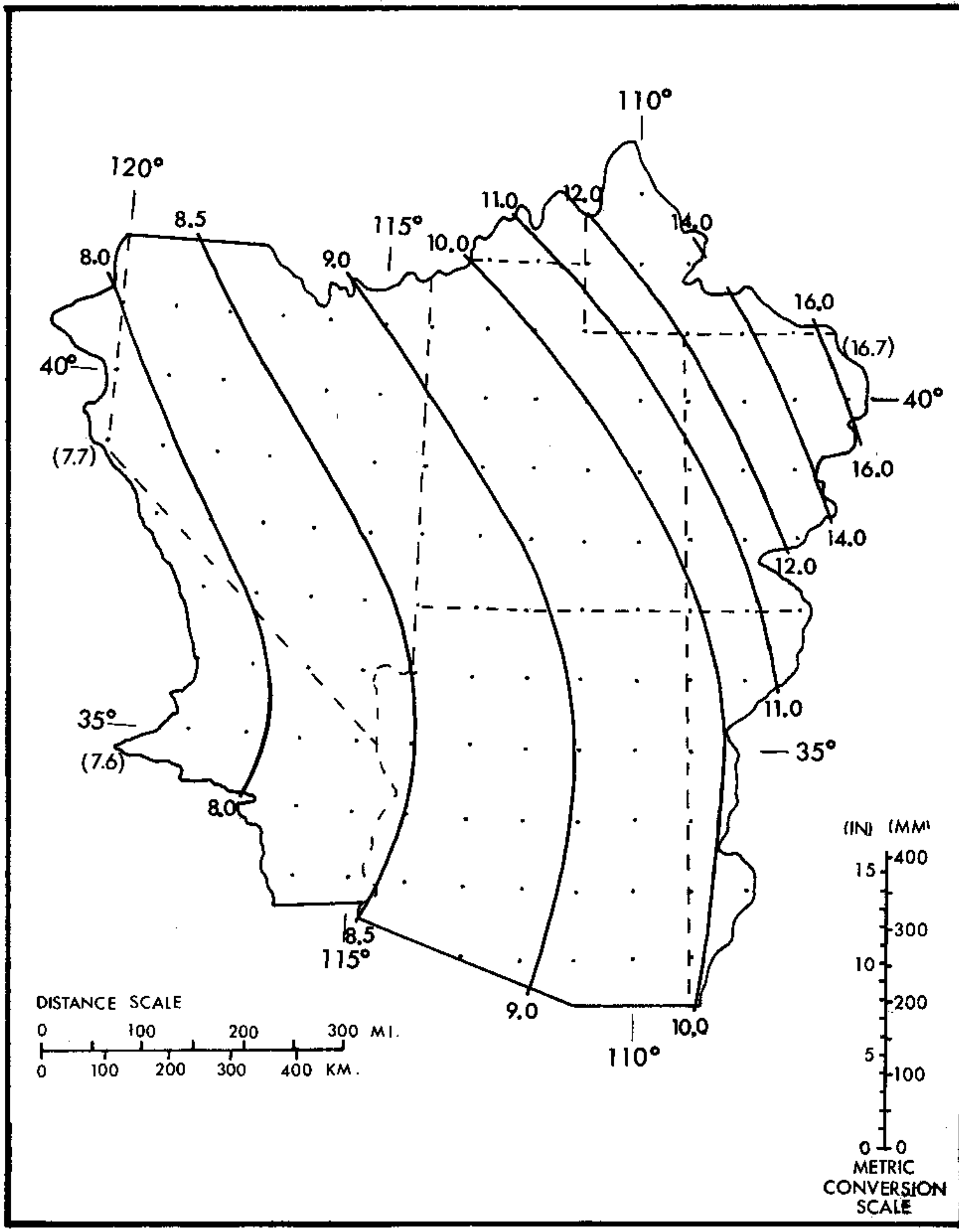


Figure 2.10.--1000-mb (100-kPa) 24-hr convergence PMP (inches) for 10 mi^2 (26 km^2) for June. Values in parentheses are limiting values and are to facilitate extrapolation beyond the indicated gradient.

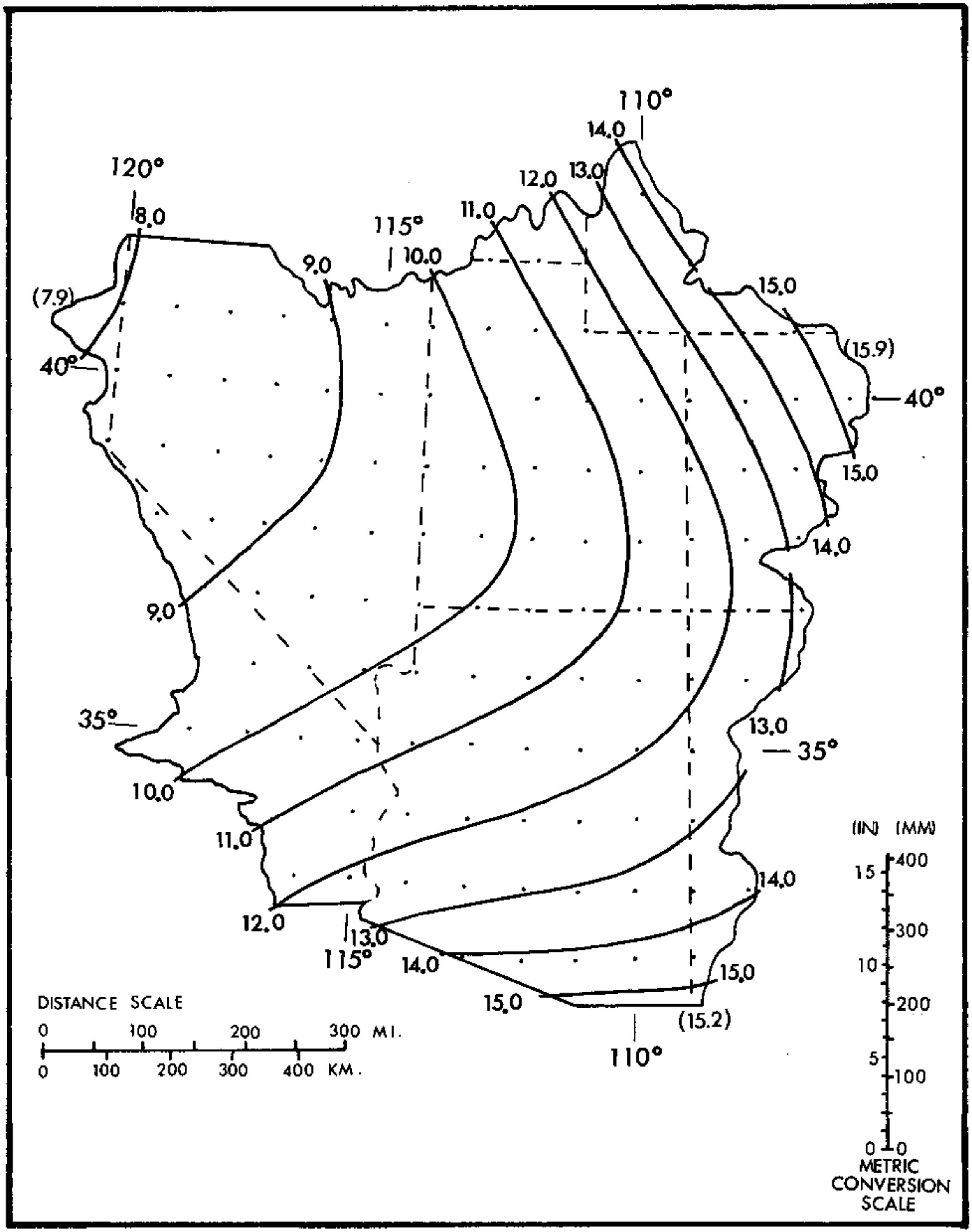


Figure 2.11.--1000-mb (100-kPa) 24-hr convergence PMP (inches) for 10 mi2 (26 km2) for July. Values in parentheses are limiting values and are to facilitate extrapolation beyond the indicated gradient.

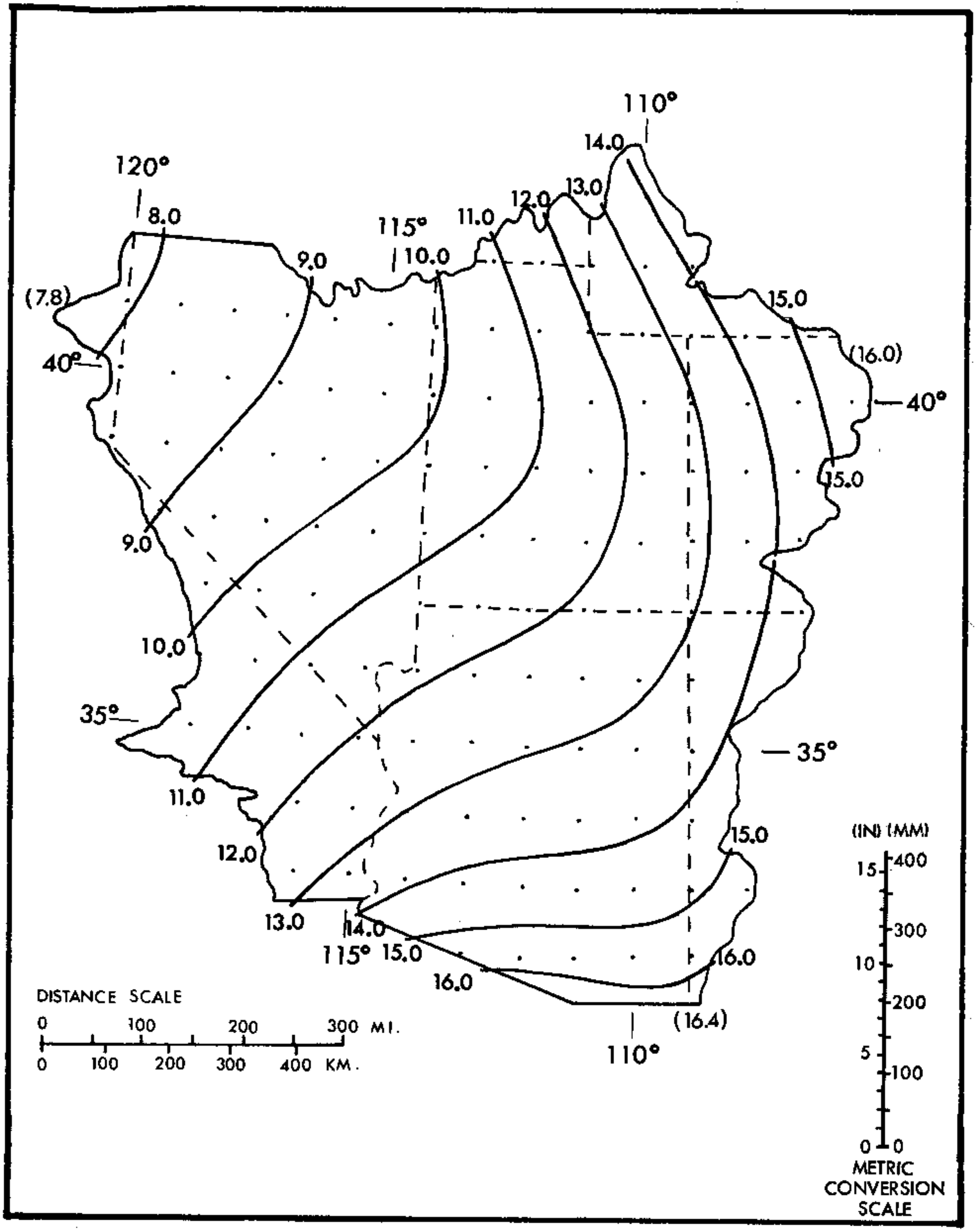


Figure 2.12.--1000-mb (100-kPa) 24-hr convergence PMP (inches) for 10 mi^2 (26 km^2) for August. Values in parentheses are limiting values and are to facilitate extrapolation beyond the indicated gradient.

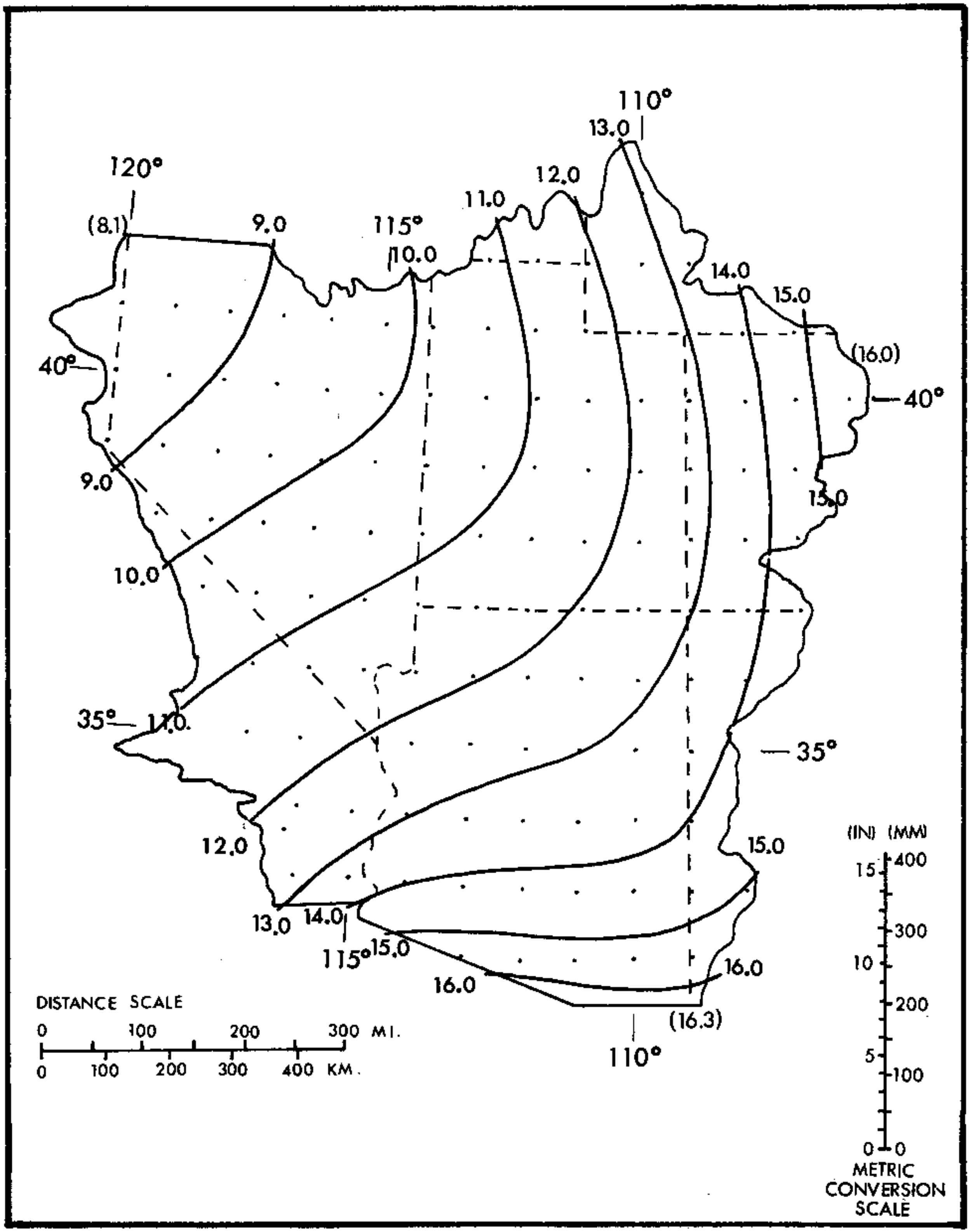


Figure 2.13.--1000-mb (100-kPa) 24-hr convergence PMP (inches) for 10 mi^2 (26 km^2) for September. Values in parentheses are limiting values and are to facilitate extrapolation beyond the indicated gradient.

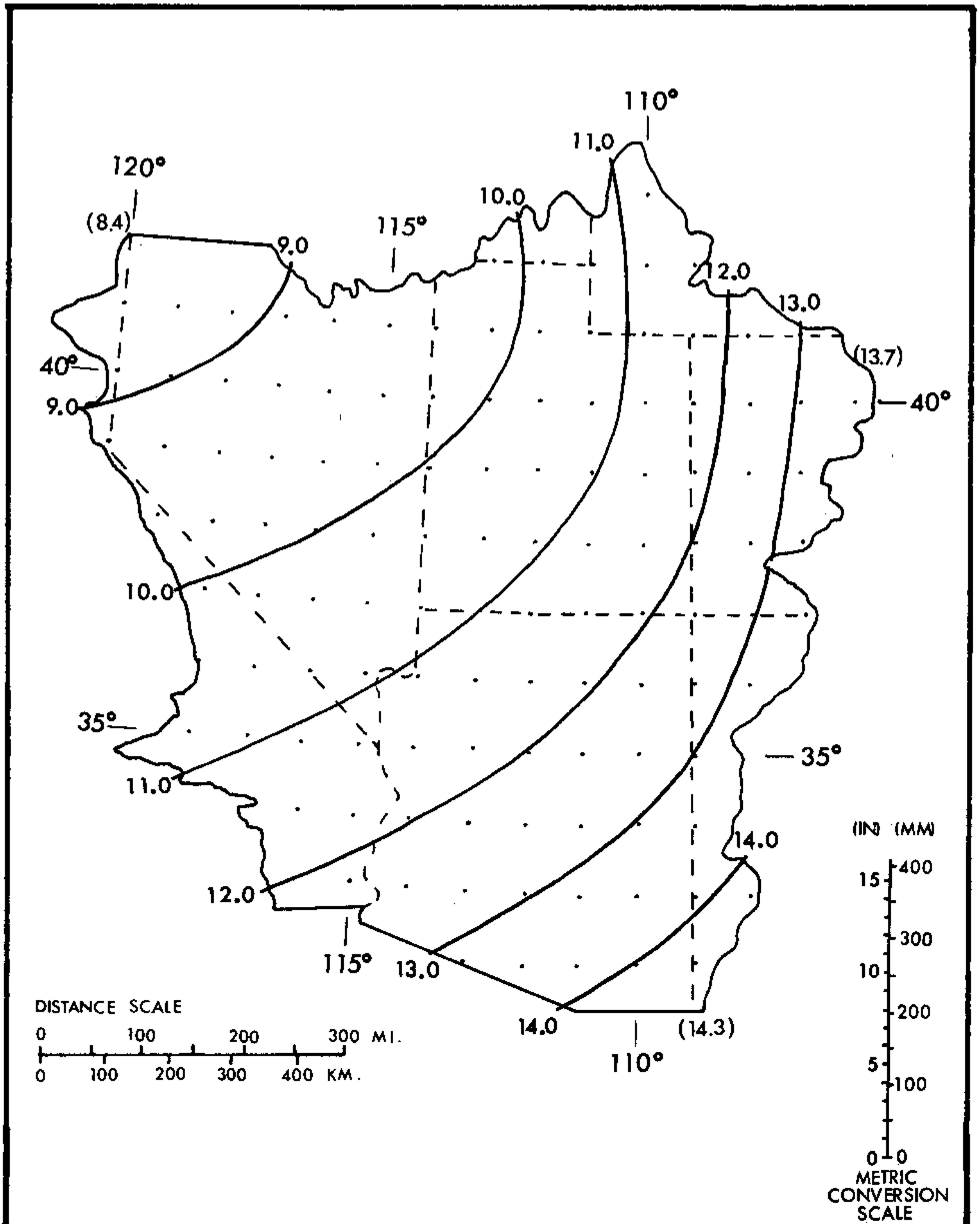


Figure 2.14.--1000-mb (100-kPa) 24-hr convergence PMP (inches) for 10 mi^2 (26 km^2) for October. Values in parentheses are limiting values and are to facilitate extrapolation beyond the indicated gradient.

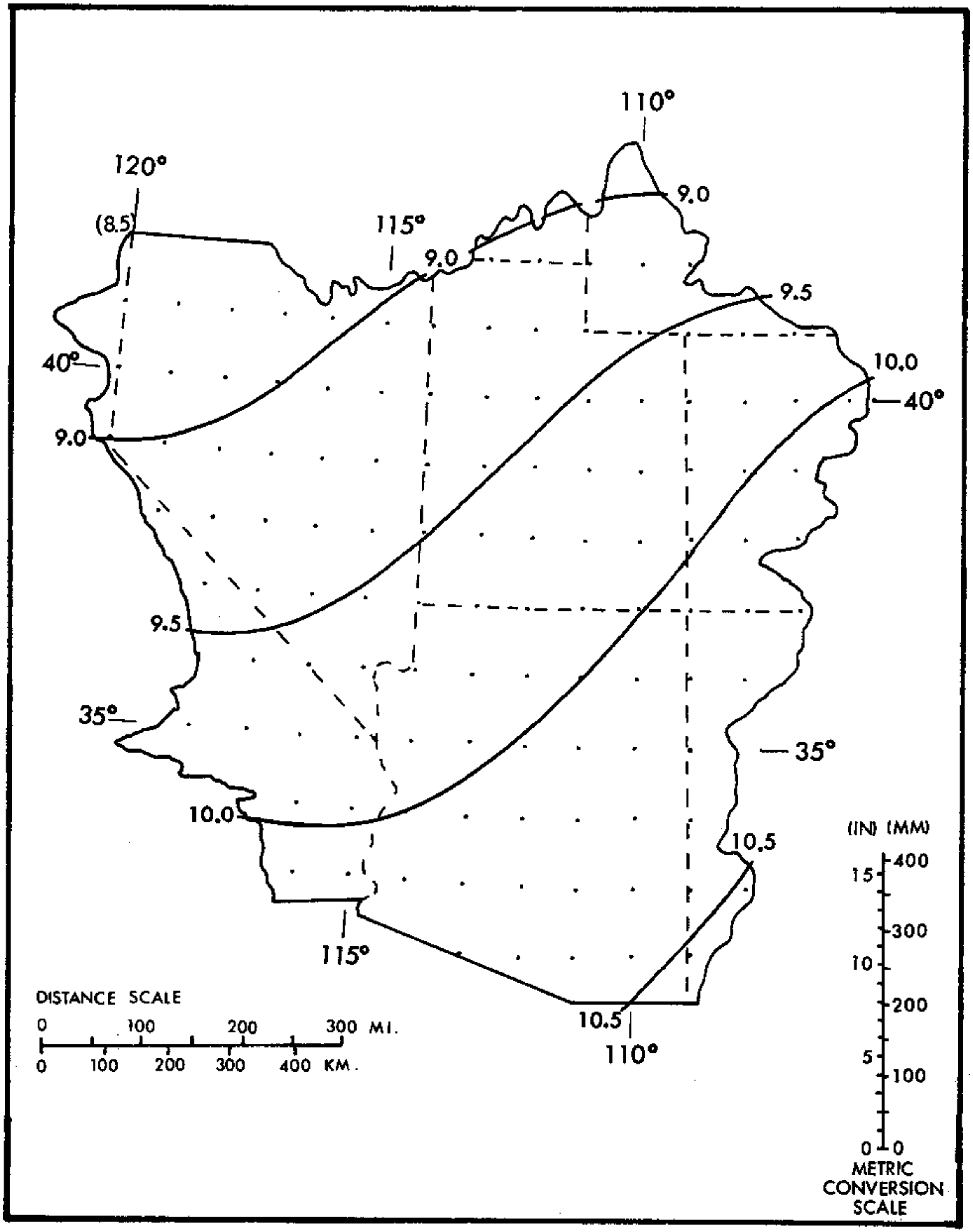


Figure 2.15.--1000-mb (100-kPa) 24-hr convergence PMP (inches) for 10 mi^2 (26 km^2) for November. Values in parentheses are limiting values and are to facilitate extrapolation beyond the indicated gradient.

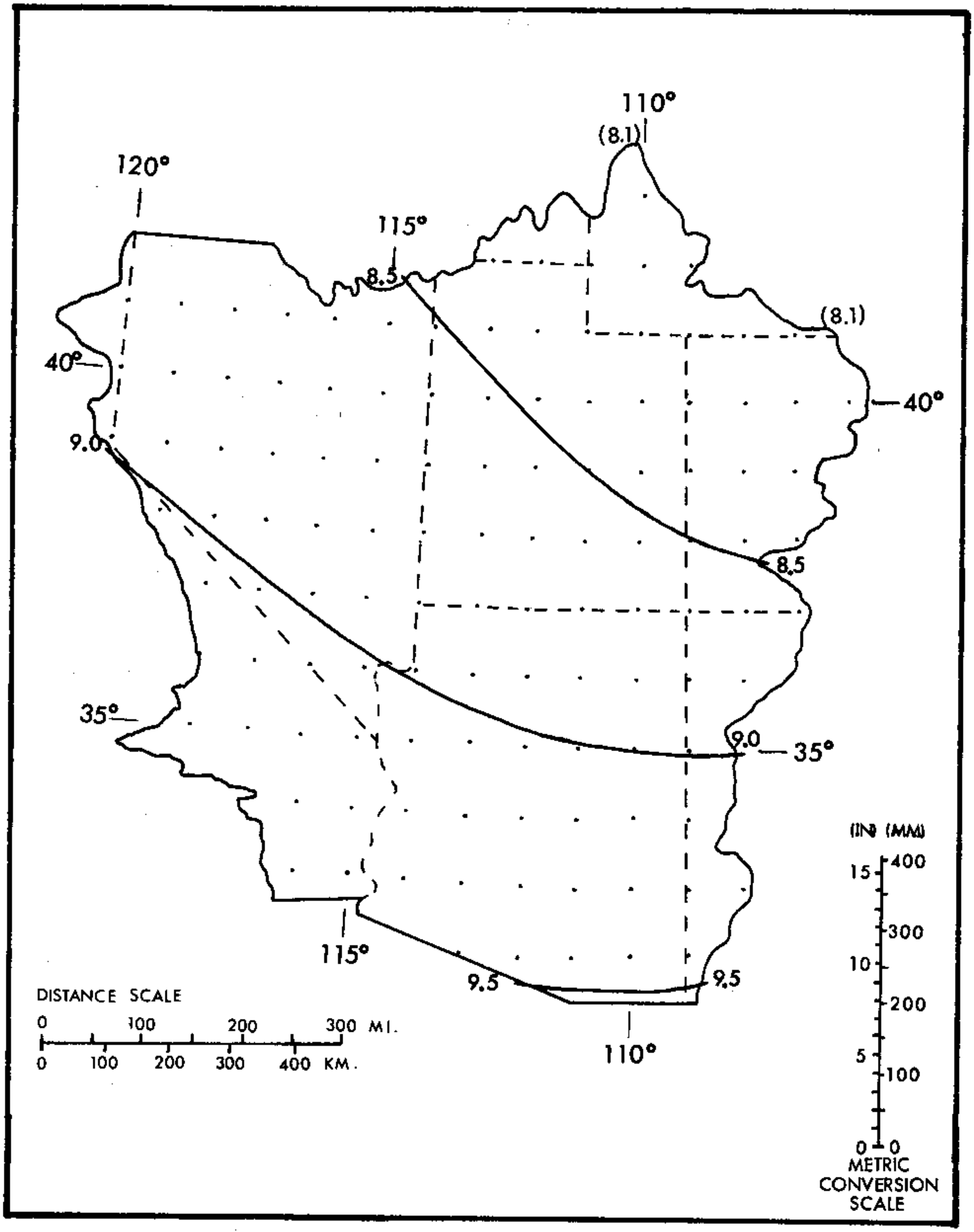


Figure 2.16.--1000-mb (100-kPa) 24-hr convergence PMP (inches) for 10 mi^2 (26 km^2) for December. Values in parentheses are limiting values and are to facilitate extrapolation beyond the indicated gradient.

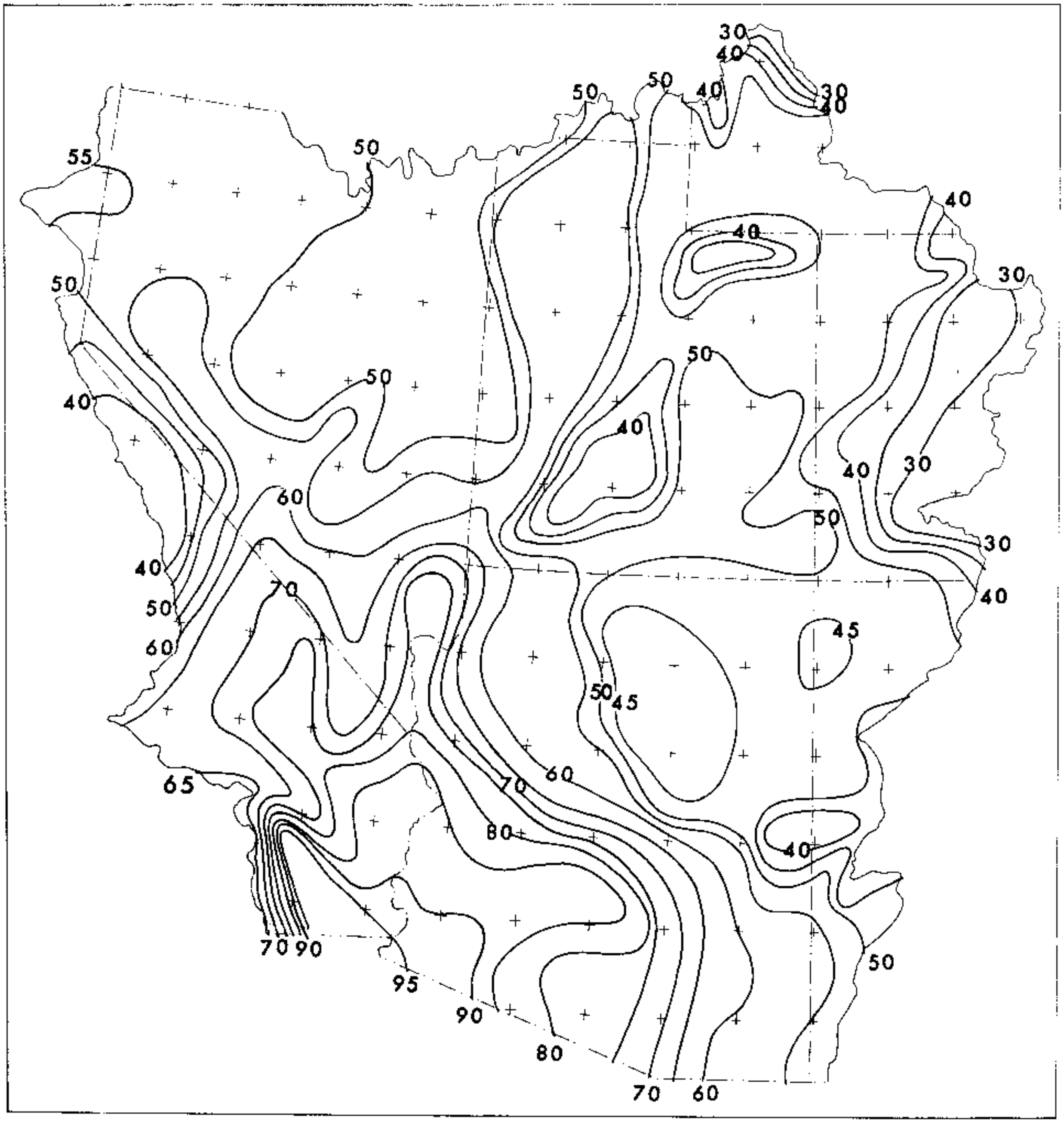
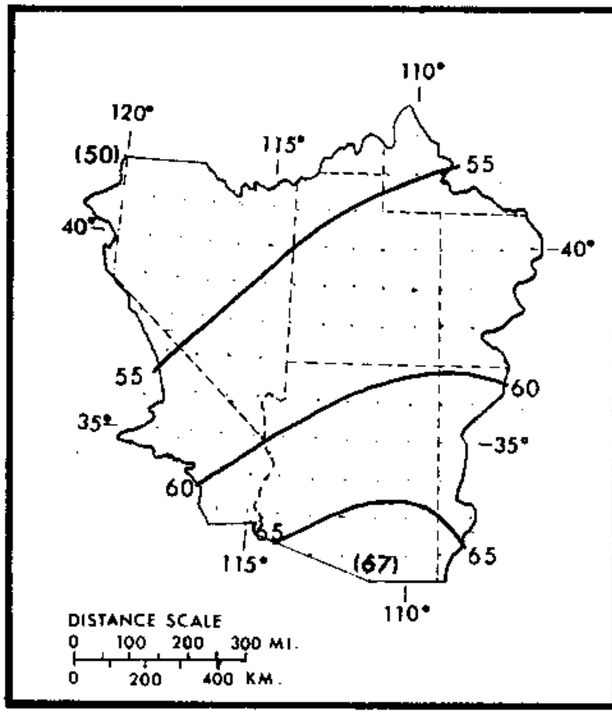
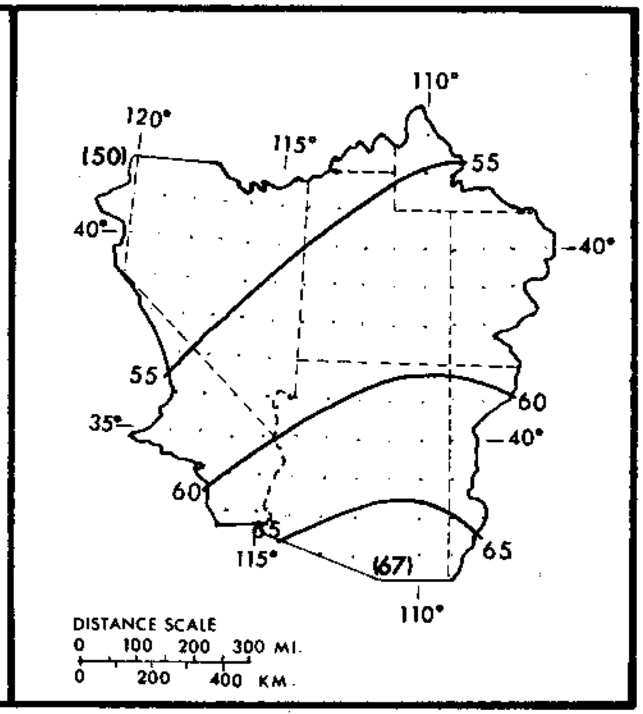


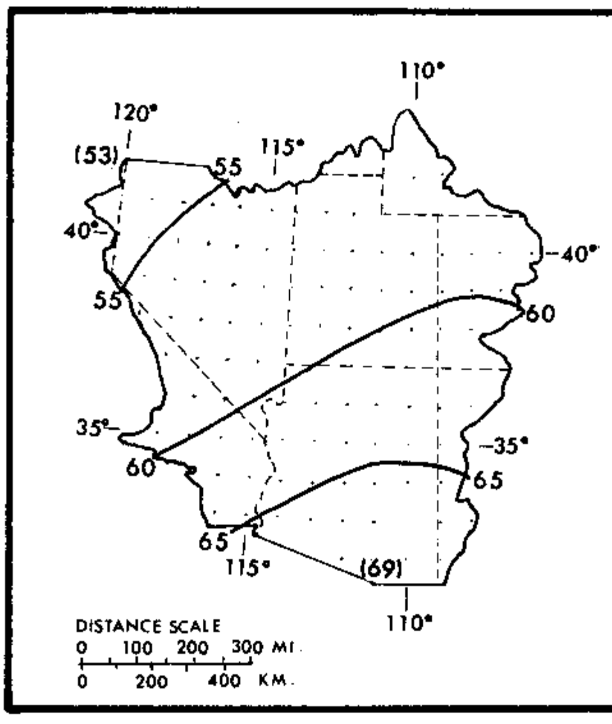
Figure 2.18.--Percent of 1000-mb (100-kPa) convergence PMP resulting from effective elevation and barrier considerations. Isolines drawn for every five percent.



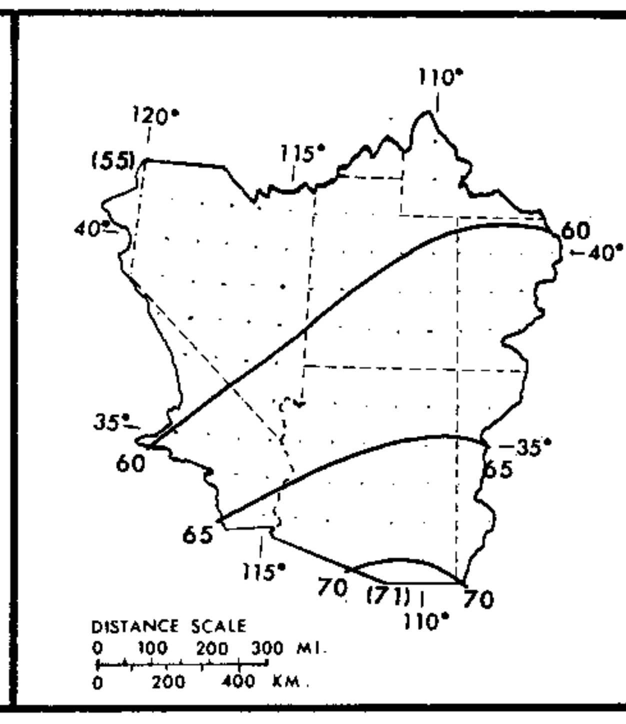
January



February

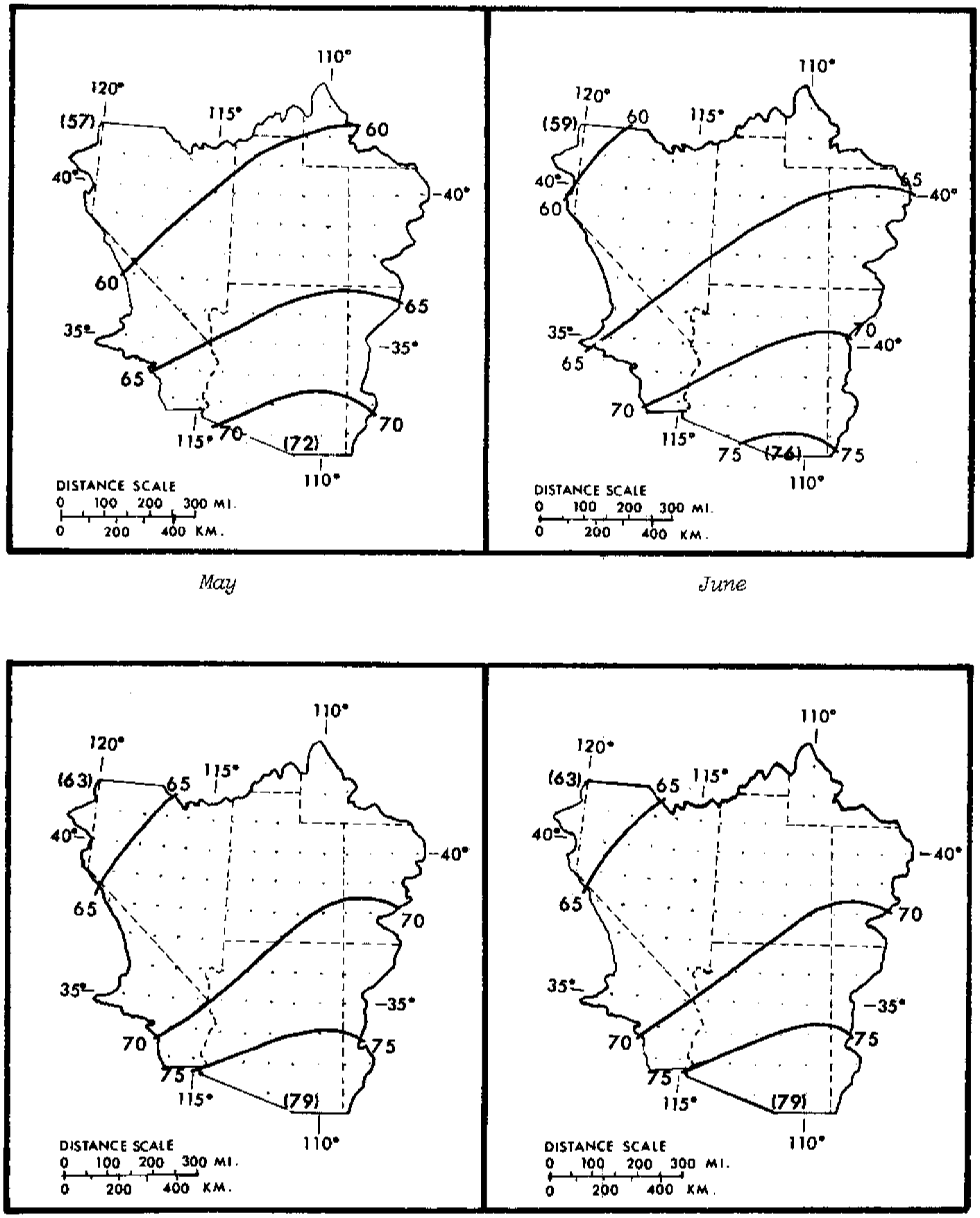


March



April

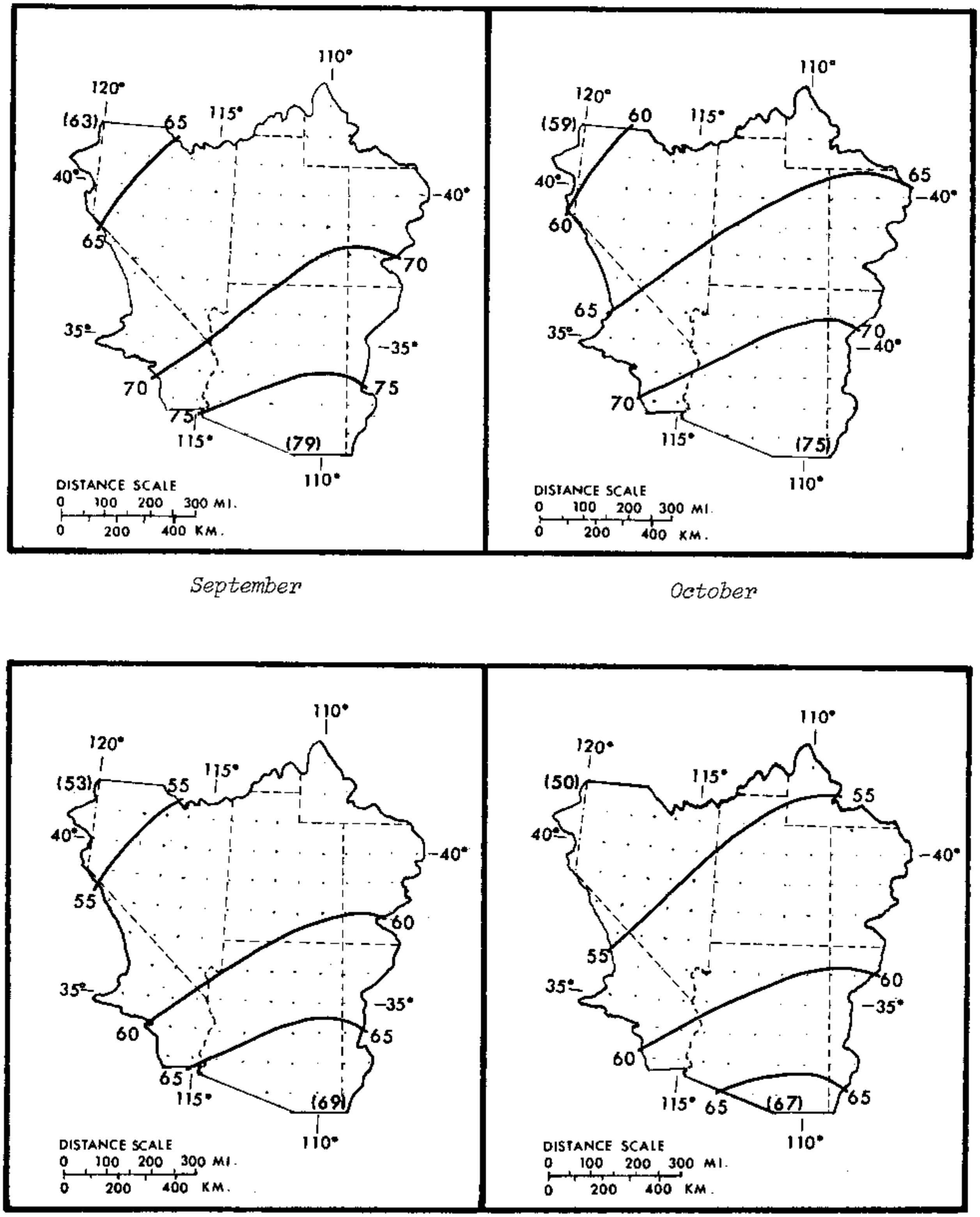
Figure 2.25.--Regional variation of 6/24-hr ratios by month (percent). Values in parentheses are limiting values and are to facilitate extrapolation beyond the indicated gradient.



May *June*

July *August*

Figure 2.26.--Regional variation of 6/24-hr ratios by month (percent). Values in parentheses are limiting values and are to facilitate extrapolation beyond the indicated gradient.



September

October

November

December

Figure 2.27.--Regional variation of 6/24-hr ratios by month (percent). Values in parentheses are limiting values and are to facilitate extrapolation beyond the indicated gradient.

For the range of 6/24-hr ratios included in figures 2.25 to 2.27, depth-duration values in percent of 24-hr amounts are found in table 2.7. The regional ratio maps, and the depth-duration curves presented in figure 2.20 were used in adjusting the major storm data to 24-hr amounts listed in table 2.1.

Table 2.7.--Durational variation of convergence PMP (in percent of 24-hr amount).

Duration (Hrs)					
6	12	18	24	48	72
50	76	90	100	129	150
51	77	90	100	128	148
52	77	90	100	127	146
53	77	91	100	127	144
54	78	91	100	126	142
55	78	91	100	125	140
56	79	91	100	124	138
57	79	92	100	123	137
58	80	92	100	122	135
59	80	92	100	121	134
60	81	92	100	120	132
61	81	92	100	120	131
62	82	93	100	119	129
63	82	93	100	118	128
64	83	93	100	117	126
65	84	93	100	117	125
66	84	93	100	116	124
67	85	94	100	116	123
68	85	94	100	115	122
69	86	94	100	115	121
70	87	94	100	114	120
71	87	95	100	114	119
72	88	95	100	113	118
73	88	95	100	113	118
74	89	95	100	112	117
75	89	96	100	112	116
76	90	96	100	111	115
77	90	96	100	110	114
78	91	96	100	110	114
79	92	97	100	109	113
80	92	97	100	109	113

Note: For use, enter first column (6 hr) with 6/24-hr ratio from figures 2.25 to 2.27.

2.5 Areal Reduction for Basin Size

For operational use, basin average values of convergence PMP are needed rather than 10-mi^2 (26-km^2) values. Preferably, the method for reducing 10-mi^2 (26-km^2) values to basin average rainfalls should be derived from depth-area relations of storms in the region. However, all general storms in the region include large proportions ot orographic precipitation.

Our solution was to use generalized depth-area relations developed for PMP estimates within bordering zones in the Central and Eastern United States (Riedel et al. 1956). The smoothed areal variations adopted for the Southwestern States are shown in figures 2.28 and 2.29 for each month or a combination of months where differences are insignificant.

Figures 2.28 and 2.29 give depth-area relations that reduce 10-mi^2 (26-km^2) convergence PMP for basin sizes up to 5,000 mi^2 (12,950 km^2) for each month. Areal variations are given for the 4 greatest (1st to 4th) 6-hr PMP increments. After the 4th increment no reduction for basin size is required. Application of these figures will become clear through consideration of an example of PMP computation in chapter 6.

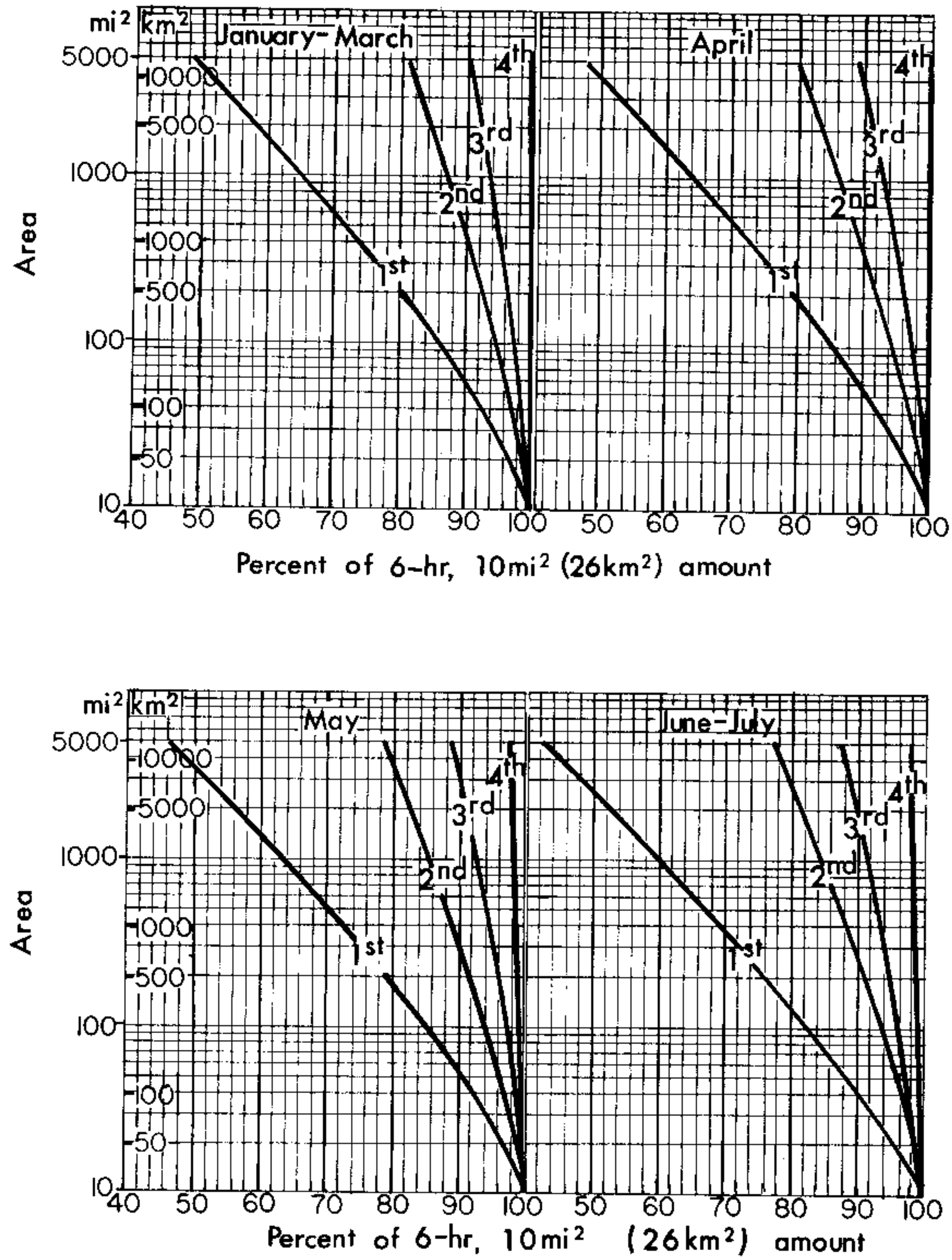


Figure 2.28.--Depth-area variation for convergence PMP for first to fourth 6-hr increments.

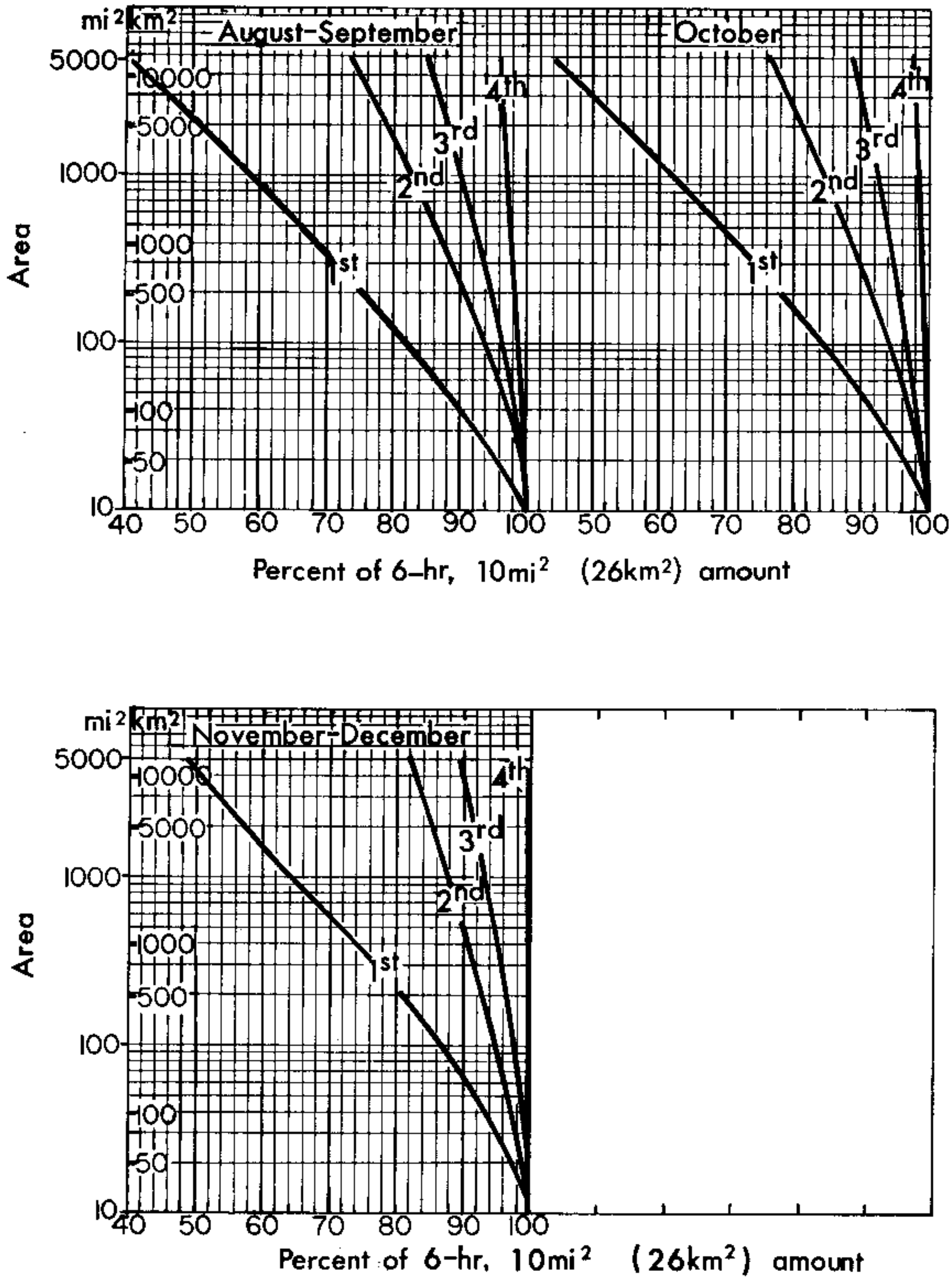


Figure 2.29.--Depth-area variation for convergence PMP for first to fourth 6-hr increments.

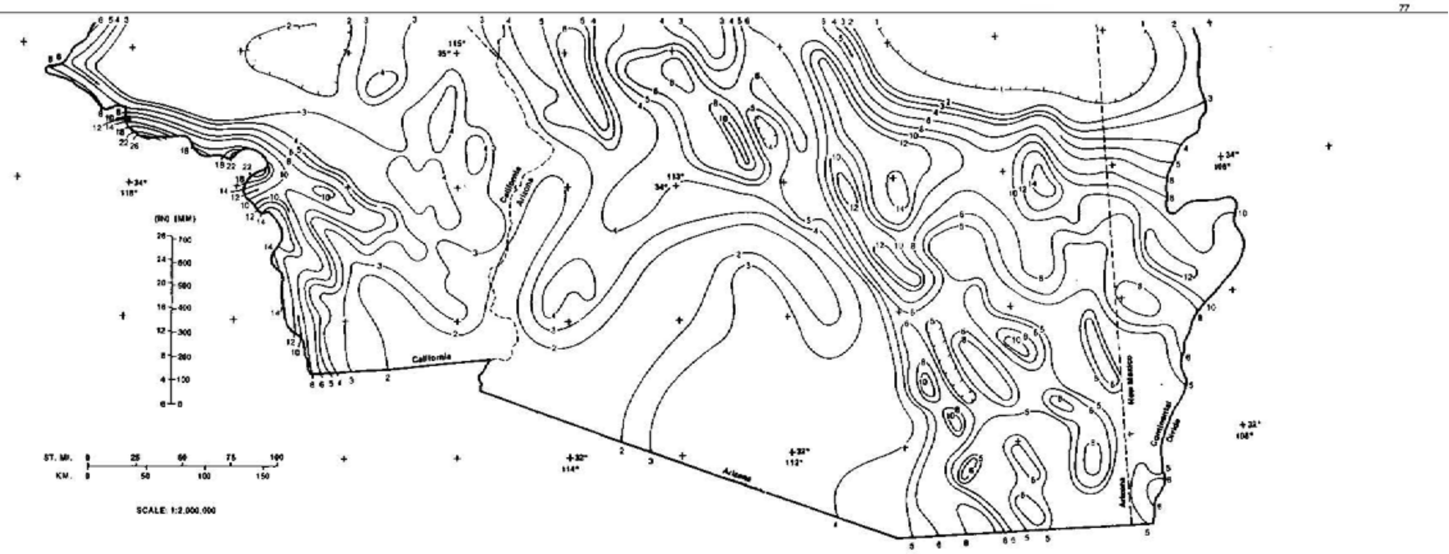
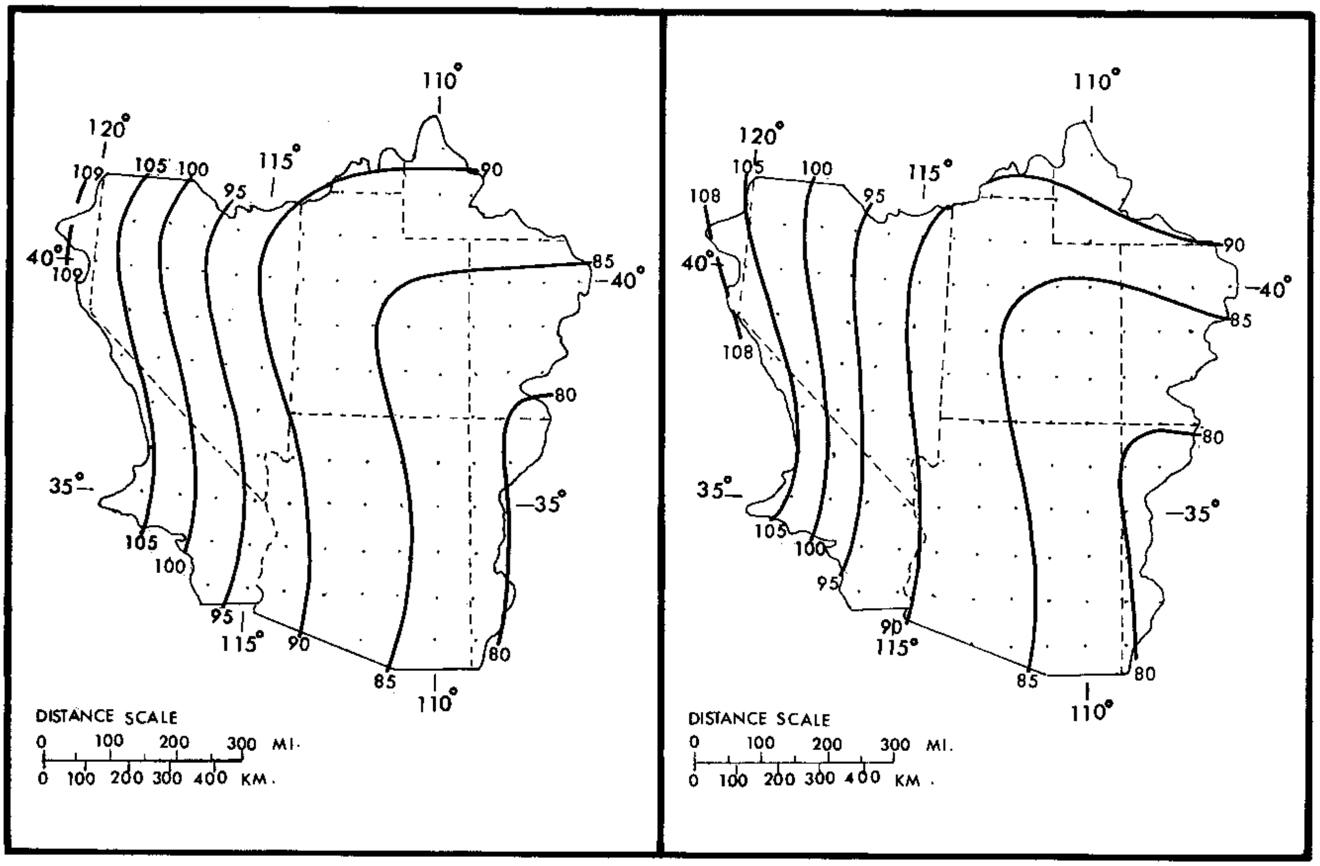
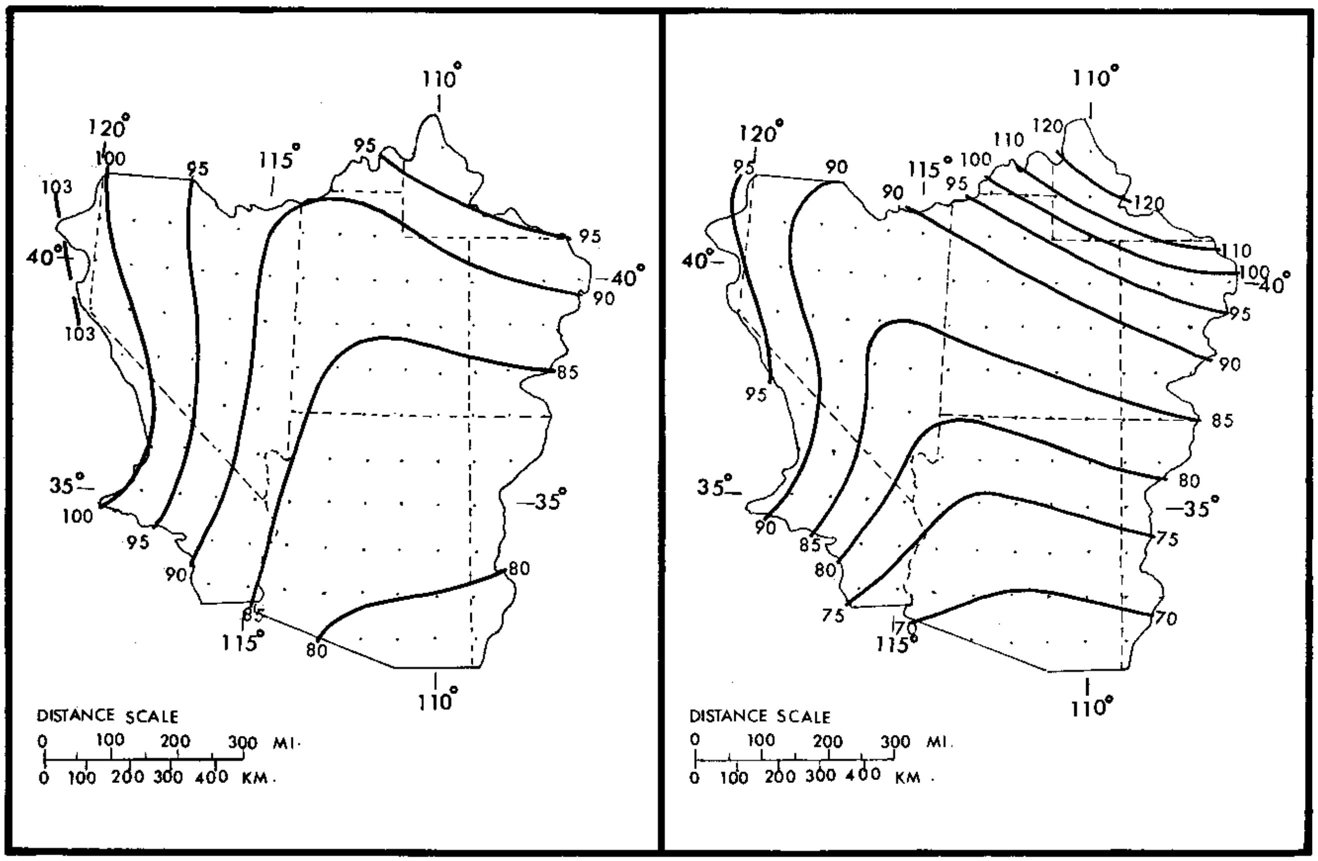


FIGURE 3.11d (Revised) — 10 mi² (26 km²) 24-hr orographic PMP index map (inches), southern section.



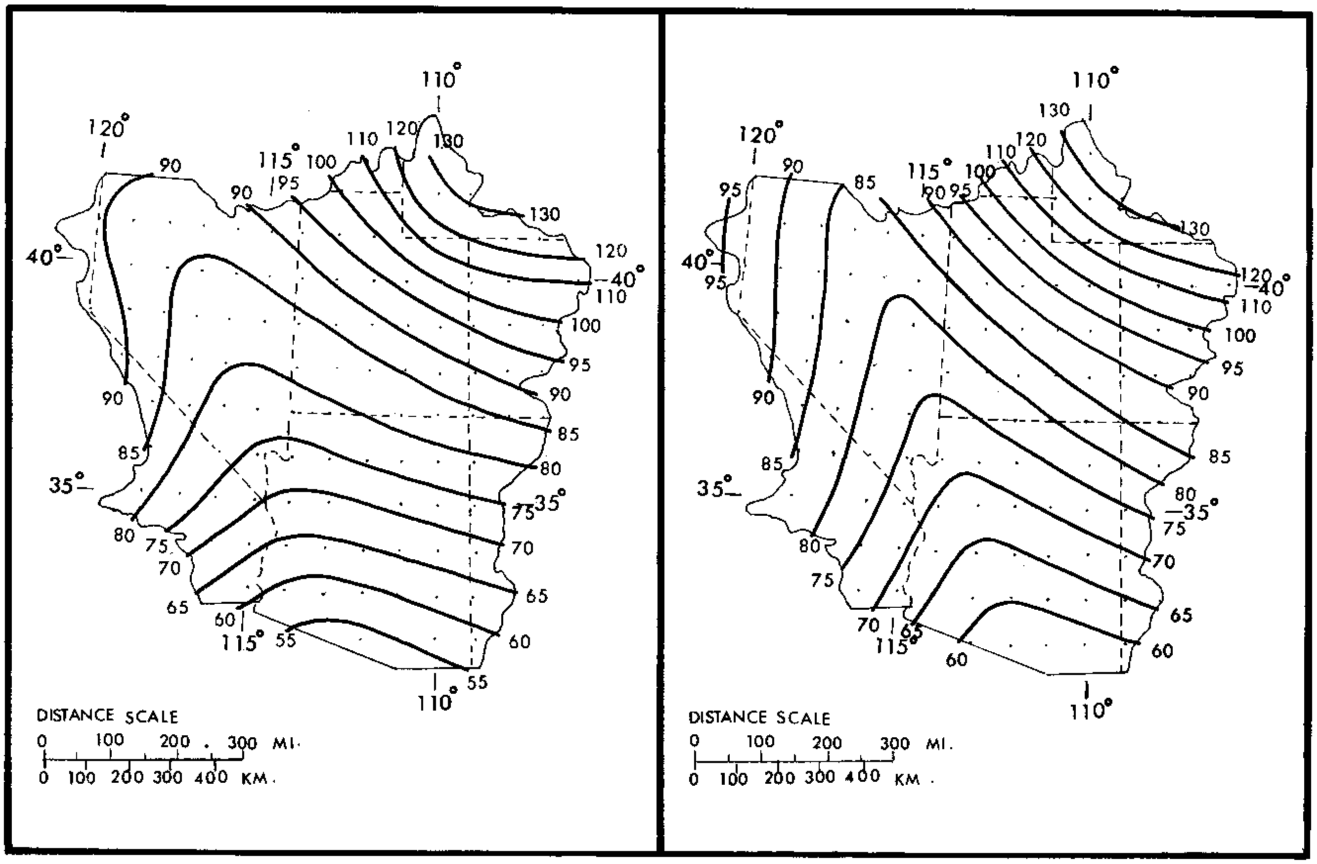
January *February*

Figure 3.12.--Seasonal variation in 10-mi^2 (26-km^2) 24-hr orographic PMP for the study region (in percent of values in figure 3.11).



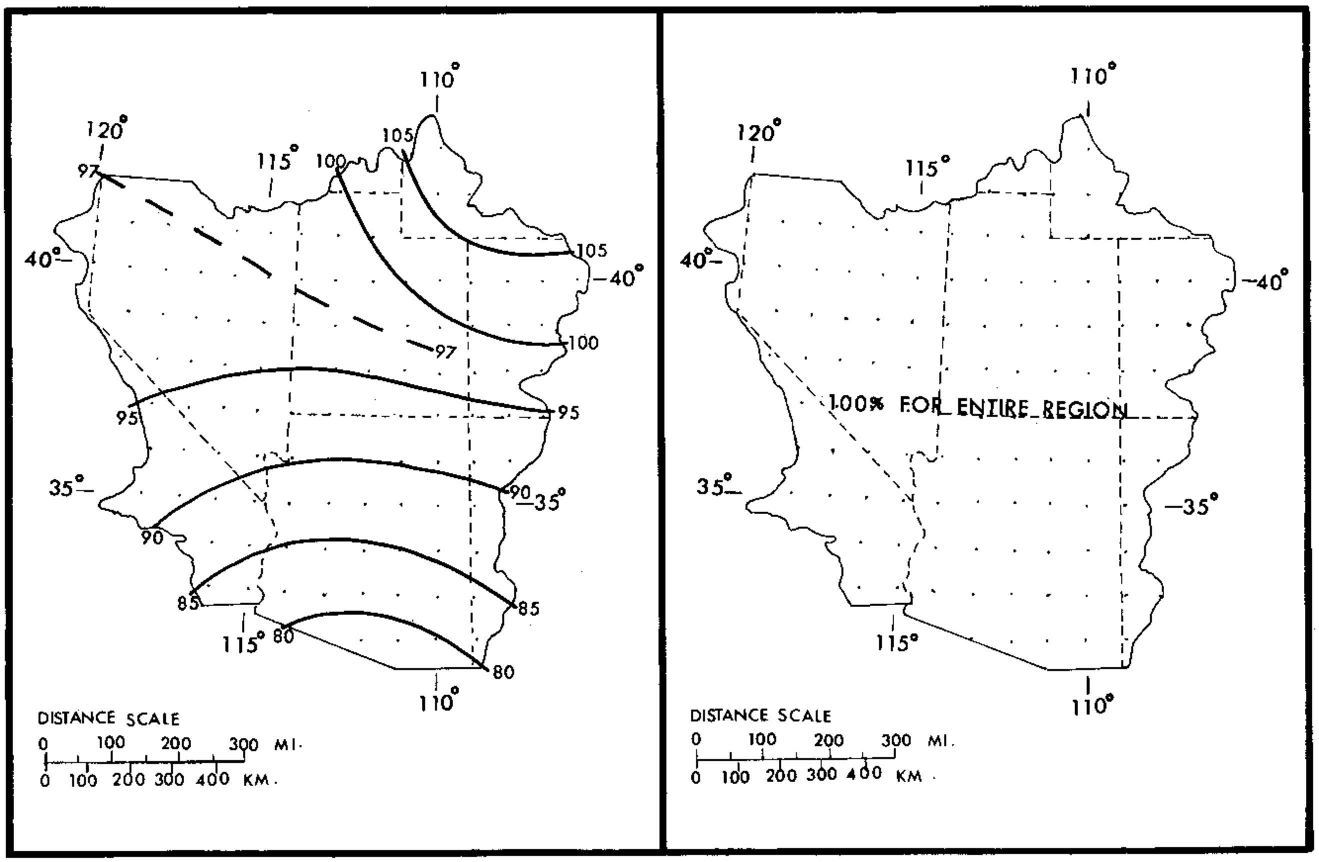
March *April*

Figure 3.13.--Seasonal variation in 10-mi^2 (26-km^2) 24-hr orographic PMP for the study region (in percent of values in figure 3.11).



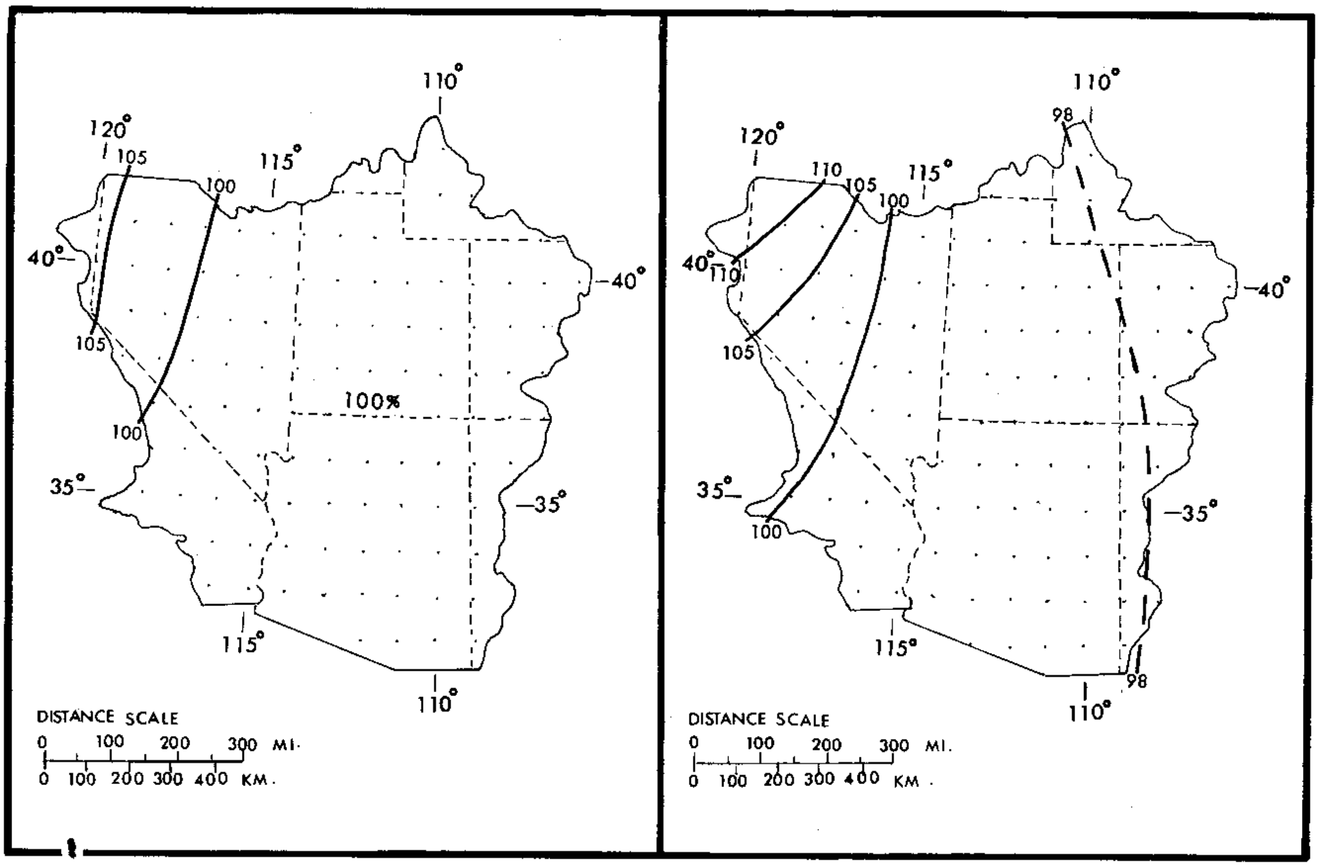
May *June*

Figure 3.14.--Seasonal variation in 10-mi^2 (26-km^2) 24-hr orographic PMP for the study region (in percent of values in figure 3.11).



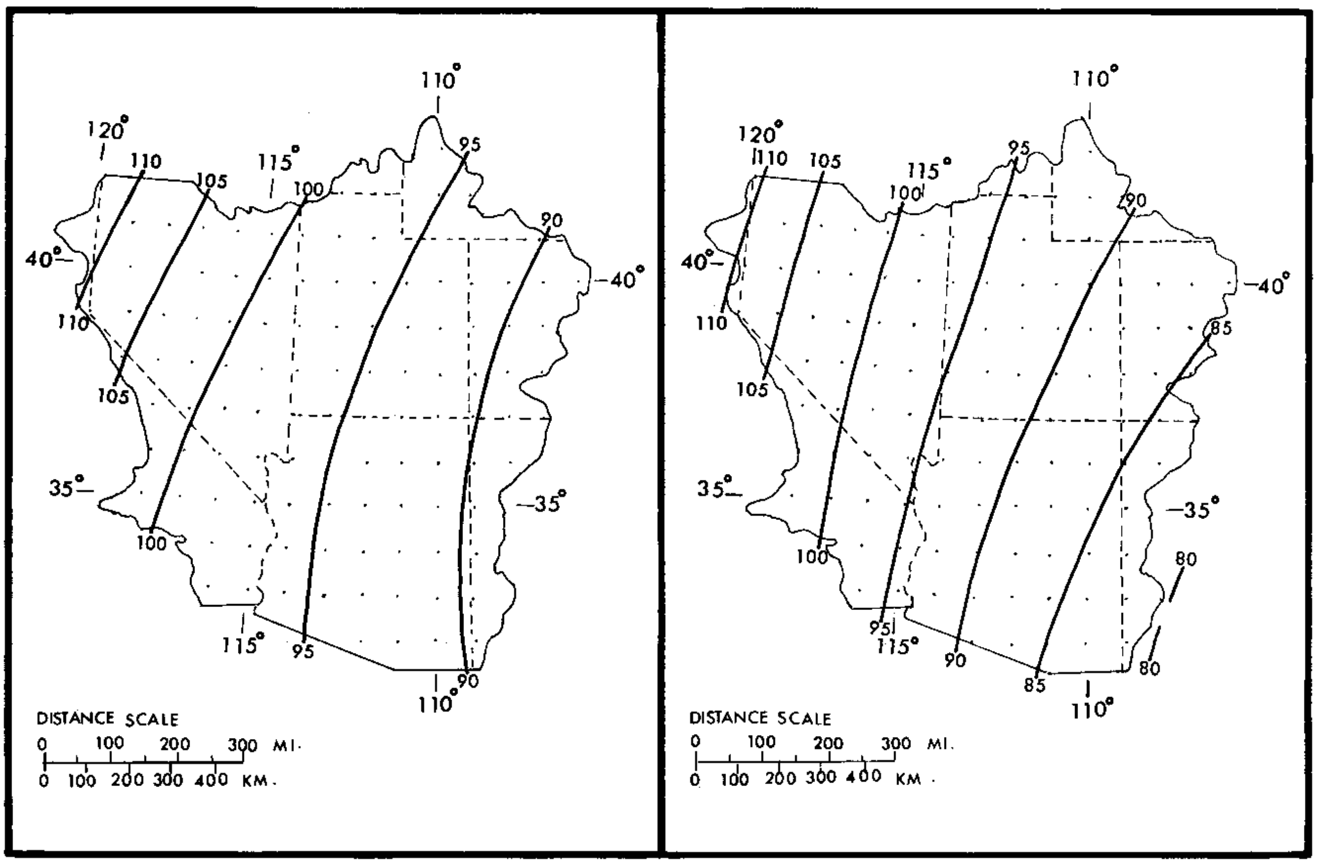
July *August*

Figure 3.15.--Seasonal variation in 10-mi^2 (26-km^2) 24-hr orographic PMP for the study region (in percent of values in figure 3.11).



September *October*

Figure 3.16.--Seasonal variation in 10-mi^2 (26-km^2) 24-hr orographic PMP for the study region (in percent of values in figure 3.11).



November *December*

Figure 3.17.--Seasonal variation in 10-mi^2 (26-km^2) 24-hr orographic PMP for the study region (in percent of values in figure 3.11).

Appendix B

General Storm PMP Calculations

Convergence PMP

Step		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	Drainage Average 1000-mb, 24-hr, 10-mi2 convergence (Fig. 2.5-2.16	9.2	9.2	9.2	9	8.8	9.4	15.2	16.4	16.3	14.1	10.5	9.5
2	1000-mb, 24-hr, 10-mi2 convergence PMP reduction factor (Fig 2.18)	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65
3	Multiply Step 1 by Step 2 for barrier-elevation reduced 24-hr converge PMP average	5.98	5.98	5.98	5.85	5.72	6.11	9.88	10.66	10.595	9.165	6.825	6.175
4	Determine 6/24 hr ratio for each month (Fig 2.25 and 2.27)												
4a	% 6-hr (Table 2.7)	0.67	0.67	0.69	0.71	0.72	0.76	0.79	0.79	0.79	0.75	0.69	0.67
	%12-hr	0.85	0.85	0.86	0.87	0.88	0.90	0.92	0.92	0.92	0.89	0.86	0.85
	% 18-hr	0.94	0.94	0.94	0.95	0.95	0.96	0.97	0.97	0.97	0.96	0.94	0.94
	% 24-hr	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	% 48-hr	1.16	1.16	1.15	1.14	1.13	1.11	1.09	1.09	1.09	1.12	1.15	1.16
	% 72-hr	1.23	1.23	1.22	1.19	1.18	1.15	1.13	1.13	1.13	1.16	1.22	1.23
5	Step 3 time percent from step 4a gives convergence PMP for 10 mi2												
	% 6-hr	4.01	4.01	4.13	4.15	4.12	4.64	7.81	8.42	8.37	6.87	4.71	4.14
	%12-hr	5.08	5.08	5.14	5.09	5.03	5.50	9.09	9.81	9.75	8.16	5.87	5.25
	% 18-hr	5.62	5.62	5.62	5.56	5.43	5.87	9.58	10.34	10.28	8.80	6.42	5.80
	% 24-hr	5.98	5.98	5.98	5.85	5.72	6.11	9.88	10.66	10.60	9.17	6.83	6.18
	% 48-hr	6.94	6.94	6.88	6.67	6.46	6.78	10.77	11.62	11.55	10.26	7.85	7.16
	% 72-hr	7.36	7.36	7.30	6.96	6.75	7.03	11.16	12.05	11.97	10.63	8.33	7.60
6	Create incremental convergence PMP												
	Incremental hrs 0 - 6	4.01	4.01	4.13	4.15	4.12	4.64	7.81	8.42	8.37	6.87	4.71	4.14
	Incremental hrs 6 - 12	1.08	1.08	1.02	0.94	0.92	0.86	1.28	1.39	1.38	1.28	1.16	1.11
	Incremental hrs 12 - 18	0.54	0.54	0.48	0.47	0.40	0.37	0.49	0.53	0.53	0.64	0.55	0.56
	Incremental hrs 18 - 24	0.36	0.36	0.36	0.29	0.29	0.24	0.30	0.32	0.32	0.37	0.41	0.37
	Incremental hrs 24 - 48	0.96	0.96	0.90	0.82	0.74	0.67	0.89	0.96	0.95	1.10	1.02	0.99
	Incremental hrs 48 - 72	0.42	0.42	0.42	0.29	0.29	0.24	0.40	0.43	0.42	0.37	0.48	0.43
7	Aerial reduction for drainage area (Fig 2.28 and 2.29)												
	1st - hours 0 to 6	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	2nd - hours 7 to 12	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	3rd - hours 13 to 18	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	4th - hours 19 to 24	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
8	Aerial reduced incremental convergence PMP (Step 6 x 7)												
	Incremental hrs 0 - 6	4.01	4.01	4.13	4.15	4.12	4.64	7.81	8.42	8.37	6.87	4.71	4.14
	Incremental hrs 6 - 12	1.08	1.08	1.02	0.94	0.92	0.86	1.28	1.39	1.38	1.28	1.16	1.11
	Incremental hrs 12 - 18	0.54	0.54	0.48	0.47	0.40	0.37	0.49	0.53	0.53	0.64	0.55	0.56
	Incremental hrs 18 - 24	0.36	0.36	0.36	0.29	0.29	0.24	0.30	0.32	0.32	0.37	0.41	0.37
	Incremental hrs 24 - 48	0.96	0.96	0.90	0.82	0.74	0.67	0.89	0.96	0.95	1.10	1.02	0.99
	Incremental hrs 48 - 72	0.42	0.42	0.42	0.29	0.29	0.24	0.40	0.43	0.42	0.37	0.48	0.43
9	Accumulation of incremental values from Step 8 - Drainage Average Convergent PMP												
	Cumulative 6 hr	4.01	4.01	4.13	4.15	4.12	4.64	7.81	8.42	8.37	6.87	4.71	4.14
	Cumulative 12 hr	5.08	5.08	5.14	5.09	5.03	5.50	9.09	9.81	9.75	8.16	5.87	5.25
	Cumulative 18 hr	5.62	5.62	5.62	5.56	5.43	5.87	9.58	10.34	10.28	8.80	6.42	5.80
	Cumulative 24 hr	5.98	5.98	5.98	5.85	5.72	6.11	9.88	10.66	10.60	9.17	6.83	6.18
	Cumulative 48 hr	6.94	6.94	6.88	6.67	6.46	6.78	10.77	11.62	11.55	10.26	7.85	7.16
	Cumulative 72 hr	7.36	7.36	7.30	6.96	6.75	7.03	11.16	12.05	11.97	10.63	8.33	7.60

Orographic PMP

Step		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	Drainage Average orographic PMP, 24-hr, 10-mi2 (Fig.3.11a to d)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
2	Aerial reduction factor in % for drainage size (Fig 3.20)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
3	Seasonal adjustment - average % for drainage (Fig 3.12 to 3.17)	0.84	0.84	0.76	0.65	0.54	0.57	0.78	1.00	1.00	0.98	0.91	0.83
4	Aerially and seasonally adjusted 24-hr orographic PMP (Multiply 1 x 2% x 3%)	5.04	5.04	4.56	3.90	3.24	3.42	4.68	6.00	6.00	5.88	5.46	4.98
5	Durational variation of orographic PMP of the 24-hr value (Table 3.9)												
	% 6-hr	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36
	%12-hr	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66
	% 18-hr	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
	% 24-hr	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	% 48-hr	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32
	% 72-hr	1.46	1.46	1.46	1.46	1.46	1.46	1.46	1.46	1.46	1.46	1.46	1.46
6	Orographic PMP (Multiply 4 x 5)												
	Cumulative 6 hr	1.81	1.81	1.64	1.40	1.17	1.23	1.68	2.16	2.16	2.12	1.97	1.79
	Cumulative 12 hr	3.33	3.33	3.01	2.57	2.14	2.26	3.09	3.96	3.96	3.88	3.60	3.29
	Cumulative 18 hr	4.28	4.28	3.88	3.32	2.75	2.91	3.98	5.10	5.10	5.00	4.64	4.23
	Cumulative 24 hr	5.04	5.04	4.56	3.90	3.24	3.42	4.68	6.00	6.00	5.88	5.46	4.98
	Cumulative 48 hr	6.65	6.65	6.02	5.15	4.28	4.51	6.18	7.92	7.92	7.76	7.21	6.57
	Cumulative 72 hr	7.36	7.36	6.66	5.69	4.73	4.99	6.83	8.76	8.76	8.58	7.97	7.27

Total PMP

Step		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	Combine Convergent and Orographic PMP Values from above	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Cumulative 6 hr	5.82	5.82	5.77	5.56	5.28	5.87	9.49	10.58	10.53	8.99	6.67	5.93
	Cumulative 12 hr	8.41	8.41	8.15	7.66	7.17	7.76	12.18	13.77	13.71	12.04	9.47	8.54
	Cumulative 18 hr	9.91	9.91	9.50	8.87	8.19	8.77	13.56	15.44	15.38	13.80	11.06	10.04
	Cumulative 24 hr	11.02	11.02	10.54	9.75	8.96	9.53	14.56	16.66	16.60	15.05	12.29	11.16
	Cumulative 48 hr	13.59	13.59	12.90	11.82	10.74	11.30	16.95	19.54	19.47	18.03	15.06	13.74
	Cumulative 72 hr	14.71	14.71	13.95	12.66	11.48	12.02	18.00	20.81	20.73	19.22	16.30	14.87

Appendix C

Graphical and Tabular Data for Local Storm PMP

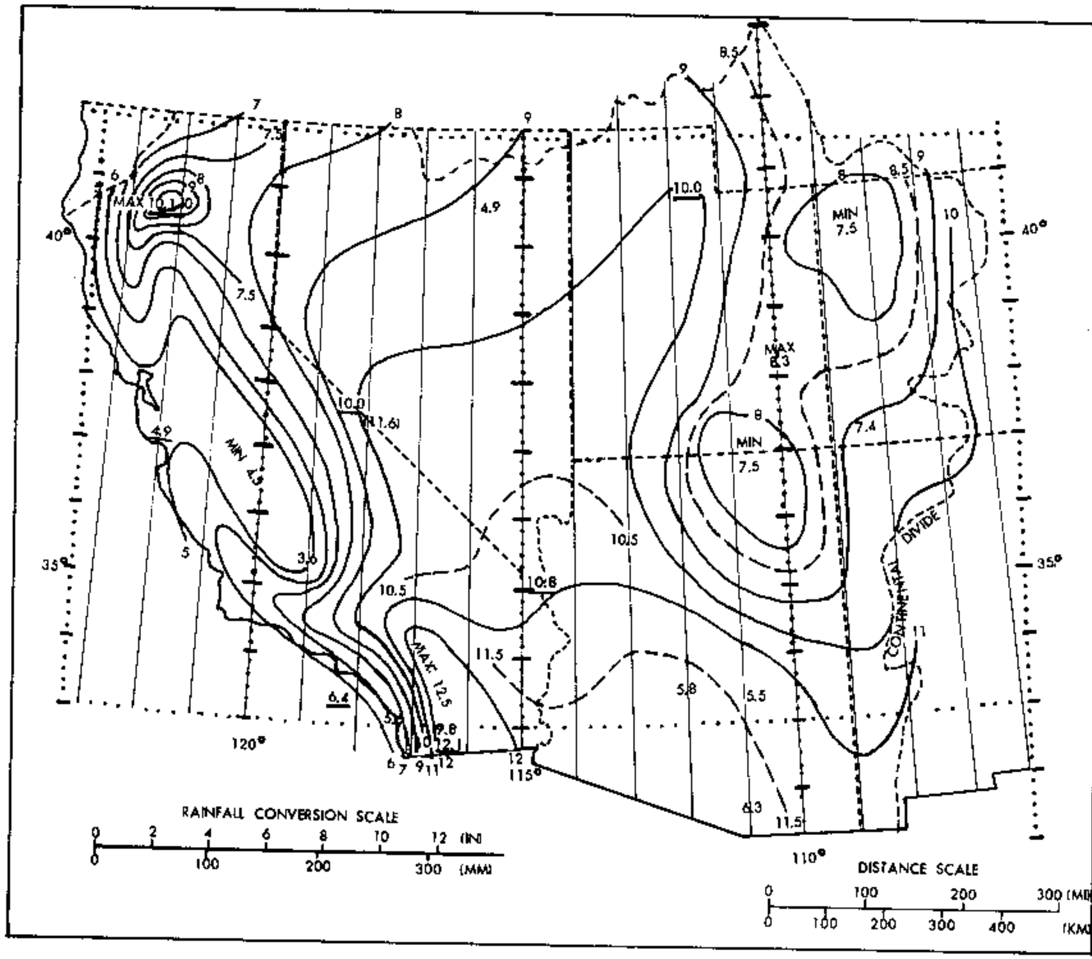


Figure 4.5--Local-storm PMP for 1 mi^2 (2.6 km^2) 1 hr. Directly applicable for locations between sea level and 5000 ft (1524 m). Elevation adjustment must be applied for locations above 5000 ft.

events. In contrast to figure 4.4, figure 4.5 maintains a maximum between these two locations. There is no known meteorological basis for a different solution. The analysis suggests that in the northern portion of the region maximum PMP occurs between the Sierra Nevada on the west and the Wasatch range on the east.

A discrete maximum (> 10 inches, 254 mm) occurs at the north end of the Sacramento Valley in northern California because the northward-flowing moist air is increasingly channeled and forced upslope. Support for this PMP center comes from the Newton, Kennett, and Red Bluff storms (fig. 4.1). Although the analysis in this region appears to be an extension of the broad maximum through the center of the Southwestern Region, it does not indicate the direction of moist inflow. The pattern has evolved primarily as a result of attempts to tie plotted maxima into a reasonable picture while considering inflow directions, terrain effects, and moisture potential.

ratios than storms with high 3/1-hr ratios. The geographical distribution of 15-min to 1-hr ratios also were inversely correlated with magnitudes of the 6/1-hr ratios of figure 4.7. For example, Los Angeles and San Diego (high 6/1-hr ratios) have low 15-min to 1-hr ratios (approximately 0.60) whereas the 15-min to 1-hr ratios in Arizona and Utah (low 6/1-hr ratios) were generally higher (approximately 0.75).

Depth-duration relations for durations less than 1 hour were then smoothed to provide a family of curves consistent with the relations determined for 1 to 6 hours, as shown in figure 4.3. Adjustment was necessary to some of the curves to provide smoother relations through the common point at 1 hour.

We believe we were justified in reducing the number of the curves shown in figure 4.3 for durations less than 1 hour, letting one curve apply to a range of 6/1-hr ratios. The corresponding curves have been indicated by letter designators, A-D, on figure 4.3. As an example, for any 6-hr amount between 115% and 135% of 1-hr, 1-mi^2 (2.6-km^2) PMP, the associated values for durations less than 1 hour are obtained from the curve designated as "B".

Table 4.4 lists durational variations in percent of 1-hr PMP for selected 6/1-hr rain ratios. These values were interpolated from figure 4.3.

To determine 6-hr PMP for a basin, use figure 4.3 (or table 4.4) and the geographical distribution of 6/1-hr ratios given in figure 4.7.

Table 4.4.--Durational variation of 1-mi^2 (2.6-km^2) local-storm PMP in percent of 1-hr PMP (see figure 4.3)

6/1-hr	Duration (hr)								
ratio	1/4	1/2	3/4	1	2	3	4	5	6
1.1	86	93	97	100	107	109	110	110	110
1.2	74	89	95	100	110	115	118	119	120
1.3	74	89	95	100	114	121	125	128	130
1.4	63	83	93	100	118	126	132	137	140
1.5	63	83	93	100	121	132	140	145	150
1.6	43	70	87	100	124	138	147	154	160
1.8	43	70	87	100	130	149	161	171	180
2.0	43	70	87	100	137	161	175	188	200

4.5 Depth-Area Relation

We have thus far developed local-storm PMP for an area of 1 mi^2 (2.6 km^2). To apply PMP to a basin, we need to determine how 1-mi^2 (2.6-km^2) PMP should decrease with increasing area. We have adopted depth-area relations based on rainfalls in the Southwest and from consideration of a model thunderstorm.

ratios than storms with high 3/1-hr ratios. The geographical distribution of 15-min to 1-hr ratios also were inversely correlated with magnitudes of the 6/1-hr ratios of figure 4.7. For example, Los Angeles and San Diego (high 6/1-hr ratios) have low 15-min to 1-hr ratios (approximately 0.60) whereas the 15-min to 1-hr ratios in Arizona and Utah (low 6/1-hr ratios) were generally higher (approximately 0.75).

Depth-duration relations for durations less than 1 hour were then smoothed to provide a family of curves consistent with the relations determined for 1 to 6 hours, as shown in figure 4.3. Adjustment was necessary to some of the curves to provide smoother relations through the common point at 1 hour.

We believe we were justified in reducing the number of the curves shown in figure 4.3 for durations less than 1 hour, letting one curve apply to a range of 6/1-hr ratios. The corresponding curves have been indicated by letter designators, A-D, on figure 4.3. As an example, for any 6-hr amount between 115% and 135% of 1-hr, 1-mi^2 (2.6-km^2) PMP, the associated values for durations less than 1 hour are obtained from the curve designated as "B".

Table 4.4 lists durational variations in percent of 1-hr PMP for selected 6/1-hr rain ratios. These values were interpolated from figure 4.3.

To determine 6-hr PMP for a basin, use figure 4.3 (or table 4.4) and the geographical distribution of 6/1-hr ratios given in figure 4.7.

Table 4.4.--Durational variation of 1-mi^2 (2.6-km^2) local-storm PMP in percent of 1-hr PMP (see figure 4.3)

6/1-hr	Duration (hr)								
ratio	1/4	1/2	3/4	1	2	3	4	5	6
1.1	86	93	97	100	107	109	110	110	110
1.2	74	89	95	100	110	115	118	119	120
1.3	74	89	95	100	114	121	125	128	130
1.4	63	83	93	100	118	126	132	137	140
1.5	63	83	93	100	121	132	140	145	150
1.6	43	70	87	100	124	138	147	154	160
1.8	43	70	87	100	130	149	161	171	180
2.0	43	70	87	100	137	161	175	188	200

4.5 Depth-Area Relation

We have thus far developed local-storm PMP for an area of 1 mi^2 (2.6 km^2). To apply PMP to a basin, we need to determine how 1-mi^2 (2.6-km^2) PMP should decrease with increasing area. We have adopted depth-area relations based on rainfalls in the Southwest and from consideration of a model thunderstorm.

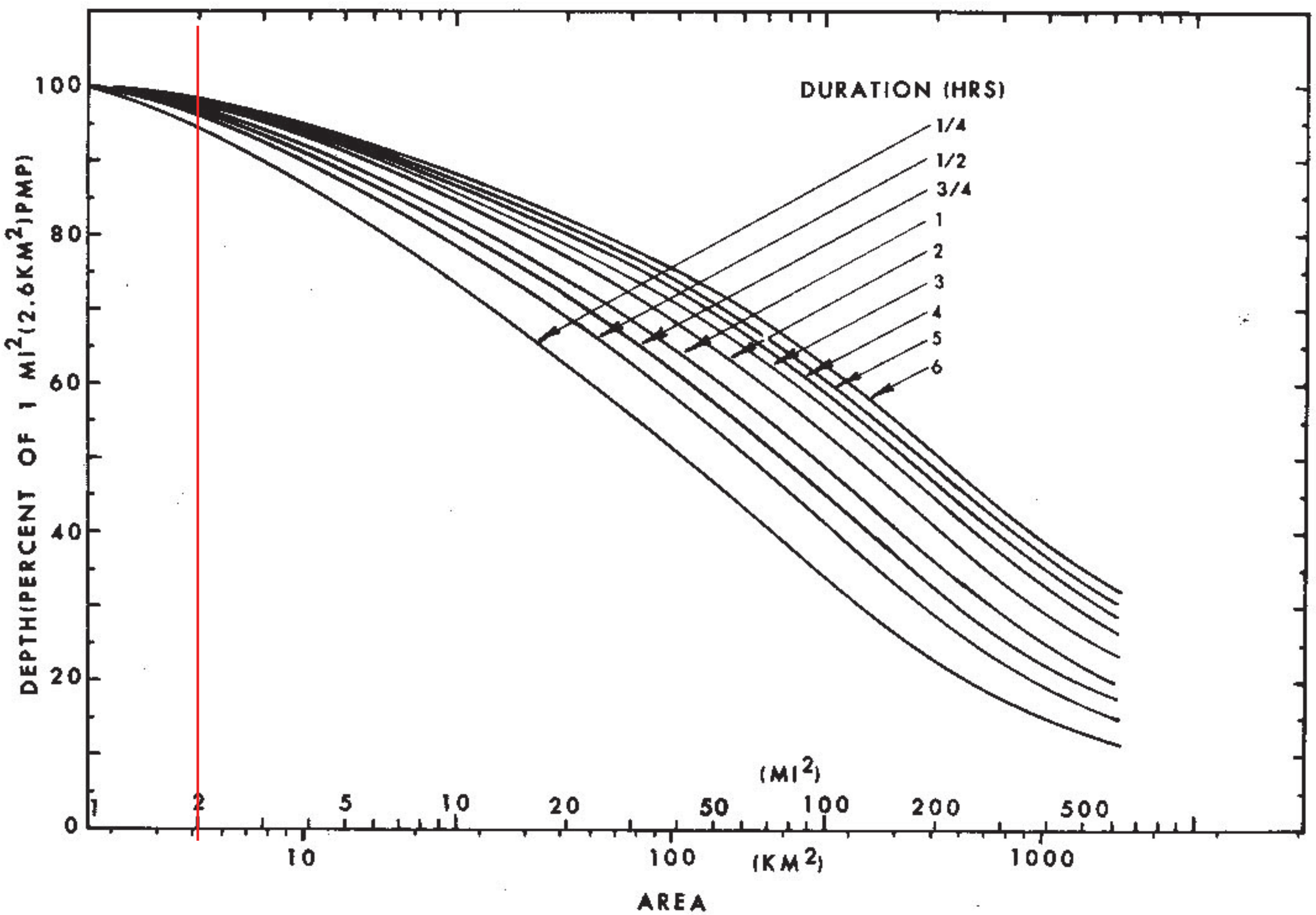


Figure 4.9.--Adopted depth-area relations for local-storm PMP.

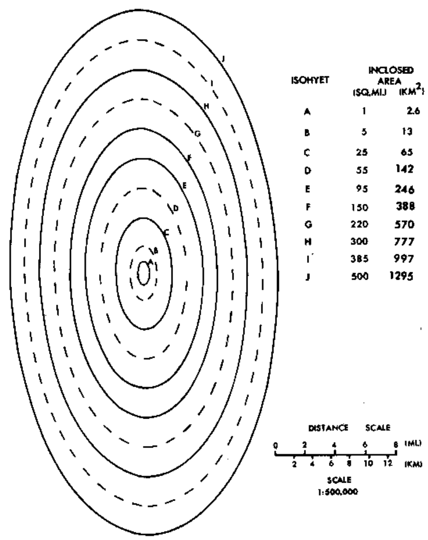


Figure 4.10.--Idealized local-storm isohyetal pattern.

storm period. The sequence of hourly incremental PMP for the Southwest 6-hr thunderstorm in accord with this study is presented in column 2 of table 4.7. A small variation from this sequence is given in Engineering Manual 1110-2-1411 (U. S. Army, Corps of Engineers 1965). The latter, listed in column 3 of table 4.7, places greater incremental amounts somewhat more toward the end of the 6-hr storm period. In application, the choice of either of these distributions is left to the user since one may prove to be more critical in a specific case than the other.

Table 4.7.--Time sequence for hourly incremental PMP in 6-hr storm

	HMR No. 5[1]	EM1110-2-1411[2]
Increment	Sequence Position	
Largest hourly amount	Third	Fourth
2nd largest	Fourth	Third
3rd largest	Second	Fifth
4th largest	Fifth	Second
5th largest	First	Last
least	Last	First

[1]U. S. Weather Bureau 1947.
[2]U. S. Corps of Engineers 1952.

Also of importance is the sequence of the four 15-min incremental PMP values. We recommend a time distribution, table 4.8, giving the greatest intensity in the first 15-min interval (U.S. Weather Bureau 1947). This is based on data from a broad geographical region. Additional support for this time distribution is found in the reports of specific storms by Keppell (1963) and Osborn and Renard (1969).

Table 4.8.--Time sequence for 15-min incremental PMP within 1 hr.

Increment	Sequence Position
Largest 15-min amount	First
2nd largest	Second
3rd largest	Third
least	Last

4.8 Seasonal Distribution

The time of the year when local-storm PMP is most likely is of interest. Guidance was obtained from analysis of the distribution of maximum 1-hr thunderstorm events through the warm season at the recording stations in Utah, Arizona, and in southern California (south of 37°N and east of the Sierra Nevada ridgeline). The period of record used was for 1940-72 with an average record length for the stations considered of 27 years. The month with the one greatest thunderstorm rainfall for the period of record at each station was noted. The totals of these events for each month, by States, are shown in table 4.9.

Table 4.9.--Seasonal distribution of thunderstorm rainfalls.

(The maximum event at each of 108 stations, period of record 1940-72.)

	Month						
	M	J	J	A	S	O	No. of Cases
Utah	1	5	9	14	5		34
Arizona		4	16	19	4		43
S. Calif.*		14	10	7			31
No. of cases/mo.	1	23	35	40	9	0	

*South of 37°N and east of Sierra Nevada ridgeline.

Appendix D

Local Storm PMP Calculations

Local PMP

Step		
1	Read interpolated Avg. PMP for 1-hr, 1 mi2 (Figure 4.5)	11.6
2a	Determine lowest elevation within drainage	5200
2b	If lowest elevation is above 5000 ft, reduce (1) by 5% for every 1000 ft.	0.12
2c	This gives elevation adjusted drainage average 1-hr, 1-mi2 PMP	11.48
3	Find 6/1 hr ratio for drainage locaiton (Figure 4.7)	1.3
4	Determine % durational variation given results of (3) and Table 4.4	
	0.25 hr	0.74
	0.5 hr	0.89
	0.75 hr	0.95
	1 hr	1.00
	2 hr	1.14
	3 hr	1.21
	4 hr	1.25
	5 hr	1.28
	6 hr	1.30
5	Obtain PMP for 1/4 to 6 hrs (Multiply step 2 by step 4)	
	0.25 hr	8.50
	0.5 hr	10.22
	0.75 hr	10.91
	1 hr	11.48
	2 hr	13.09
	3 hr	13.90
	4 hr	14.36
	5 hr	14.70
	6 hr	14.93
6	Determine aerial reduction in % given size of drainage (Figure 4.9)	
	0.25 hr	0.94
	0.5 hr	0.95
	0.75 hr	0.96
	1 hr	0.96
	2 hr	0.97
	3 hr	0.97
	4 hr	0.98
	5 hr	0.98
	6 hr	0.98
7	Determine aerial reduced PMP value (Multiply 5 by 6)	
	0.25 hr	7.99
	0.5 hr	9.71
	0.75 hr	10.47
	1 hr	11.02
	2 hr	12.70
	3 hr	13.48
	4 hr	14.07
	5 hr	14.41
	6 hr	14.63
8	Incremental PMP Values by subtraction of 7	
	0.25 hr	7.99
	0.5 hr	1.72
	0.75 hr	0.76
	1 hr	0.55
	2 hr	1.67
	3 hr	0.78
	4 hr	0.59
	5 hr	0.34
	6 hr	0.23

9	Arrange hourly incremental precip and 4 peak 15 minute intervals (Tables 4.7 and 4.8)	
	1 hr	0.34
	2 hr	0.78
	3 hr	11.02
	4 hr	1.67
	5 hr	0.59
	6 hr	0.23
10	Arrange hourly incremental precip and 4 peak 15 minute intervals (Tables 4.7 and 4.8)	
	0.00	0.00
	0.25	0.08
	0.50	0.08
	0.75	0.08
	1.00	0.08
	1.25	0.19
	1.50	0.19
	1.75	0.19
	2.00	0.19
	2.25	7.99
	2.50	1.72
	2.75	0.76
	3.00	0.55
	3.25	0.42
	3.50	0.42
	3.75	0.42
	4.00	0.42
	4.25	0.15
	4.50	0.15
	4.75	0.15
	5.00	0.15
	5.25	0.06
	5.50	0.06
	5.75	0.06
	6.00	0.06

APPENDIX D

Geotechnical Information

APPENDIX D.1

Geotechnical Borrow Source Investigation Summary

NewFields
Perspective. Vision. Solutions.

TECHNICAL MEMORANDUM

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Reviewed By: R. Michael Smith, P.E. – Project Principal
Craig M. Thompson, P.E. – Project Manager
Project: Hermosa Project

Project No: 475.0014.029

Subject: Geotechnical Borrow Source Investigation Summary (Existing Material Stockpiles Located at the Infrastructure Pad and Other Miscellaneous Sources)

Date: December 1, 2023

This Technical Memorandum provides supporting information for the Tailings Storage Facility 1 (TSF1) Aquifer Protection Permit (APP) Significant Amendment Best Available Demonstrated Control Technology (BADCT) Design Report.

1.0 INTRODUCTION

South32 (AMI) commissioned NewFields to perform a geotechnical borrow source investigation focusing on qualifying construction material borrow sources in support of design work on the tailings storage facilities. NewFields mobilized a field engineer to site on June 14th, 2021, to evaluate the following locations as potential construction material borrow sources:

- Material stockpile on the Infrastructure Pad (IP) generated from the exploration related construction activities. This stockpile will be referred to as the existing stockpile at the IP.
- Material stockpile on the IP generated from the Water Treatment Plant 2 (WTP2) earthworks. This stockpile will be referred to as the WTP2 material stockpile at the IP.
- Proposed Shaft Platform area.
- Proposed Plant Site area.

During the June 2021 geotechnical investigation, the following was completed:

- The existing stockpile at the IP was investigated using test pits as well as three large rock gradations. Samples were collected and transported to NewFields' soils laboratory located in Elko, Nevada.
- The WTP2 material stockpile at the IP was not investigated because cut material from WTP2 earthworks was not stockpiled at the time of the initial geotechnical investigation.
- Two test pits (TP21-05 and TP21-06) were completed in the proposed Shaft Platform / Plant Site areas. The remainder of the test pits were suspended by South32 site personnel due to the potential fire hazard which would be created by moving equipment to the various locations. South32 directed NewFields to de-mobilize and return after the start of the monsoonal season to complete the remainder of the test pitting program. Samples collected from the completed test pits were transported to NewFields' laboratory.

South32 and NewFields restarted the geotechnical investigation on August 3rd, 2021, to complete the remainder of the test pitting program on the WTP2 material stockpile at the IP and the proposed Shaft Platform and Plant Site areas. The test pitting program was completed on August 5th, 2021.

The geotechnical investigation was focused on reducing financial risks by identification and quantification of potential construction borrow source locations and quantities for construction associated with the potential future tailings storage facility (TSF) expansion. The investigation centered on evaluating the various locations for potential Protective Layer (PL) and Low Permeability Soil Layer (LPSL) which make up a significant quantity of the TSF construction materials and therefore were the main focus of the investigation.

1.1 Existing Stockpile Located at the IP

Approximately 250,000 cubic yards (cy) of material was stockpiled as a result of exploration related construction activities and placed as an uncontrolled fill on the south side of the IP. The stockpile is approximately 70 feet deep and was created from excess cut which was progressively end dumped off the stockpile face. The near surface cut was placed first and exists in the bottom and middle of the stockpile. This material is the most likely candidate for processing of LPSL material. The deeper cuts were placed last and exists at the top and outside of the stockpile. This material is the most likely candidate for PL material processing as well as potentially road wearing course and/or riprap. Please note, access to the middle and bottom of the stockpile was not possible at this time using test pits due to stockpile depth, equipment limitations, and safety considerations. The test pits were completed to the limits of the excavator from the top of the stockpile.

1.2 WTP2 Material Stockpile Located at the IP

Approximately 20,000 cy of material was stockpiled during the WTP2 platform construction on the IP as an uncontrolled fill on top of the existing stockpile. The WTP2 material stockpile is approximately 20 ft high and was created from excess cut generated during construction in July/August of 2021.

1.3 Shaft Platform and Plant Site Area

The proposed layouts for the shaft platform and plant site area were created by Fluor and can be referenced on **Figure 1**. **Figure 1** shows the following:

- Approximate limits of the shaft platform and plant site earthworks construction as well as the material stockpiles located at the IP.
- Earthwork isopach to identify depths of proposed cuts and fills for the proposed shaft platform and plant site grading.
- Earthwork volumetric table to show approximate cut and fill volumes.
- Approximate locations of existing roads, laydown yards, drill platforms, ponds, and other site infrastructure.
- Locations of previous test pits performed as part of the Voluntary Remediation Program (VRP) project[1] located within the proposed limits of the shaft platform and plant site.

Based on the layouts, the Plant Site Platform earthworks is balanced requiring approximately 184,000 cy of cut to fill and the Shaft Platform is unbalanced requiring approximately 151,000 cy of cut to fill as well as 84,000 cy of cut to stockpile.

[1]NewFields Mining Design & Technical Services, (2017), Tailings and Potentially Acid Generating (PAG) Material Remediation, Placement and Storage Project Voluntary Remediation Program Design, dated April 26.

2.0 GEOTECHNICAL INVESTIGATION RESULTS

2.1 Existing Stockpile Located at the IP

The geotechnical investigation of the existing stockpile located on the IP consisted of the following:

- 11 test pits completed in the locations shown on **Figure 1**. Individual test pit logs can be referenced in **Attachment A** and select photos in **Attachment C**.
- Three large rock gradations completed on the existing stockpile to determine the particle size distribution (PSD) of the stockpile. Field results can be referenced in **Table 2.1** and **Attachment B**.
- Samples were obtained from the test pits as well as the large rock gradations (minus 3 inch material) for subsequent laboratory testing. A summary of the laboratory index testing is presented in **Table B1** and individual test results can be referenced in **Attachment B**.

TABLE 2.1 – LARGE ROCK GRADATION SUMMARY TABLE

Location	Grain Size Distribution (Percent Passing)				
	16”	8”	6”	4”	3” (see note 1)
TP21-16	100	83.3	71.3	56.6	50.2
TP21-17	100	63.5	59.2	54.4	48.1
TP21-19	100	90.1	84.8	77.9	71.5
Average	**100**	**79**	**72**	**63**	**57**

[1] Large rock gradation was stopped at 3” nominal particle size, at which point a representative 3” minus material was sampled for subsequent laboratory testing.

Listed below is a summary of results from the geotechnical field investigation at the existing stockpile located at the IP. The results are a compilation of field observations, test pit logs, and large rock gradations.

- The majority of the stockpile is 16” minus material with the exception of occasional larger particles randomly dispersed throughout the stockpile. The larger particles were only visually identified and were not quantified due to the limited quantity.
- Based on the three large rock gradations, a range of approximately 48% to 72% of the existing stockpile is minus 3” material with an average of 57%.
- The large rock gradations and test pits were performed on the upper part of the material stockpile, therefore the information obtained from the stockpile is representative of this

zone. It is currently assumed that the bottom of the stockpile consists of slightly finer grained material due to the nature of the construction activities and the order of which material was delivered to the stockpile (see **Section 1.1** for additional detail). At this time, NewFields has assumed that the material near the bottom of the stockpile is not appreciably different from the material classification from the upper portion of the stockpile. It is NewFields' opinion, that this is a conservative assumption. If the stockpile consisted of finer grained material in the lower reaches, there is a good chance that additional LPSL material over and beyond the quantities estimated herein, can be captured through processing.

- The existing stockpile consisted mainly of clayey sand and clayey gravel. The test pits showed a relatively homogeneous distribution of material properties within the portion of the stockpile accessible from the surface with conventional excavation equipment.

Laboratory Testing Summary:

Existing stockpile samples (10) were tested in the laboratory for index properties. The laboratory results indicate the following:

- The material sampled consisted of 3" minus material, which represents approximately 57% of the stockpile volume (in the zone investigated) as determined by the large rock gradations performed on site.
- The average fines content on the 3" minus material was measured to be 16.5% passing the #200 sieve (ranging from a minimum of 11.9% to a maximum of 25.6%).
- The average plasticity index (PI) was measured to be 13 (ranging from a minimum of 11 to a maximum of 17).
- Samples TP21-16 (21-164-03) and TP21-19 (21-167-07) were selected as the most representative of the average PSD and PI for subsequent testing.

In order to evaluate the existing stockpile as a potential PL and LPSL material borrow source, material gradations were performed on the selected samples (TP21-16 and TP21-19). The goal of the analysis was to define a screen size which would produce a product similar to the technical specification for LPSL which requires a minimum plasticity index of 15 and the following material gradation:

Sieve Size (square openings)	Percent Passing (by dry weight)
3-inch	100
No. 4	55-100
No. 200	25 Min

Based on the analysis, screening the material on the 3/4" sieve would produce a material resulting in 21% passing the #200 sieve and a PI of 13. The 3/4" screen was selected as the minimum screen size which could be practically used in the field, without blinding off, based on experience gained during the VRP project.

TP21-16 and TP21-19 samples were screened on the 3/4" sieve and flex wall permeability (ASTM D5084) testing was performed on the undersize material using the following criteria:

- Bentonite amendment: 0% (as is), +2%, and +4%.
- Placement: 95% compaction of the maximum dry density (MDD) at +2% optimum moisture content (OMC) based on the modified proctor (ASTM D1557).
- Confining pressure: 5 psi and 20 psi.

The laboratory permeability test results for the minus 3/4" material (LPSL material candidate) can be referenced in **Table 2.2**.

TABLE 2.2 – EXISTING STOCKPILE AT THE IP TESTING SUMMARY TABLE (LPSL MATERIAL)

Sample Location*	Bentonite Addition (%)	Confining Pressure (psi)	Permeability** (cm/sec)
TP21-16	0	5	6.0×10^{-6}
TP21-16	0	20	2.2×10^{-6}
TP21-16	2	5	1.5×10^{-6}
TP21-16	2	20	8.6×10^{-7}
TP21-16	4	5	4.2×10^{-7}
TP21-16	4	20	1.1×10^{-7}
TP21-19	2	5	5.7×10^{-7}
TP21-19	2	20	2.0×10^{-7}
TP21-19	4	5	4.6×10^{-7}
TP21-19	4	20	1.5×10^{-7}

* Samples were screened on the ¾" sieve. LPSL testing utilized the minus ¾" material.
**Target permeability is a maximum of 1.0×10^{-6} cm/sec.

The oversize particles (plus 3/4", up to 3") were evaluated as a potential aggregate source for the project. The testing suite on these materials included the following.

- Los Angeles abrasion (ASTM C131)
- Sodium sulfate soundness (ASTM C88)
- Slake durability (ASTM D4644)

The aggregate test results can be referenced in **Table 2.3**.

TABLE 2.3 – EXISTING STOCKPILE AT THE IP TESTING SUMMARY TABLE (PL MATERIAL)

Sample Location*	LA Abrasion (% loss)	Sodium Sulfate Soundness (% loss)	Slake Durability Index (% retained) and Description
TP21-16	39	12.9	NT
TP21-17	40	60.3	78.2, Type II
TP21-19	45	83.1	81.8, Type II
TP21-24	39	69.1	90.3, Type II

* Samples were screened on the ¾" sieve. PL testing utilized the plus ¾" material.
NT: Not Tested (not enough material)

2.2 WTP2 Material Stockpile Located on the IP

The geotechnical investigation of the existing WTP2 material stockpile located on the IP consisted of the following:

- Five samples were collected at various depths within the material stockpile for subsequent laboratory testing. Individual test results can be referenced in **Attachment B**.

Laboratory Testing Summary:

Select samples (4) from the WTP2 material stockpile were tested in the laboratory for index properties. The laboratory results showed the following:

- The material samples consisted of 4" minus material.
- No large rock gradations were performed on this stockpiled material because virtually all material was minus 4".
- The average fines content in the WTP2 material stockpile was 8.3% passing the #200 sieve (ranging from a minimum of 6.9% to a maximum of 9.9%). Due to the relatively low percentage of minus #200 sieve material, the WTP2 material stockpile was not considered as a candidate for LPLS material.

- The average PI of this material was 12 (ranging from a minimum of 10 to a maximum of 16).
- Sample WTP2 21-02 (21-242-11) was selected as the most representative samples of the average PSD and PI for subsequent testing.

Material from sample WTP2 21-02 was screened on the 1.5" sieve and 1.5" minus material was utilized for an aggregate testing suite including:

- Los Angeles abrasion (ASTM C131)
- Slake durability (ASTM D4644)

The aggregate test results can be referenced in **Table 2.4**.

TABLE 2.4 – WTP2 MATERIAL STOCKPILE AT THE IP TESTING SUMMARY TABLE (PL MATERIAL)

Sample*	LA Abrasion (% loss)	Slake Durability Index (% retained) and Description
WTP2 21-02	31.4	96.5, Type I

* Samples were screened on the 1.5" sieve. PL testing utilized the 1.5" minus material.

2.3 Shaft Platform and Plant Site Areas

The geotechnical investigation consisted of the following:

- 14 test pits at the Shaft Platform and Plant Site areas completed in the locations shown on **Figure 1**. Individual test pit logs can be referenced in **Attachment A** and select photos in **Attachment C**.
- Samples were obtained from the test pits for subsequent laboratory testing. Individual testing results can be referenced in **Attachment B**.

<u>Laboratory Testing Summary:</u>

Select test pit samples (14) were tested in the laboratory for index properties. The index properties showed the following:

- The material samples consisted of 4" minus material.
- The average fines content resulted in 16.5% passing the #200 sieve (ranging from a minimum of 13.1% to a maximum of 25.6%).
- The average PI was 13 (ranging from a minimum of 11 to a maximum of 17).
- Based on the index property results, samples were selected for subsequent testing to qualify the material as a potential construction borrow source.

Both TP21-03 and TP21-07 were selected as potential LPSL material and flex wall permeability testing (ASTM D5084) was performed using the following criteria:

- Bentonite amendment: +0% (as-is), +2% and +4%.
- Placement: 95% MDD at +2% OMC based on the modified proctor (ASTM D1557).
- Confining pressure: 5 psi and 20 psi.

The laboratory test results for the Shaft Platform and Plant Site areas specific to LPSL can be referenced in **Table 2.5**.

TABLE 2.5 – SHAFT PLATFORM/PLANT SITE AREA TESTING SUMMARY TABLE (LPSL MATERIAL)

Sample Location[1]	Bentonite Addition (%)	Confining Pressure (psi)	Permeability[2] (cm/sec)
TP21-03	0	5	6.4×10^{-5}
TP21-03[3]	0	20	4.6×10^{-5}
TP21-07	0	5	3.9×10^{-5}
TP21-07	0	20	2.5×10^{-5}
TP21-07	2	5	3.9×10^{-6}
TP21-07	2	20	3.6×10^{-6}
TP21-07	4	5	1.0×10^{-6}
TP21-07	4	20	5.2×10^{-7}

[1] Samples were screened on the ¾" sieve. LPSL testing utilized the minus ¾" material.
[2] Target permeability is a maximum of 1.0×10^{-6} cm/sec.
[3] Not enough material to run bentonite amended tests.

Test pits, TP21-06 and TP21-07, were selected as potential PL material source and the following laboratory testing was performed:

- Rigid wall permeability (USBR 5600 / USBR 5605)
- Los Angeles abrasion (ASTM C131)
- Slake durability (ASTM D4644)

The testing results can be referenced in **Table 2.6**.

TABLE 2.6 – SHAFT PLATFORM/PLANT SITE AREA TESTING SUMMARY TABLE (PL MATERIAL)

Sample Location[1]	LA Abrasion (% loss)	Slake Durability Index (% retained) and Description	Rigid Wall Permeability		
			Normal Stress (psf)	Equivalent Load Height (ft)	Permeability[2] (cm/sec)
TP21-06	67.8	NT	6,250	50	1.7×10^{-2}
			12,500	100	2.6×10^{-3}
TP21-07	7.6	91.9, Type I	NT		
TP21-13	25.2	98.9, Type I	NT		

[1] Samples were screened on the ¾” sieve. PL testing utilized the plus ¾” material.
[2] Target permeability is minimum 1.0×10^{-3} cm/sec
NT: Not tested (not enough material)

3.0 CONCLUSIONS

3.1 Existing Stockpile Located at the IP

The existing stockpile located at the IP consists of approximately 250,000 cy of uncontrolled fill and was evaluated as a potential candidate for primarily LPSL and PL but also for riprap, drainage aggregate (DA), wearing course, and construction aggregate. Lab testing results are provided in **Section 2.1**.

The large rock gradation as well as the laboratory test results were utilized to determine a screen size which would produce a product capable of meeting the LPSL Technical Specifications for permeability (minimum 1.0×10^{-6} cm/sec). The 3/4" sieve was selected and used to produce the candidate LPSL material. The LPSL material generally met the minimum permeability specification at +4% bentonite amendment.

Utilizing the data obtained from the field and laboratory tests, **Table 3.1** was created to estimate the quantity of material within the existing stockpile by particle size.

TABLE 3.1 – ESTIMATED PARTICLE SIZE DISTRIBUTION FOR THE EXISTING STOCKPILE (AS A PERCENT FINER THAN THE NOMINAL SIZE INDICATED)

Particle Size	**16" ***	**8"**	**6"**	**4"**	**3"**	**2"**
Avg Quantity (%)	100%	79%	72%	63%	57%	55%
Avg Quantity (cy)	250,000	197,500	180,000	157,500	142,500	137,500
Particle Size	**1.5"**	**1"**	**0.75"**	**0.5" ****	**0.375"**	**#4**
Avg Quantity (%)	52%	48%	45%	41%	39%	37%
Avg Quantity (cy)	130,000	120,000	112,500	102,500	97,500	92,500

* The majority of the stockpile is 16" minus material with the exception of occasional larger particles randomly dispersed throughout the stockpile. The larger particles were only visually identified and were not quantified due to the limited quantity.

** Screening of the existing stockpile not considered viable less than 0.75" (identified in gray shading).

If the stockpile was screened on the ¾" to make the LPSL material, the stockpile would yield approximate 112,500 cy. It is important to note, the volume calculations as well as the laboratory results are based on ideal laboratory conditions. Inefficiencies would be realized during an actual crushing and screening operation performed in the field (i.e., the screening operation will not capture 100% of the minus ¾" material). As currently designed, TSF1 requires approximately 31,000 cy of LPSL (includes 35% additional to account for overbuild and shrinkage of material during placement). The existing stockpile could provide the entire LPSL quantity required for TSF1 construction.

Based on initial testing and experience from VRP construction, the existing stockpile would not be suitable for use as PL because the aggregates do not appear to have sufficient durability. This is based on durability testing performed on select samples consisting of screened material between ¾" and 3" showing that the particles do not meet durability requirements. There may be an opportunity to evaluate potentially more competent particles (plus 3" material) through additional testing. However, this would likely require a pilot scale crushing and screening operation to produce the target PL materials and subsequent laboratory test work to verify acceptable material properties are achieved. If the plus 3" particles (3" to 16") produce an acceptable PL product (to be determined), approximately 43% of the material stockpile (~107,500 CY) could be utilized for PL. So, it is worth accessing a pilot scale crushing and screening test, prior to initiation of expansion construction to capture a potential opportunity to reduce capital cost associated with importing PL material. The plus 3" fraction of the stockpile was not sampled and tested because it was NewFields opinion, based on field observation, that the minus 3" aggregate fraction in the stockpile would be representative of the engineering characteristics of the larger rock fraction. There is a chance that the larger fraction is more competent and could be acceptable as a PL feed source to a crushing and screening operation.

As currently designed, TSF1 requires approximately 67,000 cy of PL (includes 10% additional to account for overbuild). If the plus 3" portion of the existing stockpile is more durable and can meet the required specifications, this material could provide the PL required for TSF1 construction.

Based on the initial round of durability testing on the minus 3" fraction of the stockpile and considering other potential borrow sources exist for PL material (i.e., main and ventilation shaft waste rock), the initial assessment of the marginally durable minus 3", plus ¾" material in the existing stockpile does not appear to be a leading candidate for the PL material borrow source. However, there is a chance that the plus 3" fraction of the stockpile is more durable, so additional characterization testing could capture an opportunity to reduce capital cost for PL. This test work should be completed prior to construction.

Listed below are additional takeaways from the laboratory testing results:

- Rock with diameters between 3 and 16 inches, constitute approximately 43% of the material stockpile (approximately 107,500 cy) volume and may be suitable for smaller riprap, however, additional engineering judgement and confirmatory testing will be necessary to determine whether this material is durable enough for use as riprap.
- Durability test results indicate that the aggregates within the material stockpile are not suitable for use as DA material as the samples evaluated do not meet the technical specification requirements. This could change with additional durability on the plus 3" fraction of the stockpile.
- The material within this stockpile may be suitable for use as road wearing course, assuming enough fines remain after processing of LPSL material.
- Contractors should utilize the lab data to determine if the test results meet requirements for concrete aggregate.

3.2 WTP2 Material Stockpile Located at the IP

The WTP2 material stockpile at the IP contains approximately 20,000 cy of uncontrolled fill. Samples, which primarily consist of 4-inch minus material, were collected from the material stockpile and subsequently tested. A representative sample was screened on the 1.5-inch sieve and 1.5-inch minus material was utilized to determine its suitability for use primarily as LPSL and PL, DA, wearing course, and construction aggregate. Lab testing results are provided in **Section 2.2**. The laboratory results indicate the following:

- Material encountered in this stockpile is not suitable for LPSL due to insufficient fines content.
- Material encountered in this stockpile could be considered for production of PL and DA material through processing (crushing and/or screening), based on the limited testing that was completed. Additional sampling and laboratory testing is recommended to further qualify this material prior to expansion construction. Rigid wall permeability tests should also be performed in addition to durability tests to estimate the performance of the material after any breakdown of the material has occurred, through crushing and screening.
- Material encountered in this stockpile is not suitable for riprap due to the absence of larger particles.
- Contractors should utilize the lab data to determine if the test results meet requirements for concrete aggregate.
- Due to the relatively small volume of material in this stockpile, it should be considered as a candidate stockpile for material processing in conjunction with other material stockpiles.

3.3 Shaft Platform and Plant Site Areas

Based on the layouts, the Plant Site Platform requires approximately 184,000 cy of cut to fill earthworks and the Shaft Platform requires approximately 151,000 cy of cut to fill earthworks as well as 84,000 cy of cut to stockpile or to use as construction materials. Samples from both areas were tested and considered for use as both LPSL and aggregate materials. Lab testing results are provided in **Section 2.3**.

Samples from TP21-03 (shaft platform area) and TP21-07 (plant site area) were screened on the ¾” sieve and tested for their potential use as LPSL material, as these samples contained the greatest percentage of fines. Results indicate that with a +4% bentonite amendment, the minimum permeability requirement can be achieved, thus LPSL material could be produced from these locations. In order to better quantify the extent of these potential borrow sources, a subsequent investigation is recommended to target these specific locations and to confirm material locations and quantities that are the best candidates for LPSL.

An aggregate testing suite was performed on plus ¾" material from representative samples collected from both platform areas. Sample TP21-06, collected in the shaft platform area, yielded a 67% loss during the LA Abrasion test, therefore, the shaft platform cut area should not be considered as a viable borrow source for PL or construction aggregates. Samples TP21-07 and TP21-13, collected in the plant site area, exhibited a 7% and 25% loss in the LA Abrasion test, respectively and were classified as Type I in the slake durability test. As a result, this material could be used as PL or construction aggregates. As cited above, in order to better quantify the extent of these potential borrow sources for use as PL and/or construction aggregates, a subsequent investigation is recommended to target specific locations within the Shaft platform and plant site areas and to confirm quantities.

3.4 Future Work Recommendations

Based on data collected during the geotechnical field investigation and the laboratory testing, NewFields recommends the following:

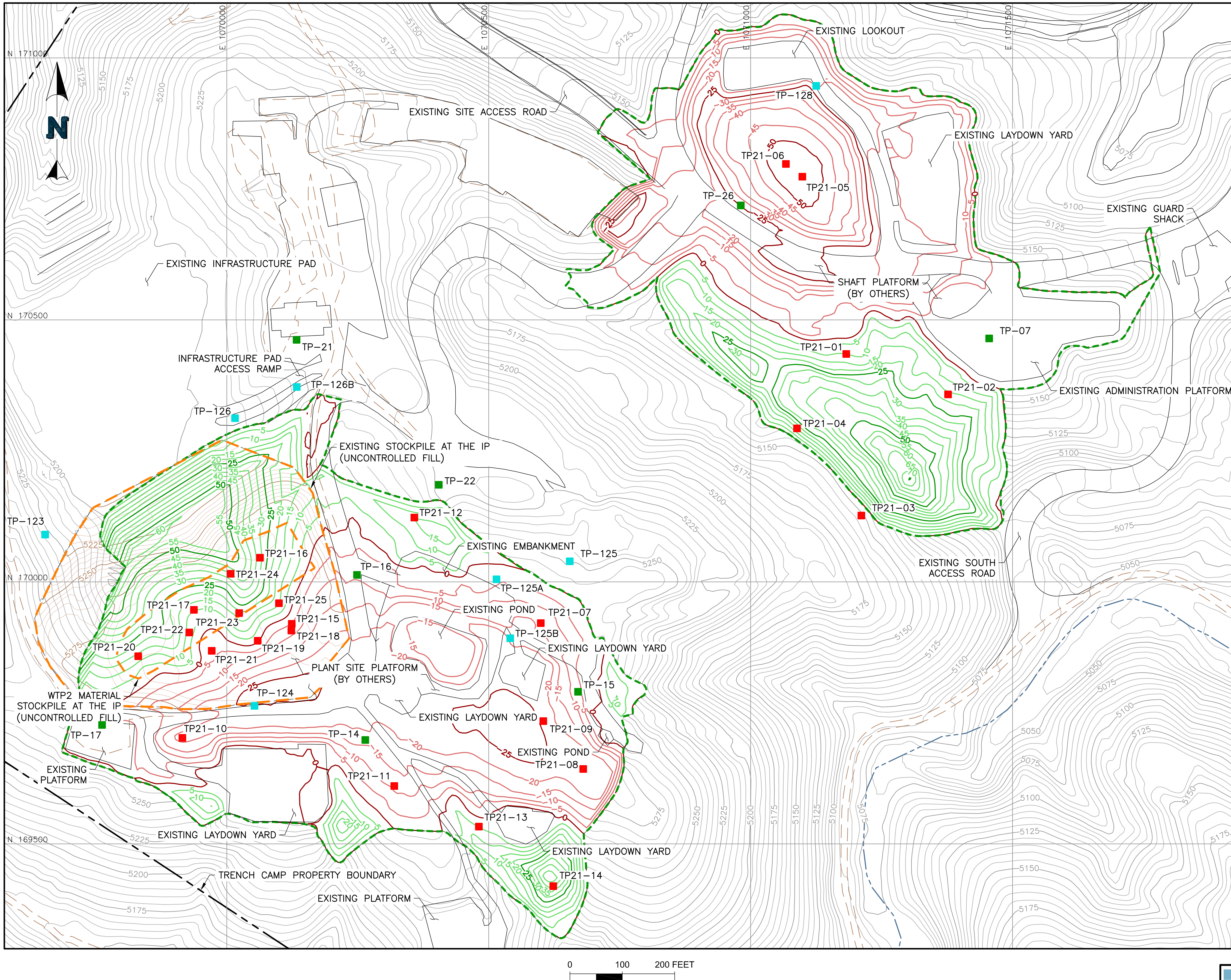
- The existing stockpile located at the IP is the leading candidate for processing of LPSL material on site. Interface strength testing utilizing LPSL (amended with bentonite), friction layer, and 60 mil HDPE double sided textured geomembrane should be performed to measure interface strengths for this important potential borrow source material prior to construction.
- Additional work could be performed to evaluate suitability of plus 3" rock in the existing stockpile at the IP, as a feed source for PL, DA, concrete aggregate and riprap. Though quality of the rock is in question, it is worth an additional assessment to see if abrasion resistance and durability improves with larger rock sizes. However, a pilot scale crushing and screening operation may be required to target the potential construction materials. A subsequent laboratory testing program should be conducted on the processed material to assess acceptability of the material. Aggregates greater than 3" diameter were not sampled from this stockpile during the initial geotechnical investigation (only 3" minus material). Sampling of the minus 3" material was the first step in the investigation process which was performed under the assumption that the engineering characteristics of the minus 3" fraction of the rock would be representative of all of the rock in the stockpile. Due to unfavorable results from initial testing, there may be an opportunity to capture the plus 3" material as a potential construction source through addition testing rather than discard it based on results from the minus 3" material.
- Evaluate potential locations for material processing as well as temporary storage areas considering construction timing of the various onsite facilities.

4.0 ATTACHMENTS

The following is a list of attachments included with this technical memo:

- Figure 1 – Geotechnical Investigation Figure
- Attachment A – Test Pit Logs
- Attachment B – Laboratory Testing Results
- Attachment C – Photo Log

FIGURE



LEGEND:

- EXISTING GROUND CONTOURS
- EXISTING MATERIAL STOCKPILE CONTOURS
- EARTHWORK ISOPACH FILL CONTOURS
- EARTHWORK ISOPACH CUT CONTOURS
- EXISTING ROADS/TRAILS
- EXISTING DRAINAGES
- PROJECT BOUNDARY
- APPROXIMATE LIMITS OF EARTHWORKS
- APPROXIMATE LIMITS OF UNCONTROLLED FILL
- TP-01 NEWFIELDS TEST PIT (JAN 2017)
- TP-01 NEWFIELDS TEST PIT (JUN 2017)
- TP21-01 NEWFIELDS TEST PIT (JUN-AUG 2021)

VOLUMETRICS		
FEATURE	CUT VOLUME (cy)	FILL VOLUME (cy)
EXISTING STOCKPILE AT THE IP (UNCONTROLLED FILL)	243,400	0
WTP2 MATERIAL STOCKPILE AT THE IP (UNCONTROLLED FILL)	~20,000	0
PLANT SITE PLATFORM*	185,900	183,700
SHAFT PLATFORM	234,600	151,000

*ASSUMES THE UNCONTROLLED MATERIAL STOCKPILE IS REMOVED PRIOR TO CONSTRUCTION.

TEST PIT AS-BUILT LOCATIONS		
POINT	NORTHING	EASTING
TP21-01	170,434.92	1,071,182.66
TP21-02	170,357.76	1,071,376.96
TP21-03	170,126.61	1,071,211.49
TP21-04	170,292.99	1,071,088.65
TP21-05	170,773.29	1,071,098.75
TP21-06	170,797.65	1,071,067.37
TP21-07	169,921.27	1,070,599.39
TP21-08	169,642.94	1,070,680.49
TP21-09	169,734.21	1,070,604.24
TP21-10	169,702.20	1,069,915.19
TP21-11	169,610.39	1,070,319.70
TP21-12	170,122.77	1,070,358.09
TP21-13	169,532.96	1,070,481.18
TP21-14	169,419.26	1,070,623.28
TP21-15	169,919.93	1,070,124.11
TP21-16	170,046.12	1,070,063.31
TP21-17	169,946.59	1,069,937.11
TP21-18	169,907.12	1,070,123.23
TP21-19	169,887.54	1,070,059.06
TP21-20	169,858.07	1,069,830.85
TP21-21	169,868.43	1,069,971.25
TP21-22	169,903.52	1,069,928.28
TP21-23	169,940.42	1,070,023.49
TP21-24	170,015.46	1,070,007.44
TP21-25	169,959.34	1,070,099.52

REFERENCE:

EXISTING GROUND TOPOGRAPHY DEVELOPED FROM MARCH, 2020 AERIAL SURVEY DATA PROVIDED BY SOUTH32 (AMI). DATA PROJECTED TO STATE PLANE ARIZONA CENTRAL NAD 83 FEET, NAVD88.

P:\Projects\0014.029 Hermosa Geotech Investigation\A-CAD\FIGS\14.029.001F.dwg-12/1/2023 2:51 PM

NewFields

CLIENT: SOUTH32 (AMI)

PROJECT: HERMOSA PROJECT

TITLE: GEOTECHNICAL INVESTIGATION PLAN VIEW/ ISOPACH (EXISTING MATERIAL STOCKPILES AT IP AND PROPOSED PLANT SITE/SHAFT PLATFORMS)

FILENAME: 14.029.001F

FIGURE NO.: 1

REVISION: 0

ATTACHMENT A

NewFields

CLIENT South32 (Arizona Minerals Inc.)
PROJECT NAME Hermosa Project Geotechnical Investigation
PROJECT NUMBER 475.0014.029
PROJECT LOCATION Patagonia, Arizona
DATE STARTED 8/4/21 **COMPLETED** 8/4/21
GROUND ELEVATION 5150 ft **TOTAL PIT DEPTH** 4 ft
EXCAVATION CONTRACTOR RUMCO
COORDINATES (UTM Zone 12N):
EQUIPMENT DEERE 350G
NORTHING 3480954 **EASTING** 526014
LOGGED BY G. Peltack **CHECKED BY** C. Thompson
DEPTH TO WATER (FT BGS) No Groundwater Encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	MOISTURE CONTENT (%)	ATTERBERG LIMITS		% GRAVEL	% SAND	% FINES	REMARKS
						LIQUID LIMIT	PLASTICITY INDEX				
5150	0		Surface Conditions: Grass, Exposed Rock								
			[TOPSOIL] silty, clayey SAND with gravel (SC-SM), nonplastic to low plasticity, reddish brown, dry to moist, roots	LD 01-01							
			poorly graded GRAVEL with silt (GP-GM), subangular to angular gravel, fine to coarse grained sand, reddish brown, dry								
			Testpit Terminated at 4 feet due to bucket refusal								

TP21-02

NewFields

CLIENT South32 (Arizona Minerals Inc.)
PROJECT NAME Hermosa Project Geotechnical Investigation
PROJECT NUMBER 475.0014.029
PROJECT LOCATION Patagonia, Arizona
DATE STARTED 8/4/21 **COMPLETED** 8/4/21
GROUND ELEVATION 5143 ft **TOTAL PIT DEPTH** 8 ft
EXCAVATION CONTRACTOR RUMCO
COORDINATES (UTM Zone 12N):
EQUIPMENT DEERE 350G
NORTHING 3480930 **EASTING** 526073
LOGGED BY G. Peltack **CHECKED BY** C. Thompson
DEPTH TO WATER (FT BGS) No Groundwater Encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION Surface Conditions: Heavy Vegetation & Grass	SAMPLE TYPE NUMBER	MOISTURE CONTENT (%)	ATTERBERG LIMITS		% GRAVEL	% SAND	% FINES	REMARKS
	0					LIQUID LIMIT	PLASTICITY INDEX				
			[TOPSOIL] silty, clayey SAND with gravel (SC-SM) , nonplastic to low plasticity, reddish brown, dry to moist, roots								
5140			clayey SAND with gravel (SC), with cobbles, fine to coarse grained sand, subangular to angular gravel, reddish brown, dry	LD 02-01	5.1	32	12	33.1	49.8	17.1	

Testpit Terminated at 8 feet due to bucket refusal

TP21-03

NewFields

CLIENT South32 (Arizona Minerals Inc.)
PROJECT NAME Hermosa Project Geotechnical Investigation
PROJECT NUMBER 475.0014.029
PROJECT LOCATION Patagonia, Arizona
DATE STARTED 8/4/21 **COMPLETED** 8/4/21
GROUND ELEVATION 5151 ft **TOTAL PIT DEPTH** 6 ft
EXCAVATION CONTRACTOR RUMCO
COORDINATES (UTM Zone 12N):
EQUIPMENT DEERE 350G
NORTHING 3480860 **EASTING** 526022
LOGGED BY G. Peltack **CHECKED BY** C. Thompson
DEPTH TO WATER (FT BGS) No Groundwater Encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0		Surface Conditions: Trees, Vegetation, Exposed Rock								
5150			[TOPSOIL] silty, clayey SAND with gravel (SC-SM), nonplastic to low plasticity, reddish brown, dry to moist, roots								
			clayey GRAVEL with sand (GC), with cobbles, fine to medium grained sand, reddish brown, dry to moist	LD 03-01	7.4	33	12	44.9	36.8	18.3	

Testpit Terminated at 6 feet due to bucket refusal

NewFields

CLIENT South32 (Arizona Minerals Inc.)
PROJECT NAME Hermosa Project Geotechnical Investigation
PROJECT NUMBER 475.0014.029
PROJECT LOCATION Patagonia, Arizona
DATE STARTED 8/4/21 **COMPLETED** 8/4/21
GROUND ELEVATION 5137 ft **TOTAL PIT DEPTH** 4 ft
EXCAVATION CONTRACTOR RUMCO
COORDINATES (UTM Zone 12N):
EQUIPMENT DEERE 350G
NORTHING 3480911 **EASTING** 525985
LOGGED BY G. Peltack **CHECKED BY** C. Thompson
DEPTH TO WATER (FT BGS) No Groundwater Encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0		Surface Conditions: Heavy Vegetation, Exposed Rock								
			[TOPSOIL] silty, clayey SAND with gravel (SC-SM), nonplastic to low plasticity, reddish brown, dry to moist, roots								
			clayey GRAVEL (GC), some sand, subangular to angular gravel, fine to coarse grained sand, medium plasticity, brown, dry to moist	LD 04-01	6.6	34	13	75.3	14.9	9.8	
			Testpit Terminated at 4 feet due to bucket refusal								

TP21-05

NewFields

CLIENT South32 (Arizona Minerals Inc.)
PROJECT NAME Hermosa Project Geotechnical Investigation
PROJECT NUMBER 475.0014.029
PROJECT LOCATION Patagonia, Arizona
DATE STARTED 6/18/21 **COMPLETED** 6/18/21
GROUND ELEVATION 5211 ft **TOTAL PIT DEPTH** 8 ft
EXCAVATION CONTRACTOR RUMCO
COORDINATES (UTM Zone 12N):
EQUIPMENT DEERE 350G
NORTHING 3481057.3 **EASTING** 525989.3
LOGGED BY J. Miandad **CHECKED BY** C.Thompson
DEPTH TO WATER (FT BGS) No Groundwater Encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0		Surface Conditions: Grass								
5210			clayey SAND (SC), fine to medium sand, medium plasticity, dry, reddish brown	LD 05-01	9.5	37	15	0	63.4	36.6	
			poorly graded GRAVEL with sand (GP), with cobbles and boulders, fine to coarse sand, angular to subangular gravel, nonplastic, dry, brown								

Testpit Terminated at 8 feet due to bucket refusal

NewFields

CLIENT South32 (Arizona Minerals Inc.)
PROJECT NAME Hermosa Project Geotechnical Investigation
PROJECT NUMBER 475.0014.029
PROJECT LOCATION Patagonia, Arizona
DATE STARTED 6/18/21 **COMPLETED** 6/18/21
GROUND ELEVATION 5212 ft **TOTAL PIT DEPTH** 8 ft
EXCAVATION CONTRACTOR RUMCO
COORDINATES (UTM Zone 12N):
EQUIPMENT DEERE 350G
NORTHING 3481064.8 **EASTING** 525979.8
LOGGED BY J. Miandad **CHECKED BY** C.Thompson
DEPTH TO WATER (FT BGS) No Groundwater Encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0		Surface Conditions: Grass								
			silty SAND with gravel (SM), fine to coarse sand, angular to subangular gravel, nonplastic, dry, light brown								
5210			well graded SAND with silt and gravel (SW-SM), some cobbles and boulders, fine to coarse sand, angular to subangular gravel, nonplastic, dry, dark gray	LD 06-01	6	NP	NP	28.2	63.4	8.4	

Testpit Terminated at 8 feet due to bucket refusal

TP21-07

NewFields

CLIENT South32 (Arizona Minerals Inc.)
PROJECT NAME Hermosa Project Geotechnical Investigation
PROJECT NUMBER 475.0014.029
PROJECT LOCATION Patagonia, Arizona
DATE STARTED 8/3/21 **COMPLETED** 8/3/21
GROUND ELEVATION 5274 ft **TOTAL PIT DEPTH** 15 ft
EXCAVATION CONTRACTOR RUMCO
COORDINATES (UTM Zone 12N):
EQUIPMENT DEERE 350G
NORTHING 3480799 **EASTING** 525835
LOGGED BY G. Peltack/J. Schmidt **CHECKED BY** C. Thompson
DEPTH TO WATER (FT BGS) No Groundwater Encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0		Surface Conditions: Vegetation and Grass								
			[TOPSOIL] silty, clayey SAND with gravel (SC-SM), nonplastic to low plasticity, reddish brown, dry to moist, roots								
5270			clayey GRAVEL with sand (GC), some cobbles, subangular to angular gravel, medium plasticity, brown, dry to moist	LD 07-01	9.4	37	15	54.8	31.9	13.3	
	10										
5260											

Testpit Terminated at 15 feet

NewFields

CLIENT South32 (Arizona Minerals Inc.)
PROJECT NAME Hermosa Project Geotechnical Investigation
PROJECT NUMBER 475.0014.029
PROJECT LOCATION Patagonia, Arizona
DATE STARTED 8/3/21 **COMPLETED** 8/3/21
GROUND ELEVATION 5284 ft **TOTAL PIT DEPTH** 15 ft
EXCAVATION CONTRACTOR RUMCO
COORDINATES (UTM Zone 12N):
EQUIPMENT DEERE 350G
NORTHING 3480714 **EASTING** 525859
LOGGED BY G. Peltack/J. Schmidt **CHECKED BY** C. Thompson
DEPTH TO WATER (FT BGS) No Groundwater Encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0		Surface Conditions: Grass								
			[TOPSOIL] silty, clayey SAND with gravel (SC-SM), nonplastic to low plasticity, reddish brown, dry to moist, roots								
5280			silty, clayey SAND with gravel (SC-SM), some cobbles, fine to coarse grained sand, subangular to angular gravel, cobbles, low plasticity, brown, dry to moist	LD 08-01	7.5	27	7	38.5	47.2	14.3	
	10										
5270											

Testpit Terminated at 15 feet

NewFields

CLIENT South32 (Arizona Minerals Inc.)
PROJECT NAME Hermosa Project Geotechnical Investigation
PROJECT NUMBER 475.0014.029
PROJECT LOCATION Patagonia, Arizona
DATE STARTED 8/3/21 **COMPLETED** 8/3/21
GROUND ELEVATION 5284 ft **TOTAL PIT DEPTH** 12 ft
EXCAVATION CONTRACTOR RUMCO
COORDINATES (UTM Zone 12N):
EQUIPMENT DEERE 350G
NORTHING 3480742 **EASTING** 525836
LOGGED BY G. Peltack/J. Schmidt **CHECKED BY** C. Thompson
DEPTH TO WATER (FT BGS) No Groundwater Encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0		Surface Conditions: Grass								
			[TOPSOIL] silty, clayey SAND with gravel (SC-SM), nonplastic to low plasticity, reddish brown, dry to moist, roots								
5280			poorly graded GRAVEL with clay and sand (GP-GC), some cobbles, fine to coarse grained sand, medium plasticity, reddish brown, dry to moist	LD 09-01	6.7	37	15	56.1	31.9	12	
	10										

Testpit Terminated at 12 feet

TP21-10

NewFields

CLIENT South32 (Arizona Minerals Inc.)
PROJECT NAME Hermosa Project Geotechnical Investigation
PROJECT NUMBER 475.0014.029
PROJECT LOCATION Patagonia, Arizona
DATE STARTED 8/3/21 **COMPLETED** 8/3/21
GROUND ELEVATION 5281 ft **TOTAL PIT DEPTH** 10 ft
EXCAVATION CONTRACTOR RUMCO
COORDINATES (UTM Zone 12N):
EQUIPMENT DEERE 350G
NORTHING 3480734 **EASTING** 525626
LOGGED BY G. Peltack/J. Schmidt **CHECKED BY** C. Thompson
DEPTH TO WATER (FT BGS) No Groundwater Encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	MOISTURE CONTENT (%)	ATTERBERG LIMITS		% GRAVEL	% SAND	% FINES	REMARKS
						LIQUID LIMIT	PLASTICITY INDEX				
	0		Surface Conditions: No Vegetation								
5280	0–10		[FILL] poorly graded GRAVEL with sand (GP), cobbles and boulders, fine to coarse grained sand, nonplastic, reddish brown, dry	LD 10-01							Increasing cobble size with depth

Testpit Terminated at 10 feet due to bucket refusal

NewFields

CLIENT South32 (Arizona Minerals Inc.)
PROJECT NAME Hermosa Project Geotechnical Investigation
PROJECT NUMBER 475.0014.029
PROJECT LOCATION Patagonia, Arizona
DATE STARTED 8/3/21 **COMPLETED** 8/3/21
GROUND ELEVATION 5271 ft **TOTAL PIT DEPTH** 15 ft
EXCAVATION CONTRACTOR RUMCO
COORDINATES (UTM Zone 12N):
EQUIPMENT DEERE 350G
NORTHING 3480705 **EASTING** 525749
LOGGED BY G. Peltack/J. Schmidt **CHECKED BY** C. Thompson
DEPTH TO WATER (FT BGS) No Groundwater Encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0		Surface Conditions: Vegetation and Grass								
5270			[TOPSOIL] silty, clayey SAND with gravel (SC-SM), nonplastic to low plasticity, reddish brown, dry to moist, roots								
			poorly graded GRAVEL with clay and sand (GP-GC), some cobbles and boulders, medium plasticity, reddish brown, dry to moist	LD 11-01	6.5	37	17	71.3	20.2	8.5	
5260	10										

Testpit Termintated at 15 feet

TP21-12

NewFields

CLIENT South32 (Arizona Minerals Inc.)
PROJECT NAME Hermosa Project Geotechnical Investigation
PROJECT NUMBER 475.0014.029
PROJECT LOCATION Patagonia, Arizona
DATE STARTED 8/3/21 **COMPLETED** 8/3/21
GROUND ELEVATION 5244 ft **TOTAL PIT DEPTH** 15 ft
EXCAVATION CONTRACTOR RUMCO
COORDINATES (UTM Zone 12N):
EQUIPMENT DEERE 350G
NORTHING 3480861 **EASTING** 525762
LOGGED BY G. Peltack/J. Schmidt **CHECKED BY** C. Thompson
DEPTH TO WATER (FT BGS) No Groundwater Encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0		Surface Conditions: Heavy Vegetation, Trees								
			[TOPSOIL] silty, clayey SAND with gravel (SC-SM), nonplastic to low plasticity, reddish brown, dry to moist, roots								
5240			poorly graded GRAVEL with sand (GP), trace silt and clay, cobbles, subangular to angular gravel, nonplastic, brown, dry	LD 12-01							
	10										
5230											

Testpit Terminated at 15 feet

TP21-13

NewFields

CLIENT South32 (Arizona Minerals Inc.)
PROJECT NAME Hermosa Project Geotechnical Investigation
PROJECT NUMBER 475.0014.029
PROJECT LOCATION Patagonia, Arizona
DATE STARTED 8/3/21 **COMPLETED** 8/3/21
GROUND ELEVATION 5255 ft **TOTAL PIT DEPTH** 12 ft
EXCAVATION CONTRACTOR RUMCO
COORDINATES (UTM Zone 12N):
EQUIPMENT DEERE 350G
NORTHING 3480681 **EASTING** 525798
LOGGED BY G. Peltack/J. Schmidt **CHECKED BY** C. Thompson
DEPTH TO WATER (FT BGS) No Groundwater Encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION Surface Conditions: Vegetation and Grass	SAMPLE TYPE NUMBER	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0		[TOPSOIL] silty, clayey SAND with gravel (SC-SM), nonplastic to low plasticity, reddish brown, dry to moist, roots								
5250	10		well graded GRAVEL (GW), some sand, clay, and cobbles, subangular to angular gravel, medium plasticity, reddish brown, dry	LD 13-01	2.3	36	16	88.5	8.3	3.2	

Testpit Terminated at 12 feet

NewFields

CLIENT South32 (Arizona Minerals Inc.)
PROJECT NAME Hermosa Project Geotechnical Investigation
PROJECT NUMBER 475.0014.029
PROJECT LOCATION Patagonia, Arizona
DATE STARTED 8/3/21 **COMPLETED** 8/3/21
GROUND ELEVATION 5210 ft **TOTAL PIT DEPTH** 10 ft
EXCAVATION CONTRACTOR RUMCO
COORDINATES (UTM Zone 12N):
EQUIPMENT DEERE 350G
NORTHING 3480646 **EASTING** 525841
LOGGED BY G. Peltack/J. Schmidt **CHECKED BY** C. Thompson
DEPTH TO WATER (FT BGS) No Groundwater Encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	MOISTURE CONTENT (%)	ATTERBERG LIMITS		% GRAVEL	% SAND	% FINES	REMARKS
			Surface Conditions: Vegetation and Trees			LIQUID LIMIT	PLASTICITY INDEX				
5210	0		[TOPSOIL] silty, clayey SAND with gravel (SC-SM), nonplastic to low plasticity, reddish brown, dry to moist, roots								
			clayey SAND with gravel (SC), some cobbles, subangular to angular sand and gravel, medium plasticity, red, dry to moist	LD 14-01	7	34	13	43	43.9	13.1	
5200	10										

Testpit Terminated at 10 feet

NewFields

CLIENT South32 (Arizona Minerals Inc.)
PROJECT NAME Hermosa Project Geotechnical Investigation
PROJECT NUMBER 475.0014.029
PROJECT LOCATION Patagonia, Arizona
DATE STARTED 6/17/21 **COMPLETED** 6/17/21
GROUND ELEVATION 5282 ft **TOTAL PIT DEPTH** 20 ft
EXCAVATION CONTRACTOR RUMCO
COORDINATES (UTM Zone 12N):
EQUIPMENT CAT 374E
NORTHING 3480799.8 **EASTING** 525690.2
LOGGED BY J. Miandad **CHECKED BY** C.Thompson
DEPTH TO WATER (FT BGS) No Groundwater Encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0		Surface Conditions: No Vegetation								
5280			poorly graded GRAVEL with sand (GP), cobbles and boulders, fine to coarse sand, angular to subangular gravel, nonplastic to low plastic, dry, light brown								
	10			LD 15-01							
5270											
	20										

Testpit terminated at 20 feet

TP21-16

NewFields

CLIENT South32 (Arizona Minerals Inc.)
PROJECT NAME Hermosa Project Geotechnical Investigation
PROJECT NUMBER 475.0014.029
PROJECT LOCATION Patagonia, Arizona
DATE STARTED 6/17/21 **COMPLETED** 6/17/21
GROUND ELEVATION 5285 ft **TOTAL PIT DEPTH** 20 ft
EXCAVATION CONTRACTOR RUMCO
COORDINATES (UTM Zone 12N):
EQUIPMENT CAT 374E
NORTHING 3480838.4 **EASTING** 525672
LOGGED BY J. Miandad **CHECKED BY** C.Thompson
DEPTH TO WATER (FT BGS) No Groundwater Encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	MOISTURE CONTENT (%)	ATTERBERG LIMITS		% GRAVEL	% SAND	% FINES	REMARKS
			Surface Conditions: No Vegetation			LIQUID LIMIT	PLASTICITY INDEX				
	0		clayey SAND with gravel (SC), cobbles and boulders, fine to coarse sand, angular to subrounded gravel, medium plasticity, dry, dark brown to purple	LD 16-01	6.5	30	11	41.7	42.4	15.9	Large Scale Rock Gradation between 0 and 10 feet. Gradation shown here reflect 3"minus materisl only
5280											
	10										
5270											
	20										

Testpit Terminated at 20 feet

NewFields

CLIENT South32 (Arizona Minerals Inc.)
PROJECT NAME Hermosa Project Geotechnical Investigation
PROJECT NUMBER 475.0014.029
PROJECT LOCATION Patagonia, Arizona
DATE STARTED 6/16/21 **COMPLETED** 6/16/21
GROUND ELEVATION 5288 ft **TOTAL PIT DEPTH** 20.5 ft
EXCAVATION CONTRACTOR RUMCO
COORDINATES (UTM Zone 12N):
EQUIPMENT CAT 374E
NORTHING 3480808.4 **EASTING** 525633.3
LOGGED BY J. Miandad **CHECKED BY** C.Thompson
DEPTH TO WATER (FT BGS) No Goundwater Encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0		Surface Conditions: No Vegetation								
			clayey SAND with gravel (SC), fine to coarse sand, subrounded to subangular gravel, medium plasticity, brown, dry								Large Scale Rock Gradation between 0 and 20 feet
5280											
	10			LD 17-01	7	30	12	37.5	44.5	18	
5270											
	20			LD 17-02							
			Testpit Terminated at 20.5 feet								

CLIENT South32 (Arizona Minerals Inc.)
PROJECT NAME Hermosa Project Geotechnical Investigation
PROJECT NUMBER 475.0014.029
PROJECT LOCATION Patagonia, Arizona
DATE STARTED 6/17/21 **COMPLETED** 6/17/21
GROUND ELEVATION 5282 ft **TOTAL PIT DEPTH** 21 ft
EXCAVATION CONTRACTOR RUMCO
COORDINATES (UTM Zone 12N):
EQUIPMENT CAT 374E
NORTHING 3480795.9 **EASTING** 525689.9
LOGGED BY J. Miandad **CHECKED BY** C.Thompson
DEPTH TO WATER (FT BGS) No Groundwater Encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0		Surface Conditions: No Vegetation								
5280			poorly graded SAND with clay and gravel (SP-SC), fine to coarse sand, subrounded to subangular gravel, medium plasticity, dry to moist, greenish to dark brown	LD 18-01							
5270	10			LD 18-02	10	36	17	35.7	52.4	11.9	
	20										

Testpit Terminated at 21 feet

NewFields

CLIENT South32 (Arizona Minerals Inc.)
PROJECT NAME Hermosa Project Geotechnical Investigation
PROJECT NUMBER 475.0014.029
PROJECT LOCATION Patagonia, Arizona
DATE STARTED 6/17/21 **COMPLETED** 6/17/21
GROUND ELEVATION 5286 ft **TOTAL PIT DEPTH** 28 ft
EXCAVATION CONTRACTOR RUMCO
COORDINATES (UTM Zone 12N):
EQUIPMENT CAT 374E
NORTHING 3480790.1 **EASTING** 525670.3
LOGGED BY J. Miandad **CHECKED BY** C.Thompson
DEPTH TO WATER (FT BGS) No Groundwater Encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0		Surface Conditions: No Vegetation								
5280			clayey SAND (SC), some gravel, fine to coarse sand, subangular gravel, medium plasticity, dry, light to dark brown	LD 19-01	7	32	12	13.3	61.1	25.6	
5270	10										
5260	20		clayey SAND with gravel (SC), fine to coarse sand, subangular gravel, medium plasticity, light to dark brown, dry to moist	LD 19-02	6.5	30	12	30.4	56.5	13.1	Large Scale Rock Gradation between 20 and 28 feet

Testpit Terminated at 28 feet

TP21-20

NewFields

CLIENT South32 (Arizona Minerals Inc.)
PROJECT NAME Hermosa Project Geotechnical Investigation
PROJECT NUMBER 475.0014.029
PROJECT LOCATION Patagonia, Arizona
DATE STARTED 6/17/21 **COMPLETED** 6/17/21
GROUND ELEVATION 5289 ft **TOTAL PIT DEPTH** 13 ft
EXCAVATION CONTRACTOR RUMCO
COORDINATES (UTM Zone 12N):
EQUIPMENT CAT 374E
NORTHING 3480781.7 **EASTING** 525600.7
LOGGED BY J. Miandad **CHECKED BY** C.Thompson
DEPTH TO WATER (FT BGS) No Groundwater Encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0		Surface Conditions: No Vegetation								
5280	10		clayey SAND with gravel (SC), some roots and pieces of wood, fine to coarse sand, subrounded to subangular gravel, medium plasticity, slightly moist, dark brown	LD 20-01	6.5	28	11	35.8	47.7	16.5	

Testpit Terminated at 13 feet

TP21-21

CLIENT South32 (Arizona Minerals Inc.)
PROJECT NAME Hermosa Project Geotechnical Investigation
PROJECT NUMBER 475.0014.029
PROJECT LOCATION Patagonia, Arizona
DATE STARTED 6/16/21 **COMPLETED** 6/16/21
GROUND ELEVATION 5288 ft **TOTAL PIT DEPTH** 25 ft
EXCAVATION CONTRACTOR RUMCO
COORDINATES (UTM Zone 12N):
EQUIPMENT CAT 374E
NORTHING 3480784.5 **EASTING** 525643.5
LOGGED BY J. Miandad **CHECKED BY** C.Thompson
DEPTH TO WATER (FT BGS) No Groundwater Encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0		Surface Conditions: No Vegetation								
			clayey GRAVEL with sand (GC), cobbles and boulders, fine to coarse sand, subrounded to subangular gravel, medium plasticity, dry, dark brown to green	LD 21-01							
5280	10										
				LD 21-02	7	28	11	43.3	41	15.7	
5270	20										

Testpit Terminated at 25 feet

TP21-22

NewFields

CLIENT South32 (Arizona Minerals Inc.)
PROJECT NAME Hermosa Project Geotechnical Investigation
PROJECT NUMBER 475.0014.029
PROJECT LOCATION Patagonia, Arizona
DATE STARTED 6/17/21 **COMPLETED** 6/17/21
GROUND ELEVATION 5288 ft **TOTAL PIT DEPTH** 20 ft
EXCAVATION CONTRACTOR RUMCO
COORDINATES (UTM Zone 12N):
EQUIPMENT CAT 374E
NORTHING 3480795.3 **EASTING** 525630.5
LOGGED BY J. Miandad **CHECKED BY** C.Thompson
DEPTH TO WATER (FT BGS) No GroundWater Encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0		Surface Conditions: No Vegetation								
			clayey GRAVEL with sand (GC), fine to coarse sand, subrounded to subangular gravel, low plasticity to medium plasticity, dry, purple and brown	LD 22-01							
5280	10		poorly graded GRAVEL with sand (GP), cobbles and boulders, fine to coarse sand, subrounded to subangular gravel, low plasticity, dry, light brown								
5270	20										

Testpit Terminated at 20 feet

NewFields

CLIENT South32 (Arizona Minerals Inc.)
PROJECT NAME Hermosa Project Geotechnical Investigation
PROJECT NUMBER 475.0014.029
PROJECT LOCATION Patagonia, Arizona
DATE STARTED 6/18/21 **COMPLETED** 6/18/21
GROUND ELEVATION 5287 ft **TOTAL PIT DEPTH** 21 ft
EXCAVATION CONTRACTOR RUMCO
COORDINATES (UTM Zone 12N):
EQUIPMENT CAT 374E
NORTHING 3480806.3 **EASTING** 525659.6
LOGGED BY J. Miandad **CHECKED BY** C.Thompson
DEPTH TO WATER (FT BGS) No Groundwater Encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION Surface Conditions: No Vegetation	SAMPLE TYPE NUMBER	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0		clayey SAND with gravel (SC), fine to coarse sand, subangular gravel, medium plasticity, dry, purple brown	LD 23-01	6	30	11	42.8	43.8	13.4	
5280	10		poorly graded GRAVEL with sand (GP), cobbles and boulders, fine to coarse sand, angular to subrounded gravel, nonplastic, dry, brown and gray								
5270	20										

Testpit Terminated at 21 feet

NewFields

CLIENT South32 (Arizona Minerals Inc.)
PROJECT NAME Hermosa Project Geotechnical Investigation
PROJECT NUMBER 475.0014.029
PROJECT LOCATION Patagonia, Arizona
DATE STARTED 6/18/21 **COMPLETED** 6/18/21
GROUND ELEVATION 5286 ft **TOTAL PIT DEPTH** 20 ft
EXCAVATION CONTRACTOR RUMCO
COORDINATES (UTM Zone 12N):
EQUIPMENT CAT 374E
NORTHING 3480829.2 **EASTING** 525654.9
LOGGED BY J. Miandad **CHECKED BY** C.Thompson
DEPTH TO WATER (FT BGS) No Groundwater Encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION Surface Conditions: No Vegetation	SAMPLE TYPE NUMBER	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0		clayey SAND with gravel (SC), cobbles, fine to coarse sand, angular to subangular gravel, medium plasticity, slightly moist, dark brown to greenish brown								
5280											
	10			LD 24-01	12.2	32	15	36.6	44.9	18.5	
5270											
	20										

Testpit Terminated at 20 feet

TP21-25

NewFields

CLIENT South32 (Arizona Minerals Inc.)
PROJECT NAME Hermosa Project Geotechnical Investigation
PROJECT NUMBER 475.0014.029
PROJECT LOCATION Patagonia, Arizona
DATE STARTED 6/18/21 **COMPLETED** 6/18/21
GROUND ELEVATION 5282 ft **TOTAL PIT DEPTH** 18 ft
EXCAVATION CONTRACTOR RUMCO
COORDINATES (UTM Zone 12N):
EQUIPMENT CAT 374E
NORTHING 3480811.87 **EASTING** 525682.81
LOGGED BY J. Miandad **CHECKED BY** C.Thompson
DEPTH TO WATER (FT BGS) No Groundwater Encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION Surface Conditions: No Vegetation	SAMPLE TYPE NUMBER	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0		clayey SAND with gravel (SC), cobbles, fine to coarse sand, subangular to angular gravel, medium plasticity, dry, dark brown								
5280											
	10										
5270				LD 25-01	9	34	13	33.1	50.4	16.5	

Testpit Terminated at 18 feet

ATTACHMENT B

Table B1
South32 (AMI)
Hermosa Project
Geotechnical Borrow Source Investigation
Laboratory Index Testing Summary

Location	Laboratory Sample ID	Date Tested	Test Pit ID	Sample Depth	GRAIN SIZE DISTRIBUTION - PERCENT PASSING																USCS	NATURAL MOISTURE CONTENT (%)	ATTERBERG LIMITS		
					GRAVEL									SAND						CLAY/ SILT			LIQUID LIMIT	PLASTIC LIMIT	PLASTIC INDEX
					6"	4.0"	3.0"	2.0"	1.5"	1.0"	0.75"	0.5"	0.375"	#4	#10	#16	#40	#50	#100	#200					
						SPECIFICATION (LPSL)																	SPECIFICATION (LPSL)		
							100							55-100						25 Min.					15 Min.
Shaft/ Plant Site Platform	21-242-01	8/18/2021	TP21-02	2-8'	100.0	100.0	100.0	100.0	98.0	94.3	88.4	78.2	71.5	66.9	57.3	51.4	39.3	34.4	24.1	17.1	SC	5.1	32	20	12
	21-242-02	8/19/2021	TP21-03	1-6'	100.0	100.0	100.0	93.9	84.4	77.4	71.1	63.7	59.1	55.1	50.1	46.9	39.4	35.3	25.3	18.3	GC	7.4	33	21	12
	21-242-03	8/18/2021	TP21-04	1-4'	100.0	89.8	79.6	55.9	47.1	36.4	27.7	26.2	25.5	24.7	22.9	21.8	19.1	17.3	12.7	9.8	GC	6.6	34	21	13
	21-164-01	6/21/2021	TP21-05	0-1'	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.8	96.7	78.3	68.2	49.2	36.6	SC	9.4	37	22	15
	21-164-02	6/21/2021	TP21-06	1-8'	100.0	100.0	100.0	92.1	86.7	81.7	77.9	74.4	73.4	71.8	67.8	51.1	27.4	21.1	12.9	8.4	SW-SM	5.9	NP	NP	NP
	21-242-04	8/18/2021	TP21-07	1.5-15'	100.0	100.0	100.0	91.7	84.4	73.0	65.1	55.0	49.8	45.2	38.9	35.6	28.0	24.3	17.7	13.3	GC	7.9	32	19	13
	21-242-05	8/18/2021	TP21-08	2-15'	100.0	100.0	100.0	88.2	78.7	73.7	71.2	69.0	68.2	61.5	53.9	49.1	38.7	34.0	23.3	14.3	SC-SM	7.5	27	20	7
	21-242-06	8/18/2021	TP21-09	2-12'	100.0	100.0	100.0	98.6	94.8	81.0	71.7	59.4	52.8	43.9	37.0	34.1	27.8	24.5	17.2	12.0	GP-GC	6.7	37	22	15
	21-242-07	8/18/2021	TP21-11	2-15'	100.0	100.0	95.0	78.6	72.1	59.3	52.4	41.0	35.3	28.7	23.3	21.2	17.1	15.2	11.3	8.5	GP-GC	6.5	37	20	17
	21-242-08	8/18/2021	TP21-13	3-12'	100.0	100.0	93.0	72.6	61.7	44.4	32.6	22.9	18.7	11.5	8.2	7.2	6.0	5.5	4.2	3.2	GW	2.3	36	20	16
	21-242-09	8/18/2021	TP21-14	3.5-10'	100.0	100.0	100.0	98.7	95.5	76.4	81.1	71.0	64.9	57.0	45.4	39.2	28.0	24.1	17.6	13.1	SC	7.0	34	21	13
WTP2 Material Stockpile at the IP	21-242-10	8/19/2021	WTP2 21-01	-	100.0	100.0	94.8	81.9	77.1	64.4	54.5	42.9	37.0	31.0	23.6	20.2	14.2	12.3	9.1	6.9	GP-GC	6.7	33	17	16
	21-242-11	8/19/2021	WTP2 21-02	-	100.0	100.0	100.0	88.0	75.8	63.1	53.9	43.0	37.8	31.8	24.4	21.0	14.9	12.8	9.4	7.1	GP-GC	5.2	32	22	10
	21-242-12	8/19/2021	WTP2 21-04	-	100.0	100.0	100.0	93.8	81.1	68.9	60.8	49.4	43.5	39.1	32.9	29.6	21.6	18.6	13.3	9.9	GW-GC	7.8	34	22	12
	21-242-13	8/19/2021	WTP2 21-05	-	100.0	100.0	100.0	89.3	82.5	65.7	55.7	45.5	41.2	36.1	30.3	27.3	20.0	17.2	12.5	9.3	GW-GC	8.5	33	22	11
Existing Stockpile at the IP	21-164-03	6/21/2021	TP21-16*	0-10'	100.0	100.0	100.0	97.7	93.1	83.9	76.7	68.0	63.3	58.3	51.3	43.5	31.9	27.9	21.0	15.9	SC	6.5	30	19	11
	21-164-04	6/22/2021	TP21-17*	0-20'	100.0	100.0	100.0	94.9	89.4	82.4	77.1	70.8	66.7	62.5	55.6	48.0	35.6	31.3	23.7	18.0	SC	7.1	30	18	12
	21-164-05	6/22/2021	TP21-18	2-21'	100.0	100.0	100.0	96.1	90.0	84.0	80.2	72.9	69.2	64.3	57.0	46.0	29.0	24.1	16.6	11.9	SP-SC	10.2	36	19	17
	21-164-06	6/22/2021	TP21-19	0-5'	100.0	100.0	100.0	98.8	97.4	95.0	92.8	89.6	87.7	86.7	83.1	73.2	54.2	47.4	34.9	25.6	SC	7.0	32	20	12
	21-164-07	6/22/2021	TP21-19*	20-28'	100.0	100.0	100.0	100.0	96.1	88.4	83.6	77.2	73.8	69.6	63.4	51.1	33.2	27.8	18.6	13.1	SC	6.5	30	18	12
	21-164-08	6/22/2021	TP21-20	0-13'	100.0	100.0	96.8	92.8	89.8	83.5	78.8	73.1	69.7	64.2	57.7	49.4	36.4	31.6	22.8	16.5	SC	6.5	28	17	11
	21-164-09	6/22/2021	TP21-21	4-25'	100.0	100.0	100.0	91.2	85.8	77.4	70.8	64.2	60.2	56.7	49.6	42.9	32.0	28.1	21.0	15.7	GC	7.4	28	17	11
	21-164-10	6/22/2021	TP21-23	0-5'	100.0	100.0	100.0	94.5	90.4	83.4	78.0	69.4	64.7	57.2	47.9	40.1	28.5	24.7	18.2	13.4	SC	6.2	30	19	11
	21-164-11	6/22/2021	TP21-24	0-20'	100.0	100.0	100.0	100.0	92.6	85.9	80.6	72.3	67.7	63.4	56.3	48.1	36.2	32.1	24.3	18.5	SC	12.2	32	17	15
	21-164-12	6/22/2021	TP21-25	5-18'	100.0	100.0	100.0	97.0	88.3	79.9	75.6	73.2	69.0	66.9	62.2	52.2	37.0	31.8	22.7	16.5	SC	9.1	34	21	13

* These samples include 3" minus material from the large rock gradation performed on site.

NewFields

MOISTURE CONTENT
(ASTM D 2216 / ASTM D 4643)
LABORATORY WORKSHEET

NF Form #15

Client:	South 32	**Location:**	See Below
Project Title:	Hermosa Geotech Investigation	**Elevation:**	See Below
Project Number:	475.0014.029	**Test Date:**	6/21/2021
Project Engineer:	Craig Thompson	**Tested By:**	ZM
Field Sample ID:	See Below	**Checked By:**	JH

Drying Conditions: 60 deg C / **110 deg C** Method: **Oven (O)** / Microwave (M) / Hot Plate (H)

Sample No.		21-164-01	21-164-02	21-164-03	21-164-04	21-164-05
Location		TP21-05	TP21-06	TP21-16	TP21-17	TP21-18
Depth		0-1'	1-8'	0-10'	0-20'	2-21'
Soil Description						
(USCS)						
Trial No.		**1**	**2**	**3**	**4**	**5**
Tare No.						
Tare + Wet Soil	**A**	721.9	589.6	589.2	828.6	1039.7
Tare + Dry Soil	**B**	671.1	564.1	561.5	782.8	955.7
Tare	**C**	131.3	134.3	132.9	133.4	132.4
Wt. of Water	**D= A-B**	50.8	25.5	27.7	45.8	84
Dry Soil, Ws	**E= B-C**	539.8	429.8	428.6	649.4	823.3
Moisture Content, (%)	**(D/E) x100**	**9.4%**	**5.9%**	**6.5%**	**7.1%**	**10.2%**

Sample No.		21-164-06	21-164-07	21-164-08	21-164-09	21-164-10
Location		TP21-19	TP21-19	TP21-20	TP21-21	TP21-23
Depth		0-5'	20-28'	0-13'	4-25'	0-5'
Soil Description						
(USCS)						
Trial No.		**6**	**7**	**8**	**9**	**10**
Tare No.						
Tare + Wet Soil	**A**	1009.7	908.8	806.8	642	1050.8
Tare + Dry Soil	**B**	952.3	861.8	765.8	606.9	997
Tare	**C**	133.5	133.8	133.9	133.5	132.3
Wt. of Water	**D= A-B**	57.4	47	41	35.1	53.8
Dry Soil, Ws	**E= B-C**	818.8	728	631.9	473.4	864.7
Moisture Content, (%)	**(D/E) x100**	**7.0%**	**6.5%**	**6.5%**	**7.4%**	**6.2%**

Remarks:

NewFields

MOISTURE CONTENT
(ASTM D 2216 / ASTM D 4643)
LABORATORY WORKSHEET

NF Form #15

Client:	South 32	**Location:**	See Below
Project Title:	Hermosa Geotech Investigation	**Elevation:**	See Below
Project Number:	475.0014.029	**Test Date:**	6/21/2021
Project Engineer:	Craig Thompson	**Tested By:**	ZM
Field Sample ID:	See Below	**Checked By:**	JH

Drying Conditions: 60 deg C / **110 deg C** Method: **Oven (O)** / Microwave (M) / Hot Plate (H)

Sample No.		21-164-11	21-164-12			
Location		TP21-24	TP21-25			
Depth		0-20'	5-18'			
Soil Description						
(USCS)						
Trial No.		**11**	**12**	**13**	**14**	**15**
Tare No.						
Tare + Wet Soil	**A**	800.2	833.7			
Tare + Dry Soil	**B**	727.5	775.2			
Tare	**C**	132.7	132.9			
Wt. of Water	**D= A-B**	72.7	58.5			
Dry Soil, Ws	**E= B-C**	594.8	642.3			
Moisture Content, (%)	**(D/E) x100**	**12.2%**	**9.1%**			

Sample No.						
Location						
Depth						
Soil Description						
(USCS)						
Trial No.		**16**	**17**	**18**	**19**	**20**
Tare No.						
Tare + Wet Soil	**A**					
Tare + Dry Soil	**B**					
Tare	**C**					
Wt. of Water	**D= A-B**					
Dry Soil, Ws	**E= B-C**					
Moisture Content, (%)	**(D/E) x100**					

Remarks:

NewFields

MOISTURE CONTENT
(ASTM D 2216 / ASTM D 4643)
LABORATORY WORKSHEET

NF Form #15

Client:	South 32	**Location:**	See Below
Project Title:	Hermosa Geotech Investigation	**Elevation:**	See Below
Project Number:	475.0014.029	**Test Date:**	8/18/2021
Project Engineer:	Craig Thompson	**Tested By:**	ZM
Field Sample ID:	See Below	**Checked By:**	JH

Drying Conditions: 60 deg C / **110 deg C** Method: **Oven (O)** / Microwave (M) / Hot Plate (H)

Sample No.		21-242-01	21-242-02	21-242-03	21-242-04	21-242-05
Location		TP21-02	TP21-03	TP21-04	TP21-07	TP21-08
Depth		2-8'	1-6'	1-4'	1.5-15'	2-15'
Soil Description						
(USCS)						
Trial No.		**1**	**2**	**3**	**4**	**5**
Tare No.						
Tare + Wet Soil	A	756	782	611.8	850.6	839.8
Tare + Dry Soil	B	725.6	737.3	582.1	797.9	790.4
Tare	C	132.7	132.7	133.1	132.2	133.1
Wt. of Water	D= A-B	30.4	44.7	29.7	52.7	49.4
Dry Soil, Ws	E= B-C	592.9	604.6	449	665.7	657.3
Moisture Content, (%)	(D/E) x100	**5.1%**	**7.4%**	**6.6%**	**7.9%**	**7.5%**

Sample No.		21-242-06	21-242-07	21-242-08	21-242-09	21-242-10
Location		TP21-09	TP21-11	TP21-13	TP21-14	WTP2 21-01
Depth		2-12'	2-15'	3-12'	3.5-10'	
Soil Description						
(USCS)						
Trial No.		**6**	**7**	**8**	**9**	**10**
Tare No.						
Tare + Wet Soil	A	977.1	920.3	956	646.8	1034.2
Tare + Dry Soil	B	924.2	872.3	937.4	613.4	977.5
Tare	C	132.8	132.2	132	133.6	132.4
Wt. of Water	D= A-B	52.9	48	18.6	33.4	56.7
Dry Soil, Ws	E= B-C	791.4	740.1	805.4	479.8	845.1
Moisture Content, (%)	(D/E) x100	**6.7%**	**6.5%**	**2.3%**	**7.0%**	**6.7%**

Remarks:

NewFields

MOISTURE CONTENT
(ASTM D 2216 / ASTM D 4643)
LABORATORY WORKSHEET

NF Form #15

Client:	South 32	**Location:**	See Below
Project Title:	Hermosa Geotech Investigation	**Elevation:**	See Below
Project Number:	475.0014.029	**Test Date:**	8/18/2021
Project Engineer:	Craig Thompson	**Tested By:**	ZM
Field Sample ID:	See Below	**Checked By:**	JH

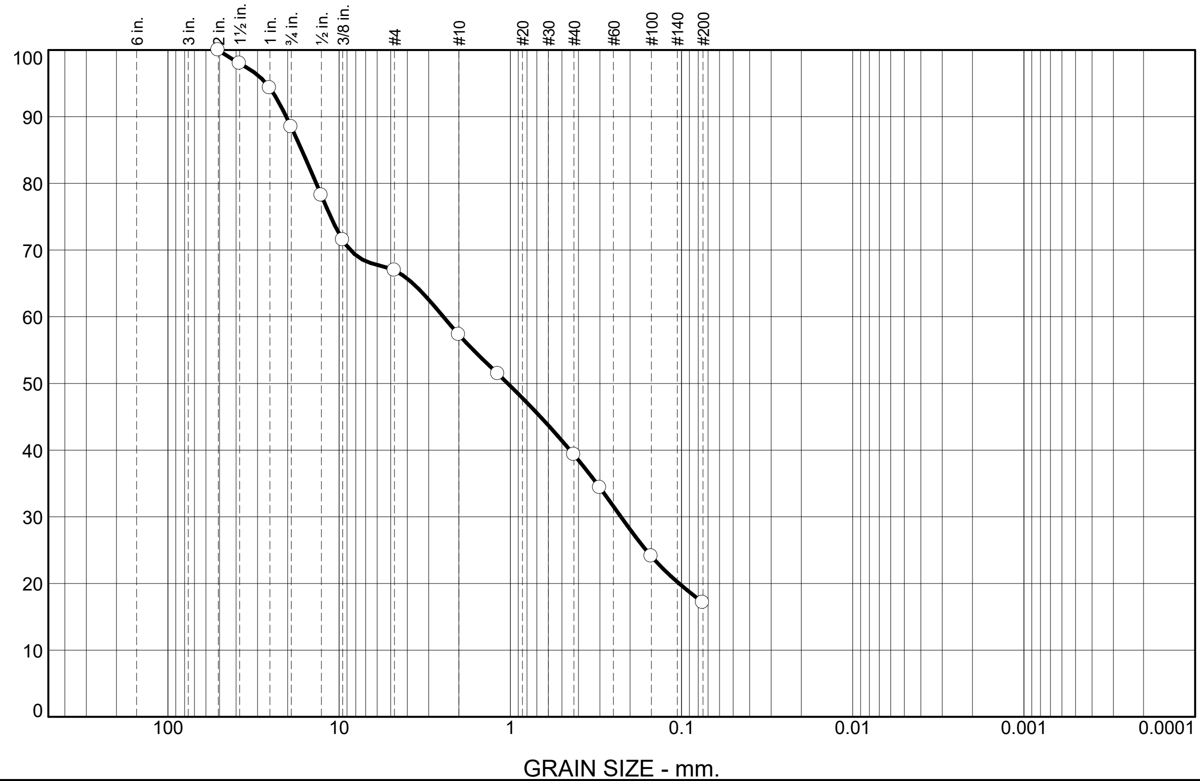
Drying Conditions: 60 deg C / **110 deg C** Method: **Oven (O)** / Microwave (M) / Hot Plate (H)

Sample No.		21-242-11	21-242-12	21-242-13		
Location		WTP2 21-02	WTP2 21-04	WTP2 21-05		
Depth						
Soil Description						
(USCS)						
Trial No.		**11**	**12**	**13**	**14**	**15**
Tare No.						
Tare + Wet Soil	**A**	1014.5	981.6	632.8		
Tare + Dry Soil	**B**	970.7	920	593.8		
Tare	**C**	133.4	133.3	132.3		
Wt. of Water	**D= A-B**	43.8	61.6	39		
Dry Soil, Ws	**E= B-C**	837.3	786.7	461.5		
Moisture Content, (%)	**(D/E) x100**	**5.2%**	**7.8%**	**8.5%**		

Sample No.						
Location						
Depth						
Soil Description						
(USCS)						
Trial No.		**16**	**17**	**18**	**19**	**20**
Tare No.						
Tare + Wet Soil	**A**					
Tare + Dry Soil	**B**					
Tare	**C**					
Wt. of Water	**D= A-B**					
Dry Soil, Ws	**E= B-C**					
Moisture Content, (%)	**(D/E) x100**					

Remarks:

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	11.6	21.5	9.6	18.0	22.2	17.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2"	100.0		
1.5"	98.0		
1"	94.3		
.75"	88.4		
.5"	78.2		
.375"	71.5		
#4	66.9		
#10	57.3		
#16	51.4		
#40	39.3		
#50	34.4		
#100	24.1		
#200	17.1		

* (no specification provided)

Soil Description

Dark Brown clayey sand with gravel

Atterberg Limits

PL= 20 LL= 32 PI= 12

Coefficients

D_{90}= 20.3628 D_{85}= 16.5409 D_{60}= 2.4631
D_{50}= 1.0355 D_{30}= 0.2260 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO= A-2-6(0)

Remarks

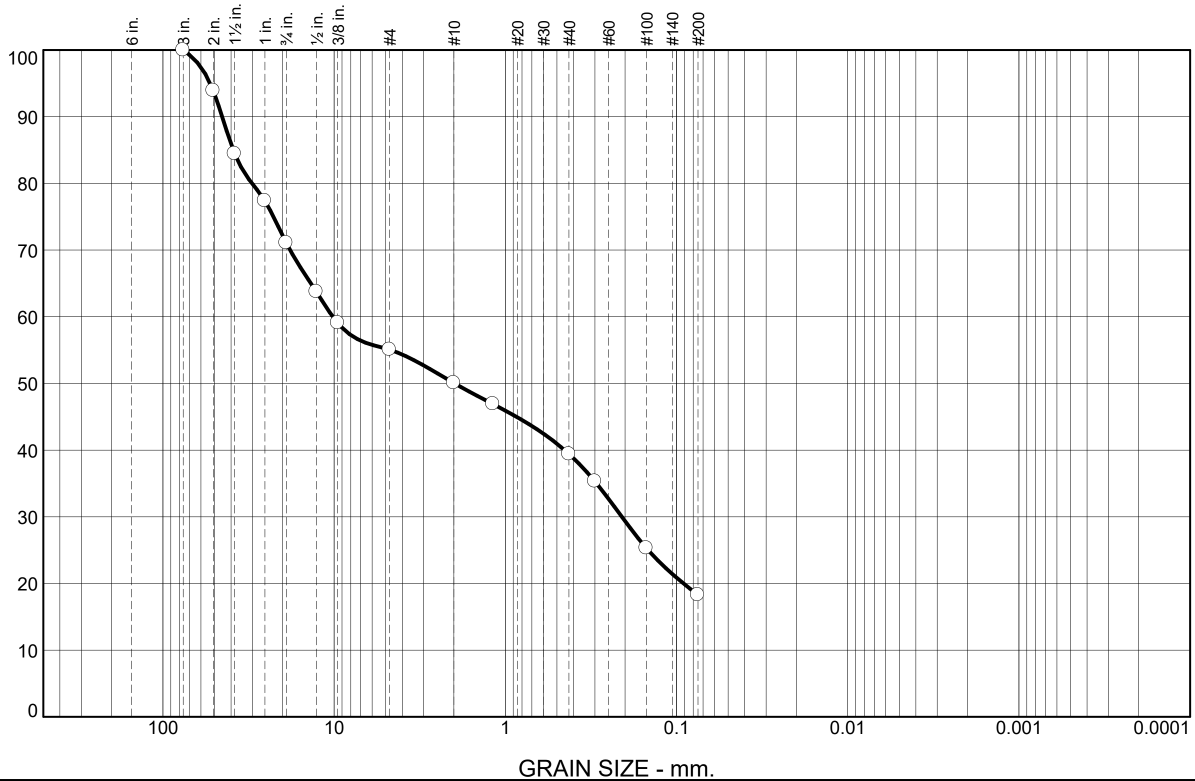
Location: TP21-02
Sample Number: 21-242-01 **Depth:** 2-8' **Date:** 8/18/2021

NewFields

Client: South 32
Project: Hermosa Geotech Investigation
Project No: 475.0014.029 **Figure** 21-242-01

Tested By: EG/ZM **Checked By:** JH

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	28.9	16.0	5.0	10.7	21.1	18.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100.0		
2"	93.9		
1.5"	84.4		
1"	77.4		
.75"	71.1		
.5"	63.7		
.375"	59.1		
#4	55.1		
#10	50.1		
#16	46.9		
#40	39.4		
#50	35.3		
#100	25.3		
#200	18.3		

* (no specification provided)

Soil Description

Dark brown clayey gravel with sand

Atterberg Limits

PL= 21 LL= 33 PI= 12

Coefficients

D_{90}= 45.0703 D_{85}= 38.8437 D_{60}= 10.1722
D_{50}= 1.9791 D_{30}= 0.2087 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= GC AASHTO= A-2-6(0)

Remarks

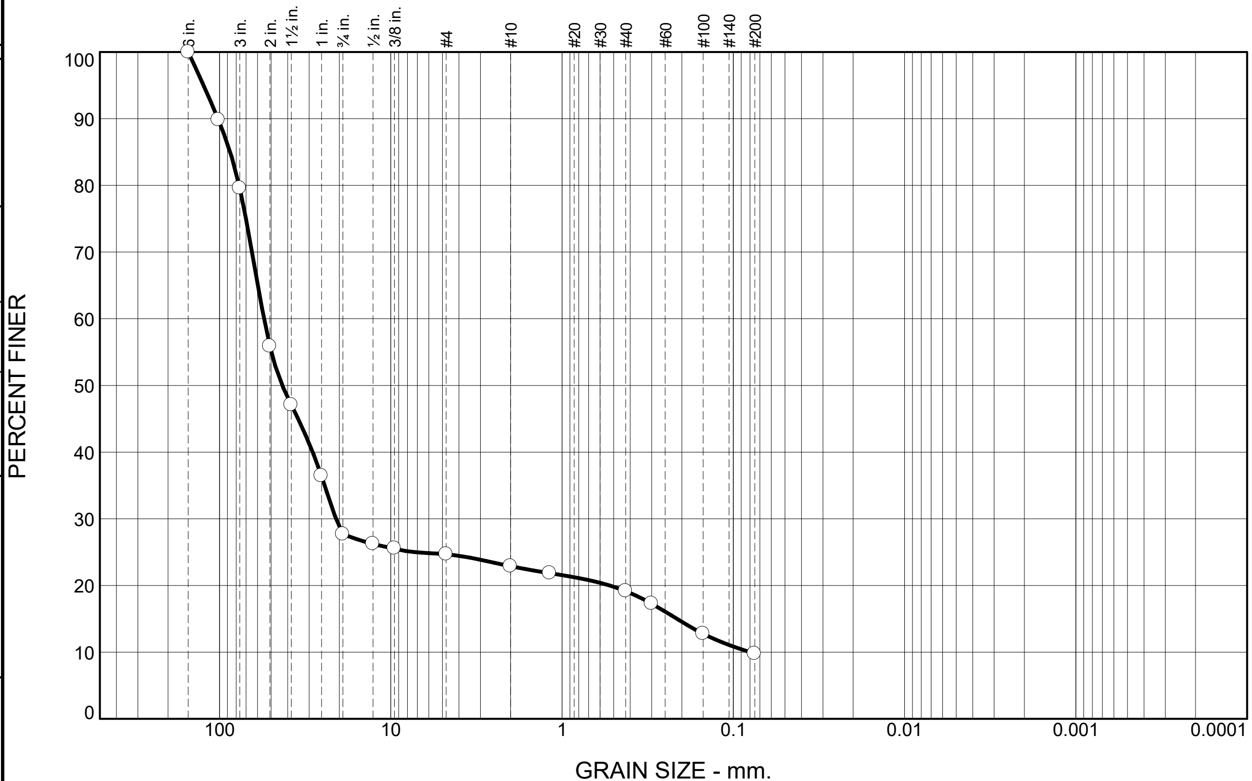
Location: TP21-03
Sample Number: 21-242-02 **Depth:** 1-6' **Date:** 8/19/2021

NewFields

Client: South 32
Project: Hermosa Geotech Investigation
Project No: 475.0014.029 **Figure** 21-242-02

Tested By: ZM **Checked By:** JH

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
20.4	51.9	3.0	1.8	3.8	9.3	9.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
6"	100.0		
4"	89.8		
3"	79.6		
2"	55.9		
1.5"	47.1		
1"	36.4		
.75"	27.7		
.5"	26.2		
.375"	25.5		
#4	24.7		
#10	22.9		
#16	21.8		
#40	19.1		
#50	17.3		
#100	12.7		
#200	9.8		

* (no specification provided)

Soil Description

Dark brown clayey gravel with sand

Atterberg Limits

PL= 21 LL= 34 PI= 13

Coefficients

D_{90}= 102.3099 D_{85}= 86.6734 D_{60}= 55.0152
D_{50}= 42.9824 D_{30}= 20.9046 D_{15}= 0.2135
D_{10}= 0.0801 C_u= 686.67 C_c= 99.14

Classification

USCS= GC AASHTO= A-2-6(0)

Remarks

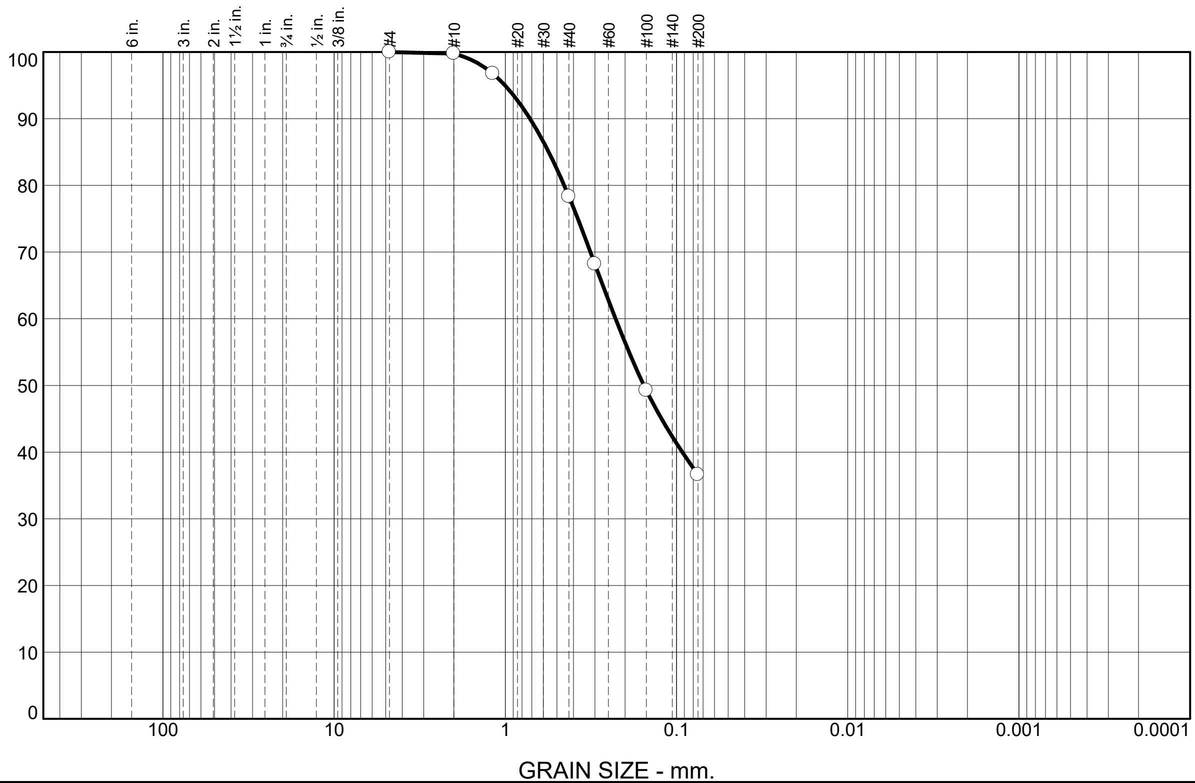
Location: TP21-04
Sample Number: 21-242-03 **Depth:** 1-4' **Date:** 8/18/2021

NewFields

Client: South 32
Project: Hermosa Geotech Investigation
Project No: 475.0014.029 **Figure** 21-242-03

Tested By: ZM **Checked By:** JH

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.2	21.5	41.7	36.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.8		
#16	96.7		
#40	78.3		
#50	68.2		
#100	49.2		
#200	36.6		

* (no specification provided)

Soil Description

Brown clayey sand

Atterberg Limits

PL= 22 LL= 37 PI= 15

Coefficients

D_{90}= 0.7168 D_{85}= 0.5577 D_{60}= 0.2270
D_{50}= 0.1551 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO= A-6(1)

Remarks

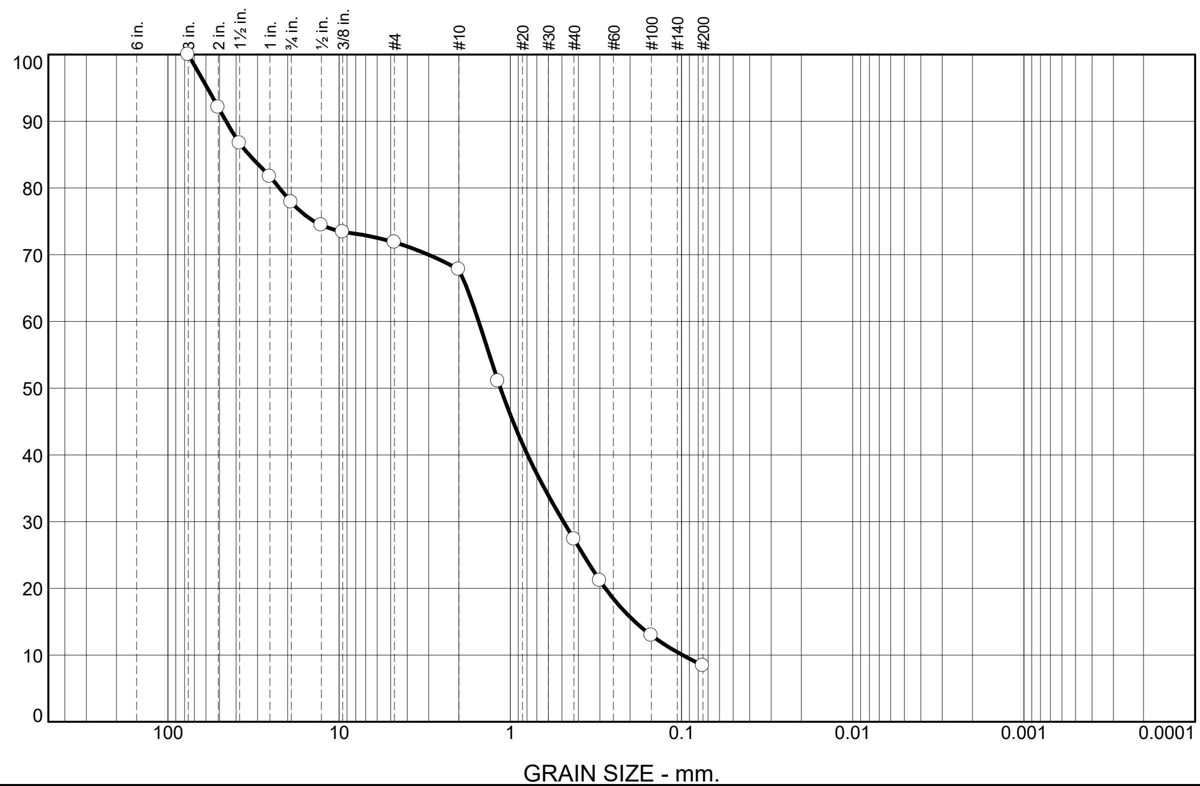
Location: TP21-05
Sample Number: 21-164-01 **Depth:** 0-1' **Date:** 6/21/2021

NewFields

Client: South 32
Project: Hermosa Geotech Investigation
Project No: 475.0014.029 **Figure** 21-164-01

Tested By: EG/LS **Checked By:** JH

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	22.1	6.1	4.0	40.4	19.0	8.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100.0		
2"	92.1		
1.5"	86.7		
1"	81.7		
.75"	77.9		
.5"	74.4		
.375"	73.4		
#4	71.8		
#10	67.8		
#16	51.1		
#40	27.4		
#50	21.1		
#100	12.9		
#200	8.4		

* (no specification provided)

Soil Description

Brown well-graded sand with silt and gravel

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 45.7496 D_{85}= 33.6767 D_{60}= 1.5309
D_{50}= 1.1422 D_{30}= 0.4896 D_{15}= 0.1873
D_{10}= 0.0989 C_u= 15.49 C_c= 1.58

Classification

USCS= SW-SM AASHTO= A-1-b

Remarks

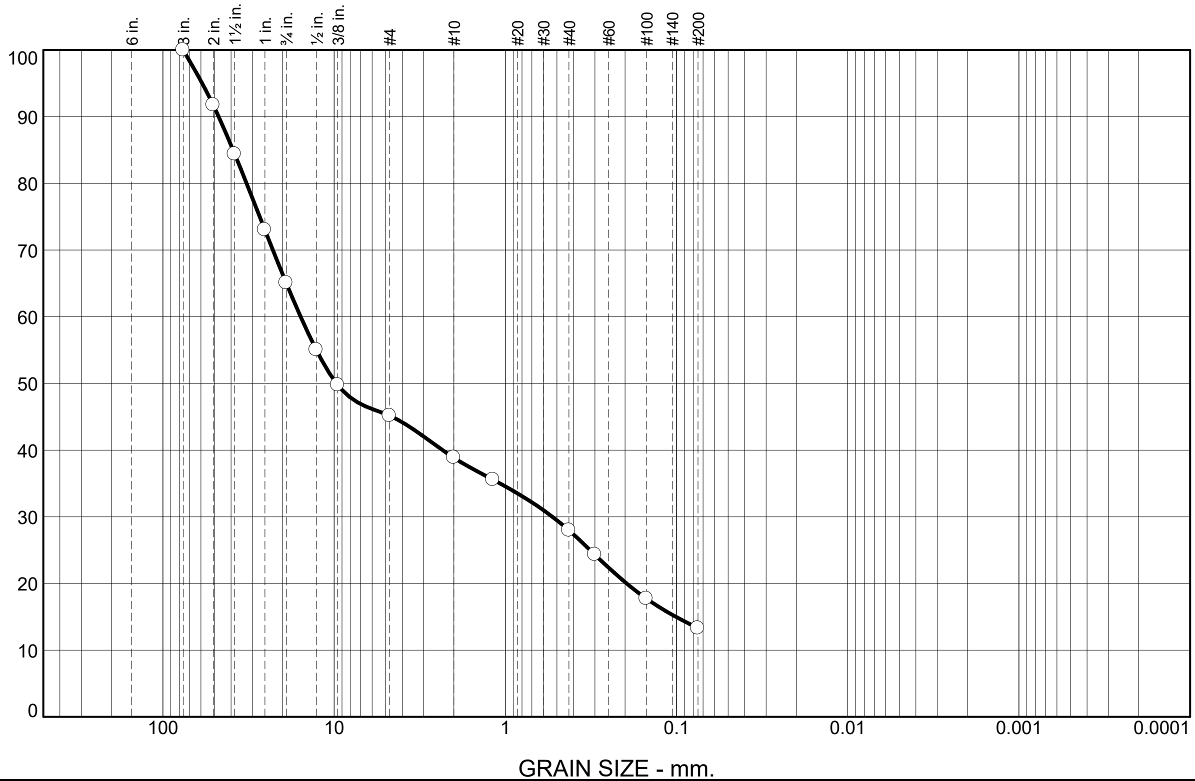
Location: TP21-06
Sample Number: 21-164-02 **Depth:** 1-8' **Date:** 6/21/2021

NewFields

Client: South 32
Project: Hermosa Geotech Investigation
Project No: 475.0014.029 **Figure** 21-164-02

Tested By: EG/LS **Checked By:** JH

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	34.9	19.9	6.3	10.9	14.7	13.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100.0		
2"	91.7		
1.5"	84.4		
1"	73.0		
.75"	65.1		
.5"	55.0		
.375"	49.8		
#4	45.2		
#10	38.9		
#16	35.6		
#40	28.0		
#50	24.3		
#100	17.7		
#200	13.3		

* (no specification provided)

Soil Description

Dark brown clayey gravel with sand

Atterberg Limits

PL= 19 LL= 32 PI= 13

Coefficients

D_{90}= 47.2230 D_{85}= 38.9564 D_{60}= 15.6964
D_{50}= 9.6842 D_{30}= 0.5307 D_{15}= 0.1008
D_{10}= C_u= C_c=

Classification

USCS= GC AASHTO= A-2-6(0)

Remarks

Location: TP21-07
Sample Number: 21-242-04 **Depth:** 1.5-15' **Date:** 8/18/2021

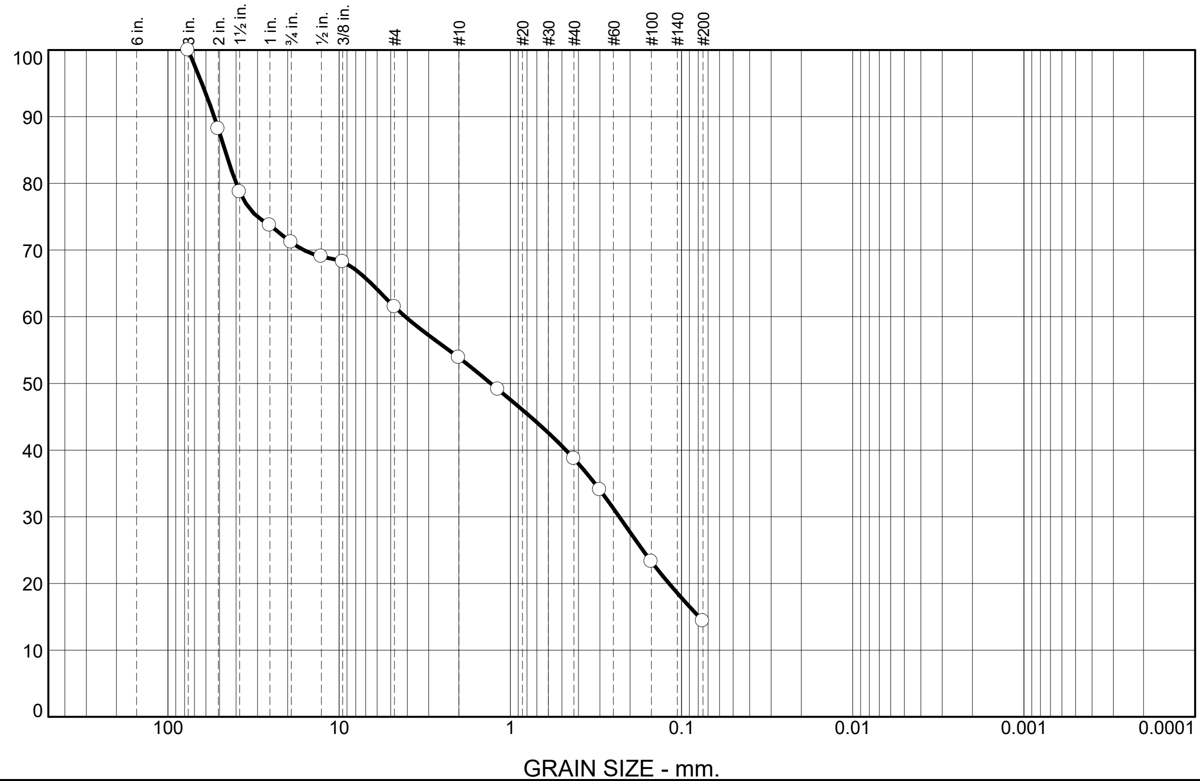
NewFields

Client: South 32
Project: Hermosa Geotech Investigation

Project No: 475.0014.029 **Figure** 21-242-04

Tested By: ZM **Checked By:** JH

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	28.8	9.7	7.6	15.2	24.4	14.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100.0		
2"	88.2		
1.5"	78.7		
1"	73.7		
.75"	71.2		
.5"	69.0		
.375"	68.2		
#4	61.5		
#10	53.9		
#16	49.1		
#40	38.7		
#50	34.0		
#100	23.3		
#200	14.3		

* (no specification provided)

Soil Description

Dark brown silty, clayey sand with gravel

Atterberg Limits

PL= 20 LL= 27 PI= 7

Coefficients

D_{90}= 53.6665 D_{85}= 46.4144 D_{60}= 4.1031
D_{50}= 1.3017 D_{30}= 0.2310 D_{15}= 0.0792
D_{10}= C_u= C_c=

Classification

USCS= SC-SM AASHTO= A-2-4(0)

Remarks

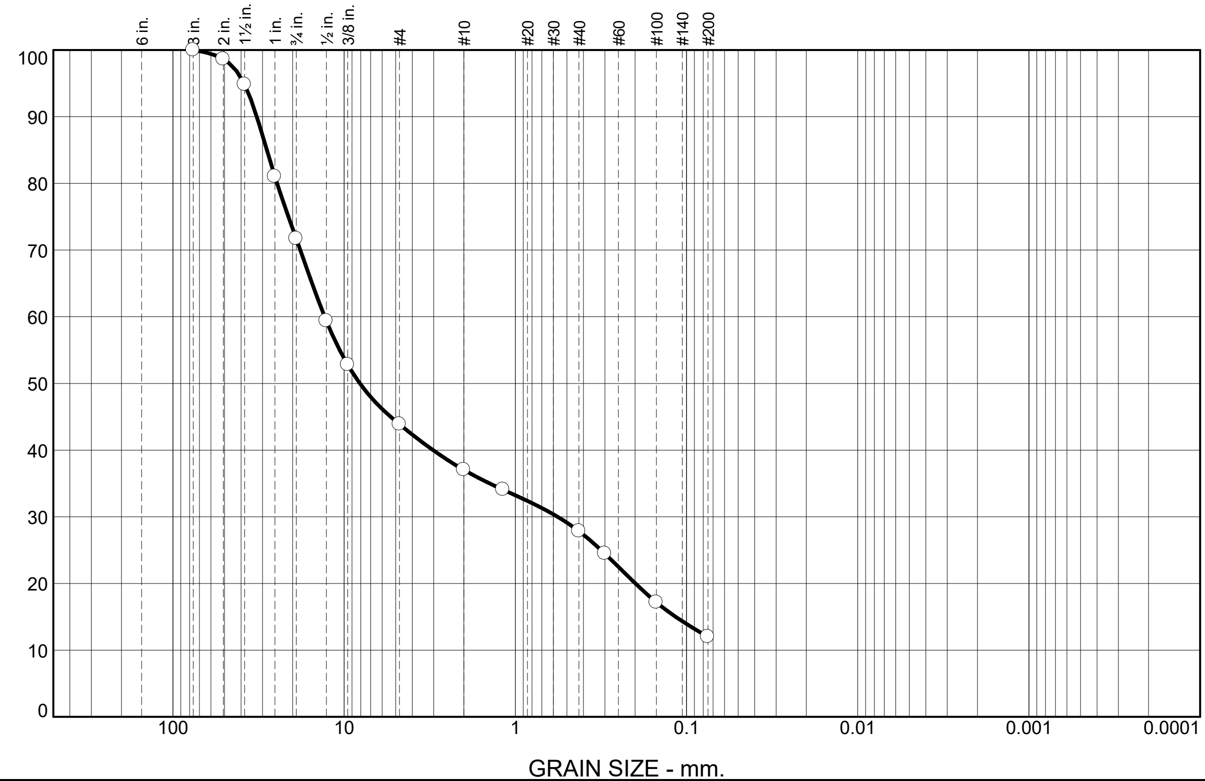
Location: TP21-08
Sample Number: 21-242-05 **Depth:** 2-15' **Date:** 8/18/2021

NewFields

Client: South 32
Project: Hermosa Geotech Investigation
Project No: 475.0014.029 **Figure** 21-242-05

Tested By: ZM **Checked By:** JH

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	28.3	27.8	6.9	9.2	15.8	12.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100.0		
2"	98.6		
1.5"	94.8		
1"	81.0		
.75"	71.7		
.5"	59.4		
.375"	52.8		
#4	43.9		
#10	37.0		
#16	34.1		
#40	27.8		
#50	24.5		
#100	17.2		
#200	12.0		

* (no specification provided)

Soil Description

Brown poorly graded gravel with clay and sand

Atterberg Limits

PL= 22 LL= 37 PI= 15

Coefficients

D_{90}= 32.4226 D_{85}= 28.2906 D_{60}= 12.9973
D_{50}= 8.0906 D_{30}= 0.5657 D_{15}= 0.1159
D_{10}= C_u= C_c=

Classification

USCS= GP-GC AASHTO= A-2-6(0)

Remarks

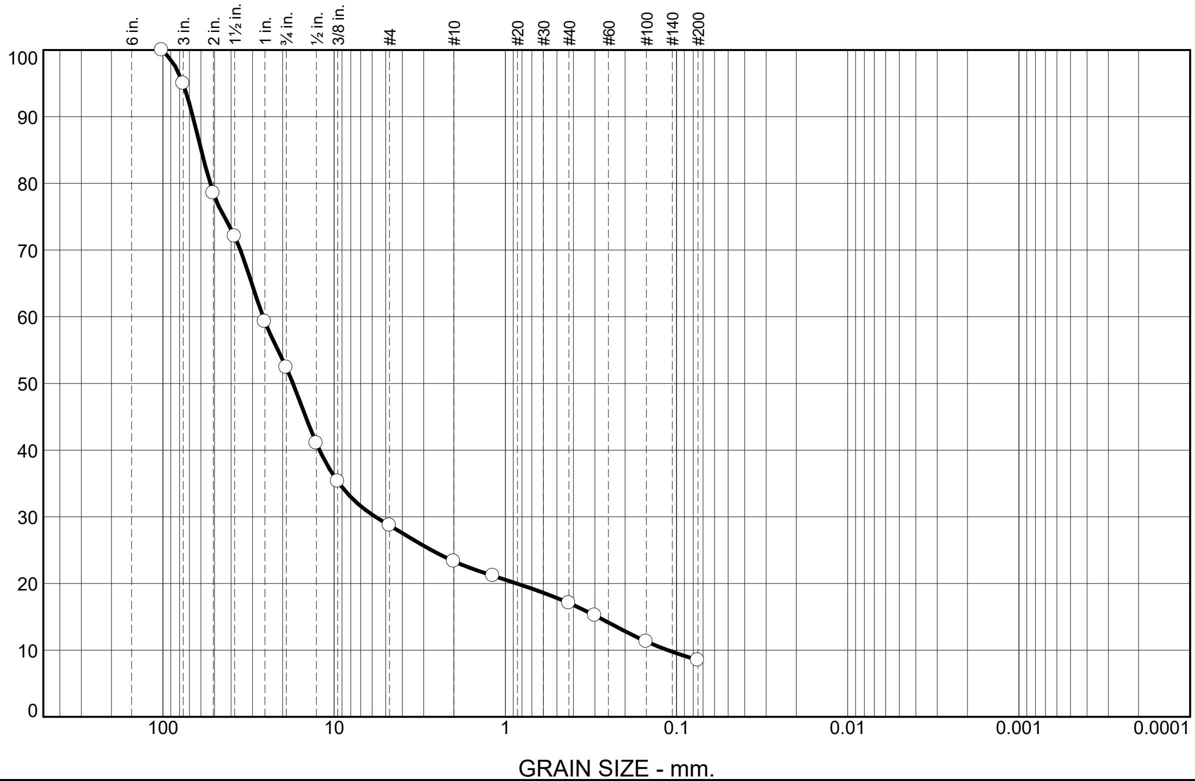
Location: TP21-09
Sample Number: 21-242-06 **Depth:** 2-12' **Date:** 8/18/2021

NewFields

Client: South 32
Project: Hermosa Geotech Investigation
Project No: 475.0014.029 **Figure** 21-242-06

Tested By: ZM **Checked By:** JH

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
5.0	42.6	23.7	5.4	6.2	8.6	8.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
4"	100.0		
3"	95.0		
2"	78.6		
1.5"	72.1		
1"	59.3		
.75"	52.4		
.5"	41.0		
.375"	35.3		
#4	28.7		
#10	23.3		
#16	21.2		
#40	17.1		
#50	15.2		
#100	11.3		
#200	8.5		

* (no specification provided)

Soil Description

Brown poorly graded gravel with clay and sand

Atterberg Limits

PL= 20 LL= 37 PI= 17

Coefficients

D_{90}= 66.8635 D_{85}= 59.7809 D_{60}= 26.0372
D_{50}= 17.4097 D_{30}= 5.7430 D_{15}= 0.2896
D_{10}= 0.1124 C_u= 231.68 C_c= 11.27

Classification

USCS= GP-GC AASHTO= A-2-6(0)

Remarks

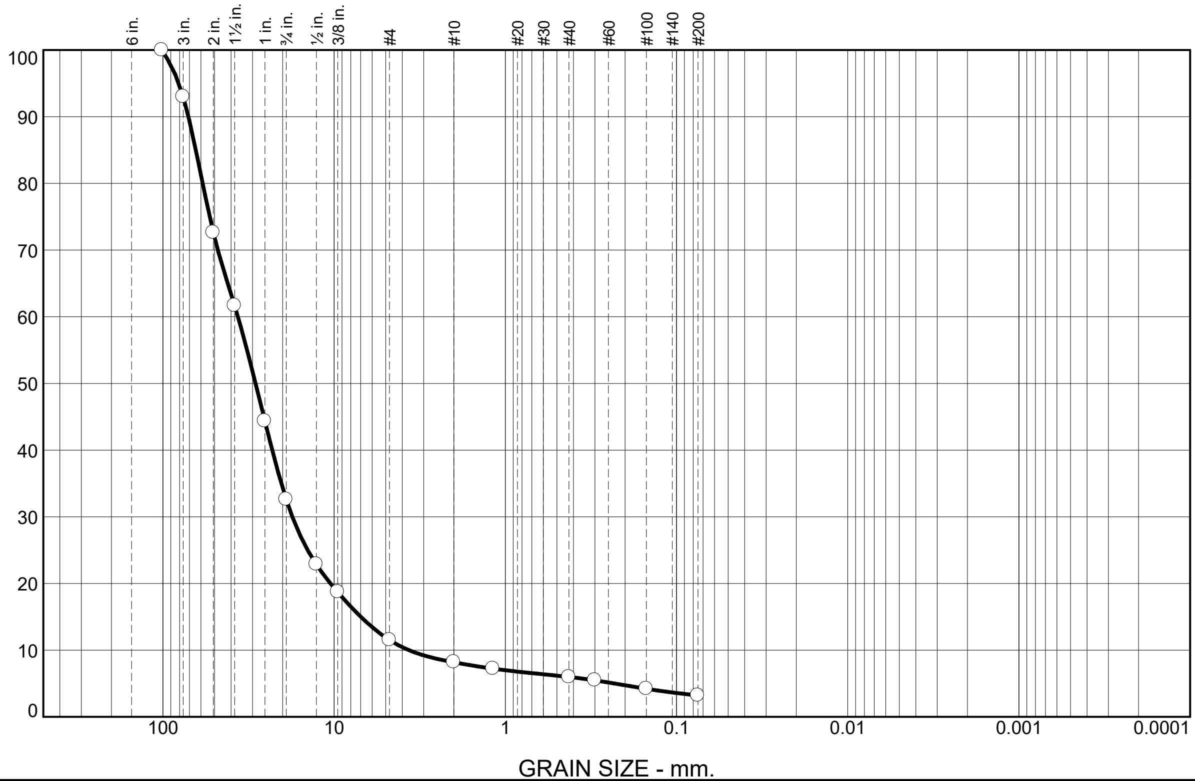
Location: TP21-11
Sample Number: 21-242-07 **Depth:** 2-15' **Date:** 8/18/2021

NewFields

Client: South 32
Project: Hermosa Geotech Investigation
Project No: 475.0014.029 **Figure** 21-242-07

Tested By: ZM/KS **Checked By:** JH

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
7.0	60.4	21.1	3.3	2.2	2.8	3.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
4"	100.0		
3"	93.0		
2"	72.6		
1.5"	61.7		
1"	44.4		
.75"	32.6		
.5"	22.9		
.375"	18.7		
#4	11.5		
#10	8.2		
#16	7.2		
#40	6.0		
#50	5.5		
#100	4.2		
#200	3.2		

* (no specification provided)

Soil Description

Dark brown well-graded gravel

Atterberg Limits

PL= 20 LL= 36 PI= 16

Coefficients

D_{90}= 70.9925 D_{85}= 64.2918 D_{60}= 36.4843
D_{50}= 28.8107 D_{30}= 17.5580 D_{15}= 6.9804
D_{10}= 3.6670 C_u= 9.95 C_c= 2.30

Classification

USCS= GW AASHTO= A-2-6(0)

Remarks

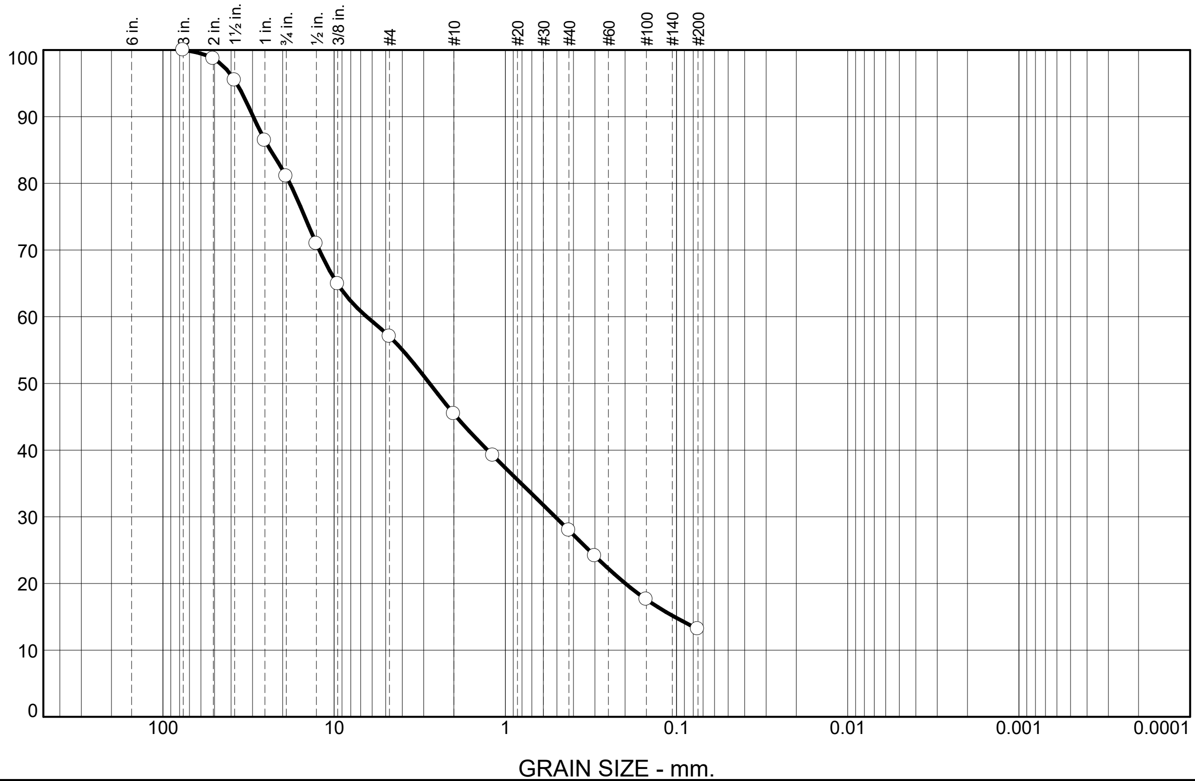
Location: TP21-13
Sample Number: 21-242-08 **Depth:** 3-12' **Date:** 8/18/2021

NewFields

Client: South 32
Project: Hermosa Geotech Investigation
Project No: 475.0014.029 **Figure** 21-242-08

Tested By: ZM/KS **Checked By:** JH

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	18.9	24.1	11.6	17.4	14.9	13.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100.0		
2"	98.7		
1.5"	95.5		
1"	86.4		
.75"	81.1		
.5"	71.0		
.375"	64.9		
#4	57.0		
#10	45.4		
#16	39.2		
#40	28.0		
#50	24.1		
#100	17.6		
#200	13.1		

* (no specification provided)

Soil Description

Brown clayey sand with gravel

Atterberg Limits

PL= 21 LL= 34 PI= 13

Coefficients

D_{90}= 29.7054 D_{85}= 23.5662 D_{60}= 6.4418
D_{50}= 2.7714 D_{30}= 0.5113 D_{15}= 0.1029
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO= A-2-6(0)

Remarks

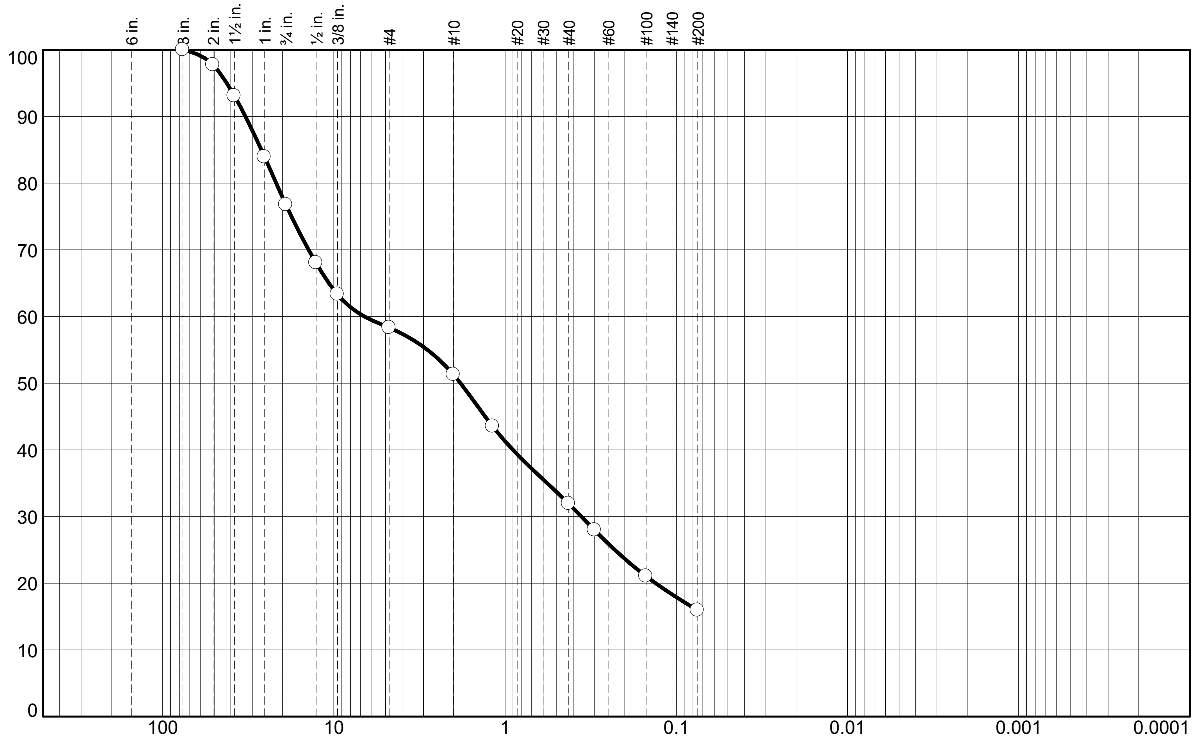
Location: TP21-14
Sample Number: 21-242-09 **Depth:** 3.5-10' **Date:** 8/18/2021

NewFields

Client: South 32
Project: Hermosa Geotech Investigation
Project No: 475.0014.029 **Figure** 21-242-09

Tested By: ZM/KS **Checked By:** JH

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	23.3	18.4	7.0	19.4	16.0	15.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100.0		
2"	97.7		
1.5"	93.1		
1"	83.9		
.75"	76.7		
.5"	68.0		
.375"	63.3		
#4	58.3		
#10	51.3		
#16	43.5		
#40	31.9		
#50	27.9		
#100	21.0		
#200	15.9		

* (no specification provided)

Soil Description

Dark brown clayey sand with gravel

Atterberg Limits

PL= 19 LL= 30 PI= 11

Coefficients

D_{90}= 32.8919 D_{85}= 26.5447 D_{60}= 6.6323
D_{50}= 1.8233 D_{30}= 0.3587 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO= A-2-6(0)

Remarks

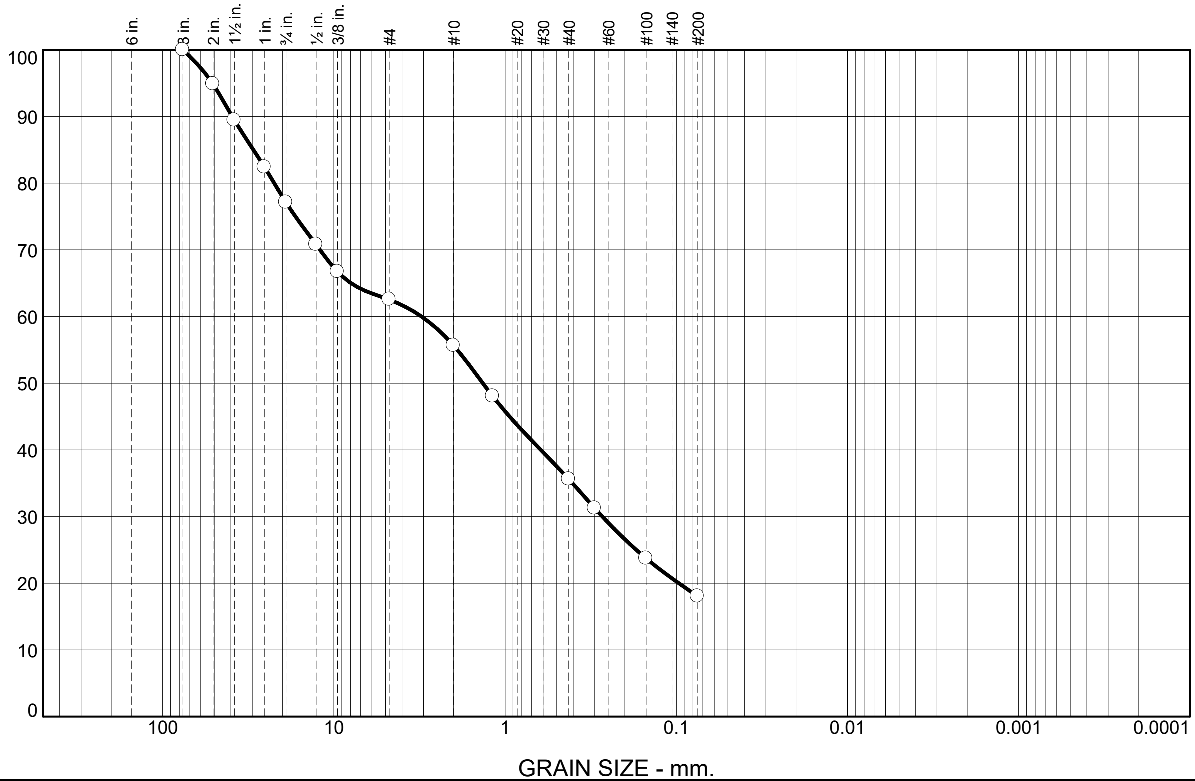
Location: TP21-16
Sample Number: 21-164-03 **Depth:** 0-10' **Date:** 6/21/2021

NewFields

Client: South 32
Project: Hermosa Geotech Investigation
Project No: 475.0014.029 **Figure** 21-164-03

Tested By: LS/ZM **Checked By:** JH

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	22.9	14.6	6.9	20.0	17.6	18.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100.0		
2"	94.9		
1.5"	89.4		
1"	82.4		
.75"	77.1		
.5"	70.8		
.375"	66.7		
#4	62.5		
#10	55.6		
#16	48.0		
#40	35.6		
#50	31.3		
#100	23.7		
#200	18.0		

* (no specification provided)

Soil Description

Brown clayey sand with gravel

Atterberg Limits

PL= 18 LL= 30 PI= 12

Coefficients

D_{90}= 39.2685 D_{85}= 29.5627 D_{60}= 3.0805
D_{50}= 1.3505 D_{30}= 0.2705 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO= A-2-6(0)

Remarks

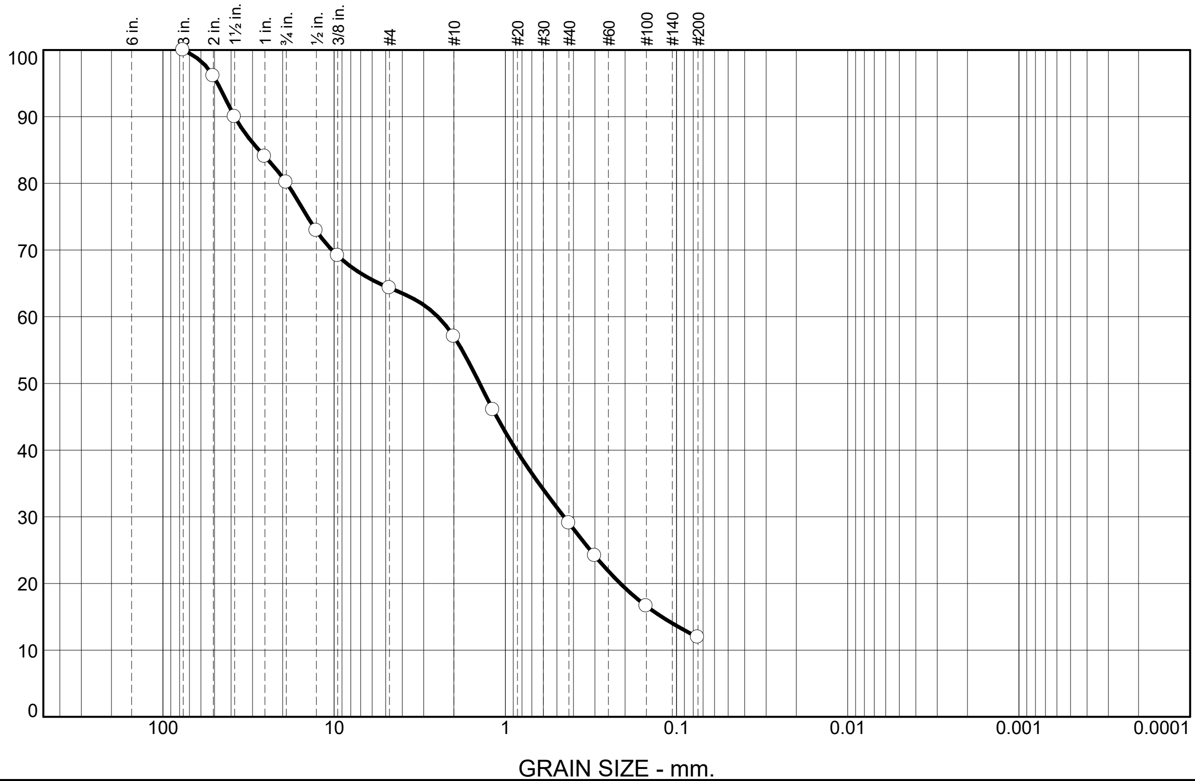
Location: TP21-17
Sample Number: 21-164-04 **Depth:** 0-20' **Date:** 6/22/2021

NewFields

Client: South 32
Project: Hermosa Geotech Investigation
Project No: 475.0014.029 **Figure** 21-164-04

Tested By: LS/ZM **Checked By:** JH

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	19.8	15.9	7.3	28.0	17.1	11.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100.0		
2"	96.1		
1.5"	90.0		
1"	84.0		
.75"	80.2		
.5"	72.9		
.375"	69.2		
#4	64.3		
#10	57.0		
#16	46.0		
#40	29.0		
#50	24.1		
#100	16.6		
#200	11.9		

* (no specification provided)

Soil Description

Dark brown poorly graded sand with clay and gravel

Atterberg Limits

PL= 19 LL= 36 PI= 17

Coefficients

D_{90}= 38.1291 D_{85}= 27.4854 D_{60}= 2.4776
D_{50}= 1.4139 D_{30}= 0.4540 D_{15}= 0.1221
D_{10}= C_u= C_c=

Classification

USCS= SP-SC AASHTO= A-2-6(0)

Remarks

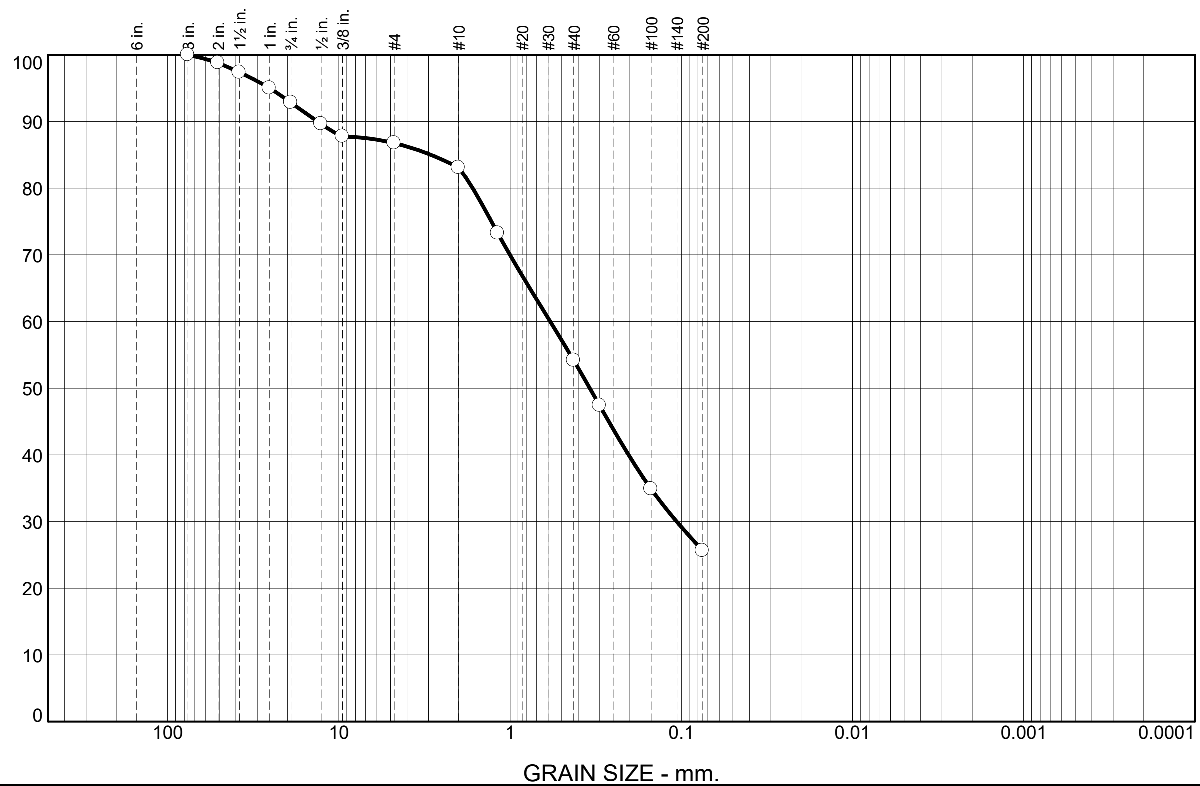
Location: TP21-18
Sample Number: 21-164-05 **Depth:** 2-21' **Date:** 6/22/2021

NewFields

Client: South 32
Project: Hermosa Geotech Investigation
Project No: 475.0014.029 **Figure** 21-164-05

Tested By: ZM/EG **Checked By:** JH

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	7.2	6.1	3.6	28.9	28.6	25.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100.0		
2"	98.8		
1.5"	97.4		
1"	95.0		
.75"	92.8		
.5"	89.6		
.375"	87.7		
#4	86.7		
#10	83.1		
#16	73.2		
#40	54.2		
#50	47.4		
#100	34.9		
#200	25.6		

* (no specification provided)

Soil Description

Light brown clayey sand

Atterberg Limits

PL= 20 LL= 32 PI= 12

Coefficients

D_{90}= 13.3266 D_{85}= 2.9110 D_{60}= 0.5828
D_{50}= 0.3428 D_{30}= 0.1065 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO= A-2-6(0)

Remarks

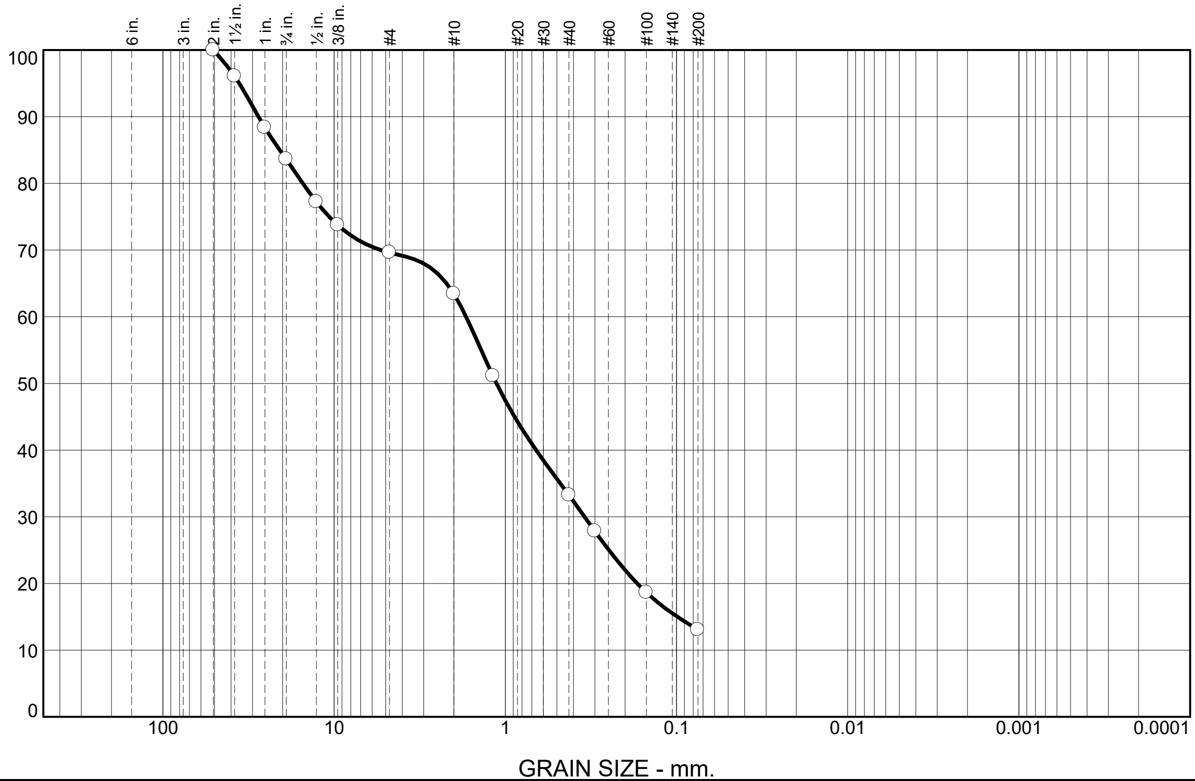
Location: TP21-19
Sample Number: 21-164-06 **Depth:** 0-5' **Date:** 6/22/2021

NewFields

Client: South 32
Project: Hermosa Geotech Investigation
Project No: 475.0014.029 **Figure** 21-164-06

Tested By: EG/ZM **Checked By:** JH

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	16.4	14.0	6.2	30.2	20.1	13.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2"	100.0		
1.5"	96.1		
1"	88.4		
.75"	83.6		
.5"	77.2		
.375"	73.8		
#4	69.6		
#10	63.4		
#16	51.1		
#40	33.2		
#50	27.8		
#100	18.6		
#200	13.1		

* (no specification provided)

Soil Description

Dark brown clayey sand with gravel

Atterberg Limits

PL= 18 LL= 30 PI= 12

Coefficients

D_{90}= 27.6930 D_{85}= 20.7863 D_{60}= 1.6964
D_{50}= 1.1253 D_{30}= 0.3453 D_{15}= 0.0989
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO= A-2-6(0)

Remarks

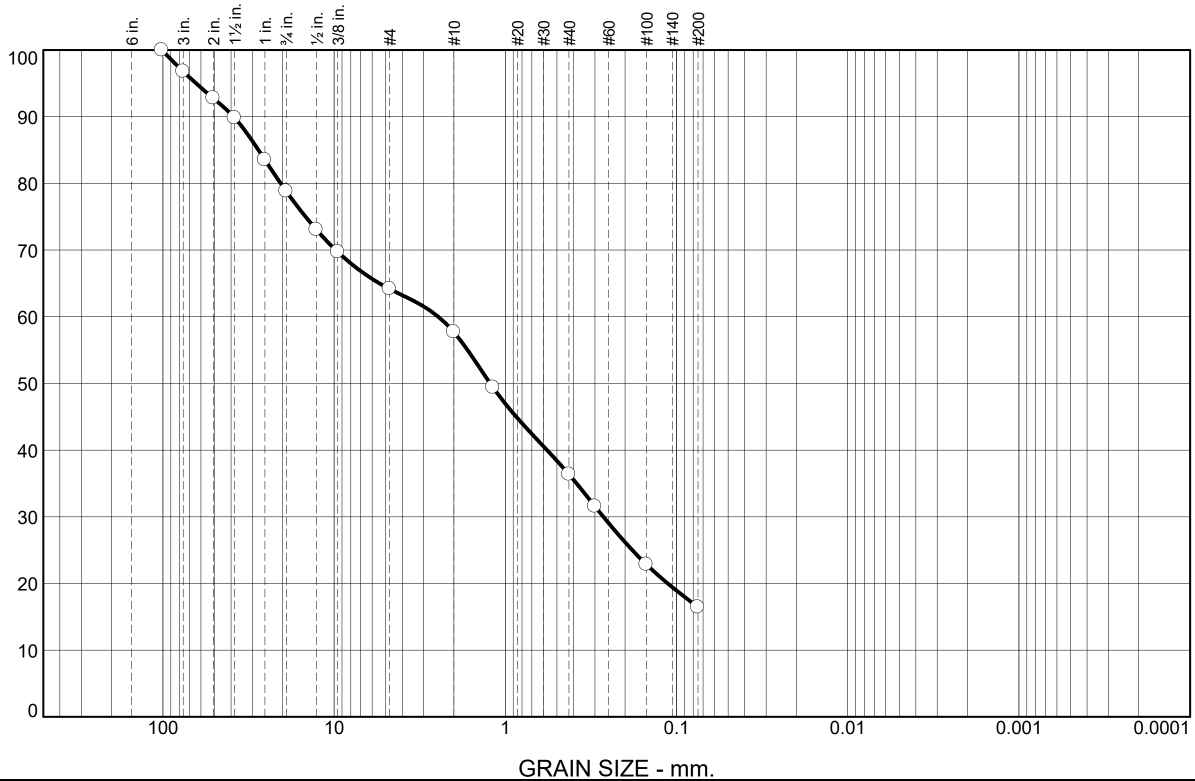
Location: TP21-19
Sample Number: 21-164-07 **Depth:** 20-28' **Date:** 6/22/2021

NewFields

Client: South 32
Project: Hermosa Geotech Investigation
Project No: 475.0014.029 **Figure** 21-164-07

Tested By: EG/ZM **Checked By:** JH

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
3.2	18.0	14.6	6.5	21.3	19.9	16.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
4"	100.0		
3"	96.8		
2"	92.8		
1.5"	89.8		
1"	83.5		
.75"	78.8		
.5"	73.1		
.375"	69.7		
#4	64.2		
#10	57.7		
#16	49.4		
#40	36.4		
#50	31.6		
#100	22.8		
#200	16.5		

* (no specification provided)

Soil Description

Dark brown clayey sand with gravel

Atterberg Limits

PL= 17 LL= 28 PI= 11

Coefficients

D_{90}= 38.6280 D_{85}= 27.7159 D_{60}= 2.4656
D_{50}= 1.2258 D_{30}= 0.2676 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO= A-2-6(0)

Remarks

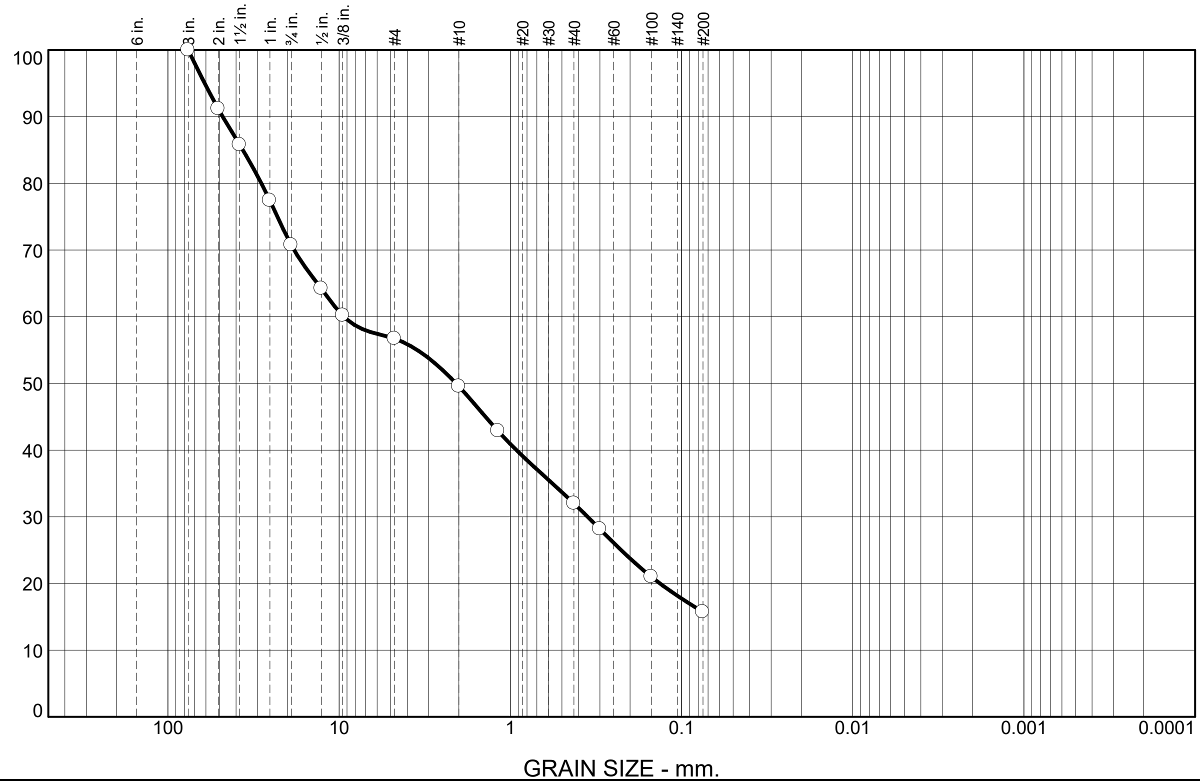
Location: TP21-20
Sample Number: 21-164-08 **Depth:** 0-13' **Date:** 6/22/2021

NewFields

Client: South 32
Project: Hermosa Geotech Investigation
Project No: 475.0014.029 **Figure** 21-164-08

Tested By: EG/LS **Checked By:** JH

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	29.2	14.1	7.1	17.6	16.3	15.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100.0		
2"	91.2		
1.5"	85.8		
1"	77.4		
.75"	70.8		
.5"	64.2		
.375"	60.2		
#4	56.7		
#10	49.6		
#16	42.9		
#40	32.0		
#50	28.1		
#100	21.0		
#200	15.7		

* (no specification provided)

Soil Description

Dark brown clayey gravel with sand

Atterberg Limits

PL= 17 LL= 28 PI= 11

Coefficients

D_{90}= 47.8134 D_{85}= 36.5130 D_{60}= 9.3747
D_{50}= 2.0756 D_{30}= 0.3542 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= GC AASHTO= A-2-6(0)

Remarks

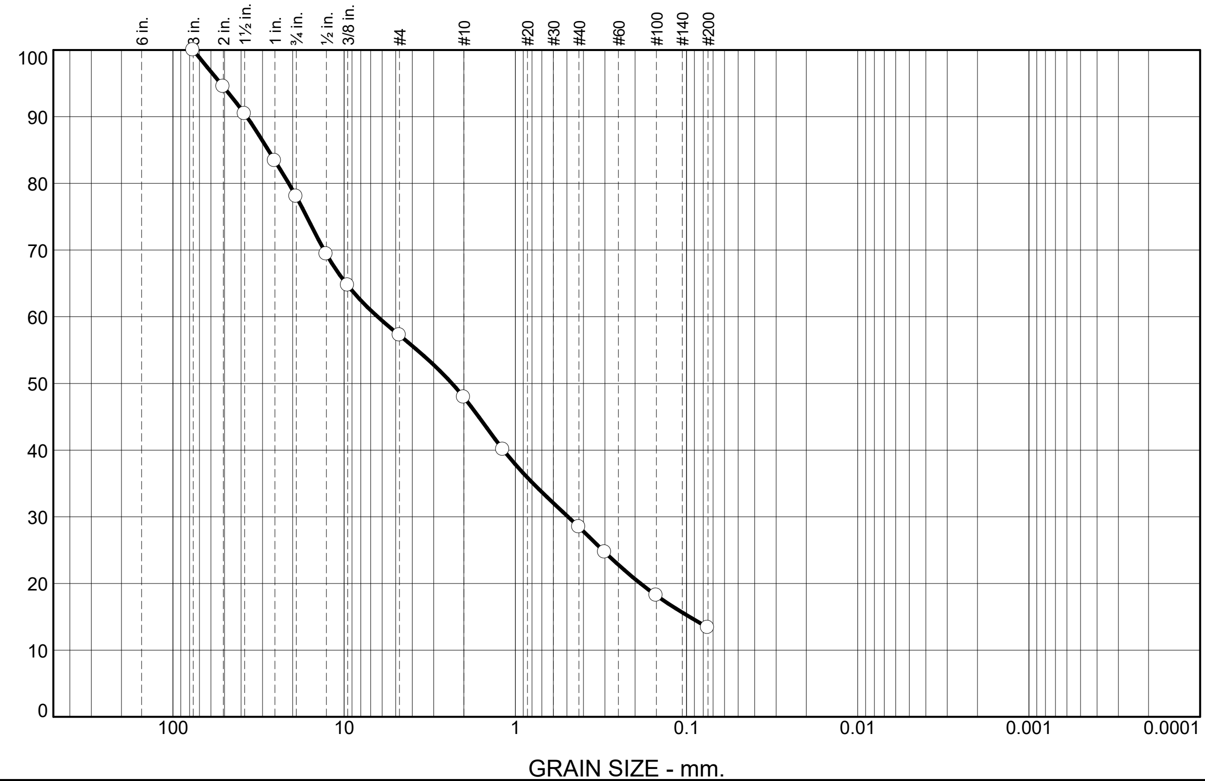
Location: TP21-21
Sample Number: 21-164-09 **Depth:** 4-25' **Date:** 6/22/2021

NewFields

Client: South 32
Project: Hermosa Geotech Investigation
Project No: 475.0014.029 **Figure** 21-164-09

Tested By: ZM/EG **Checked By:** JH

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	22.0	20.8	9.3	19.4	15.1	13.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100.0		
2"	94.5		
1.5"	90.4		
1"	83.4		
.75"	78.0		
.5"	69.4		
.375"	64.7		
#4	57.2		
#10	47.9		
#16	40.1		
#40	28.5		
#50	24.7		
#100	18.2		
#200	13.4		

* (no specification provided)

Soil Description

Dark brown clayey sand with gravel

Atterberg Limits

PL= 19 LL= 30 PI= 11

Coefficients

D_{90}= 37.0723 D_{85}= 27.7786 D_{60}= 6.3677
D_{50}= 2.3452 D_{30}= 0.4920 D_{15}= 0.0963
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO= A-2-6(0)

Remarks

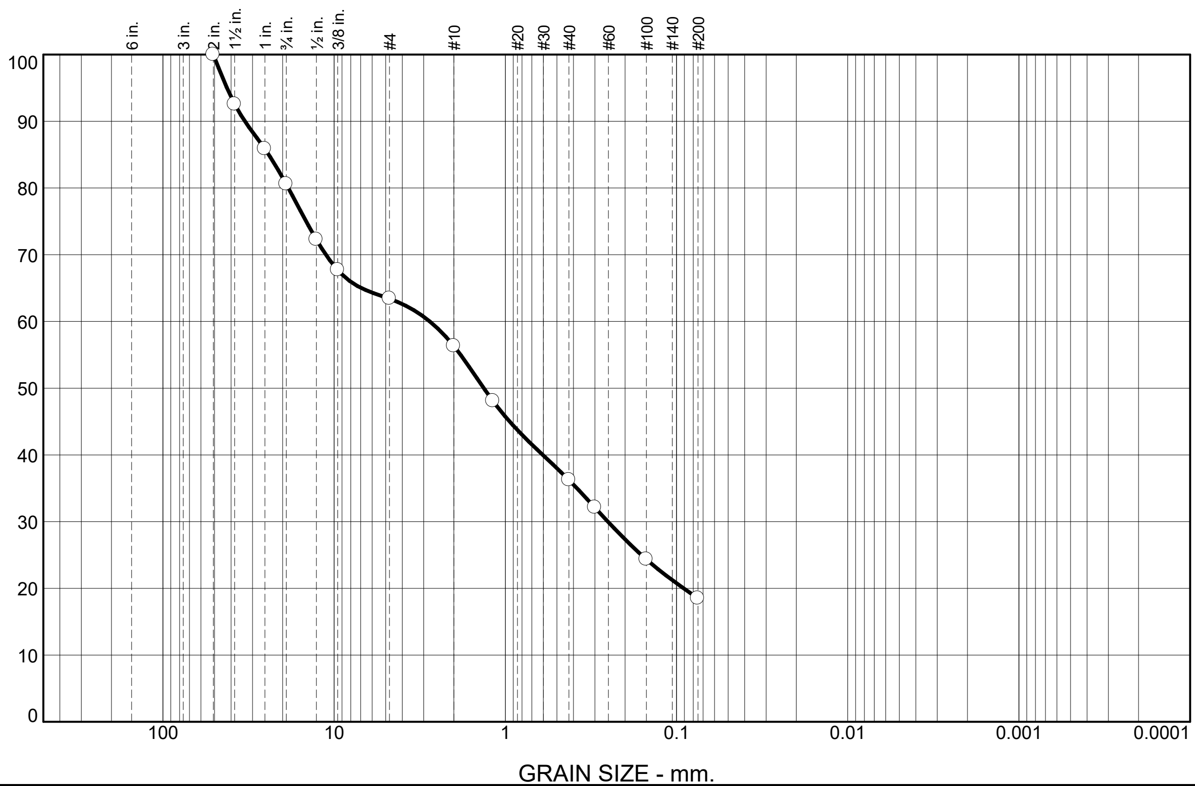
Location: TP21-23
Sample Number: 21-164-10 **Depth:** 0-5' **Date:** 6/22/2021

NewFields

Client: South 32
Project: Hermosa Geotech Investigation
Project No: 475.0014.029 **Figure** 21-164-10

Tested By: EG/ZM **Checked By:** JH

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	19.4	17.2	7.1	20.1	17.7	18.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2"	100.0		
1.5"	92.6		
1"	85.9		
.75"	80.6		
.5"	72.3		
.375"	67.7		
#4	63.4		
#10	56.3		
#16	48.1		
#40	36.2		
#50	32.1		
#100	24.3		
#200	18.5		

* (no specification provided)

Soil Description

Brown clayey sand with gravel

Atterberg Limits

PL= 17 LL= 32 PI= 15

Coefficients

D_{90}= 33.2439 D_{85}= 24.1096 D_{60}= 2.7647
D_{50}= 1.3367 D_{30}= 0.2517 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO= A-2-6(0)

Remarks

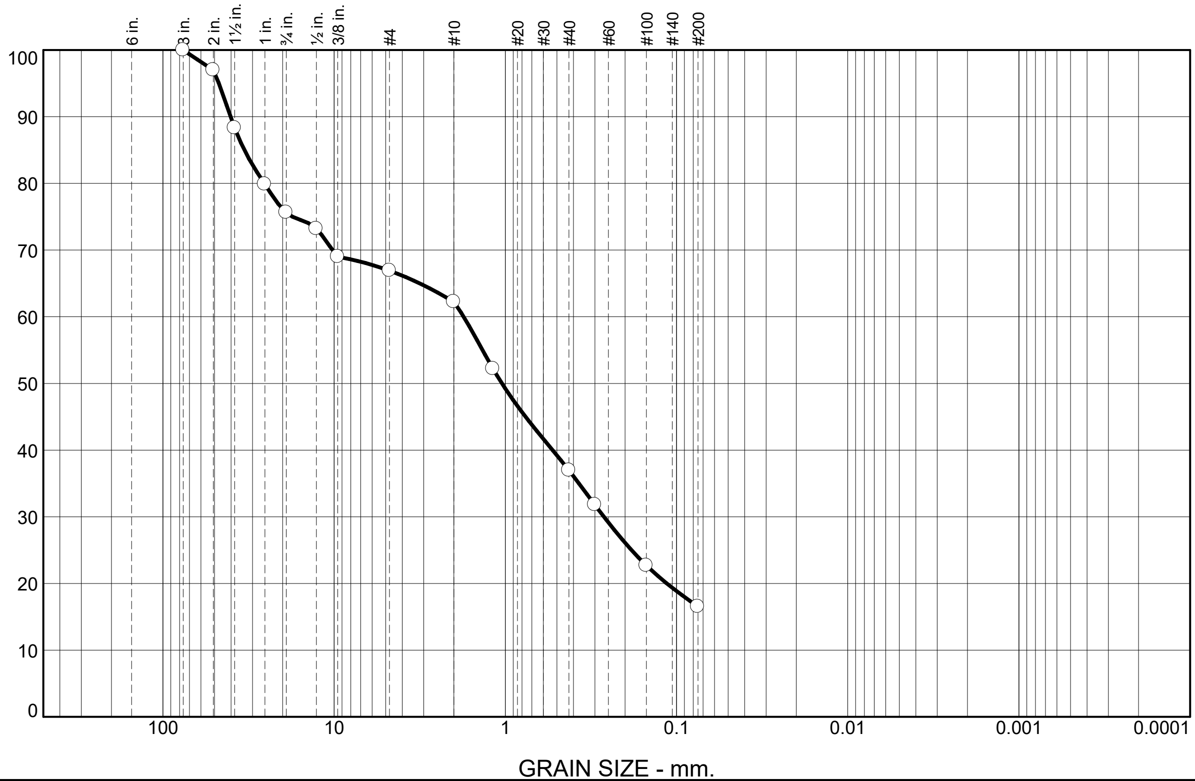
Location: TP21-24
Sample Number: 21-164-11 **Depth:** 0-20' **Date:** 6/22/2021

NewFields

Client: South 32
Project: Hermosa Geotech Investigation
Project No: 475.0014.029 **Figure** 21-164-11

Tested By: LS/ZM **Checked By:** JH

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	24.4	8.7	4.7	25.2	20.5	16.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100.0		
2"	97.0		
1.5"	88.3		
1"	79.9		
.75"	75.6		
.5"	73.2		
.375"	69.0		
#4	66.9		
#10	62.2		
#16	52.2		
#40	37.0		
#50	31.8		
#100	22.7		
#200	16.5		

* (no specification provided)

Soil Description

Dark brown clayey sand with gravel

Atterberg Limits

PL= 21 LL= 34 PI= 13

Coefficients

D_{90}= 40.2580 D_{85}= 33.4760 D_{60}= 1.7516
D_{50}= 1.0463 D_{30}= 0.2655 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO= A-2-6(0)

Remarks

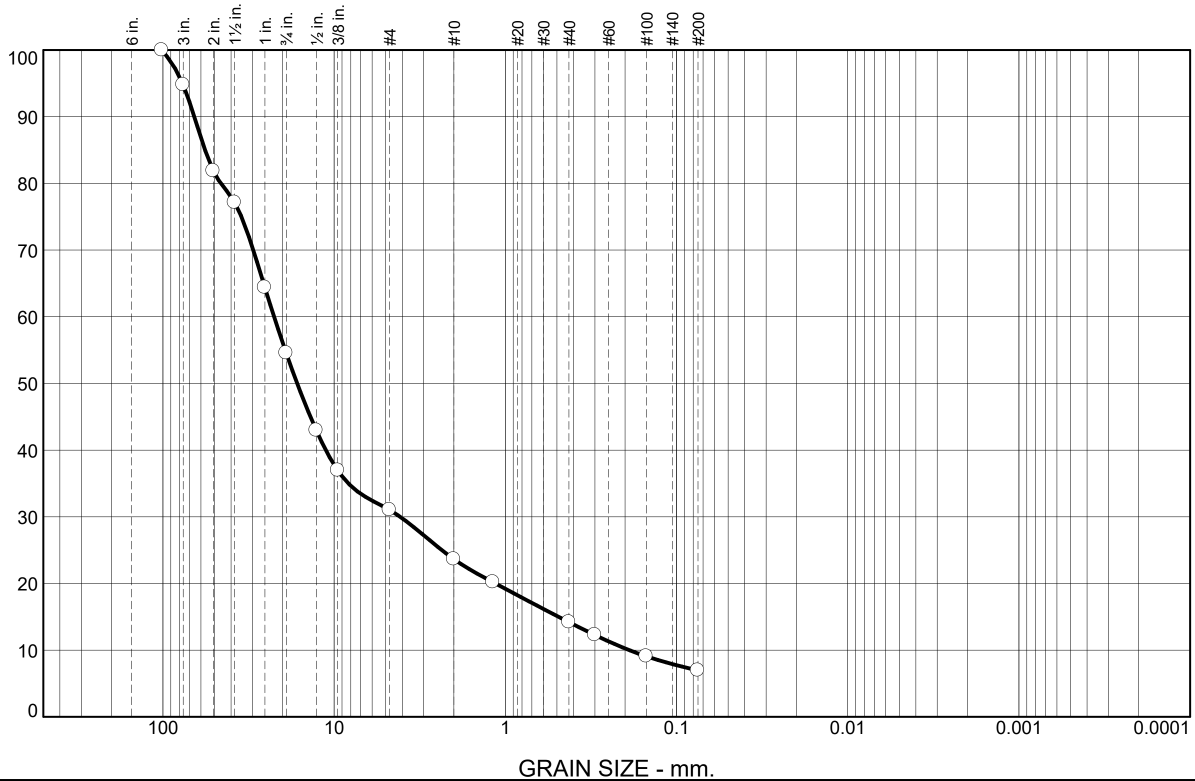
Location: TP21-25
Sample Number: 21-164-12 **Depth:** 5-18' **Date:** 6/22/2021

NewFields

Client: South 32
Project: Hermosa Geotech Investigation
Project No: 475.0014.029 **Figure** 21-164-12

Tested By: ZM/LS **Checked By:** JH

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
5.2	40.3	23.5	7.4	9.4	7.3	6.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
4"	100.0		
3"	94.8		
2"	81.9		
1.5"	77.1		
1"	64.4		
.75"	54.5		
.5"	42.9		
.375"	37.0		
#4	31.0		
#10	23.6		
#16	20.2		
#40	14.2		
#50	12.3		
#100	9.1		
#200	6.9		

* (no specification provided)

Soil Description

Brown poorly graded gravel with clay and sand

Atterberg Limits

PL= 17 LL= 33 PI= 16

Coefficients

D_{90}= 65.6078 D_{85}= 56.7733 D_{60}= 22.4412
D_{50}= 16.4510 D_{30}= 4.1195 D_{15}= 0.4890
D_{10}= 0.1887 C_u= 118.93 C_c= 4.01

Classification

USCS= GP-GC AASHTO= A-2-6(0)

Remarks

Location: WTP2 21-01
Sample Number: 21-242-10

Date: 8/19/2021

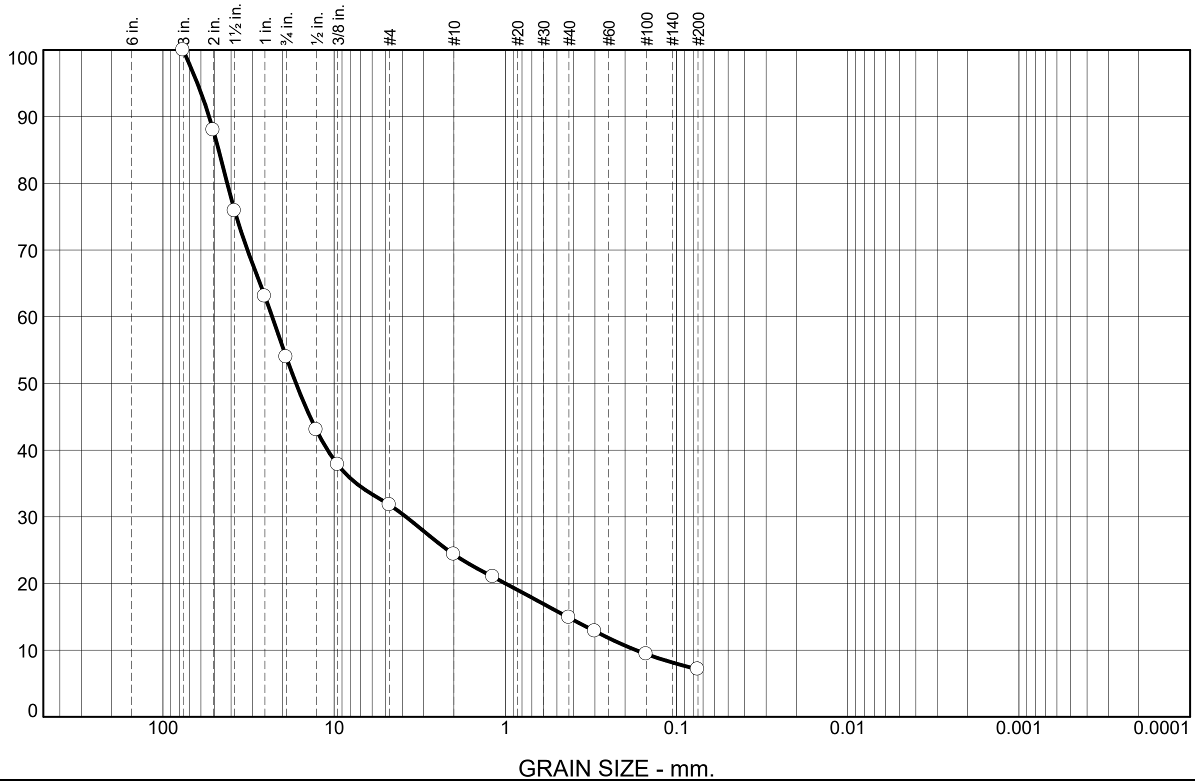
NewFields

Client: South 32
Project: Hermosa Geotech Investigation

Project No: 475.0014.029 **Figure** 21-242-10

Tested By: ZM **Checked By:** JH

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	46.1	22.1	7.4	9.5	7.8	7.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100.0		
2"	88.0		
1.5"	75.8		
1"	63.1		
.75"	53.9		
.5"	43.0		
.375"	37.8		
#4	31.8		
#10	24.4		
#16	21.0		
#40	14.9		
#50	12.8		
#100	9.4		
#200	7.1		

* (no specification provided)

Soil Description

Dark brown poorly graded gravel with clay and sand

Atterberg Limits

PL= 22 LL= 32 PI= 10

Coefficients

D_{90}= 53.6549 D_{85}= 47.2384 D_{60}= 23.0234
D_{50}= 16.7033 D_{30}= 3.8113 D_{15}= 0.4343
D_{10}= 0.1727 C_u= 133.30 C_c= 3.65

Classification

USCS= GP-GC AASHTO= A-2-4(0)

Remarks

Location: WTP2 21-02
Sample Number: 21-242-11

Date: 8/18/2021

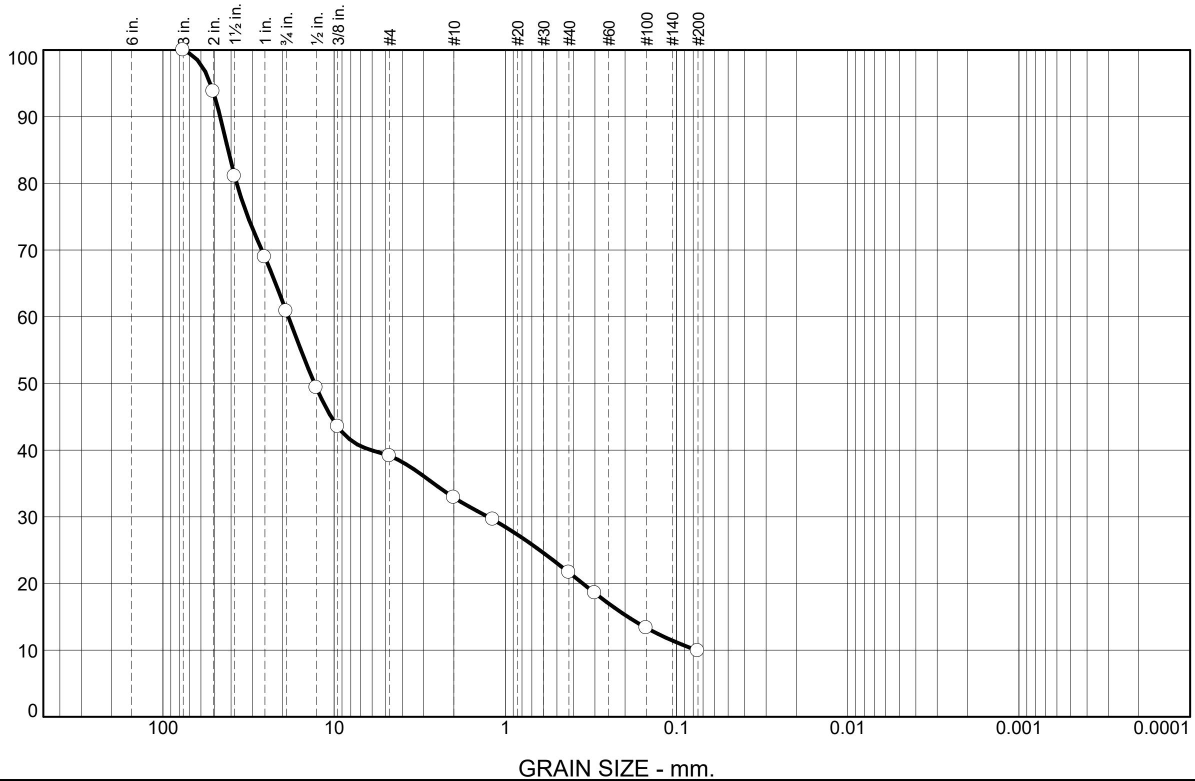
NewFields

Client: South 32
Project: Hermosa Geotech Investigation

Project No: 475.0014.029 **Figure** 21-242-11

Tested By: EG/ZM **Checked By:** JH

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	39.2	21.7	6.2	11.3	11.7	9.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100.0		
2"	93.8		
1.5"	81.1		
1"	68.9		
.75"	60.8		
.5"	49.4		
.375"	43.5		
#4	39.1		
#10	32.9		
#16	29.6		
#40	21.6		
#50	18.6		
#100	13.3		
#200	9.9		

* (no specification provided)

Soil Description

Brown well-graded gravel with clay and sand

Atterberg Limits

PL= 22 LL= 34 PI= 12

Coefficients

D_{90}= 46.2775 D_{85}= 41.5801 D_{60}= 18.5235
D_{50}= 13.0255 D_{30}= 1.2637 D_{15}= 0.1926
D_{10}= 0.0770 C_u= 240.48 C_c= 1.12

Classification

USCS= GW-GC AASHTO= A-2-6(0)

Remarks

Location: WTP2 21-04
Sample Number: 21-242-12

Date: 8/18/2021

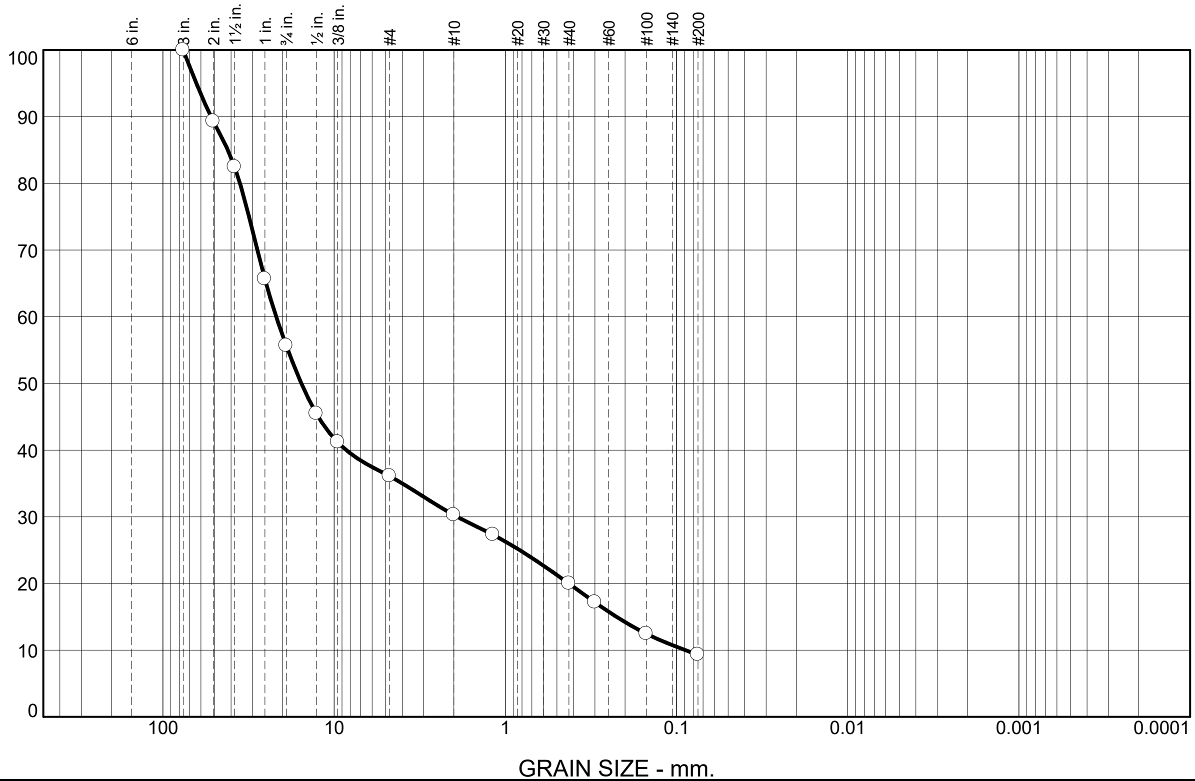
NewFields

Client: South 32
Project: Hermosa Geotech Investigation

Project No: 475.0014.029 **Figure** 21-242-12

Tested By: ZM/EG **Checked By:** JH

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	44.3	19.6	5.8	10.3	10.7	9.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100.0		
2"	89.3		
1.5"	82.5		
1"	65.7		
.75"	55.7		
.5"	45.5		
.375"	41.2		
#4	36.1		
#10	30.3		
#16	27.3		
#40	20.0		
#50	17.2		
#100	12.5		
#200	9.3		

* (no specification provided)

Soil Description

Dark brown well-graded gravel with clay and sand

Atterberg Limits

PL= 22 LL= 33 PI= 11

Coefficients

D_{90}= 52.3798 D_{85}= 41.7151 D_{60}= 21.8118
D_{50}= 15.5418 D_{30}= 1.9116 D_{15}= 0.2242
D_{10}= 0.0889 C_u= 245.28 C_c= 1.88

Classification

USCS= GW-GC AASHTO= A-2-6(0)

Remarks

Location: WTP 21-05
Sample Number: 21-242-13

Date: 8/18/2021

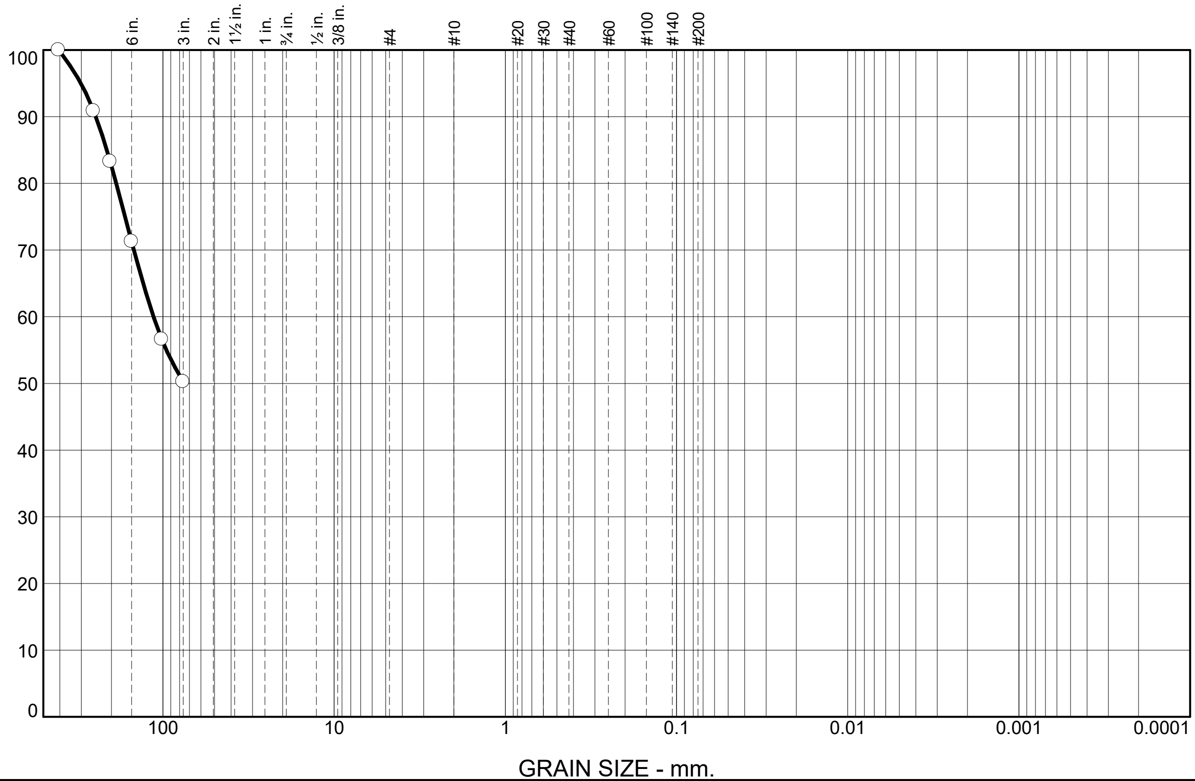
NewFields

Client: South 32
Project: Hermosa Geotech Investigation

Project No: 475.0014.029 **Figure** 21-242-13

Tested By: EG/KS **Checked By:** JH

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
49.8	50.2						

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
16"	100.0		
10"	90.8		
8"	83.3		
6"	71.3		
4"	56.6		
3"	50.2		

* (no specification provided)

Soil Description

Atterberg Limits

PL= - LL= - PI= -

Coefficients

D_{90}= 246.7523 D_{85}= 212.7332 D_{60}= 113.6480
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

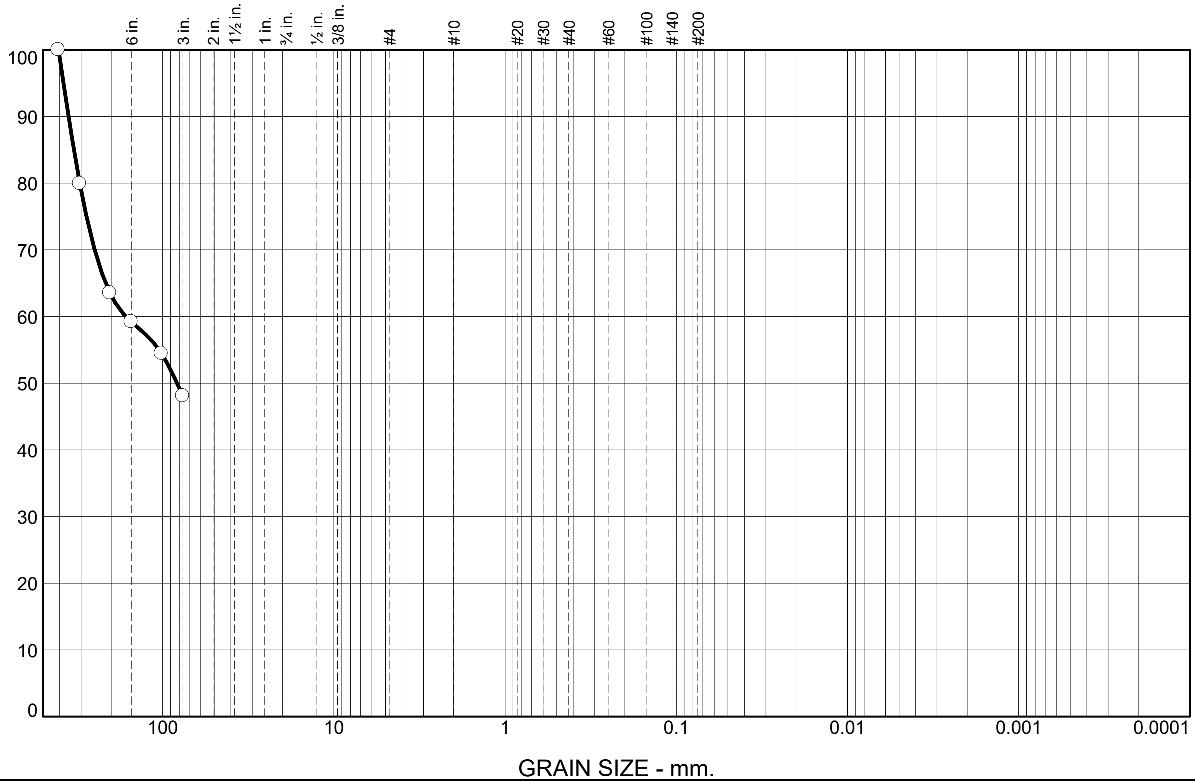
Location: TP21-16 Grade 2
Sample Number: - **Depth:** 0-10' **Date:** 6/17/2021

NewFields

Client: South 32
Project: Hermosa Geotech Investigation
Project No: 475.0014.029 **Figure** TP21-16

Tested By: JM **Checked By:** JH

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
51.9	48.1						

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
16"	100.0		
12"	79.9		
8"	63.5		
6"	59.2		
4"	54.4		
3"	48.1		

* (no specification provided)

Soil Description

Atterberg Limits

PL= - LL= - PI= -

Coefficients

D_{90}= 354.8652 D_{85}= 330.2013 D_{60}= 164.2717
D_{50}= 82.5122 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

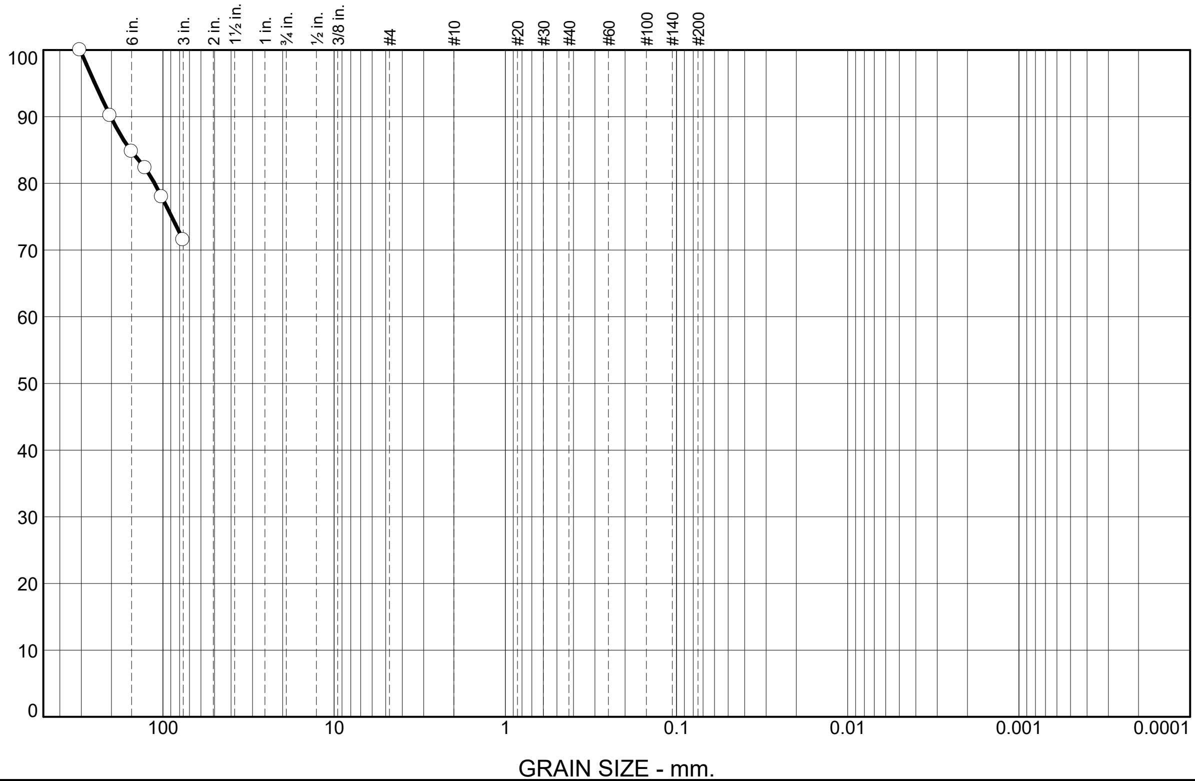
Location: TP21-17 G01-01
Sample Number: - **Depth:** 0-20'
Date: 6/16/2021

NewFields

Client: South 32
Project: Hermosa Geotech Investigation
Project No: 475.0014.029 **Figure** TP21-17

Tested By: JM **Checked By:** JH

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
28.5	71.5						

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
12"	100.0		
8"	90.1		
6"	84.8		
5"	82.3		
4"	77.9		
3"	71.5		

* (no specification provided)

Soil Description

Atterberg Limits

PL= - LL= - PI= -

Coefficients

D_{90}= 201.8446 D_{85}= 154.8505 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

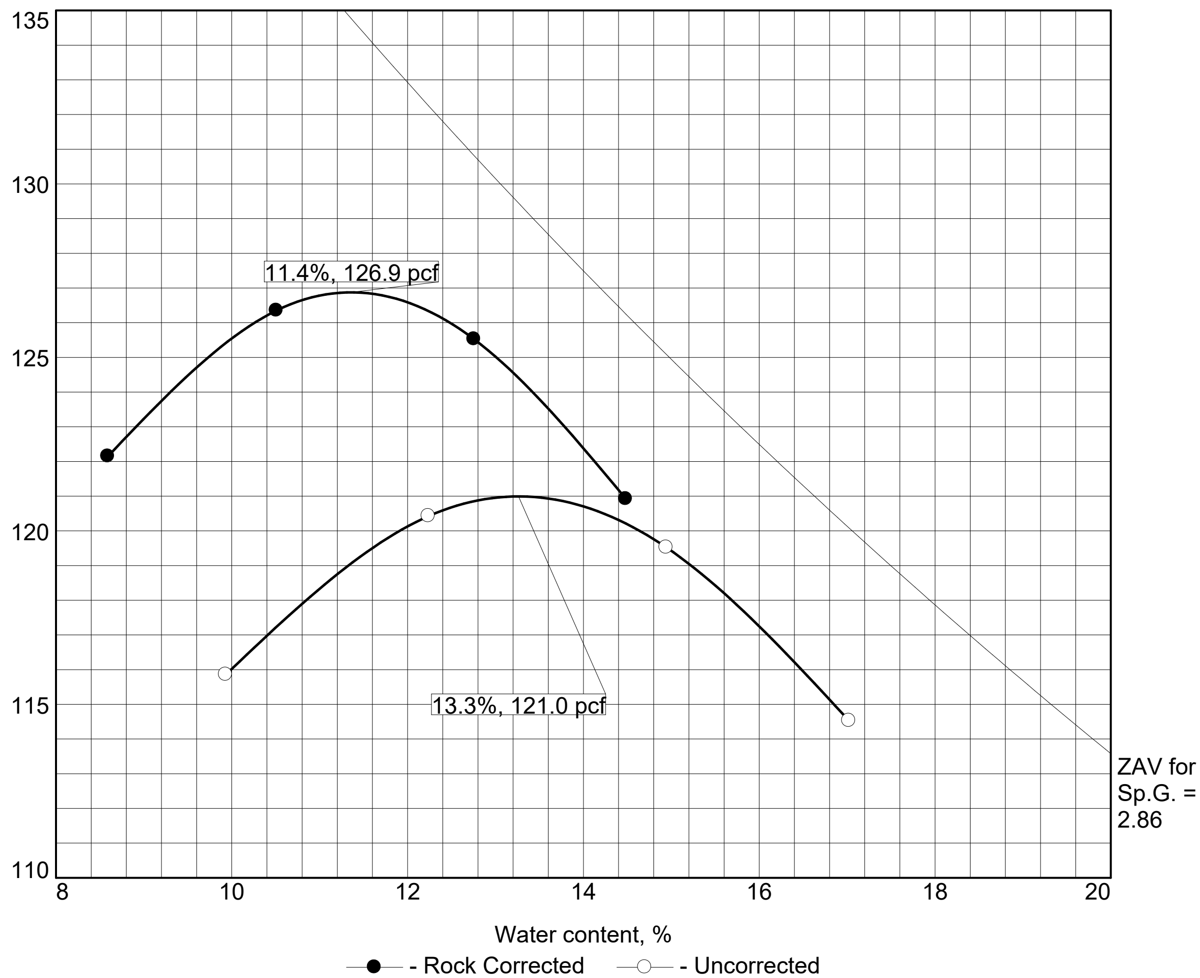
Location: TP21-19 Grade 3
Sample Number: - **Depth:** 25-28'
Date: 6/17/2021

NewFields

Client: South 32
Project: Hermosa Geotech Investigation
Project No: 475.0014.029 **Figure** TP21-19

Tested By: JM **Checked By:** JH

COMPACTION TEST REPORT



Test specification: ASTM D 1557-12 Method B Modified
ASTM D4718-15 Oversize Corr. Applied to Each Test Point

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/8 in.	% < No.200
	USCS	AASHTO						
1-6'	SC	A-2-6(0)		2.86	33	12	16.9	25.7

ROCK CORRECTED TEST RESULTS	UNCORRECTED	MATERIAL DESCRIPTION
Maximum dry density = 126.9 pcf	121.0 pcf	Dark brown clayey gravel with sand
Optimum moisture = 11.4 %	13.3 %	

Project No. 475.0014.029 **Client:** South 32
Project: Hermosa Geotech Investigation

○**Location:** TP21-03 **Sample Number:** 21-242-02

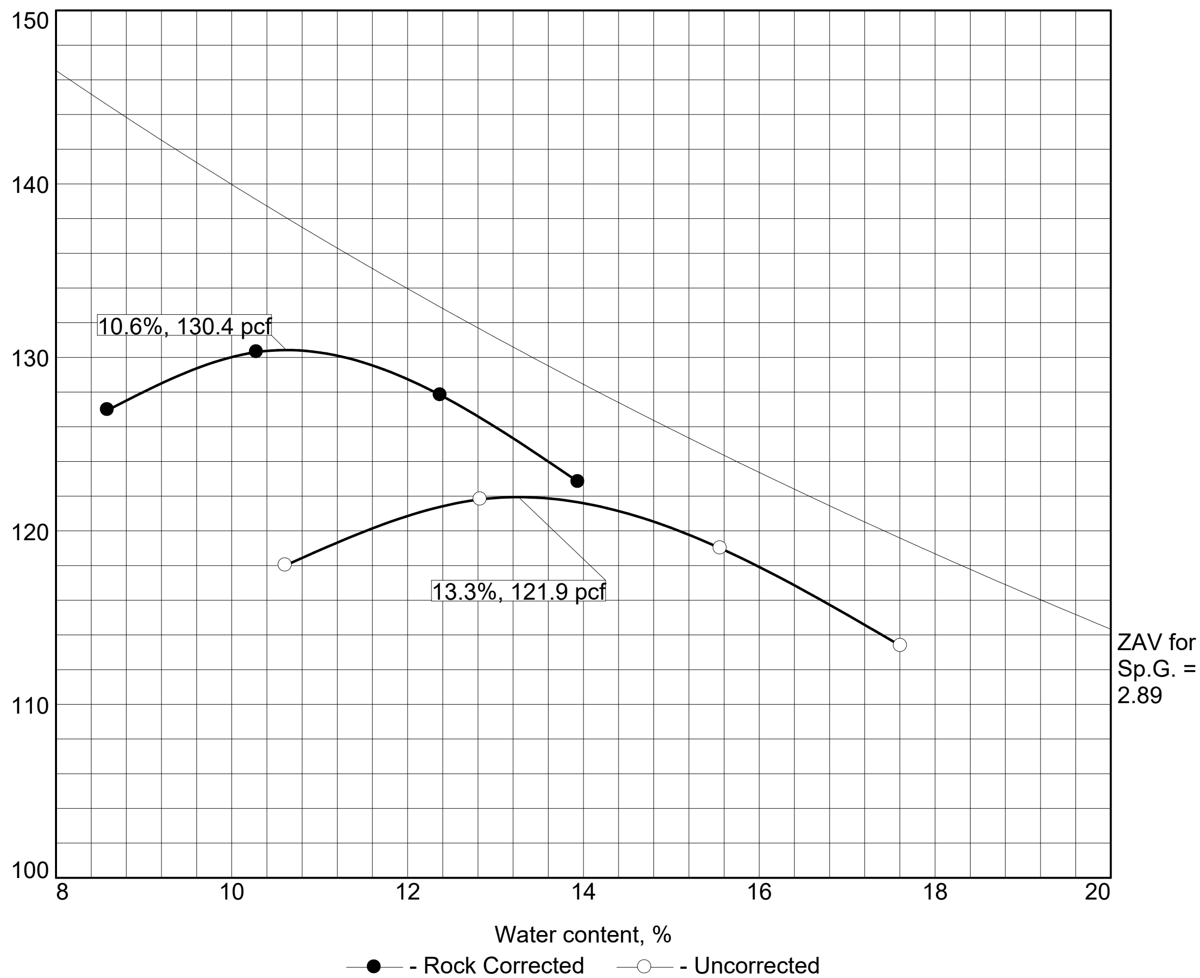
NewFields

Remarks:
*Assumed Specific Gravity

Figure 21-275-01

Tested By: KS **Checked By:** JH

COMPACTION TEST REPORT



Test specification: ASTM D 1557-12 Method B Modified
ASTM D4718-15 Oversize Corr. Applied to Each Test Point

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/8 in.	% < No.200
	USCS	AASHTO						
1.5-15'	SC	A-2-6(0)		2.89	32	13	23.5	20.4

ROCK CORRECTED TEST RESULTS	UNCORRECTED	MATERIAL DESCRIPTION
Maximum dry density = 130.4 pcf	121.9 pcf	Dark brown clayey gravel with sand
Optimum moisture = 10.6 %	13.3 %	

Project No. 475.0014.029 **Client:** South 32
Project: Hermosa Geotech Investigation

Location: TP21-07 **Sample Number:** 21-242-04

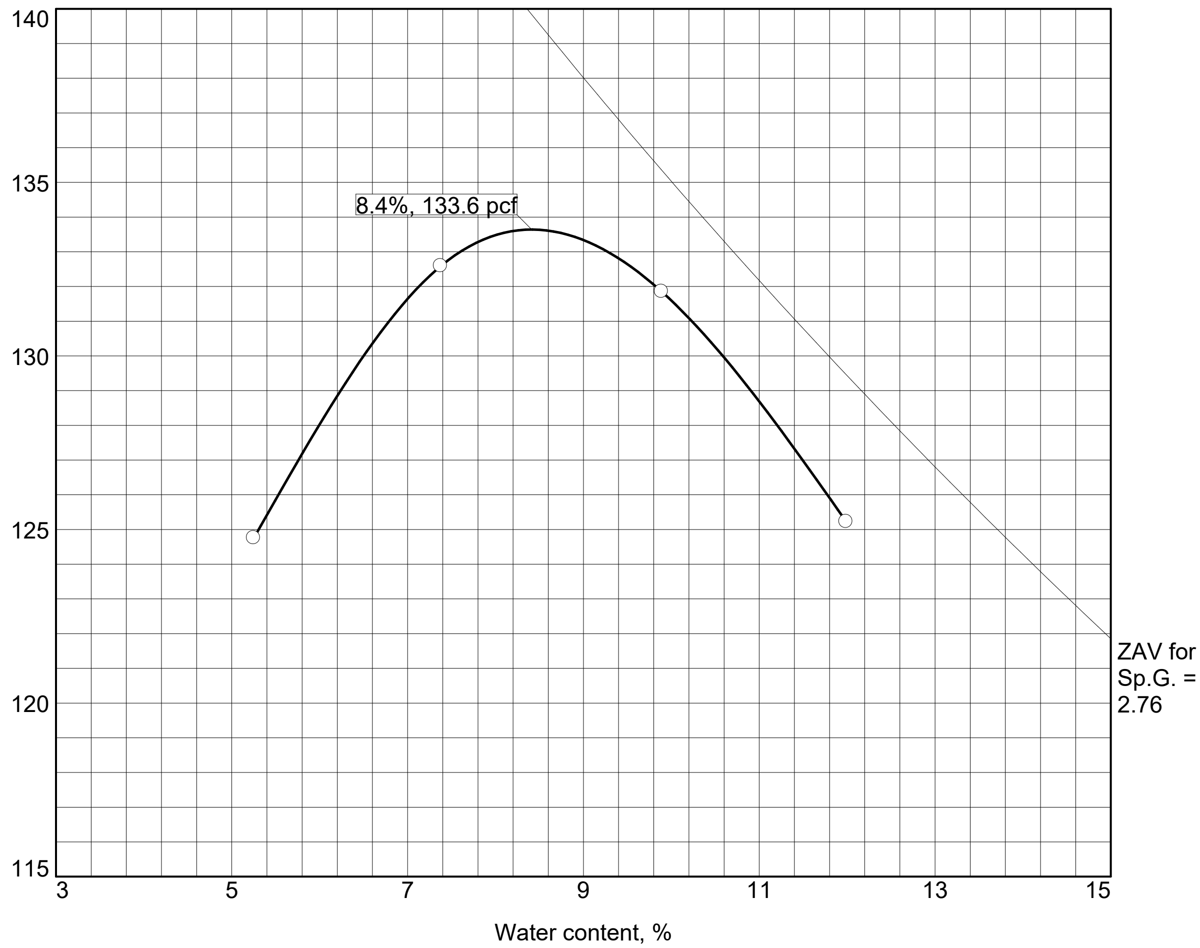
NewFields

Remarks:
*Assumed Specific Gravity

Figure 21-275-03

Tested By: ZM **Checked By:** JH

COMPACTION TEST REPORT



Test specification: ASTM D 1557-12 Method C Modified

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/4 in.	% < No.200
	USCS	AASHTO						
0-10'	SC	A-2-6(0)		2.76	30	11	0.0	20.8

TEST RESULTS

Maximum dry density = 133.6 pcf

Optimum moisture = 8.4 %

MATERIAL DESCRIPTION

Dark brown clayey sand with gravel

Project No. 475.0014.029 **Client:** South 32

Project: Hermosa Geotech Investigation

○**Location:** TP21-16 -3/4" Gradation **Sample Number:** 21-164-03

NewFields

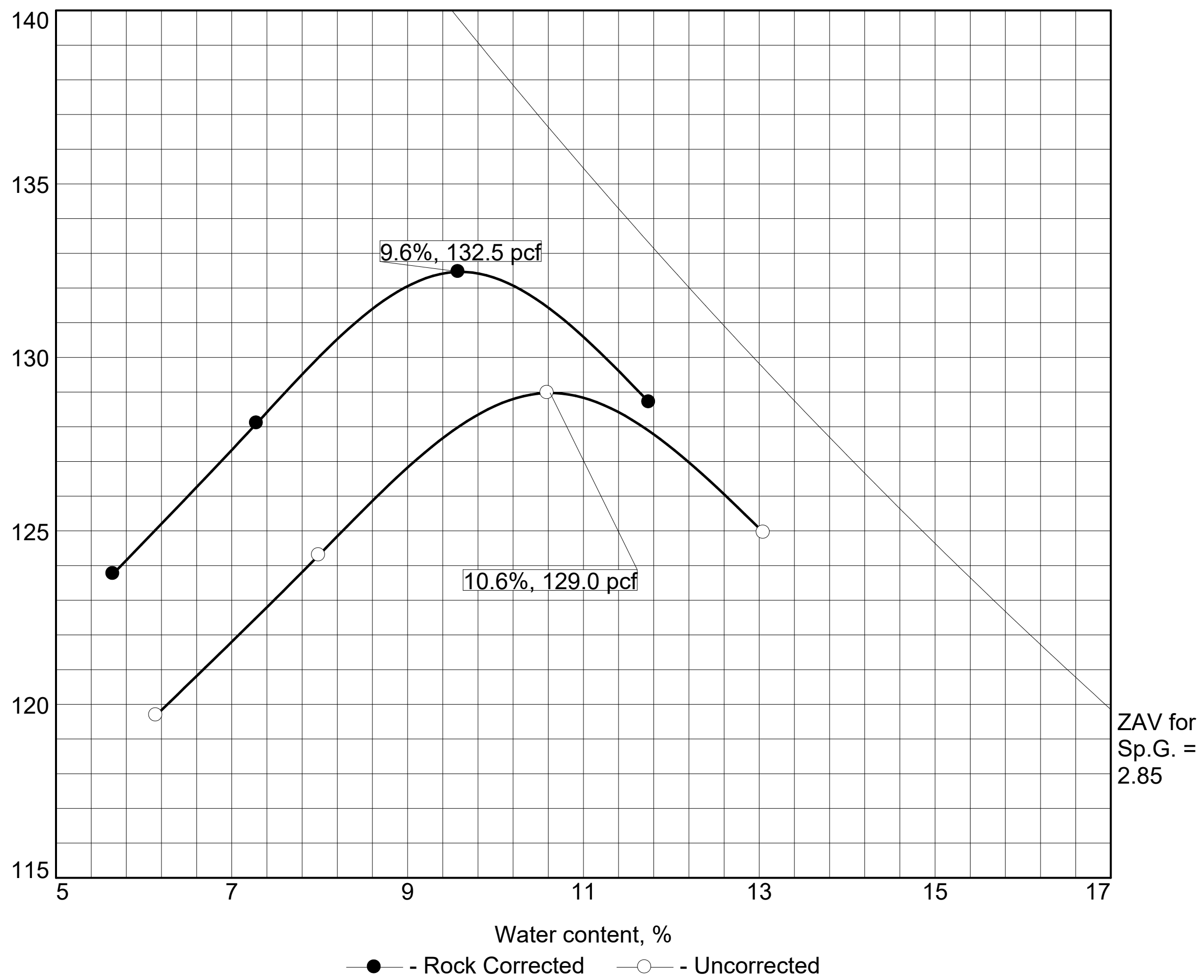
Remarks:

*Assumed Specific Gravity

Figure 21-164-03

Tested By: EG **Checked By:** JH

COMPACTION TEST REPORT



Test specification: ASTM D 1557-12 Method B Modified
ASTM D4718-15 Oversize Corr. Applied to Each Test Point

Elev/ Depth	Classification USCS	Classification AASHTO	Nat. Moist.	Sp.G.	LL	PI	% > 3/8 in.	% < No.200
20-28'	SC	A-2-6(0)		2.85	30	12	11.8	15.6

ROCK CORRECTED TEST RESULTS	UNCORRECTED	MATERIAL DESCRIPTION
Maximum dry density = 132.5 pcf	129.0 pcf	Dark brown clayey sand with gravel
Optimum moisture = 9.6 %	10.6 %	

Project No. 475.0014.029 **Client:** South 32
Project: Hermosa Geotech Investigation

Location: TP21-19 **Sample Number:** 21-164-07

NewFields

Remarks:
*Assumed Specific Gravity

Figure 21-255

Tested By: KS **Checked By:** JH

NewFields

Flexible Wall Hydraulic Conductivity
ASTM D5084

Client:	Arizona Minerals Inc.	Lab Sample No.:	21-275-01
Project:	Hermosa Geotechnical Investigation	Field Sample No.:	TP21-03
Project No.:	475.0014.029	Location:	TP21-03
Phase:	-	Elevation/Depth:	1-6'
Requested By:	Craig Thompson	Tested By:	KE
Test Started:	10/5/2021	Checked By:	KM
Test Finished:	10/12/2021	Sample Description:	Dark brown clayey gravel w/ sand

Test Boundary Conditions	
Type of Permeant	De-aired Bottled
Magnitude of Back pressure (psi)	50
Saturated (Y/N):	Yes
Stage 1: Effective Stress (psi)	5
Sample Type	Remolded
Burrete Area (cm^2)	0.877

Test Specimen Data	Initial	During k Testing	Final
Wet Soil + Tare (g)	630.2		792.34
Dry Soil + Tare (g)	555.84		688.44
Tare (g)	0.00		132.04
Wt. of Water (g)	74.36		103.90
Dry Soil (g)	555.84		556.40
Moisture Content (%)	13.4		18.7
Sample Volume (ft^3)	0.01079	0.01076	
Dry Density (pcf)	113.6	113.7	
Wet Density (pcf)	128.8	136.4	
Saturation (%)	67.0	100.0	
Percent Compaction	89.5	89.6	
Height (in)	3.046	3.044	
Diameter (in)	2.792	2.790	
Area (in^2)	6.121	6.114	
Est. Moisture Content after Consolidation (%)		19.9%	
Est. Void Ratio after Consolidation		0.570	
Specific Gravity*	2.86		

*Specific gravity is assumed	**Maximum Dry Density (pcf):**	126.9
Maximum Dry Density:	**Initial Remolded Dry Density (pcf):**	113.6
ASTM D 1557	**Initial Percent Compaction:**	89%
	Initial Void Ratio:	0.572
	Optimum Moisture Content(%):	11.4
	Initial Water Content (%):	13.4
	Confining Pressure (psi):	5.0
	Hydraulic Conductivity, k_{20} (cm/s):	**6.4E-05**
	Gradient Range (h/L):	5.4 5.4

NewFields

Flexible Wall Hydraulic Conductivity
ASTM D5084

Client:	Arizona Minerals Inc.	Lab Sample No.:	21-275-01
Project:	Hermosa Geotechnical Investigation	Field Sample No.:	TP21-03
Project No.:	475.0014.029	Location:	TP21-03
Phase:	-	Elevation/Depth:	1-6'
Requested By:	Craig Thompson	Tested By:	KE
Test Started:	10/5/2021	Checked By:	KM
Test Finished:	10/12/2021	Sample Description:	Dark brown clayey gravel w/ sand

Test Boundary Conditions	
Type of Permeant	De-aired Bottled
Magnitude of Back pressure (psi)	50
Saturated (Y/N):	Yes
Stage 2: Effective Stress (psi)	20
Sample Type	Remolded
Burrete Area (cm^2)	0.877

Test Specimen Data	Initial	During k Testing	Final
Wet Soil + Tare (g)	630.2		792.34
Dry Soil + Tare (g)	555.84		688.44
Tare (g)	0.00		132.04
Wt. of Water (g)	74.36		103.90
Dry Soil (g)	555.84		556.40
Moisture Content (%)	13.4		18.7
Sample Volume (ft^3)	0.01076	0.01063	
Dry Density (pcf)	113.7	115.1	
Wet Density (pcf)	136.4	137.3	
Saturation (%)	100.0%	100.0	
Percent Compaction	89.6	90.7	
Height (in)	3.032	3.022	
Diameter (in)	2.779	2.770	
Area (in^2)	6.066	6.026	
Est. Moisture Content after Consolidation (%)		19.3%	
Est. Void Ratio after Consolidation		0.551	
Specific Gravity*	2.86		

*Specific gravity is assumed
Maximum Dry Density:
ASTM D 1557

Maximum Dry Density (pcf):	126.9
Initial Remolded Dry Density (pcf):	113.6
Initial Percent Compaction:	89%
Initial Void Ratio:	0.572
Optimum Moisture Content(%):	11.4
Initial Water Content (%):	13.4
Confining Pressure (psi):	20.0
Hydraulic Conductivity, k_{20} (cm/s):	**4.6E-05**
Gradient Range (h/L):	5.4 5.4

NewFields

Flexible Wall Hydraulic Conductivity
ASTM D5084

Client:	Arizona Minerals Inc.	Lab Sample No.:	21-275-03
Project:	Hermosa Geotechnical Investigation	Field Sample No.:	TP21-07
Project No.:	475.0014.029	Location:	TP21-07
Phase:	-	Elevation/Depth:	1.5-15'
Requested By:	Craig Thompson	Tested By:	KE
Test Started:	10/5/2021	Checked By:	KM
Test Finished:	10/12/2021	Sample Description:	Dark brown clayey gravel w/ sand

Test Boundary Conditions	
Type of Permeant	De-aired Bottled
Magnitude of Back pressure (psi)	50
Saturated (Y/N):	Yes
Stage 1: Effective Stress (psi)	5
Sample Type	Remolded
Burrete Area (cm^2)	0.877

Test Specimen Data	Initial	During k Testing	Final
Wet Soil + Tare (g)	643.72		847.08
Dry Soil + Tare (g)	571.62		750.68
Tare (g)	0.00		180.75
Wt. of Water (g)	72.10		96.40
Dry Soil (g)	571.62		569.93
Moisture Content (%)	12.6		16.9
Sample Volume (ft^3)	0.01075	0.01072	
Dry Density (pcf)	117.2	117.4	
Wet Density (pcf)	132.0	138.8	
Saturation (%)	69.0	100.0	
Percent Compaction	89.9	90.0	
Height (in)	3.033	3.031	
Diameter (in)	2.792	2.790	
Area (in^2)	6.124	6.116	
Est. Moisture Content after Consolidation (%)		18.2%	
Est. Void Ratio after Consolidation		0.520	
Specific Gravity*	2.86		

*Specific gravity is assumed	**Maximum Dry Density (pcf):**	130.4
Maximum Dry Density:	**Initial Remolded Dry Density (pcf):**	117.2
ASTM D 1557	**Initial Percent Compaction:**	90%
	Initial Void Ratio:	0.522
	Optimum Moisture Content(%):	10.6
	Initial Water Content (%):	12.6
	Confining Pressure (psi):	5.0
	Hydraulic Conductivity, k_{20} (cm/s):	**3.9E-05**
	Gradient Range (h/L):	5.5 5.5

NewFields

Flexible Wall Hydraulic Conductivity
ASTM D5084

Client:	Arizona Minerals Inc.	Lab Sample No.:	21-275-03
Project:	Hermosa Geotechnical Investigation	Field Sample No.:	TP21-07
Project No.:	475.0014.029	Location:	TP21-07
Phase:	-	Elevation/Depth:	1.5-15'
Requested By:	Craig Thompson	Tested By:	KE
Test Started:	10/5/2021	Checked By:	KM
Test Finished:	10/12/2021	Sample Description:	Dark brown clayey gravel w/ sand

Test Boundary Conditions	
Type of Permeant	De-aired Bottled
Magnitude of Back pressure (psi)	50
Saturated (Y/N):	Yes
Stage 2: Effective Stress (psi)	20
Sample Type	Remolded
Burrete Area (cm^2)	0.877

Test Specimen Data	Initial	During k Testing	Final
Wet Soil + Tare (g)	643.72		847.08
Dry Soil + Tare (g)	571.62		750.68
Tare (g)	0.00		180.75
Wt. of Water (g)	72.10		96.40
Dry Soil (g)	571.62		569.93
Moisture Content (%)	12.6		16.9
Sample Volume (ft^3)	0.01072	0.01058	
Dry Density (pcf)	117.4	119.0	
Wet Density (pcf)	138.8	139.8	
Saturation (%)	100.0%	100.0	
Percent Compaction	90.0	91.3	
Height (in)	3.018	3.008	
Diameter (in)	2.778	2.769	
Area (in^2)	6.063	6.023	
Est. Moisture Content after Consolidation (%)		17.5%	
Est. Void Ratio after Consolidation		0.500	
Specific Gravity*	2.86		

*Specific gravity is assumed	**Maximum Dry Density (pcf):**	130.4
Maximum Dry Density:	**Initial Remolded Dry Density (pcf):**	117.2
ASTM D 1557	**Initial Percent Compaction:**	90%
	Initial Void Ratio:	0.522
	Optimum Moisture Content(%):	10.6
	Initial Water Content (%):	12.6
	Confining Pressure (psi):	20.0
	Hydraulic Conductivity, k_{20} (cm/s):	**2.5E-05**
	Gradient Range (h/L):	5.5 5.5

NewFields

Flexible Wall Hydraulic Conductivity
ASTM D5084

Client:	Arizona Minerals Inc.	Lab Sample No.:	21-275-04
Project:	Hermosa Geotechnical Investigation	Field Sample No.:	TP21-07 +2% Bent
Project No.:	475.0014.029	Location:	TP21-07 +2% Bent
Phase:	-	Elevation/Depth:	1.5-15'
Requested By:	Craig Thompson	Tested By:	KE
Test Started:	10/5/2021	Checked By:	KM
Test Finished:	10/12/2021	Sample Description:	Dark brown clayey gravel w/ sand

Test Boundary Conditions	
Type of Permeant	De-aired Bottled
Magnitude of Back pressure (psi)	50
Saturated (Y/N):	Yes
Stage 1: Effective Stress (psi)	5
Sample Type	Remolded
Burrete Area (cm^2)	0.877

Test Specimen Data	Initial	During k Testing	Final
Wet Soil + Tare (g)	643.67		849.73
Dry Soil + Tare (g)	571.58		752.86
Tare (g)	0.00		181.15
Wt. of Water (g)	72.09		96.87
Dry Soil (g)	571.58		571.71
Moisture Content (%)	12.6		16.9
Sample Volume (ft^3)	0.01074	0.01070	
Dry Density (pcf)	117.3	117.5	
Wet Density (pcf)	132.1	138.9	
Saturation (%)	69.1	100.0	
Percent Compaction	90.0	90.1	
Height (in)	3.031	3.028	
Diameter (in)	2.793	2.790	
Area (in^2)	6.125	6.115	
Est. Moisture Content after Consolidation (%)		18.1%	
Est. Void Ratio after Consolidation		0.518	
Specific Gravity*	2.86		

*Specific gravity is assumed	**Maximum Dry Density (pcf):**	130.4
Maximum Dry Density:	**Initial Remolded Dry Density (pcf):**	117.3
ASTM D 1557	**Initial Percent Compaction:**	90%
	Initial Void Ratio:	0.521
	Optimum Moisture Content(%):	10.6
	Initial Water Content (%):	12.6
	Confining Pressure (psi):	5.0
	Hydraulic Conductivity, k_{20} (cm/s):	**3.9E-06**
	Gradient Range (h/L):	5.5 5.5

NewFields

Flexible Wall Hydraulic Conductivity
ASTM D5084

Client:	Arizona Minerals Inc.	Lab Sample No.:	21-275-04
Project:	Hermosa Geotechnical Investigation	Field Sample No.:	TP21-07 +2% Bent
Project No.:	475.0014.029	Location:	TP21-07 +2% Bent
Phase:	-	Elevation/Depth:	1.5-15'
Requested By:	Craig Thompson	Tested By:	KE
Test Started:	10/5/2021	Checked By:	KM
Test Finished:	10/12/2021	Sample Description:	Dark brown clayey gravel w/ sand

Test Boundary Conditions	
Type of Permeant	De-aired Bottled
Magnitude of Back pressure (psi)	50
Saturated (Y/N):	Yes
Stage 2: Effective Stress (psi)	20
Sample Type	Remolded
Burrete Area (cm^2)	0.877

Test Specimen Data	Initial	During k Testing	Final
Wet Soil + Tare (g)	643.67		849.73
Dry Soil + Tare (g)	571.58		752.86
Tare (g)	0.00		181.15
Wt. of Water (g)	72.09		96.87
Dry Soil (g)	571.58		571.71
Moisture Content (%)	12.6		16.9
Sample Volume (ft^3)	0.01070	0.01057	
Dry Density (pcf)	117.5	119.0	
Wet Density (pcf)	138.9	139.8	
Saturation (%)	100.0%	100.0	
Percent Compaction	90.1	91.3	
Height (in)	3.016	3.006	
Diameter (in)	2.779	2.770	
Area (in^2)	6.066	6.025	
Est. Moisture Content after Consolidation (%)		17.5%	
Est. Void Ratio after Consolidation		0.500	
Specific Gravity*	2.86		

*Specific gravity is assumed	**Maximum Dry Density (pcf):**	130.4
Maximum Dry Density:	**Initial Remolded Dry Density (pcf):**	117.3
ASTM D 1557	**Initial Percent Compaction:**	90%
	Initial Void Ratio:	0.521
	Optimum Moisture Content(%):	10.6
	Initial Water Content (%):	12.6
	Confining Pressure (psi):	20.0
	Hydraulic Conductivity, k_{20} (cm/s):	**3.3E-06**
	Gradient Range (h/L):	5.5 5.5

NewFields

Flexible Wall Hydraulic Conductivity
ASTM D5084

Client:	Arizona Minerals Inc.	Lab Sample No.:	21-275-05
Project:	Hermosa Geotechnical Investigation	Field Sample No.:	TP21-07 +4% bent
Project No.:	475.0014.029	Location:	TP21-07 +4% bent
Phase:	-	Elevation/Depth:	1.5-15'
Requested By:	Craig Thompson	Tested By:	KE
Test Started:	10/5/2021	Checked By:	KM
Test Finished:	10/12/2021	Sample Description:	Dark brown clayey gravel w/ sand

Test Boundary Conditions	
Type of Permeant	De-aired Bottled
Magnitude of Back pressure (psi)	50
Saturated (Y/N):	Yes
Stage 1: Effective Stress (psi)	5
Sample Type	Remolded
Burrete Area (cm^2)	0.877

Test Specimen Data	Initial	During k Testing	Final
Wet Soil + Tare (g)	643.74		942.73
Dry Soil + Tare (g)	571.64		843.16
Tare (g)	0.00		268.74
Wt. of Water (g)	72.10		99.57
Dry Soil (g)	571.64		574.42
Moisture Content (%)	12.6		17.3
Sample Volume (ft^3)	0.01074	0.01070	
Dry Density (pcf)	117.3	117.5	
Wet Density (pcf)	132.1	139.0	
Saturation (%)	69.1	100.0	
Percent Compaction	90.0	90.1	
Height (in)	3.030	3.026	
Diameter (in)	2.793	2.790	
Area (in^2)	6.128	6.115	
Est. Moisture Content after Consolidation (%)		18.1%	
Est. Void Ratio after Consolidation		0.517	
Specific Gravity*	2.86		

*Specific gravity is assumed	**Maximum Dry Density (pcf):**	130.4
Maximum Dry Density:	**Initial Remolded Dry Density (pcf):**	117.3
ASTM D 1557	**Initial Percent Compaction:**	90%
	Initial Void Ratio:	0.521
	Optimum Moisture Content(%):	10.6
	Initial Water Content (%):	12.6
	Confining Pressure (psi):	5.0
	Hydraulic Conductivity, k_{20} (cm/s):	**1.0E-06**
	Gradient Range (h/L):	5.5 5.5

NewFields

Flexible Wall Hydraulic Conductivity
ASTM D5084

Client:	Arizona Minerals Inc.	Lab Sample No.:	21-275-05
Project:	Hermosa Geotechnical Investigation	Field Sample No.:	TP21-07 +4% bent
Project No.:	475.0014.029	Location:	TP21-07 +4% bent
Phase:	-	Elevation/Depth:	1.5-15'
Requested By:	Craig Thompson	Tested By:	KE
Test Started:	10/5/2021	Checked By:	KM
Test Finished:	10/12/2021	Sample Description:	Dark brown clayey gravel w/ sand

Test Boundary Conditions	
Type of Permeant	De-aired Bottled
Magnitude of Back pressure (psi)	50
Saturated (Y/N):	Yes
Stage 2: Effective Stress (psi)	20
Sample Type	Remolded
Burrete Area (cm^2)	0.877

Test Specimen Data	Initial	During k Testing	Final
Wet Soil + Tare (g)	643.74		942.73
Dry Soil + Tare (g)	571.64		843.16
Tare (g)	0.00		268.74
Wt. of Water (g)	72.10		99.57
Dry Soil (g)	571.64		574.42
Moisture Content (%)	12.6		17.3
Sample Volume (ft^3)	0.01070	0.01051	
Dry Density (pcf)	117.5	119.8	
Wet Density (pcf)	139.0	140.3	
Saturation (%)	100.0%	100.0	
Percent Compaction	90.1	91.9	
Height (in)	3.009	2.999	
Diameter (in)	2.774	2.765	
Area (in^2)	6.043	6.002	
Est. Moisture Content after Consolidation (%)		17.2%	
Est. Void Ratio after Consolidation		0.491	
Specific Gravity*	2.86		

*Specific gravity is assumed	**Maximum Dry Density (pcf):**	130.4
Maximum Dry Density:	**Initial Remolded Dry Density (pcf):**	117.3
ASTM D 1557	**Initial Percent Compaction:**	90%
	Initial Void Ratio:	0.521
	Optimum Moisture Content(%):	10.6
	Initial Water Content (%):	12.6
	Confining Pressure (psi):	20.0
	Hydraulic Conductivity, k_{20} (cm/s):	**5.2E-07**
	Gradient Range (h/L):	5.5 5.5

NewFields

Flexible Wall Hydraulic Conductivity
ASTM D5084

Client:	Arizona Minerals Inc.	Lab Sample No.:	21-164-03
Project:	Hermosa Geotechnical Investigation	Field Sample No.:	TP21-16 -3/4"
Project No.:	475.0014.029	Location:	+2% Opt. MC%
Phase:	-	Elevation/Depth:	0
Requested By:	Craig Thompson	Tested By:	KE
Test Started:	7/22/2019	Checked By:	KM
Test Finished:	7/26/2021	Sample Description:	Dark brown clayey sand with gravel

Test Boundary Conditions	
Type of Permeant	De-aired Bottled
Magnitude of Back pressure (psi)	45
Saturated (Y/N):	Yes
Stage 1: Effective Stress (psi)	5
Sample Type	Remolded
Burrete Area (cm^2)	0.877

Test Specimen Data	Initial	During k Testing	Final
Wet Soil + Tare (g)	683.56		802.00
Dry Soil + Tare (g)	619.31		717.90
Tare (g)	0.00		100.90
Wt. of Water (g)	64.25		84.10
Dry Soil (g)	619.31		617.00
Moisture Content (%)	10.4		13.6
Sample Volume (ft^3)	0.01080	0.01078	
Dry Density (pcf)	126.4	126.4	
Wet Density (pcf)	139.5	142.1	
Saturation (%)	84.3	100.0	
Percent Compaction	94.6	94.6	
Height (in)	3.035	3.034	
Diameter (in)	2.798	2.797	
Area (in^2)	6.149	6.146	
Est. Moisture Content after Consolidation (%)		12.3%	
Est. Void Ratio after Consolidation		0.333	
Specific Gravity*	2.70		

*Specific gravity is assumed	**Maximum Dry Density (pcf):**	133.6
Maximum Dry Density:	**Initial Remolded Dry Density (pcf):**	126.4
ASTM D 1557	**Initial Percent Compaction:**	95%
	Initial Void Ratio:	0.333
	Optimum Moisture Content(%):	8.4
	Initial Water Content (%):	10.4
	Confining Pressure (psi):	5.0
	Hydraulic Conductivity, k_{20} (cm/s):	**6.0E-06**
	Gradient Range (h/L):	5.5 5.5

NewFields

Flexible Wall Hydraulic Conductivity
ASTM D5084

Client:	Arizona Minerals Inc.	Lab Sample No.:	21-164-03
Project:	Hermosa Geotechnical Investigation	Field Sample No.:	TP21-16 -3/4"
Project No.:	475.0014.029	Location:	+2% Opt. MC%
Phase:	-	Elevation/Depth:	0
Requested By:	Craig Thompson	Tested By:	KE
Test Started:	7/22/2019	Checked By:	KM
Test Finished:	7/26/2021	Sample Description:	Dark brown clayey sand with gravel

Test Boundary Conditions	
Type of Permeant	De-aired Bottled
Magnitude of Back pressure (psi)	45
Saturated (Y/N):	Yes
Stage 2: Effective Stress (psi)	20
Sample Type	Remolded
Burrete Area (cm^2)	0.877

Test Specimen Data	Initial	During k Testing	Final
Wet Soil + Tare (g)	683.56		802.00
Dry Soil + Tare (g)	619.31		717.90
Tare (g)	0.00		100.90
Wt. of Water (g)	64.25		84.10
Dry Soil (g)	619.31		617.00
Moisture Content (%)	10.4		13.6
Sample Volume (ft^3)	0.01078	0.01067	
Dry Density (pcf)	126.4	127.8	
Wet Density (pcf)	142.1	142.9	
Saturation (%)	100.0%	100.0	
Percent Compaction	94.6	95.7	
Height (in)	3.024	3.014	
Diameter (in)	2.788	2.778	
Area (in^2)	6.103	6.062	
Est. Moisture Content after Consolidation (%)		11.8%	
Est. Void Ratio after Consolidation		0.319	
Specific Gravity*	2.70		

*Specific gravity is assumed	**Maximum Dry Density (pcf):**	133.6
Maximum Dry Density:	**Initial Remolded Dry Density (pcf):**	126.4
ASTM D 1557	**Initial Percent Compaction:**	95%
	Initial Void Ratio:	0.333
	Optimum Moisture Content(%):	8.4
	Initial Water Content (%):	10.4
	Confining Pressure (psi):	20.0
	Hydraulic Conductivity, k_{20} (cm/s):	**2.2E-06**
	Gradient Range (h/L):	5.5 5.5

NewFields

Flexible Wall Hydraulic Conductivity
ASTM D5084

Client:	Arizona Minerals Inc.	Lab Sample No.:	21-164-03 -B
Project:	Hermosa Geotechnical Investigation	Field Sample No.:	TP21-16 -3/4"
Project No.:	475.0014.029	Location:	+2% bent,+2% Opt. M
Phase:	-	Elevation/Depth:	0
Requested By:	Craig Thompson	Tested By:	KE
Test Started:	7/22/2019	Checked By:	KM
Test Finished:	7/26/2021	Sample Description:	Dark brown clayey sand with gravel

Test Boundary Conditions	
Type of Permeant	De-aired Bottled
Magnitude of Back pressure (psi)	40
Saturated (Y/N):	Yes
Stage 1: Effective Stress (psi)	5
Sample Type	Remolded
Burrete Area (cm^2)	0.877

Test Specimen Data	Initial	During k Testing	Final
Wet Soil + Tare (g)	683.5		816.70
Dry Soil + Tare (g)	619.25		730.60
Tare (g)	0.00		112.10
Wt. of Water (g)	64.25		86.10
Dry Soil (g)	619.25		618.50
Moisture Content (%)	10.4		13.9
Sample Volume (ft^3)	0.01077	0.01072	
Dry Density (pcf)	126.7	127.0	
Wet Density (pcf)	139.9	142.5	
Saturation (%)	85.2	100.0	
Percent Compaction	94.8	95.0	
Height (in)	3.040	3.036	
Diameter (in)	2.792	2.789	
Area (in^2)	6.124	6.109	
Est. Moisture Content after Consolidation (%)		12.1%	
Est. Void Ratio after Consolidation		0.325	
Specific Gravity*	2.70		

*Specific gravity is assumed	**Maximum Dry Density (pcf):**	133.6
Maximum Dry Density:	**Initial Remolded Dry Density (pcf):**	126.7
ASTM D 1557	**Initial Percent Compaction:**	95%
	Initial Void Ratio:	0.330
	Optimum Moisture Content(%):	8.4
	Initial Water Content (%):	10.4
	Confining Pressure (psi):	5.0
	Hydraulic Conductivity, k_{20} (cm/s):	**1.5E-06**
	Gradient Range (h/L):	5.5 5.5

NewFields

Flexible Wall Hydraulic Conductivity
ASTM D5084

Client:	Arizona Minerals Inc.	Lab Sample No.:	21-164-03 -B
Project:	Hermosa Geotechnical Investigation	Field Sample No.:	TP21-16 -3/4"
Project No.:	475.0014.029	Location:	+2% bent,+2% Opt. MC%
Phase:	-	Elevation/Depth:	0
Requested By:	Craig Thompson	Tested By:	KE
Test Started:	7/22/2019	Checked By:	KM
Test Finished:	7/26/2021	Sample Description:	Dark brown clayey sand with gravel

Test Boundary Conditions	
Type of Permeant	De-aired Bottled
Magnitude of Back pressure (psi)	40
Saturated (Y/N):	Yes
Stage 2: Effective Stress (psi)	20
Sample Type	Remolded
Burrete Area (cm^2)	0.877

Test Specimen Data	Initial	During k Testing	Final
Wet Soil + Tare (g)	683.5		816.70
Dry Soil + Tare (g)	619.25		730.60
Tare (g)	0.00		112.10
Wt. of Water (g)	64.25		86.10
Dry Soil (g)	619.25		618.50
Moisture Content (%)	10.4		13.9
Sample Volume (ft^3)	0.01072	0.01058	
Dry Density (pcf)	127.0	128.9	
Wet Density (pcf)	142.5	143.6	
Saturation (%)	100.0%	100.0	
Percent Compaction	95.0	96.5	
Height (in)	3.023	3.013	
Diameter (in)	2.777	2.767	
Area (in^2)	6.055	6.015	
Est. Moisture Content after Consolidation (%)		11.4%	
Est. Void Ratio after Consolidation		0.308	
Specific Gravity*	2.70		

*Specific gravity is assumed	**Maximum Dry Density (pcf):**	133.6
Maximum Dry Density:	**Initial Remolded Dry Density (pcf):**	126.7
ASTM D 1557	**Initial Percent Compaction:**	95%
	Initial Void Ratio:	0.330
	Optimum Moisture Content(%):	8.4
	Initial Water Content (%):	10.4
	Confining Pressure (psi):	20.0
	Hydraulic Conductivity, k_{20} (cm/s):	**8.6E-07**
	Gradient Range (h/L):	5.5 5.5

NewFields

Flexible Wall Hydraulic Conductivity
ASTM D5084

Client:	Arizona Minerals Inc.	Lab Sample No.:	21-164-03 -C
Project:	Hermosa Geotechnical Investigation	Field Sample No.:	TP21-16 -3/4"
Project No.:	475.0014.029	Location:	+4% bent,+2% Opt. M
Phase:	-	Elevation/Depth:	0
Requested By:	Craig Thompson	Tested By:	KE
Test Started:	7/27/2019	Checked By:	KM
Test Finished:	7/29/2021	Sample Description:	Dark brown clayey sand with gravel

Test Boundary Conditions	
Type of Permeant	De-aired Bottled
Magnitude of Back pressure (psi)	50
Saturated (Y/N):	Yes
Stage 1: Effective Stress (psi)	5
Sample Type	Remolded
Burrete Area (cm^2)	0.877

Test Specimen Data	Initial	During k Testing	Final
Wet Soil + Tare (g)	683.27		831.00
Dry Soil + Tare (g)	619.04		745.50
Tare (g)	0.00		127.10
Wt. of Water (g)	64.23		85.50
Dry Soil (g)	619.04		618.40
Moisture Content (%)	10.4		13.8
Sample Volume (ft^3)	0.01076	0.01073	
Dry Density (pcf)	126.8	126.9	
Wet Density (pcf)	140.0	142.4	
Saturation (%)	85.4	100.0	
Percent Compaction	94.9	95.0	
Height (in)	3.033	3.031	
Diameter (in)	2.794	2.792	
Area (in^2)	6.131	6.123	
Est. Moisture Content after Consolidation (%)		12.1%	
Est. Void Ratio after Consolidation		0.327	
Specific Gravity*	2.70		

*Specific gravity is assumed	**Maximum Dry Density (pcf):**	133.6
Maximum Dry Density:	**Initial Remolded Dry Density (pcf):**	126.8
ASTM D 1557	**Initial Percent Compaction:**	95%
	Initial Void Ratio:	0.329
	Optimum Moisture Content(%):	8.4
	Initial Water Content (%):	10.4
	Confining Pressure (psi):	5.0
	Hydraulic Conductivity, k_{20} (cm/s):	**4.2E-07**
	Gradient Range (h/L):	5.5 5.5

NewFields

Flexible Wall Hydraulic Conductivity
ASTM D5084

Client:	Arizona Minerals Inc.	Lab Sample No.:	21-164-03 -C
Project:	Hermosa Geotechnical Investigation	Field Sample No.:	TP21-16 -3/4"
Project No.:	475.0014.029	Location:	+4% bent,+2% Opt. MC%
Phase:	-	Elevation/Depth:	0
Requested By:	Craig Thompson	Tested By:	KE
Test Started:	7/27/2019	Checked By:	KM
Test Finished:	7/29/2021	Sample Description:	Dark brown clayey sand with gravel

Test Boundary Conditions	
Type of Permeant	De-aired Bottled
Magnitude of Back pressure (psi)	50
Saturated (Y/N):	Yes
Stage 2: Effective Stress (psi)	20
Sample Type	Remolded
Burrete Area (cm^2)	0.877

Test Specimen Data	Initial	During k Testing	Final
Wet Soil + Tare (g)	683.27		831.00
Dry Soil + Tare (g)	619.04		745.50
Tare (g)	0.00		127.10
Wt. of Water (g)	64.23		85.50
Dry Soil (g)	619.04		618.40
Moisture Content (%)	10.4		13.8
Sample Volume (ft^3)	0.01073	0.01054	
Dry Density (pcf)	126.9	129.3	
Wet Density (pcf)	142.4	143.8	
Saturation (%)	100.0%	100.0	
Percent Compaction	95.0	96.8	
Height (in)	3.013	3.003	
Diameter (in)	2.776	2.767	
Area (in^2)	6.053	6.012	
Est. Moisture Content after Consolidation (%)		11.3%	
Est. Void Ratio after Consolidation		0.304	
Specific Gravity*	2.70		

*Specific gravity is assumed	**Maximum Dry Density (pcf):**	133.6
Maximum Dry Density:	**Initial Remolded Dry Density (pcf):**	126.8
ASTM D 1557	**Initial Percent Compaction:**	95%
	Initial Void Ratio:	0.329
	Optimum Moisture Content(%):	8.4
	Initial Water Content (%):	10.4
	Confining Pressure (psi):	20.0
	Hydraulic Conductivity, k_{20} (cm/s):	**1.1E-07**
	Gradient Range (h/L):	5.5 5.5

NewFields

Flexible Wall Hydraulic Conductivity
ASTM D5084

Client:	Arizona Minerals Inc.	Lab Sample No.:	21-164-07/21-255-02
Project:	Hermosa Geotechnical Investigation	Field Sample No.:	TP21-19 -3/4"
Project No.:	475.0014.029	Location:	+2% bent,+2% Opt. M
Phase:	-	Elevation/Depth:	20'-28'
Requested By:	Craig Thompson	Tested By:	KE
Test Started:	9/8/2021	Checked By:	KM
Test Finished:	9/17/2021	Sample Description:	Dark brown clayey sand with gravel

Test Boundary Conditions	
Type of Permeant	De-aired Bottled
Magnitude of Back pressure (psi)	50
Saturated (Y/N):	Yes
Stage 1: Effective Stress (psi)	5
Sample Type	Remolded
Burrete Area (cm^2)	0.877

Test Specimen Data	Initial	During k Testing	Final
Wet Soil + Tare (g)	685.28		843.25
Dry Soil + Tare (g)	614.01		748.33
Tare (g)	0.00		134.22
Wt. of Water (g)	71.27		94.92
Dry Soil (g)	614.01		614.11
Moisture Content (%)	11.6		15.5
Sample Volume (ft^3)	0.01081	0.01077	
Dry Density (pcf)	125.3	125.4	
Wet Density (pcf)	139.8	141.5	
Saturation (%)	90.8	100.0	
Percent Compaction	94.6	94.7	
Height (in)	3.040	3.037	
Diameter (in)	2.797	2.795	
Area (in^2)	6.143	6.133	
Est. Moisture Content after Consolidation (%)		12.7%	
Est. Void Ratio after Consolidation		0.342	
Specific Gravity*	2.70		

*Specific gravity is assumed	**Maximum Dry Density (pcf):**	132.5
Maximum Dry Density:	**Initial Remolded Dry Density (pcf):**	125.3
ASTM D 1557	**Initial Percent Compaction:**	95%
	Initial Void Ratio:	0.345
	Optimum Moisture Content(%):	9.6
	Initial Water Content (%):	11.6
	Confining Pressure (psi):	5.0
	Hydraulic Conductivity, k_{20} (cm/s):	**5.7E-07**
	Gradient Range (h/L):	5.4 5.4

NewFields

Flexible Wall Hydraulic Conductivity
ASTM D5084

Client:	Arizona Minerals Inc.	Lab Sample No.:	21-164-07/21-255-02
Project:	Hermosa Geotechnical Investigation	Field Sample No.:	TP21-19 -3/4"
Project No.:	475.0014.029	Location:	+2% bent,+2% Opt. MC%
Phase:	-	Elevation/Depth:	20'-28'
Requested By:	Craig Thompson	Tested By:	KE
Test Started:	9/8/2021	Checked By:	KM
Test Finished:	9/17/2021	Sample Description:	Dark brown clayey sand with gravel

Test Boundary Conditions

Type of Permeant	De-aired Bottled
Magnitude of Back pressure (psi)	50
Saturated (Y/N):	Yes
Stage 2: Effective Stress (psi)	20
Sample Type	Remolded
Burrete Area (cm^2)	0.877

Test Specimen Data	Initial	During k Testing	Final
Wet Soil + Tare (g)	685.28		843.25
Dry Soil + Tare (g)	614.01		748.33
Tare (g)	0.00		134.22
Wt. of Water (g)	71.27		94.92
Dry Soil (g)	614.01		614.11
Moisture Content (%)	11.6		15.5
Sample Volume (ft^3)	0.01077	0.01059	
Dry Density (pcf)	125.4	127.7	
Wet Density (pcf)	141.5	142.8	
Saturation (%)	100.0%	100.0	
Percent Compaction	94.7	96.3	
Height (in)	3.021	3.011	
Diameter (in)	2.779	2.770	
Area (in^2)	6.066	6.026	
Est. Moisture Content after Consolidation (%)		11.9%	
Est. Void Ratio after Consolidation		0.320	
Specific Gravity*	2.70		

*Specific gravity is assumed	**Maximum Dry Density (pcf):**	132.5
Maximum Dry Density:	**Initial Remolded Dry Density (pcf):**	125.3
ASTM D 1557	**Initial Percent Compaction:**	95%
	Initial Void Ratio:	0.345
	Optimum Moisture Content(%):	9.6
	Initial Water Content (%):	11.6
	Confining Pressure (psi):	20.0
	Hydraulic Conductivity, k_{20} (cm/s):	**2.0E-07**
	Gradient Range (h/L):	5.4 5.4

NewFields

Flexible Wall Hydraulic Conductivity
ASTM D5084

Client:	Arizona Minerals Inc.	Lab Sample No.:	21-164-07/21-255-02
Project:	Hermosa Geotechnical Investigation	Field Sample No.:	TP21-19 -3/4"
Project No.:	475.0014.029	Location:	+4% bent,+2% Opt. M
Phase:	-	Elevation/Depth:	20'-28'
Requested By:	Craig Thompson	Tested By:	KE
Test Started:	9/8/2021	Checked By:	KM
Test Finished:	9/17/2021	Sample Description:	Dark brown clayey sand with gravel

Test Boundary Conditions

Type of Permeant	De-aired Bottled
Magnitude of Back pressure (psi)	50
Saturated (Y/N):	Yes
Stage 1: Effective Stress (psi)	5
Sample Type	Remolded
Burrete Area (cm^2)	0.877

Test Specimen Data	Initial	During k Testing	Final
Wet Soil + Tare (g)	685.46		840.45
Dry Soil + Tare (g)	614.17		746.93
Tare (g)	0.00		133.40
Wt. of Water (g)	71.29		93.52
Dry Soil (g)	614.17		613.53
Moisture Content (%)	11.6		15.2
Sample Volume (ft^3)	0.01082	0.01079	
Dry Density (pcf)	125.2	125.3	
Wet Density (pcf)	139.7	141.4	
Saturation (%)	90.6	100.0	
Percent Compaction	94.5	94.6	
Height (in)	3.044	3.043	
Diameter (in)	2.796	2.795	
Area (in^2)	6.140	6.135	
Est. Moisture Content after Consolidation (%)		12.8%	
Est. Void Ratio after Consolidation		0.345	
Specific Gravity*	2.70		

*Specific gravity is assumed	**Maximum Dry Density (pcf):**	132.5
Maximum Dry Density:	**Initial Remolded Dry Density (pcf):**	125.2
ASTM D 1557	**Initial Percent Compaction:**	94%
	Initial Void Ratio:	0.346
	Optimum Moisture Content(%):	9.6
	Initial Water Content (%):	11.6
	Confining Pressure (psi):	5.0
	Hydraulic Conductivity, k_{20} (cm/s):	**4.6E-07**
	Gradient Range (h/L):	5.4 5.4

NewFields

Flexible Wall Hydraulic Conductivity
ASTM D5084

Client:	Arizona Minerals Inc.	Lab Sample No.:	21-164-07/21-255-02
Project:	Hermosa Geotechnical Investigation	Field Sample No.:	TP21-19 -3/4"
Project No.:	475.0014.029	Location:	+4% bent,+2% Opt. MC%
Phase:	-	Elevation/Depth:	20'-28'
Requested By:	Craig Thompson	Tested By:	KE
Test Started:	9/8/2021	Checked By:	KM
Test Finished:	9/17/2021	Sample Description:	Dark brown clayey sand with gravel

Test Boundary Conditions	
Type of Permeant	De-aired Bottled
Magnitude of Back pressure (psi)	50
Saturated (Y/N):	Yes
Stage 2: Effective Stress (psi)	20
Sample Type	Remolded
Burrete Area (cm^2)	0.877

Test Specimen Data	Initial	During k Testing	Final
Wet Soil + Tare (g)	685.46		840.45
Dry Soil + Tare (g)	614.17		746.93
Tare (g)	0.00		133.40
Wt. of Water (g)	71.29		93.52
Dry Soil (g)	614.17		613.53
Moisture Content (%)	11.6		15.2
Sample Volume (ft^3)	0.01079	0.01061	
Dry Density (pcf)	125.3	127.4	
Wet Density (pcf)	141.4	142.7	
Saturation (%)	100.0%	100.0	
Percent Compaction	94.6	96.2	
Height (in)	3.026	3.016	
Diameter (in)	2.779	2.770	
Area (in^2)	6.067	6.027	
Est. Moisture Content after Consolidation (%)		11.9%	
Est. Void Ratio after Consolidation		0.323	
Specific Gravity*	2.70		

*Specific gravity is assumed	**Maximum Dry Density (pcf):**	132.5
Maximum Dry Density:	**Initial Remolded Dry Density (pcf):**	125.2
ASTM D 1557	**Initial Percent Compaction:**	94%
	Initial Void Ratio:	0.346
	Optimum Moisture Content(%):	9.6
	Initial Water Content (%):	11.6
	Confining Pressure (psi):	20.0
	Hydraulic Conductivity, k_{20} (cm/s):	**1.5E-07**
	Gradient Range (h/L):	5.4 5.4

NewFields

Rigid Wall Constant Head Permeability
USBR 5600

Client	South 32	Lab Sample No.	21-275-02
Project	Hermosa Geotech Investigation	Field Sample No.	TP21-06
Project No.	475.0014.029	Location	1-9'
Phase	1	Tested By	JH
Test Date	10/20/21	Checked By	KM
		Sample Description	Brown well graded gravel w/ silt and gravel

Test Boundary Conditions

Type of Permeant	Tap water		
Saturated (Y/N)	Yes		
Stage 1: Normal Stress (psf)	6,250	Equivalent Overburden Bulk Unit Weight (pcf)	125
Equivalent Load Height (ft)	50		

Test Specimen Data

Normal Load (lbs):	3102	Normal Stress (psf):	6250
Initial Wt. (Bulk) (lbs):	46.695	Change in Specimen Length (in):	1.408
Initial Specimen Length, L_0:	11.400	Final Specimen Length, L_f:	9.992
Initial Sample Volume (in^3):	814.9	Final Sample Volume (in^3):	714.2
Initial Sample Volume (ft^3):	0.472	Final Sample Volume (ft^3):	0.413
Initial Bulk Unit Weight (pcf):	99.0	Final Bulk Unit Weight (pcf):	130.3
Initial Moisture Content (%):	3.5	Final Moisture Content (%):	19.4
Initial Dry Unit Weight (pcf):	95.7	Final Dry Unit Weight (pcf):	109.2
Initial Void Ratio:	0.73	Final Void Ratio:	0.51
Initial Porosity:	42.1%	Final Porosity:	34.0%
Initial Saturation:	12.7%	Final Saturation:	100.0%

Hydraulic Conductivity Data

Trial #	Gradient, i	Volume of Water (ml)	ΔTime (sec)	Velocity, v (cm/sec)	Hydraulic Conductivity, k (cm/sec)
1	0.559	250	57	0.0095	1.7E-02
2	0.559	250	59	0.0092	1.6E-02
3	0.559	250	58	0.0093	1.7E-02
4	0.559	250	57	0.0095	1.7E-02
Average Hydraulic Conductivity, k (cm/sec)					**1.7E-02**

NewFields

Rigid Wall Constant Head Permeability
USBR 5600

Client	South 32	Lab Sample No.	21-275-02
Project	Hermosa Geotech Investigation	Field Sample No.	TP21-06
Project No.	475.0014.029	Location	1-9'
Phase	1	Tested By	JH
Test Date	10/20/21	Checked By	KM
		Sample Description	Brown well graded gravel w/ silt and gravel

Test Boundary Conditions

Type of Permeant	Tap water		
Saturated (Y/N)	Yes		
Stage 2: Normal Stress (psf)	12,500	Equivalent Overburden Bulk Unit Weight (pcf)	125
Equivalent Load Height (ft)	100		

Test Specimen Data

Normal Load (lbs):	6,205	Normal Stress (psf):	12,500
Initial Wt. (Bulk) (lbs):	53.875	Change in Specimen Length (in):	0.545
Initial Specimen Length, L_0:	9.992	Final Specimen Length, L_f:	9.447
Initial Sample Volume (in^3):	714.2	Final Sample Volume (in^3):	675.3
Initial Sample Volume (ft^3):	0.413	Final Sample Volume (ft^3):	0.391
Initial Bulk Unit Weight (pcf):	130.3	Final Bulk Unit Weight (pcf):	134.3
Initial Moisture Content (%):	19.4	Final Moisture Content (%):	16.3
Initial Dry Unit Weight (pcf):	109.2	Final Dry Unit Weight (pcf):	115.4
Initial Void Ratio:	0.51	Final Void Ratio:	0.43
Initial Porosity:	34.0%	Final Porosity:	30.2%
Initial Saturation:	100.0%	Final Saturation:	100.0%

Hydraulic Conductivity Data

Trial #	Gradient, i	Volume of Water (ml)	ΔTime (sec)	Velocity, v (cm/sec)	Hydraulic Conductivity, k (cm/sec)
1	0.632	250	311	0.0017	2.8E-03
2	0.632	250	322	0.0017	2.7E-03
3	0.632	250	330	0.0016	2.6E-03
4	0.632	250	335	0.0016	2.6E-03
Average Hydraulic Conductivity, k (cm/sec)					**2.6E-03**

NewFields

LOS ANGELES ABRASION (ASTM C131/ASTM C535)

LABORATORY WORKSHEET

NF Form #48

Client:	South 32	**Field Sample ID:**	TP21-06	**Test Start Date:**	12/1/2021
Project Title:	Hermosa Geotech Investigation	**Laboratory Sample ID:**	21-275-02	**Tested By:**	ZM
Project Number:	475.0014.029	**Location:**	TP21-06	**Checked By:**	JH
Project Engineer:	Craig Thompson	**Elevation:**	1-8'	**Sample Description:**	

Test Type	
ASTM C131	ASTM C535
A	1
B	2
C	3
D	

Remarks: Did not have enough material to perform testing per ASTM standards.

Sample	**Total Wt. (g)**
Tare ID	
Initial Wt. + Tare	2221.40
Post Wt. + Tare	715.9
Percent Loss	**67.77%**

NewFields

LOS ANGELES ABRASION (ASTM C131/ASTM C535)

LABORATORY WORKSHEET

NF Form #48

Client:	South 32	**Field Sample ID:**	TP21-07	**Test Start Date:**	10/29/2021
Project Title:	Hermosa Geotech Investigation	**Laboratory Sample ID:**	21-375-06	**Tested By:**	KS
Project Number:	475.0014.029	**Location:**	TP21-07	**Checked By:**	JH
Project Engineer:	Craig Thompson	**Elevation:**	1.5-15'	**Sample Description:**	

Test Type	
ASTM C131	ASTM C535
A	1
B	2
C	3
D	

Remarks:

Sample	**Total Wt. (g)**
Tare ID	
Initial Wt. + Tare	4990.80
Post Wt. + Tare	4613.1
Percent Loss	**7.57%**

NewFields

LOS ANGELES ABRASION (ASTM C131/ASTM C535)

LABORATORY WORKSHEET

NF Form #48

Client:	South 32	**Field Sample ID:**	TP21-13	**Test Start Date:**	12/1/2021
Project Title:	Hermosa Geotech Investigation	**Laboratory Sample ID:**	21-275-07	**Tested By:**	ZM
Project Number:	475.0014.029	**Location:**	TP21-13	**Checked By:**	JH
Project Engineer:	Craig Thompson	**Elevation:**	3-12'	**Sample Description:**	

Test Type

ASTM C131	ASTM C535
A	1
B	2
C	3
D	

Remarks:

Sample	Total Wt. (g)
Tare ID	
Initial Wt. + Tare	4991.60
Post Wt. + Tare	3735.1
Percent Loss	**25.17%**

NewFields

LOS ANGELES ABRASION (ASTM C131/ASTM C535)

LABORATORY WORKSHEET

NF Form #48

Client:	South 32	**Field Sample ID:**	TP21-16	**Test Start Date:**	7/29/2021
Project Title:	Hermosa Geotech Investigation	**Laboratory Sample ID:**	21-164-03	**Tested By:**	KS
Project Number:	475.0014.029	**Location:**	TP21-16	**Checked By:**	JH
Project Engineer:	Craig Thompson	**Elevation:**	0-10'	**Sample Description:**	

Test Type	
ASTM C131	ASTM C535
A	1
B	**2**
C	3
D	

Remarks:

Sample	**Total Wt. (g)**
Tare ID	
Initial Wt. + Tare	10004.00
Post Wt. + Tare	6126.1
Percent Loss	**39%**

NewFields

LOS ANGELES ABRASION (ASTM C131/ASTM C535)

LABORATORY WORKSHEET

NF Form #48

Client:	South 32	**Field Sample ID:**	TP21-17	**Test Start Date:**	9/1/2021
Project Title:	Hermosa Geotech Investigation	**Laboratory Sample ID:**	21-255-01	**Tested By:**	ZM
Project Number:	475.0014.029	**Location:**	TP21-17	**Checked By:**	JH
Project Engineer:	Craig Thompson	**Elevation:**	0-20'	**Sample Description:**	

Test Type	
ASTM C131	ASTM C535
A	1
B	2
C	3
D	

Remarks:

Sample	**Total Wt. (g)**
Tare ID	
Initial Wt. + Tare	4856.60
Post Wt. + Tare	2920.7
Percent Loss	**40%**

NewFields

LOS ANGELES ABRASION (ASTM C131/ASTM C535)

LABORATORY WORKSHEET

NF Form #48

Client:	South 32	**Field Sample ID:**	TP21-19	**Test Start Date:**	9/1/2021
Project Title:	Hermosa Geotech Investigation	**Laboratory Sample ID:**	21-255-02	**Tested By:**	ZM
Project Number:	475.0014.029	**Location:**	TP21-19	**Checked By:**	JH
Project Engineer:	Craig Thompson	**Elevation:**	20-28'	**Sample Description:**	

Test Type	
ASTM C131	ASTM C535
A	1
B	2
C	3
D	

Remarks:

Sample	**Total Wt. (g)**
Tare ID	
Initial Wt. + Tare	4844.20
Post Wt. + Tare	2644.1
Percent Loss	**45%**

NewFields

LOS ANGELES ABRASION (ASTM C131/ASTM C535)

LABORATORY WORKSHEET

NF Form #48

Client:	South 32	**Field Sample ID:**	TP21-24	**Test Start Date:**	9/1/2021
Project Title:	Hermosa Geotech Investigation	**Laboratory Sample ID:**	21-255-05	**Tested By:**	ZM
Project Number:	475.0014.029	**Location:**	TP21-24	**Checked By:**	JH
Project Engineer:	Craig Thompson	**Elevation:**	0-20'	**Sample Description:**	

Test Type	
ASTM C131	ASTM C535
A	1
B	2
C	3
D	

Remarks:

Sample	**Total Wt. (g)**
Tare ID	
Initial Wt. + Tare	5016.70
Post Wt. + Tare	3045.1
Percent Loss	**39%**

NewFields

LOS ANGELES ABRASION (ASTM C131/ASTM C535)

LABORATORY WORKSHEET

NF Form #48

Client:	South 32	**Field Sample ID:**	WTP2 21-02	**Test Start Date:**	12/1/2021
Project Title:	Hermosa Geotech Investigation	**Laboratory Sample ID:**	21-275-08	**Tested By:**	ZM
Project Number:	475.0014.029	**Location:**	WTP2 21-02	**Checked By:**	JH
Project Engineer:	Craig Thompson	**Elevation:**		**Sample Description:**	

Test Type	
ASTM C131	ASTM C535
A	1
B	2
C	3
D	

Remarks:

Sample	**Total Wt. (g)**
Tare ID	
Initial Wt. + Tare	4930.70
Post Wt. + Tare	3382.1
Percent Loss	**31.41%**

NewFields

Sodium Sulfate Soundness C88

Client:	South 32	**Field Sample ID:**	TP21-16	**Test Start Date:**	7/26/2021
Project Title:	Hermosa Geotechnical Investigation	**Laboratory Sample ID:**	1' 21-164-03	**Tested By:**	KS
Project Number:	475.0014.029	**Location:**	TP21-16	**Checked By:**	KE
Project Engineer:	Craig Thompson	**Elevation:**	0-10'	**Sample Description:**	

Coarse Aggregate

Size:	Percent Loss:	Weighted % Loss:
2.5" to 2"	11.4	5.2
2" to 1.5"	12.9	4
1.5" to 1"	13.4	2.1
1" to .75"	20	1.6
	Total:	12.9

Notes:

NewFields

Sodium Sulfate Soundness C88

Client:	South 32	**Field Sample ID:**	TP21-17	**Test Start Date:**	9/1/2021
Project Title:	Hermosa Geotechnical Investigation	**Laboratory Sample ID:**	1' 21-255-01	**Tested By:**	KS
Project Number:	475.0014.029	**Location:**	TP21-17	**Checked By:**	JH
Project Engineer:	Craig Thompson	**Elevation:**	0-20'	**Sample Description:**	

Coarse Aggregate

Size:	Percent Loss:	Weighted % Loss:
1" and .75"	56.3	30.9
.5" and .375"	65.2	22.3
#4	71.4	7.1
	Total:	60.3

Notes:

NewFields

Sodium Sulfate Soundness C88

Client:	South 32	**Field Sample ID:**	TP21-19	**Test Start Date:**	9/1/2021
Project Title:	Hermosa Geotechnical Investigation	**Laboratory Sample ID:**	1' 21-255-02	**Tested By:**	KS
Project Number:	475.0014.029	**Location:**	TP21-19	**Checked By:**	JH
Project Engineer:	Craig Thompson	**Elevation:**		**Sample Description:**	

Coarse Aggregate

Size:	Percent Loss:	Weighted % Loss:
1" and .75"	82.8	44.8
.5" and .375"	82.3	29.3
#4	87	9
	Total:	83.1

Notes:

NewFields

Sodium Sulfate Soundness C88

Client:	South 32	**Field Sample ID:**	TP21-24	**Test Start Date:**	9/1/2021
Project Title:	Hermosa Geotechnical Investigation	**Laboratory Sample ID:**	1' 21-255-05	**Tested By:**	KS
Project Number:	475.0014.029	**Location:**	TP21-24	**Checked By:**	JH
Project Engineer:	Craig Thompson	**Elevation:**		**Sample Description:**	

Coarse Aggregate

Size:	Percent Loss:	Weighted % Loss:
1" and .75"	65.4	37.8
.5" and .375"	72.1	22.2
#4	79.5	9.1
	Total:	69.1

Notes:

STANDARD TEST METHOD FOR SLAKE DURABILITY AND OTHER SIMILAR WEAK ROCKS (ASTM D4644)

NF Form #4644

Client:	Hermosa	**Field Sample ID:**	TP21-07	**Test Start Date:**	1/3/2022
Project Title:		**Laboratory Sample ID:**	21-275-06	**Tested By:**	KS
Project Number:	475.0014.029	**Location:**		**Checked By:**	JW
Project Engineer:		**Elevation:**	1.5'-13'	**Sample Description:**	

Start Date:	1/3/2022
End Date:	1/4/2022

Water Details	
Temperature Range:	1
Temperature Average:	64.5
Water Content:	

I_{d1}:	93.5
I_{d2}:	91.9

Pre Test

Desription of fragments after cycles:

Type 1 largely unchanged

Post Test

STANDARD TEST METHOD FOR SLAKE DURABILITY AND OTHER SIMILAR WEAK ROCKS
(ASTM D4644)

NF Form #4644

Client:	Hermosa	**Field Sample ID:**	TP21-13	**Test Start Date:**	1/3/2022
Project Title:		**Laboratory Sample ID:**	21-275-07	**Tested By:**	KS
Project Number:	475.0014.029	**Location:**		**Checked By:**	JW
Project Engineer:		**Elevation:**	3'-12'	**Sample Description:**	

Start Date:	1/3/2022
End Date:	1/4/2022

Water Details	
Temperature Range:	1
Temperature Average:	64.5
Water Content:	

I_{d1}:	99.0
I_{d2}:	98.9

Pre Test

Post Test

Desription of fragments after cycles:

Type 1 testing specimens largely unchanged.

STANDARD TEST METHOD FOR SLAKE DURABILITY AND OTHER SIMILAR WEAK ROCKS (ASTM D4644)

NF Form #4644

Client:	Hermosa	**Field Sample ID:**	WTP2 21-02	**Test Start Date:**	1/3/2022
Project Title:		**Laboratory Sample ID:**	21-275-08	**Tested By:**	KS
Project Number:	475.0014.029	**Location:**		**Checked By:**	JW
Project Engineer:		**Elevation:**		**Sample Description:**	

Start Date:	1/3/2022
End Date:	1/4/2022

Water Details	
Temperature Range:	2
Temperature Average:	65
Water Content:	

I_{d1}:	96.6
I_{d2}:	96.5

Pre Test

PostTes

Desription of fragments after cycles:

Type 1 largely unchanged

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STANDARD TEST METHOD FOR SLAKE DURABILITY AND OTHER SIMILAR WEAK ROCKS (ASTM D4644)

NF Form #4644

Client:	South 32	**Field Sample ID:**	TP21-17	**Test Start Date:**	9/3/2021
Project Title:	Hermosa Geotech Investigation	**Laboratory Sample ID:**	21-255-01	**Tested By:**	EK
Project Number:	475.0014.029	**Location:**	TP21-17	**Checked By:**	JH
Project Engineer:	Craig Thompson	**Elevation:**	0-20'	**Sample Description:**	

Start Date:	9/3/2021
End Date:	9/5/2021

Water Details	
Temperature Range:	6.4
Temperature Average:	67.85
Water Content:	15.8

I_{d1}:	88.2
I_{d2}:	78.2

Desription of fragments after cycles:
Type II material retained consistes of large and small particles.

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Perspective. Vision. Solutions.

STANDARD TEST METHOD FOR SLAKE DURABILITY AND OTHER SIMILAR WEAK ROCKS (ASTM D4644)

NF Form #4644

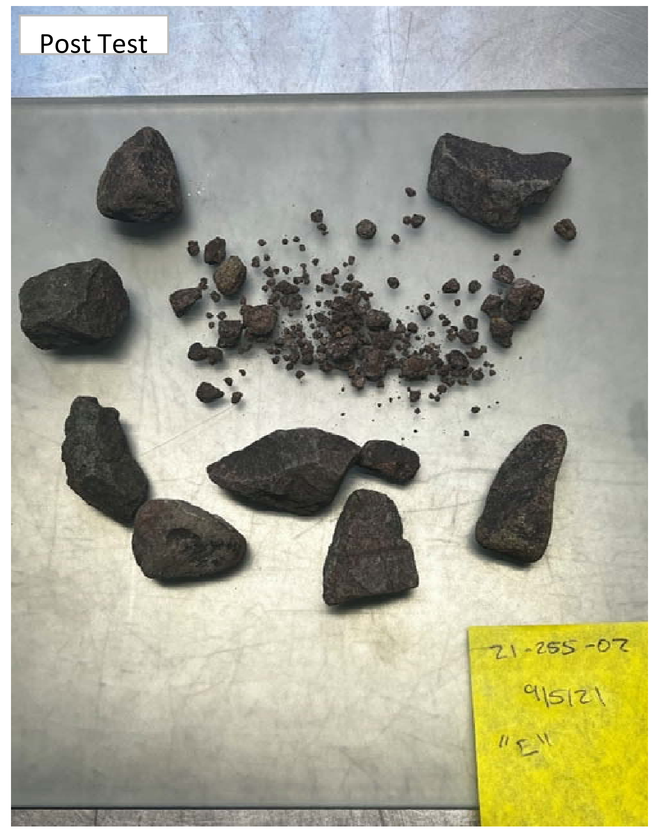
Client:	South 32	**Field Sample ID:**	TP21-19	**Test Start Date:**	9/3/2021
Project Title:	Hermosa Geotech Investigation	**Laboratory Sample ID:**	21-255-02	**Tested By:**	EK
Project Number:	475.0014.029	**Location:**		**Checked By:**	JH
Project Engineer:	Craig Thompson	**Elevation:**		**Sample Description:**	

Start Date:	9/3/2021
End Date:	9/5/2021

Water Details	
Temperature Range:	6.2
Temperature Average:	67.75
Water Content:	13.1

I_{d1}:	93.9
I_{d2}:	81.8

Desription of fragments after cycles:
Type II material retained consistes of large and small particles.



STANDARD TEST METHOD FOR SLAKE DURABILITY AND OTHER SIMILAR WEAK ROCKS (ASTM D4644)

NF Form #4644

Client:	South 32	**Field Sample ID:**	TP21-24	**Test Start Date:**	9/3/2021
Project Title:	Hermosa Geotech Investigation	**Laboratory Sample ID:**	21-255-05	**Tested By:**	EK
Project Number:	475.0014.029	**Location:**	TP21-24	**Checked By:**	JH
Project Engineer:	Craig Thompson	**Elevation:**		**Sample Description:**	

Start Date:	9/3/2021
End Date:	9/5/2021

Water Details	
Temperature Range:	5.7
Temperature Average:	67.88
Water Content:	21.1

I_{d1}:	92.1
I_{d2}:	90.3

Desription of fragments after cycles:
Type II material retained consistes of large and small particles.

ATTACHMENT C

Photo 1 – TP21-17 – Large rock gradation (existing stockpile at the IP)

Photo 2 – TP21-22 (existing stockpile at the IP)

Photo 3 – TP21-19 (Existing stockpile at the IP)

Photo 4 – TP21-11 – Plant Site Platform

Photo 5 – TP21-07 – Plant Site Platform

Photo 6 – TP21-14 – Plant Site Platform

Photo 7 – TP21-03 – Shaft Platform

Photo 8 – TP21-05 – Test Pit terminated due to bucket refusal at shaft platform

Photo 9 – WTP2 material stockpile at the IP

Photo 10 – Test Pit (WTP2 material stockpile at the IP)

APPENDIX D.2

Geotechnical Laboratory Testing
(Main and Ventilation Shaft Boreholes)

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TECHNICAL MEMORANDUM

To: Aldo Brigneti (South32)

From: Craig Thompson (NewFields)

Reviewed By: Mike Smith (NewFields)

Project: Hermosa Project

Project No: 475.0014.027

Subject: Geotechnical Laboratory Testing (Main and Ventilation Shaft Boreholes)

Date: December 1, 2023

This Technical Memorandum provides supporting information for the Tailings Storage Facility 1 (TSF1) Aquifer Protection Permit (APP) Significant Amendment Best Available Demonstrated Control Technology (BADCT) Design Report.

1.0 INTRODUCTION

South32 commissioned NewFields Mining Design and Technical Services (NewFields) to perform geotechnical laboratory testing on select samples obtained from drilling activities at the proposed main and ventilation shaft locations. The main and ventilation shafts are located on the Trench Camp property near the existing administrative platform. Two pilot holes were drilled by South32 in the location of the main and ventilation shaft using wireline coring techniques (HQ) to define the subsurface materials and obtain samples for testing.

Drilling was completed to identify samples that are representative of the non-potentially acid generating (non-PAG) waste rock that will be encountered during shaft development. This material was evaluated as a potential borrow source for Protective Layer (PL), Drainage Aggregate (DA), and Concrete Aggregate material that will be required for construction of the tailings storage facilities. Additionally, Potentially Acid Generating (PAG) waste rock samples were also tested to characterize strength parameters of the PAG waste rock that will be encountered during shaft development.

2.0 SAMPLE SELECTION AND TESTING

During development of the pilot holes, at least one sample per lithology was provided to NewFields for laboratory testing. Twelve samples from each proposed shaft location were tested and included ten non-PAG cores and two PAG cores each with an approximate weight of 100 lbs. Samples were selected at varying depths, where non-PAG materials were encountered, to provide information on the availability of construction materials at various stages of shaft development. Cores selected for laboratory testing from the Main Shaft are described in Table 2.1 and those selected from the Ventilation Shaft are described in Table 2.2.

TABLE 2.1 – MAIN SHAFT SAMPLE SELECTION

Location	Sample Number	Lithology	Sample Depth (ft bgs[1])	Core Box No.	Material Type
MVAND-21-01	22-069-01	Meadow Valley Andesite	110 – 130	15, 16, 17, 18	Non-PAG
MVAND-21-02	22-069-02	Meadow Valley Andesite	310 – 330	44, 45, 46, 47	Non-PAG
MVAND-21-03	22-069-03	Meadow Valley Andesite	725 – 745	104, 105, 106, 107	Non-PAG
HSVOL-21-01	22-069-04	Hardshell Volcanics	1005 – 1025	145, 146, 147, 148	PAG
HSVOL-21-02	22-069-05	Hardshell Volcanics	1300 – 1320	186, 187, 188, 189	PAG
HSVOL-21-03	22-069-06	Hardshell Volcanics	1700 – 1720	243, 244, 245, 246	Non-PAG
HSVOL-21-04	22-069-07	Hardshell Volcanics	1850 – 1870	264, 265, 266, 267	Non-PAG
HSVOL-21-05	22-069-08	Hardshell Volcanics	2380 – 2400	338, 339, 340, 341	Non-PAG
OLDVOL-21-01	22-069-09	Older Volcanics	2650 – 2670	377, 378, 379, 380	Non-PAG
OLDVOL-21-02	22-069-10	Older Volcanics	2890 – 2910	410, 411, 412, 413	Non-PAG
OLDVOL-21-03	22-069-11	Older Volcanics	3435 – 3455	490, 491, 492, 493	Non-PAG
C1-21-01	22-069-12	Concha 1	3905 – 3925	555, 556, 557, 558	Non-PAG

Note: [1]bgs – below ground surface

TABLE 2.2 – VENTILATION SHAFT SAMPLE SELECTION

Location	Sample Number	Lithology	Sample Depth (ft bgs[1])	Core Box No.	Material Type
MVAND-21-04	21-341-01	Meadow Valley Andesite	115 – 150	15, 16, 17, 18	Non-PAG
MVAND-21-05	21-341-02	Meadow Valley Andesite	300 – 325	40, 41, 42, 43	Non-PAG
MVAND-21-06	21-341-03	Meadow Valley Andesite	745 – 785	102, 103, 104, 105	Non-PAG
MVAND-21-07	21-341-04	Meadow Valley Andesite	895 – 925	123, 124, 125, 126	Non-PAG
HSVOL-21-06	21-341-05	Hardshell Volcanics	1180 – 1205	164, 165, 166, 167	Non-PAG
HSVOL-21-07	21-341-06	Hardshell Volcanics	1575 – 1600	219, 220, 221, 222	Non-PAG
HSVOL-21-08	21-341-07	Hardshell Volcanics	1675 – 1705	234, 235, 236, 237	Non-PAG
HSVOL-21-09	21-341-08	Hardshell Volcanics	2255 – 2280	312, 313, 314, 315	PAG
HSVOL-21-10	21-341-09	Hardshell Volcanics	2330 – 2360	323, 324, 325, 326	Non-PAG
HSVOL-21-11	21-341-10	Hardshell Volcanics	2630 – 2655	364, 365, 366, 367	Non-PAG
OLDVOL-21-04	21-341-11	Older Volcanics	2690 – 2710	373, 374, 375	PAG
OLDVOL-21-05	21-341-12	Older Volcanics	2725 – 2740	377, 378, 379	Non-PAG

Note: [1]bgs – below ground surface

Geochemical analysis of the waste rock (PAG vs non-PAG) was performed by others and is not included as a part of this analysis. In general, waste rock cores containing PAG intervals can be eliminated as potential construction materials borrow sources and will need to be stored in the TSF.

Core samples were crushed at a local laboratory for subsequent laboratory testing to evaluate geotechnical properties of the waste rock and to classify the material as a potential source for Protective Layer or Drainage Aggregate for future TSF construction. Samples were also tested to provide data for evaluating the material as a potential source of concrete aggregate. It should be noted that these crushed samples were sourced from cylindrical HQ core samples (approximately 2.5 inches in diameter) and actual development of the main/ventilation shafts will produce materials with different shapes and sizes. In NewFields opinion, the crushed samples should be considered representative of a secondary or tertiary crushed material. Laboratory testing included the following:

- Particle Size Distribution (ASTM D6913)
- Los Angeles Abrasion (ASTM C131)
- Sodium Sulfate Soundness (AASHTO T104 or ASTM C88)
- Slake Durability (ASTM D4644)

- Specific Gravity and Absorption (ASTM C127 and ASTM C128
- Alkali Silica Reactivity (ASTM C1260)
- Large Box Direct Shear

3.0 LABORATORY TESTING RESULTS

Laboratory testing results for the Main Shaft and Ventilation Shaft samples are presented in summary tables in Section 3.1 and Section 3.2, respectively. In addition, direct shear laboratory testing results for both the Main Shaft and Ventilation Shaft samples are presented in Section 3.3. Individual laboratory testing sheets can be referenced in Attachment A which is organized as follows:

- Attachment A – Laboratory Testing Results
  - Laboratory Testing Summary Table
- Attachment A.1 – Main Shaft Non-PAG Sample – Laboratory Testing Results
  - Individual laboratory testing results
- Attachment A.2 – Ventilation Shaft Non-PAG Sample – Laboratory Testing Results
  - Individual laboratory testing results
- Attachment A.3 – Direct Shear Laboratory Testing Results
  - Individual laboratory testing results

3.1 Main Shaft Non-PAG Sample Laboratory Testing Results

A summary of the average particle size distribution, specific gravity, durability, and alkali silica reaction (ASR) laboratory testing results of the Main Shaft non-PAG crushed core samples can be referenced in Tables 3.1 through 3.4, respectively.

TABLE 3.1 – PARTICLE SIZE DISTRIBUTION MAIN SHAFT[1]

Particle Size	3”	2”	1.5”	1.0”	0.75”	0.5”	0.375”
Avg Percent Passing (%)	100	100	100	87.4	56.6	30.9	23.8
Particle Size	**#4**	**#10**	**#16**	**#40**	**#50**	**#100**	**#200**
Avg Percent Passing (%)	14.2	7.9	5.9	3.5	2.8	1.9	1.3

Note: [1]Particle size distribution results (shown in Table) represent post-crushing material properties. Crushed samples were sourced from cylindrical HQ core samples (approximately 2.5 inches in diameter) and actual development of the main/ventilation shafts will produce materials with different shapes and sizes.

TABLE 3.2 – MAIN SHAFT NON-PAG SPECIFIC GRAVITY TESTING RESULTS

Location[1]	Coarse Aggregate		Fine Aggregate	
	Bulk Specific Gravity	Absorption (%)	Bulk Specific Gravity	Absorption (%)
MVAND-21-01	2.780	0.6	2.712	1.6
MVAND-21-02	2.746	0.4	2.687	1.4
MVAND-21-03	2.774	0.4	2.675	1.6
HSVOL-21-03	2.587	1.2	2.536	2.5
HSVOL-21-04	2.551	3.1	2.469	3.9
HSVOL-21-05	2.625	1.3	2.485	3.8
OLDVOL-21-01	2.438	3.3	2.370	4.6
OLDVOL-21-02	2.597	1.3	2.497	2.9
OLDVOL-21-03	2.571	1.5	2.582	2.1
C1-21-01	2.635	1.1	2.677	0.3

Note: [1]See Table 2.1 for main shaft sample details including: location, sample number, lithology, depth, core box number(s), and material type.

TABLE 3.3 – MAIN SHAFT NON-PAG DURABILITY TESTING RESULTS

Location[1]	LA Abrasion (% loss)	Sodium Sulfate Soundness (Weighted % Loss)		Slake Durability (% Retained and Description)
		Coarse Aggregate	Fine Aggregate	
MVAND-21-01	15	3.2	8.8	99.7, Type 1
MVAND-21-02	15	0.8	6.5	99.7, Type 1
MVAND-21-03	14	0.5	9.5	99.8, Type 1
HSVOL-21-03	17	6.9	15.1	99.3, Type 1
HSVOL-21-04	20	6.6	26.1	98.9, Type 1
HSVOL-21-05	18	19.3	26.7	99.4, Type 1
OLDVOL-21-01	17	13.2	31.5	95.4, Type 1
OLDVOL-21-02	17	6.3	19.5	99.1, Type 1
OLDVOL-21-03	18	3.4	17.3	99.5, Type 1
C1-21-01	65	6.3	38.8	98.6, Type 1

Note: [1]See Table 2.1 for main shaft sample details including: location, sample number, lithology, depth, core box number(s), and material type.

TABLE 3.4 – MAIN SHAFT NON-PAG ALKALI SILICA REACTIVITY (ASR) TESTING RESULTS

Location[1]	Days[2]	Expansion (%)	Classification
MVAND-21-02	14	0.10	Innocuous

Notes: [1]See Table 2.1 for main shaft sample details including: location, sample number, lithology, depth, core box number(s), and material type. [2]Number of days is based on zero reading 2 days after cast date.

Listed below is a summary of the main shaft non-PAG sample laboratory testing results:

- The material tested consists primarily of 1-inch minus material and the average fines content was measured to be 1.3% passing the #200 sieve (ranging from 0.5% to 2.7%)
- LA Abrasion tests resulted in an average loss of 16.8% (excluding the outlier of 65% as measured in sample C1-21-01)
- Sodium sulfate soundness tests resulted in an average loss of 6.7% and 20% for the coarse and fine aggregate, respectively.
- Slake durability tests resulted in an average retainment of 98.9% and all samples classified as Type 1.
- ASR testing resulted in expansion values of 0.08% at 16 days after casting which is indicative of innocuous behavior in most cases.

3.2 Ventilation Shaft Non-PAG Sample Laboratory Testing Results

A summary of the average particle size distribution, specific gravity, durability, and ASR laboratory testing results of the Ventilation Shaft non-PAG crushed core samples can be referenced in Tables 3.5 through 3.8, respectively.

TABLE 3.5 – PARTICLE SIZE DISTRIBUTION VENT SHAFT[1]

Particle Size	3”	2”	1.5”	1.0”	0.75”	0.5”	0.375”
Avg Percent Passing (%)	100	100	100	100	99.8	92.0	72.8
Particle Size	**#4**	**#10**	**#16**	**#40**	**#50**	**#100**	**#200**
Avg Percent Passing (%)	47.9	28.6	20.8	11.7	9.6	6.7	4.9

Note: [1]Particle size distribution results (shown in Table) represent post-crushing material properties. Crushed samples were sourced from cylindrical HQ core samples (approximately 2.5 inches in diameter) and actual development of the main/ventilation shafts will produce materials with different shapes and sizes.

TABLE 3.6 – VENTILATION SHAFT NON-PAG SPECIFIC GRAVITY TESTING RESULTS

Location[1]	Coarse Aggregate		Fine Aggregate	
	Bulk Specific Gravity	Absorption (%)	Bulk Specific Gravity	Absorption (%)
MVAND-21-04	2.747	0.7	2.609	2.3
MVAND-21-05	2.737	0.9	2.637	2.2
MVAND-21-06	2.722	0.6	2.658	1.6
MVAND-21-07	2.755	0.6	2.659	2.0
HSVOL-21-06	2.560	1.8	2.370	4.3
HSVOL-21-07	2.617	0.9	2.474	1.9
HSVOL-21-08	2.610	1.1	2.531	2.1
HSVOL-21-10	2.813	1.1	2.535	3.2
HSVOL-21-11	2.665	0.6	2.473	2.2
OLDVOL-21-05	2.716	1.1	2.581	2.4

Note: [1]See Table 2.2 for ventilation shaft sample details including: location, sample number, lithology, depth, core box number(s), and material type.

TABLE 3.7 – VENTILATION SHAFT NON-PAG DURABILITY TESTING RESULTS[2]

Location[1]	LA Abrasion (% loss)	Sodium Sulfate Soundness (Weighted % Loss)	
		Coarse Aggregate	Fine Aggregate
MVAND-21-04	12	8.2	8.5
MVAND-21-05	11	2.7	7.1
MVAND-21-06	10	0.7	3.3
MVAND-21-07	10	1.1	2.8
HSVOL-21-06	13	10.5	18.8
HSVOL-21-07	12	2.5	3.3
HSVOL-21-08	13	1.0	4.2
HSVOL-21-10	11	4.8	15.5
HSVOL-21-11	12	1.3	3.0
OLDVOL-21-05	13	4.5	9.1

Note: [1]See Table 2.2 for ventilation shaft sample details including: location, sample number, lithology, depth, core box number(s), and material type. [2]Ventilation Shaft samples contained particles too small to perform slake durability testing.

TABLE 3.8 – VENTILATION SHAFT NON-PAG ASR TESTING RESULTS

Location[1]	Days[2]	Expansion (%)	Classification
MVAND-21-06	14	0.10	Potentially Deleterious
HSVOL-21-08	14	0.17	Potentially Deleterious
OLDVOL-21-05	14	0.19	Potentially Deleterious

Note: [1]See Table 2.2 for ventilation shaft sample details including: location, sample number, lithology, depth, core box number(s), and material type. [1]Number of days is based on zero reading 2 days after cast date.

Listed below is a summary of the ventilation shaft non-PAG sample laboratory testing results:

- The material tested consists primarily of 1-inch minus material and the average fines content was measured to be 4.9% passing the #200 sieve (ranging from 1.5% to 7.2%)
- LA Abrasion tests resulted in an average loss of 12.2%.
- Sodium sulfate soundness tests resulted in an average loss of 4.5% and 8.0% for the coarse and fine aggregate, respectively.
- Slake durability tests were not performed on the ventilation shaft samples because the particle sizes were too small.
- ASR testing resulted in expansion values of 0.10% to 0.19% at 16 days after casting which are indicative of innocuous (on the lower end test results) and potentially deleterious expansion (on the upper end of test results).

3.3 Direct Shear Laboratory Testing Results

Direct shear tests were conducted on the PAG core samples produced from the pilot holes drilled at the main and ventilation shaft locations. The tests utilized an 8-inch diameter square mold, which required removal of particles greater than ¾-inch diameter prior to testing according to the test standard.

Sample materials were remolded to 95% of the maximum dry density. Each sample was inundated with water, loaded with a normal pressure, allowed to consolidate, and sheared at a rate of 0.01 inches per minute. Testing was continued until approximately 15% max strain was obtained. Normal loads used during testing were 2, 4, and 8 kips per square foot (kip/ft^2). Mohr-Coulomb strength parameters were interpreted at peak shear stress (with the exception of HSVOL-21-01, failure was chosen at 10% strain). Direct shear test results are summarized in Table 3.9.

TABLE 3.9 – MAIN AND VENTILATION SHAFT SAMPLE DIRECT SHEAR TESTING RESULTS

Description	Location[1]	Mohr-Coulomb Strength Properties	
		Φ (degrees)	Cohesion (psf)
Main Shaft	HSVOL-21-01	48.0	1523
	HSVOL-21-02	34.5	1182
Ventilation Shaft	HSVOL-21-09	45.8	3031
	OLDVOL-21-04	44.8	1522

[1]See Table 2.1 (main shaft) and Table 2.2 (ventilation shaft) for sample details including: location, sample number, lithology, depth, core box number(s), and material type.

Attachment A
Laboratory Testing Results

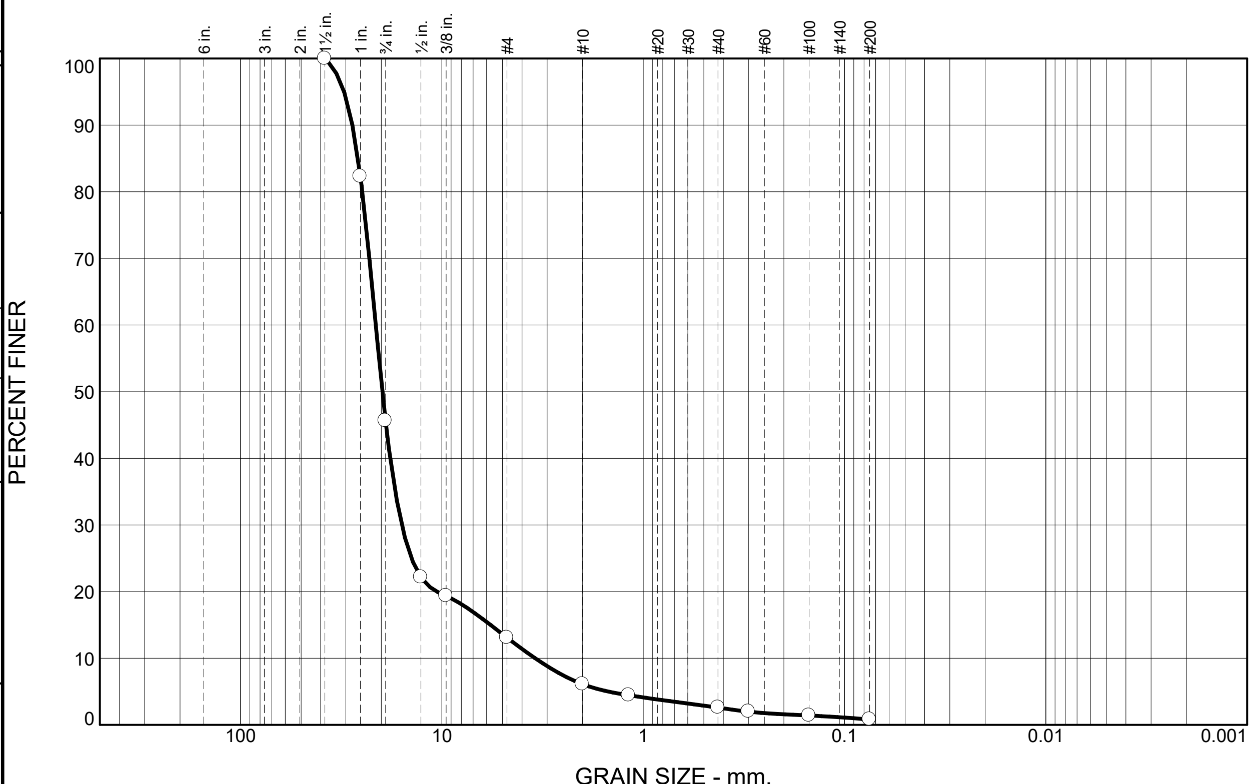
Attachment A
South32 (AMI)
Hermosa Project
Geotechnical Laboratory Testing (Main and Ventilation Shaft Boreholes)
Laboratory Testing Summary

	Location (Field ID)	Sample Number (Laboratory ID)	Date Tested	Sample Depth (ft)	GRAIN SIZE DISTRIBUTION - PERCENT PASSING														USCS	ATTERBERG LIMITS			Coarse Aggregate Bulk Specific Gravity	Coarse Aggregate Absorption (%)	Fine Aggregate Bulk Specific Gravity	Fine Aggregate Absorption (%)	LA Abrasion (%)	Coarse Aggregate Sulfate Soundess (Weighted % Loss)	Fine Aggregate Sulfate Soundess (Weighted % Loss)	Slake Durability
					GRAVEL							SAND						CLAY/ SILT												
					3.0"	2.0"	1.5"	1.0"	0.75"	0.5"	0.375"	#4	#10	#16	#40	#50	#100	#200		LIQUID LIMIT	PLASTIC LIMIT	PLASTIC INDEX								
Main Shaft	MVAND-21-01	22-069-01	4/14/2022	110 - 130	100.0	100.0	100.0	82.3	45.6	22.2	19.3	13.1	6.1	4.4	2.6	2.0	1.4	0.8	GP	NP	NP	NP	2.780	0.6	2.712	1.6	15	3.2	8.8	99.7, Type 1
	MVAND-21-02	22-069-02	4/14/2022	310 - 330	100.0	100.0	100.0	78.2	45.8	25.1	18.9	8.0	3.4	2.5	1.6	1.4	0.9	0.5	GP	NP	NP	NP	2.746	0.4	2.687	1.4	15	0.8	6.5	99.7, Type 1
	MVAND-21-03	22-069-03	4/14/2022	725 - 745	100.0	100.0	100.0	79.0	45.6	24.5	18.7	9.9	5.6	4.1	2.1	1.6	0.9	0.6	GW	NP	NP	NP	2.774	0.4	2.675	1.6	14	0.5	9.5	99.8, Type 1
	HSVOL-21-01	22-069-04	4/14/2022	1005 - 1025	100.0	100.0	100.0	84.9	51.7	28.0	21.4	14.4	8.5	6.3	3.5	2.9	2.0	1.3	GP	NP	NP	NP	-	-	-	-	-	-	-	-
	HSVOL-21-02	22-069-05	4/14/2022	1300 - 1320	100.0	100.0	100.0	96.8	78.1	48.1	37.5	26.3	14.8	10.3	5.6	4.6	3.2	2.1	GW	29	15	14	-	-	-	-	-	-	-	-
	HSVOL-21-03	22-069-06	4/14/2022	1700 - 1720	100.0	100.0	100.0	85.3	51.8	26.1	19.7	9.4	4.0	2.6	1.3	1.0	0.7	0.4	GW	21	16	5	2.587	1.2	2.536	2.5	17	6.9	15.1	99.3, Type 1
	HSVOL-21-04	22-069-07	4/14/2022	1850 - 1870	100.0	100.0	100.0	86.7	53.2	30.5	23.7	15.2	9.3	7.1	4.4	3.7	2.7	1.9	GP	24	15	9	2.551	3.1	2.469	3.9	20	6.6	26.1	98.9, Type 1
	HSVOL-21-05	22-069-08	4/14/2022	2380 - 2400	100.0	100.0	100.0	91.1	62.8	35.8	27.6	19.9	10.3	7.1	3.6	2.9	1.9	1.4	GP	NP	NP	NP	2.625	1.3	2.485	3.8	18	19.3	26.7	99.4, Type 1
	OLDVOL-21-01	22-069-09	4/15/2022	2650 - 2670	100.0	100.0	100.0	87.0	55.6	28.5	21.0	7.9	3.1	2.2	1.4	1.2	0.9	0.7	GP	37	18	19	2.438	3.3	2.370	4.6	17	13.2	31.5	95.4, Type 1
	OLDVOL-21-02	22-069-10	4/15/2022	2890 - 2910	100.0	100.0	100.0	90.4	59.7	31.3	23.2	13.0	7.7	6.0	3.8	3.2	2.3	1.6	GW	26	17	9	2.597	1.3	2.497	2.9	17	6.3	19.5	99.1, Type 1
	OLDVOL-21-03	22-069-11	4/15/2022	3435 - 3455	100.0	100.0	100.0	92.4	62.5	33.6	24.7	12.2	5.8	4.1	2.4	2.1	1.5	1.1	GW	24	14	10	2.571	1.5	2.582	2.1	18	3.4	17.3	99.5, Type 1
	C1-21-01	22-069-12	4/15/2022	3905 - 3925	100.0	100.0	100.0	94.7	66.4	37.4	30.2	20.5	15.8	14.2	9.3	7.1	4.2	2.7	GP	NP	NP	NP	2.635	1.1	2.677	0.3	65	6.3	38.8	98.6, Type 1
Ventilation Shaft	MVAND-21-04	21-341-01	12/17/2021	115 - 150	100.0	100.0	100.0	99.9	99.7	91.0	71.8	60.8	42.3	32.7	19.4	16.0	10.5	7.0	SW-SM	NP	NP	NP	2.747	0.7	2.609	2.3	12	8.2	8.5	-
	MVAND-21-05	21-341-02	12/17/2021	300 - 325	100.0	100.0	100.0	100.0	99.8	89.9	69.2	46.9	29.4	22.0	13.0	10.9	7.7	5.5	GW-GC	19	15	4	2.737	0.9	2.637	2.2	11	2.7	7.1	-
	MVAND-21-06	21-341-03	12/17/2021	745 - 785	100.0	100.0	100.0	100.0	99.7	90.8	70.3	35.1	15.6	10.2	5.9	5.0	3.6	2.6	GW	NP	NP	NP	2.722	0.6	2.658	1.6	10	0.7	3.3	-
	MVAND-21-07	21-341-04	12/17/2021	895 - 925	100.0	100.0	100.0	100.0	99.7	89.9	69.1	52.0	33.9	25.4	14.9	12.4	8.6	6.1	GW-GM	NP	NP	NP	2.755	0.6	2.659	2	10	1.1	2.8	-
	HSVOL-21-06	21-341-05	12/20/2021	1180 - 1205	100.0	100.0	100.0	100.0	99.9	93.1	73.5	55.6	34.9	25.2	13.5	11.1	7.9	5.8	SW-SC	23	16	7	2.560	1.8	2.370	4.3	13	10.5	18.8	-
	HSVOL-21-07	21-341-06	12/20/2021	1575 - 1600	100.0	100.0	100.0	100.0	99.8	93.4	75.6	46.2	23.8	16.4	8.6	6.9	4.5	3.3	GW	NP	NP	NP	2.617	0.9	2.474	1.9	12	2.5	3.3	-
	HSVOL-21-08	21-341-07	12/20/2021	1675 - 1705	100.0	100.0	100.0	99.9	99.6	91.3	71.1	52.1	33.8	25.4	14.4	11.7	7.9	5.5	GW-GM	NP	NP	NP	2.610	1.1	2.531	2.1	13	1.0	4.2	-
	HSVOL-21-09	21-341-08	12/20/2021	2255 - 2280	100.0	100.0	100.0	100.0	99.9	92.7	73.6	52.4	29.3	19.8	10.2	8.3	5.9	4.8	SW	NP	NP	NP	2.642	1.4	2.529	3.3	13	1.1	4.2	-
	HSVOL-21-10	21-341-09	12/20/2021	2330 - 2360	100.0	100.0	100.0	99.9	99.8	91.8	72.9	41.0	22.6	16.3	9.2	7.8	5.9	4.5	GW	NP	NP	NP	2.813	1.1	2.535	3.2	11	4.8	15.5	-
	HSVOL-21-11	21-341-10	12/20/2021	2630 - 2655	100.0	100.0	100.0	100.0	99.8	91.6	72.9	46.6	30.5	23.3	13.6	11.1	7.2	5.0	GW-GM	NP	NP	NP	2.665	0.6	2.473	2.2	12	1.3	3.0	-
	OLDVOL-21-04	21-341-11	12/20/2021	2690 - 2710	100.0	100.0	100.0	100.0	99.9	94.6	78.0	57.4	35.8	26.1	14.5	12.2	9.3	7.2	SW-SC	19	15	4	2.648	2.3	2.452	3.3	16	15.4	16.7	-
	OLDVOL-21-05	21-341-12	12/20/2021	2725 - 2740	100.0	100.0	100.0	100.0	99.9	93.3	75.8	28.3	11.2	6.3	2.6	2.1	1.6	1.5	GW	NP	NP	NP	2.716	1.1	2.581	2.4	13	4.5	9.1	-

Attachment A.1

Main Shaft Non-PAG Sample – Laboratory Testing Results

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	54.4	32.5	7.0	3.5	1.8	0.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
1	82.3		
.75	45.6		
.5	22.2		
.375	19.3		
#4	13.1		
#10	6.1		
#16	4.4		
#40	2.6		
#50	2.0		
#100	1.4		
#200	0.8		

* (no specification provided)

Soil Description

Gray poorly graded gravel

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 27.8277 D_{85}= 26.1172 D_{60}= 21.3076
D_{50}= 19.7563 D_{30}= 15.8056 D_{15}= 5.7315
D_{10}= 3.4440 C_u= 6.19 C_c= 3.40

Classification

USCS= GP AASHTO= A-1-a

Remarks

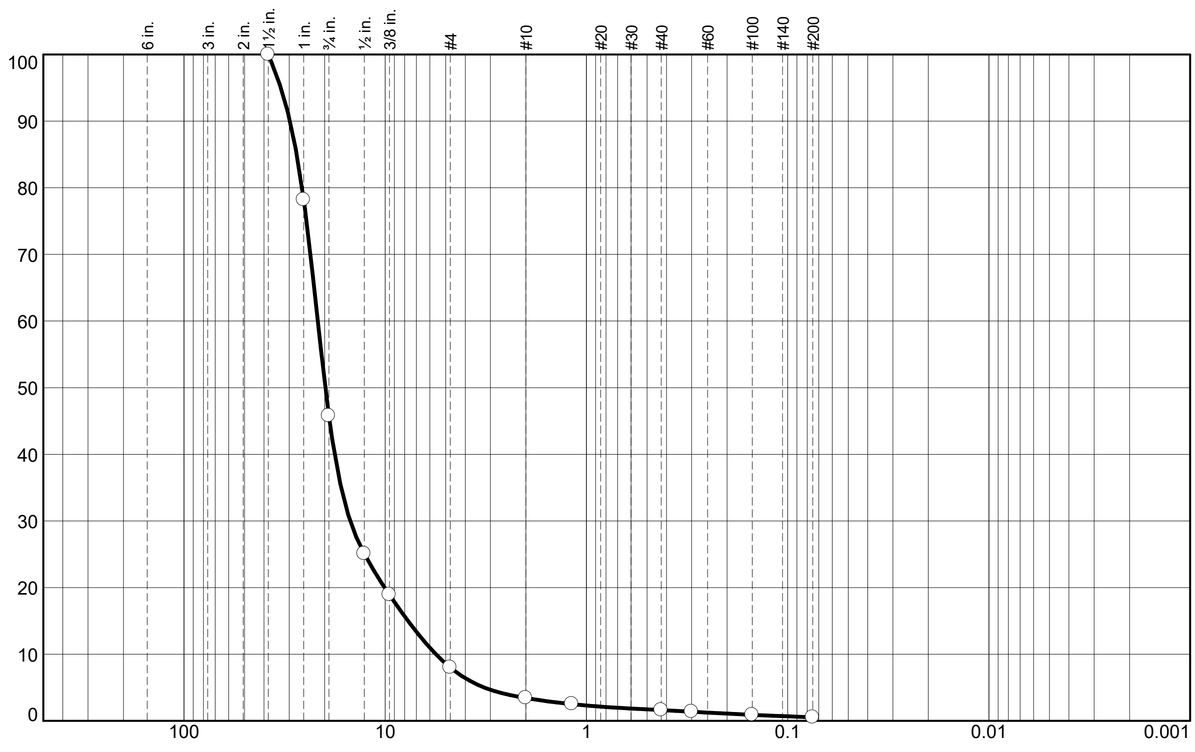
Location: MVAND-21-01
Sample Number: 22-069-01 **Depth:** 110-130' **Date:** 4/14/2022

NewFields

Client: South 32
Project: Hermosa Core Lab Testing
Project No: 475.0014.027 **Figure** 22-069-01

Tested By: TF/EG **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	54.2	37.8	4.6	1.8	1.1	0.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
1	78.2		
.75	45.8		
.5	25.1		
.375	18.9		
#4	8.0		
#10	3.4		
#16	2.5		
#40	1.6		
#50	1.4		
#100	0.9		
#200	0.5		

* (no specification provided)

Soil Description

Gray poorly graded gravel

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 29.7143 D_{85}= 27.5132 D_{60}= 21.6406
D_{50}= 19.8480 D_{30}= 14.9208 D_{15}= 7.7037
D_{10}= 5.5979 C_u= 3.87 C_c= 1.84

Classification

USCS= GP AASHTO= A-1-a

Remarks

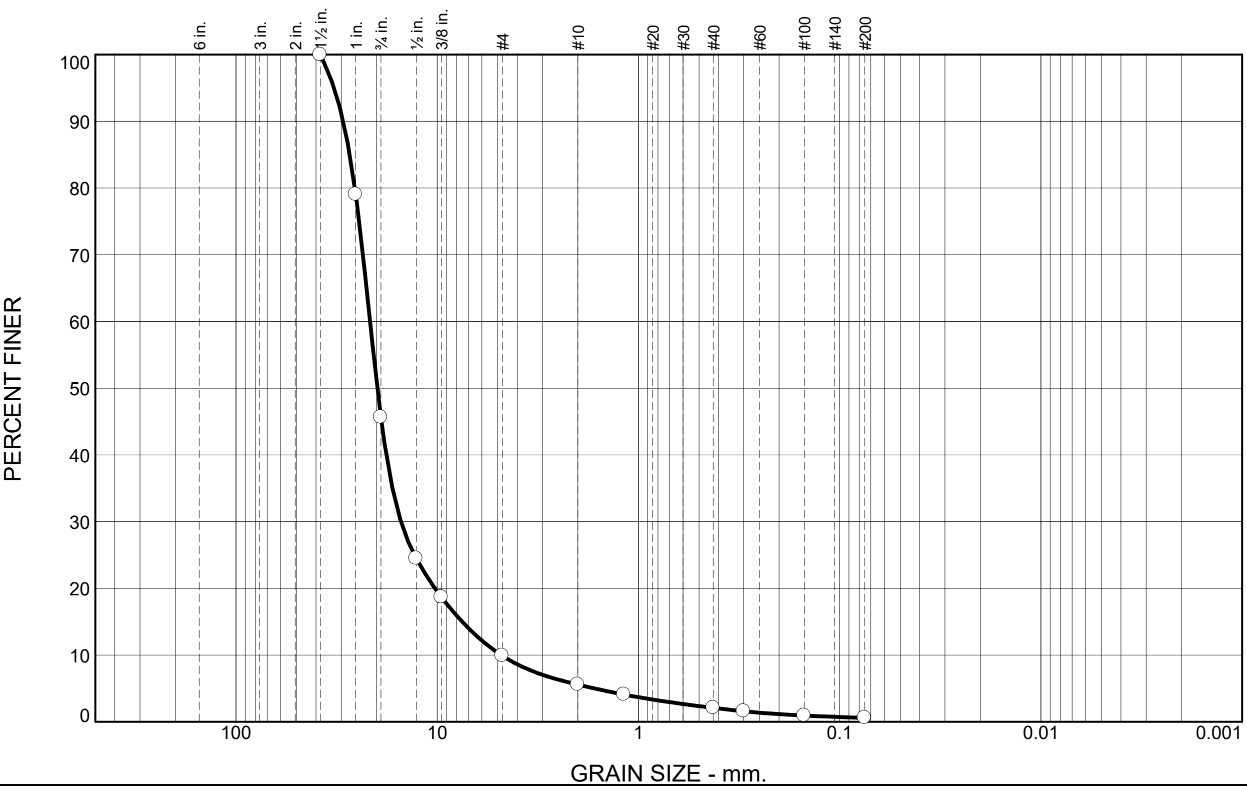
Location: MVAND-21-02
Sample Number: 22-069-02 **Depth:** 310-330' **Date:** 4/14/2022

NewFields

Client: South 32
Project: Hermosa Core Lab Testing
Project No: 475.0014.027 **Figure** 22-069-02

Tested By: EG/TF **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	54.4	35.7	4.3	3.5	1.5	0.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
1	79.0		
.75	45.6		
.5	24.5		
.375	18.7		
#4	9.9		
#10	5.6		
#16	4.1		
#40	2.1		
#50	1.6		
#100	0.9		
#200	0.6		

* (no specification provided)

Soil Description

Gray well-graded gravel

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 29.2941 D_{85}= 27.1896 D_{60}= 21.5769
D_{50}= 19.8441 D_{30}= 15.1350 D_{15}= 7.5148
D_{10}= 4.8074 C_u= 4.49 C_c= 2.21

Classification

USCS= GW AASHTO= A-1-a

Remarks

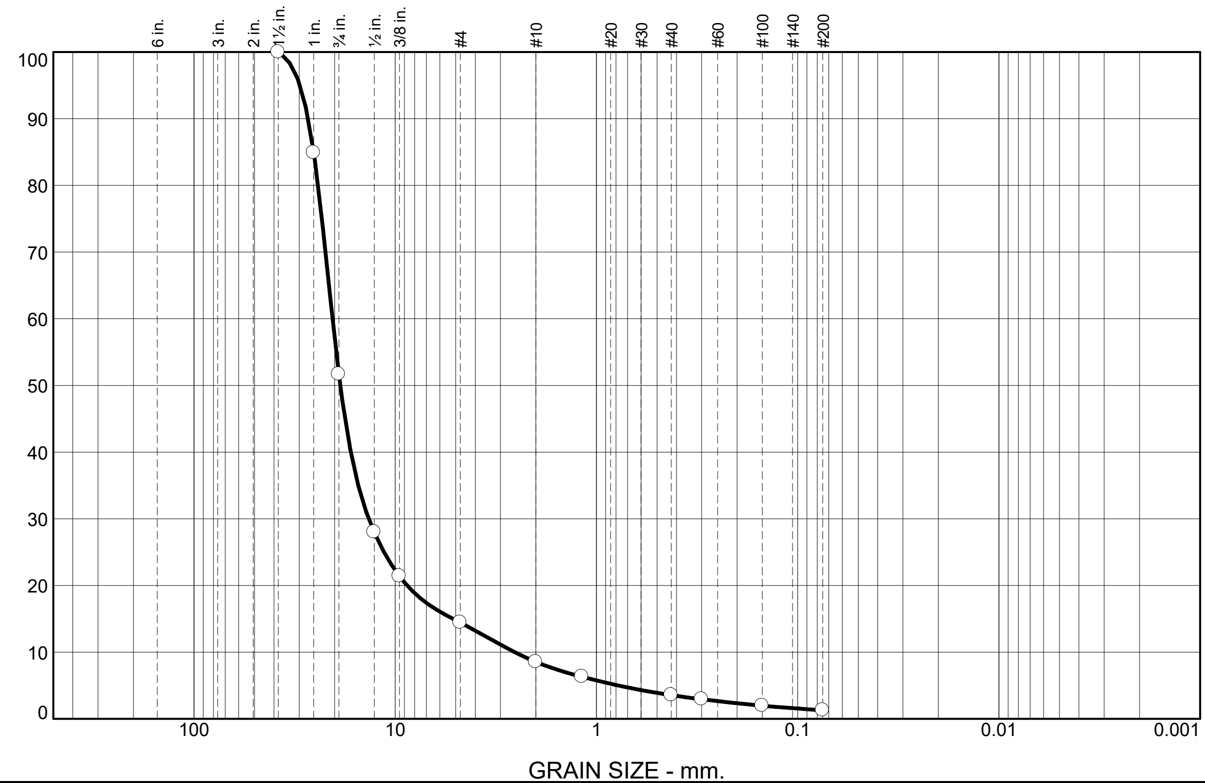
Location: MVAND-21-03
Sample Number: 22-069-03 **Depth:** 725-745' **Date:** 4/14/2022

NewFields

Client: South 32
Project: Hermosa Core Lab Testing
Project No: 475.0014.027 **Figure** 22-069-03

Tested By: TF/EG **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	48.3	37.3	5.9	5.0	2.2	1.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
1	84.9		
.75	51.7		
.5	28.0		
.375	21.4		
#4	14.4		
#10	8.5		
#16	6.3		
#40	3.5		
#50	2.9		
#100	2.0		
#200	1.3		

* (no specification provided)

Soil Description

Gray poorly graded gravel

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 27.0738 D_{85}= 25.4232 D_{60}= 20.4943
D_{50}= 18.7419 D_{30}= 13.5302 D_{15}= 5.1581
D_{10}= 2.5454 C_u= 8.05 C_c= 3.51

Classification

USCS= GP AASHTO= A-1-a

Remarks

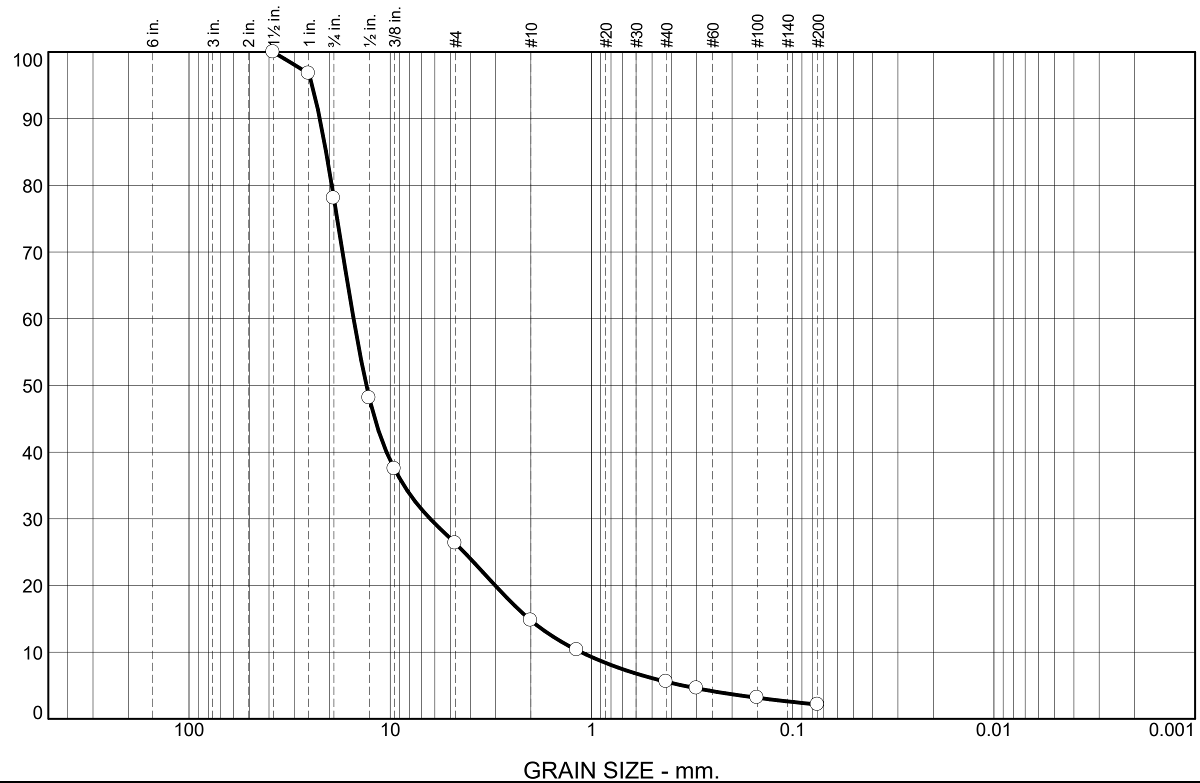
Location: HSVOL-21-01
Sample Number: 22-069-04 **Depth:** 1005-1025' **Date:** 4/14/2022

NewFields

Client: South 32
Project: Hermosa Core Lab Testing
Project No: 475.0014.027 **Figure** 22-069-04

Tested By: TF/EG **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	21.9	51.8	11.5	9.2	3.5	2.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
1	96.8		
.75	78.1		
.5	48.1		
.375	37.5		
#4	26.3		
#10	14.8		
#16	10.3		
#40	5.6		
#50	4.6		
#100	3.2		
#200	2.1		

* (no specification provided)

Soil Description

Gray well-graded gravel with sand

Atterberg Limits

PL= 15 LL= 29 PI= 14

Coefficients

D_{90}= 22.3836 D_{85}= 20.8360 D_{60}= 15.1934
D_{50}= 13.1270 D_{30}= 6.3304 D_{15}= 2.0437
D_{10}= 1.1262 C_u= 13.49 C_c= 2.34

Classification

USCS= GW AASHTO= A-2-6(0)

Remarks

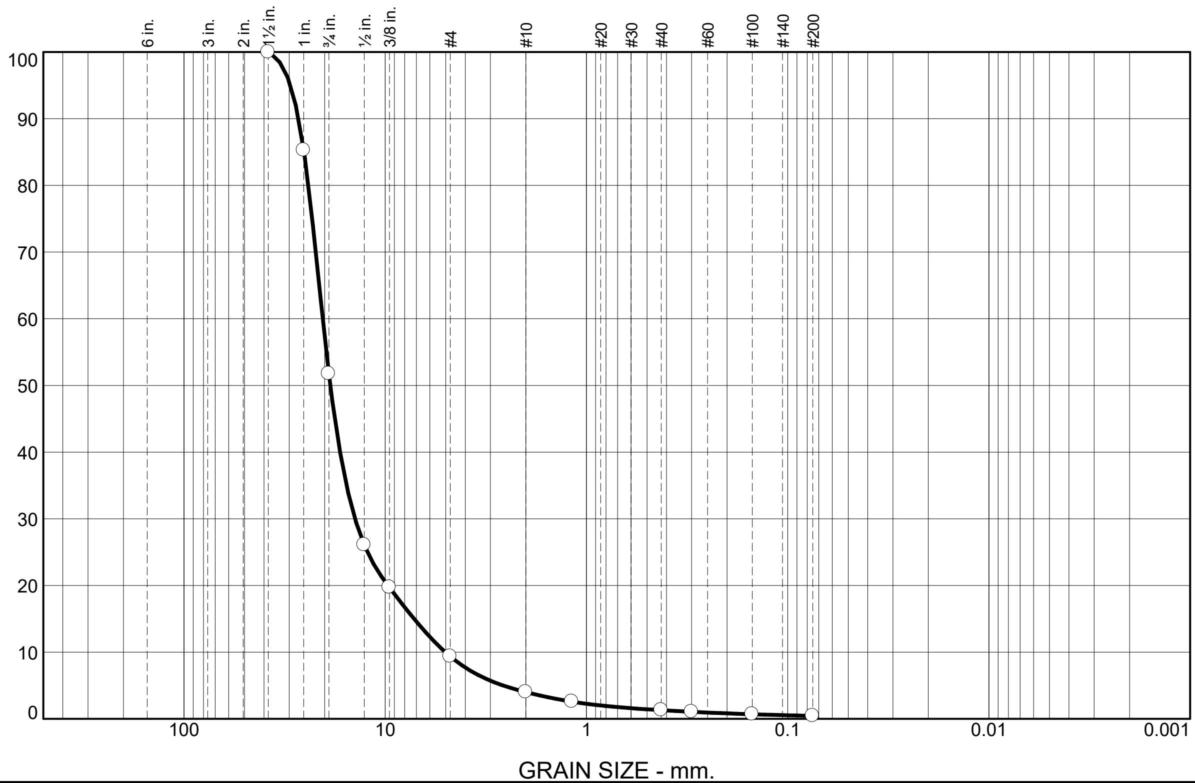
Location: HSVOL-21-02
Sample Number: 22-069-05 **Depth:** 1300-1320' **Date:** 4/14/2022

NewFields

Client: South 32
Project: Hermosa Core Lab Testing
Project No: 475.0014.027 **Figure** 22-069-05

Tested By: TF/EG **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	48.2	42.4	5.4	2.7	0.9	0.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
1	85.3		
.75	51.8		
.5	26.1		
.375	19.7		
#4	9.4		
#10	4.0		
#16	2.6		
#40	1.3		
#50	1.0		
#100	0.7		
#200	0.4		

* (no specification provided)

Soil Description

Gray well-graded gravel

Atterberg Limits

PL= 16 LL= 21 PI= 5

Coefficients

D_{90}= 26.9524 D_{85}= 25.3265 D_{60}= 20.4456
D_{50}= 18.7371 D_{30}= 14.1165 D_{15}= 7.1888
D_{10}= 5.0262 C_u= 4.07 C_c= 1.94

Classification

USCS= GW AASHTO= A-1-a

Remarks

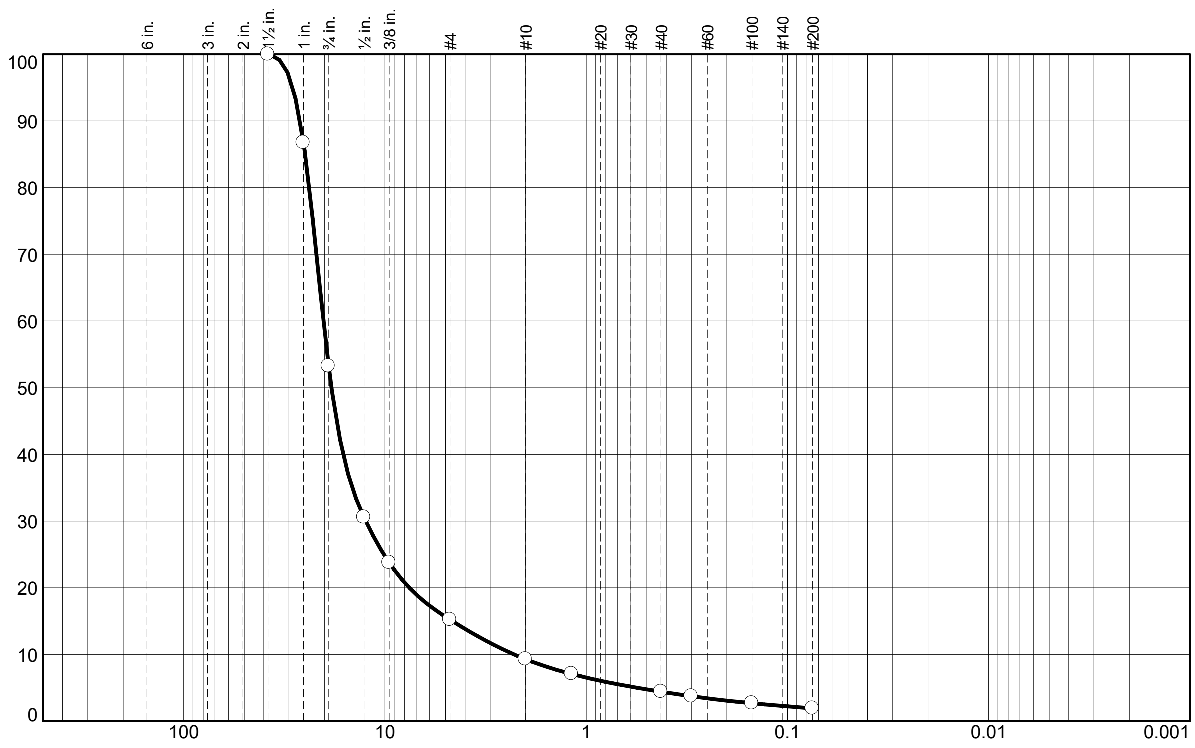
Location: HSVOL-21-03
Sample Number: 22-069-06 **Depth:** 1700-1720' **Date:** 4/14/2022

NewFields

Client: South 32
Project: Hermosa Core Lab Testing
Project No: 475.0014.027 **Figure** 22-069-06

Tested By: TF/EG **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	46.8	38.0	5.9	4.9	2.5	1.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
1	86.7		
.75	53.2		
.5	30.5		
.375	23.7		
#4	15.2		
#10	9.3		
#16	7.1		
#40	4.4		
#50	3.7		
#100	2.7		
#200	1.9		

* (no specification provided)

Soil Description

Gray poorly graded gravel

Atterberg Limits

PL= 15 LL= 24 PI= 9

Coefficients

D_{90}= 26.4193 D_{85}= 24.9409 D_{60}= 20.2233
D_{50}= 18.4358 D_{30}= 12.4554 D_{15}= 4.6319
D_{10}= 2.2857 C_u= 8.85 C_c= 3.36

Classification

USCS= GP AASHTO= A-2-4(0)

Remarks

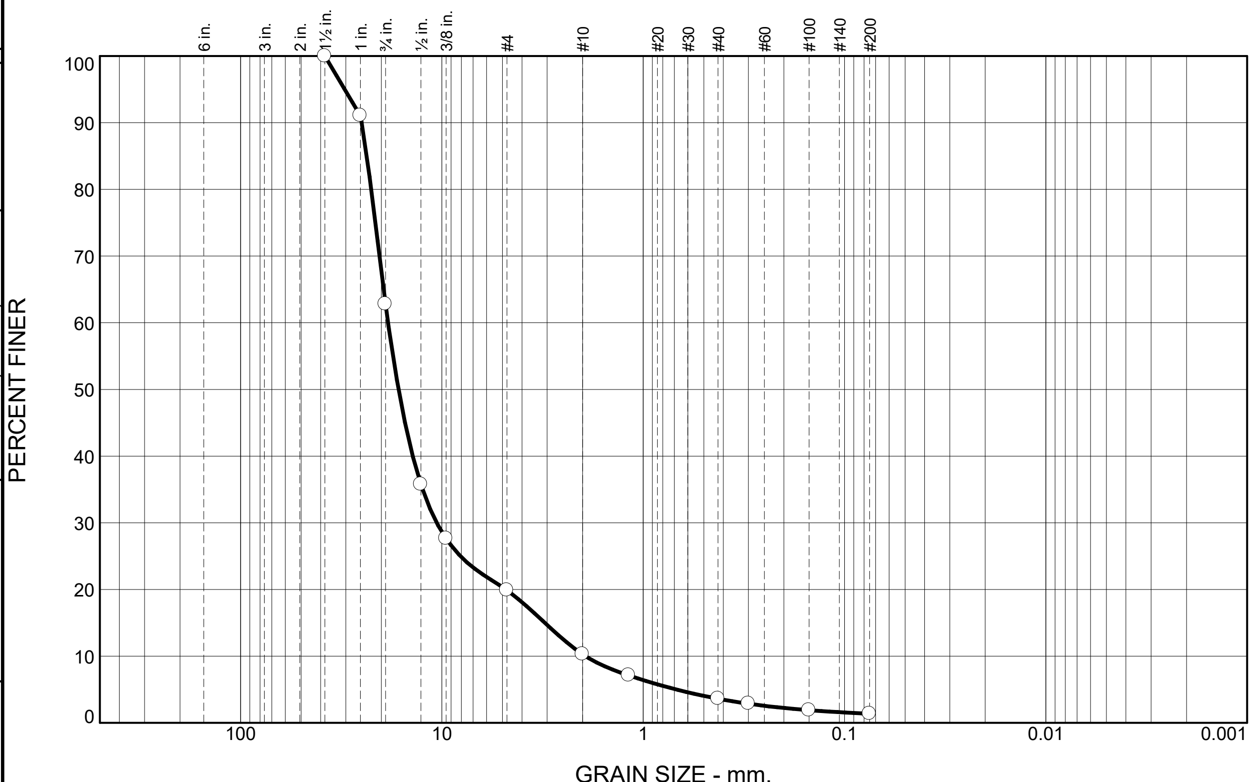
Location: HSVOL-21-04
Sample Number: 22-069-07 **Depth:** 1850-1870' **Date:** 4/14/2022

NewFields

Client: South 32
Project: Hermosa Core Lab Testing
Project No: 475.0014.027 **Figure** 22-069-07

Tested By: TF/EG **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	37.2	42.9	9.6	6.7	2.2	1.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
1	91.1		
.75	62.8		
.5	35.8		
.375	27.6		
#4	19.9		
#10	10.3		
#16	7.1		
#40	3.6		
#50	2.9		
#100	1.9		
#200	1.4		

* (no specification provided)

Soil Description

Gray poorly graded gravel with sand

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 25.0418 D_{85}= 23.6211 D_{60}= 18.5021
D_{50}= 16.4016 D_{30}= 10.6100 D_{15}= 3.0810
D_{10}= 1.9360 C_u= 9.56 C_c= 3.14

Classification

USCS= GP AASHTO= A-1-a

Remarks

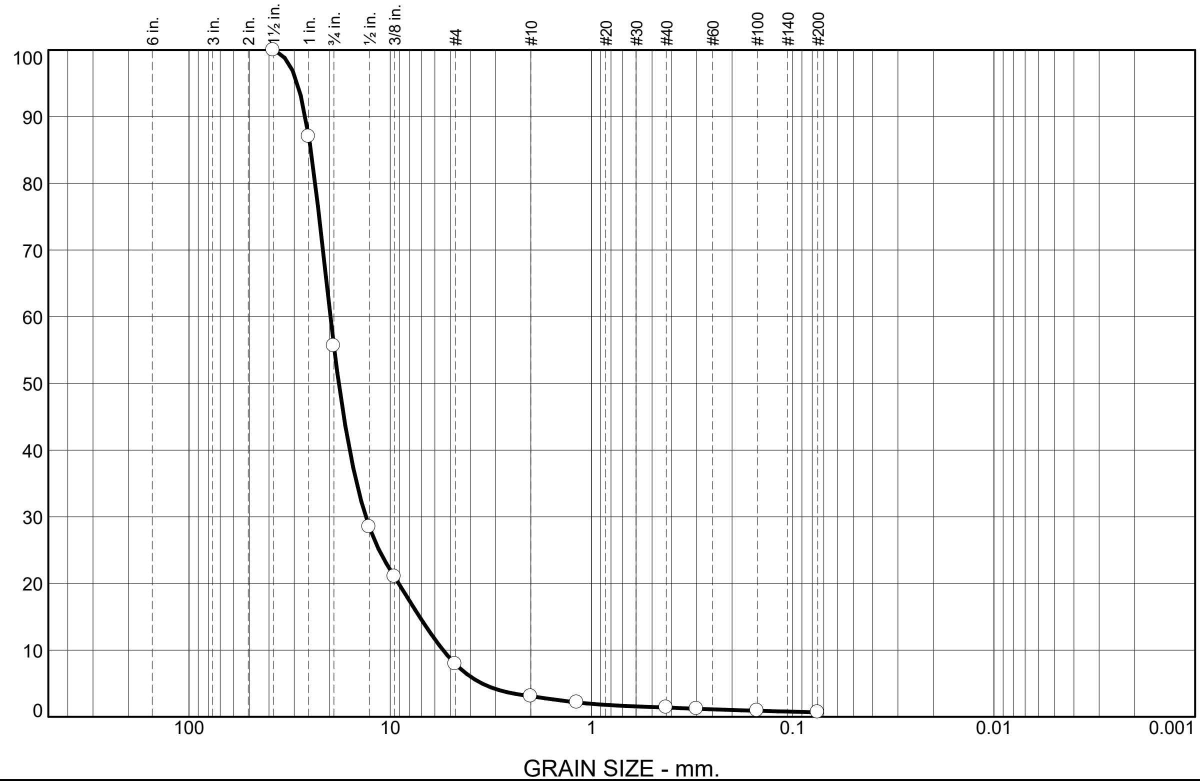
Location: HSVOL-21-05
Sample Number: 22-069-08 **Depth:** 2380-2400' **Date:** 4/14/2022

NewFields

Client: South 32
Project: Hermosa Core Lab Testing
Project No: 475.0014.027 **Figure** 22-069-08

Tested By: TF/EG **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	44.4	47.7	4.8	1.7	0.7	0.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
1	87.0		
.75	55.6		
.5	28.5		
.375	21.0		
#4	7.9		
#10	3.1		
#16	2.2		
#40	1.4		
#50	1.2		
#100	0.9		
#200	0.7		

* (no specification provided)

Soil Description

Gray poorly graded gravel

Atterberg Limits

PL= 18 LL= 37 PI= 19

Coefficients

D_{90}= 26.4124 D_{85}= 24.8221 D_{60}= 19.8241
D_{50}= 17.9953 D_{30}= 13.2075 D_{15}= 7.1432
D_{10}= 5.4600 C_u= 3.63 C_c= 1.61

Classification

USCS= GP AASHTO= A-2-6(0)

Remarks

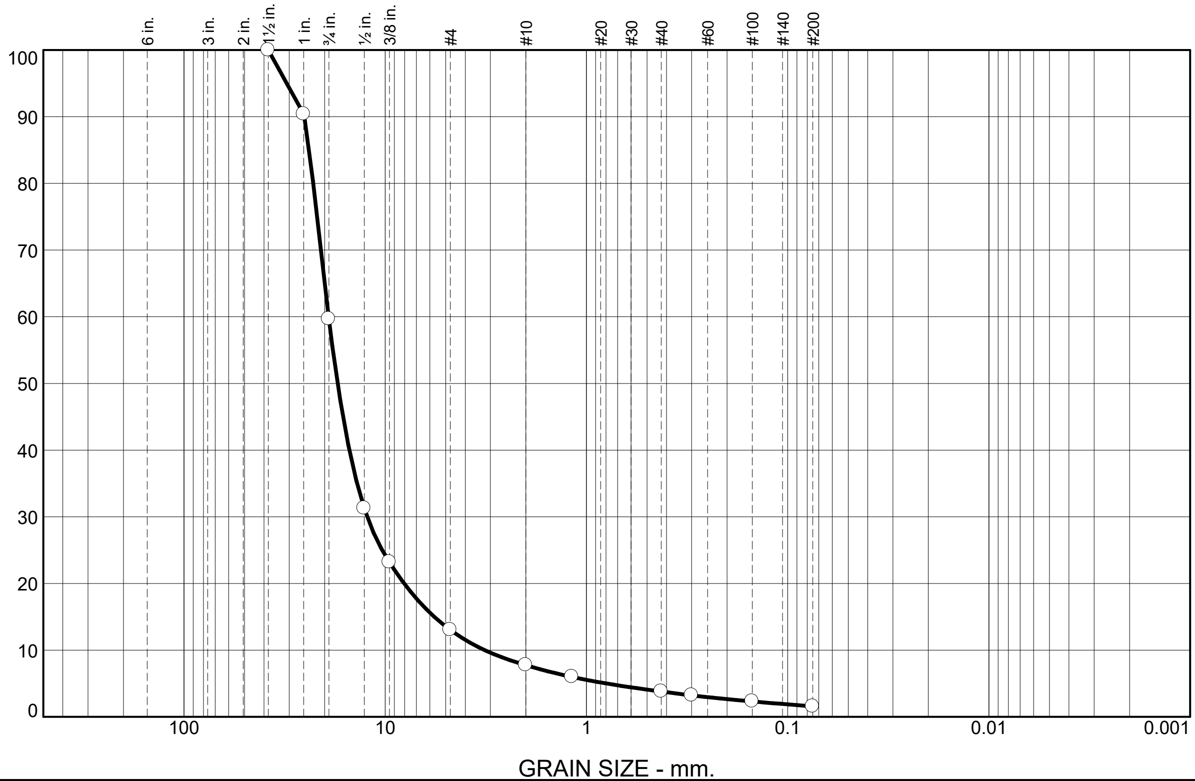
Location: OLDVOL-21-01
Sample Number: 22-069-09 **Depth:** 2650-2670' **Date:** 4/15/2022

NewFields

Client: South 32
Project: Hermosa Core Lab Testing
Project No: 475.0014.027 **Figure** 22-069-09

Tested By: TF **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	40.3	46.7	5.3	3.9	2.2	1.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
1	90.4		
.75	59.7		
.5	31.3		
.375	23.2		
#4	13.0		
#10	7.7		
#16	6.0		
#40	3.8		
#50	3.2		
#100	2.3		
#200	1.6		

* (no specification provided)

Soil Description

Gray well-graded gravel

Atterberg Limits

PL= 17 LL= 26 PI= 9

Coefficients

D_{90}= 25.2742 D_{85}= 23.9082 D_{60}= 19.1112
D_{50}= 17.2258 D_{30}= 12.2831 D_{15}= 5.7029
D_{10}= 3.2044 C_u= 5.96 C_c= 2.46

Classification

USCS= GW AASHTO= A-2-4(0)

Remarks

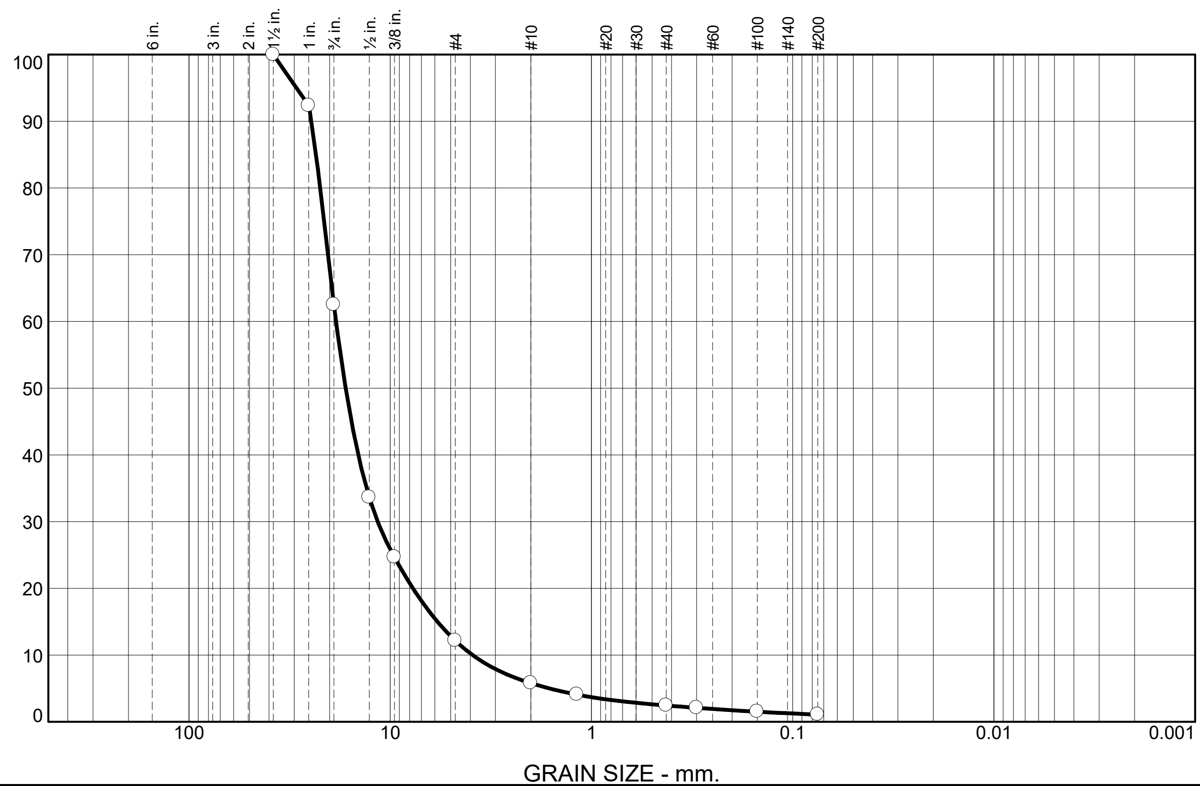
Location: OLDVOL-21-02
Sample Number: 22-069-10 **Depth:** 2890-2910' **Date:** 4/15/2022

NewFields

Client: South 32
Project: Hermosa Core Lab Testing
Project No: 475.0014.027 **Figure** 22-069-10

Tested By: EG/TF **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	37.5	50.3	6.4	3.4	1.3	1.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
1	92.4		
.75	62.5		
.5	33.6		
.375	24.7		
#4	12.2		
#10	5.8		
#16	4.1		
#40	2.4		
#50	2.1		
#100	1.5		
#200	1.1		

* (no specification provided)

Soil Description

Gray well-graded gravel

Atterberg Limits

PL= 14 LL= 24 PI= 10

Coefficients

D_{90}= 24.6593 D_{85}= 23.3724 D_{60}= 18.5882
D_{50}= 16.6380 D_{30}= 11.5428 D_{15}= 5.8271
D_{10}= 3.8948 C_u= 4.77 C_c= 1.84

Classification

USCS= GW AASHTO= A-2-4(0)

Remarks

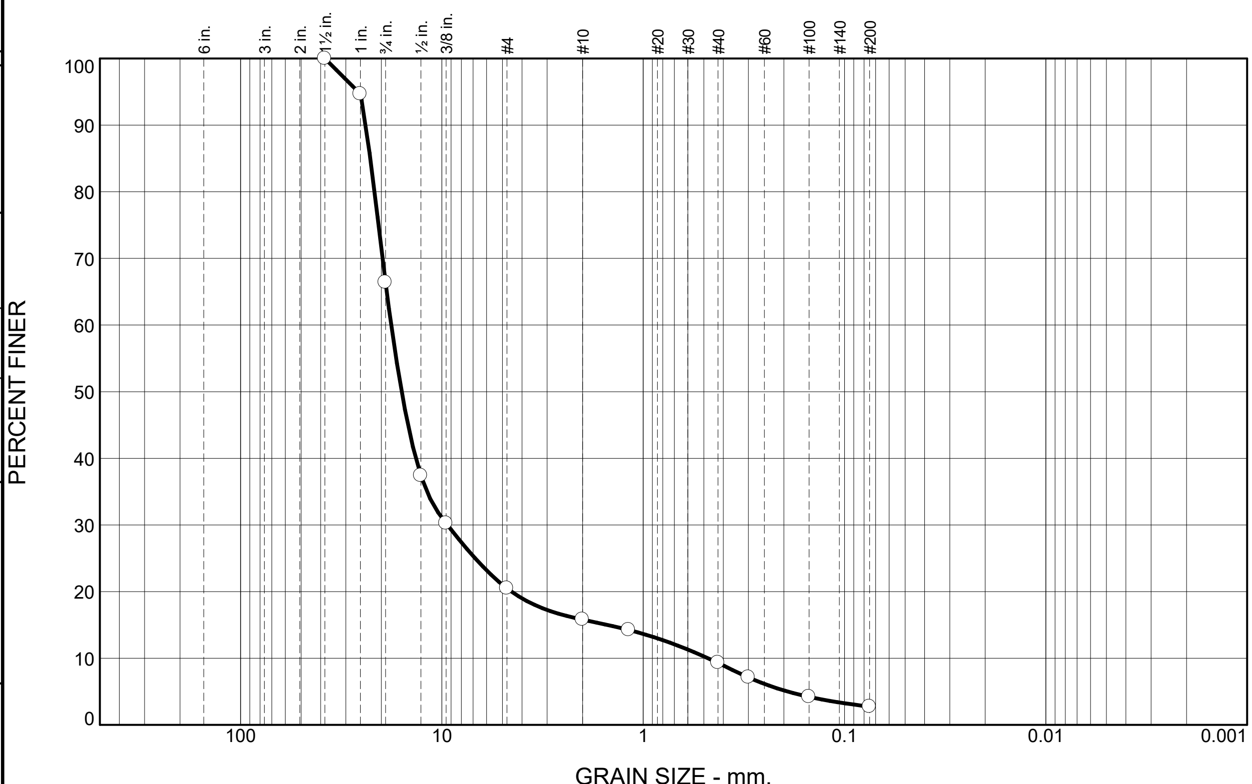
Location: OLDVOL-21-03
Sample Number: 22-069-11 **Depth:** 3435-3455' **Date:** 4/15/2022

NewFields

Client: South 32
Project: Hermosa Core Lab Testing
Project No: 475.0014.027 **Figure** 22-069-11

Tested By: TF **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	33.6	45.9	4.7	6.5	6.6	2.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
1	94.7		
.75	66.4		
.5	37.4		
.375	30.2		
#4	20.5		
#10	15.8		
#16	14.2		
#40	9.3		
#50	7.1		
#100	4.2		
#200	2.7		

* (no specification provided)

Soil Description

Gray poorly graded gravel with sand

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 23.9236 D_{85}= 22.6898 D_{60}= 17.8436
D_{50}= 15.8304 D_{30}= 9.3861 D_{15}= 1.5133
D_{10}= 0.4764 C_u= 37.46 C_c= 10.36

Classification

USCS= GP AASHTO= A-1-a

Remarks

Location: C1-21-01
Sample Number: 22-069-12 **Depth:** 3905-3925' **Date:** 4/15/2022

NewFields

Client: South 32
Project: Hermosa Core Lab Testing
Project No: 475.0014.027 **Figure** 22-069-12

Tested By: TF/EG **Checked By:** JW

SPECIFIC GRAVITY COARSE AGGREGATE (ASTM C127)

LABORATORY WORKSHEET

NF Form #8

Client:	South 32	**Location:**	See Below
Project Title:	Hermosa Geotechnical Lab Testing	**Elevation:**	See Below
Project Number:	475.0014.027	**Test Start Date:**	04/20/22
Project Engineer:	Craig Thompson	**Tested By:**	KE/ZM
Field Sample ID:	See Below	**Checked By:**	JW
Laboratory Sample ID:	22-069		

Sample No		22-069-01	22-069-02	22-069-03
Sample Location		MVAND-21-01	MVAND-21-02	MVAND-21-03
Depth		110-130'	310-330'	725-745'
Tare Name				
Saturated Surface Dry Aggregate + Tare		4761.9	4668.8	4782.3
Dry Aggregate + Tare		4735.2	4651.2	4766.1
Tare		570.7	596.8	703.4
Saturated Surface Dry	(B)	4191.2	4072	4078.9
Dry Aggregate	(A)	4164.5	4054.4	4062.7
Aggregate Submerged	(C)	2693.4	2595.4	2614.2
Temperature of Water		77.0	77.0	77.0
Apparent Specific Gravity	(A / (A-C))	2.831	2.779	2.805
Bulk Specific Gravity, SSD	(B/ (B-C))	2.798	2.758	2.785
Bulk Specific Gravity	(A / (B-C))	2.780	2.746	2.774
Absorption (%)		0.6%	0.4%	0.4%

Remarks:

NewFields

SPECIFIC GRAVITY COARSE AGGREGATE (ASTM C127)

LABORATORY WORKSHEET

NF Form #8

Client:	South 32	**Location:**	See Below
Project Title:	Hermosa Geotechnical Lab Testing	**Elevation:**	See Below
Project Number:	475.0014.027	**Test Start Date:**	04/20/22
Project Engineer:	Craig Thompson	**Tested By:**	KE/ZM
Field Sample ID:	See Below	**Checked By:**	JW
Laboratory Sample ID:	22-069		

Sample No		22-069-06	22-069-07	22-069-08
Sample Location		HSVOL-21-03	HSVOL-21-04	HSVOL-21-05
Depth		1700-1720'	1850-1870'	2380-2400'
Tare Name				
Saturated Surface Dry Aggregate + Tare		4941.2	4915.4	6262.2
Dry Aggregate + Tare		4893.3	4793.8	6210.1
Tare		850.5	825.8	2195.7
Saturated Surface Dry	(B)	4090.7	4089.6	4066.5
Dry Aggregate	(A)	4042.8	3968	4014.4
Aggregate Submerged	(C)	2527.8	2534	2537.1
Temperature of Water		77.0	77.0	77.0
Apparent Specific Gravity	(A / (A-C))	2.669	2.767	2.717
Bulk Specific Gravity, SSD	(B/ (B-C))	2.617	2.629	2.659
Bulk Specific Gravity	(A / (B-C))	2.587	2.551	2.625
Absorption (%)		1.2%	3.1%	1.3%

Remarks:

NewFields

SPECIFIC GRAVITY COARSE AGGREGATE (ASTM C127)

LABORATORY WORKSHEET

NF Form #8

Client:	South 32	**Location:**	See Below
Project Title:	Hermosa Geotechnical Lab Testing	**Elevation:**	See Below
Project Number:	475.0014.027	**Test Start Date:**	04/20/22
Project Engineer:	Craig Thompson	**Tested By:**	KE/ZM
Field Sample ID:	See Below	**Checked By:**	JW
Laboratory Sample ID:	22-069		

Sample No		22-069-09	22-069-10	22-069-11
Sample Location		OLDVOL-21-01	OLDVOL-21-02	OLDVOL-21-03
Depth		2650-2670'	2890-2910'	3435-3455'
Tare Name				
Saturated Surface Dry Aggregate + Tare		6140.7	6373	6284.3
Dry Aggregate + Tare		6013.1	6321.3	6223.4
Tare		2198.5	2188.3	2195.5
Saturated Surface Dry	(B)	3942.2	4184.7	4088.8
Dry Aggregate	(A)	3814.6	4133	4027.9
Aggregate Submerged	(C)	2377.5	2593	2522.2
Temperature of Water		77.0	77.0	77.0
Apparent Specific Gravity	(A / (A-C))	2.654	2.684	2.675
Bulk Specific Gravity, SSD	(B/ (B-C))	2.519	2.629	2.610
Bulk Specific Gravity	(A / (B-C))	2.438	2.597	2.571
Absorption (%)		3.3%	1.3%	1.5%

Remarks:

SPECIFIC GRAVITY COARSE AGGREGATE (ASTM C127)

LABORATORY WORKSHEET

NF Form #8

Client:	South 32	**Location:**	See Below
Project Title:	Hermosa Geotechnical Lab Testing	**Elevation:**	See Below
Project Number:	475.0014.027	**Test Start Date:**	04/20/22
Project Engineer:	Craig Thompson	**Tested By:**	KE/ZM
Field Sample ID:	See Below	**Checked By:**	JW
Laboratory Sample ID:	22-069		

Sample No		22-069-12		
Sample Location		C1-21-01		
Depth		3905-3925'		
Tare Name				
Saturated Surface Dry Aggregate + Tare		6350.8		
Dry Aggregate + Tare		6305.9		
Tare		2194.3		
Saturated Surface Dry	(B)	4156.5		
Dry Aggregate	(A)	4111.6		
Aggregate Submerged	(C)	2596.3		
Temperature of Water		77.0		
Apparent Specific Gravity	(A / (A-C))	2.713		
Bulk Specific Gravity, SSD	(B/ (B-C))	2.664		
Bulk Specific Gravity	(A / (B-C))	2.635		
Absorption (%)		1.1%		

Remarks:

NewFields

SPECIFIC GRAVITY FINE AGGREGATE (ASTM C128)

LABORATORY WORKSHEET

NF Form #10

Client: South 32	**Test Start Date: 4/26/2022**
Project Title: Hermosa Geotechnical Testing	**Tested By: TF/JW**
Project Number: 475.0014.027	**Checked By: JW**
Project Engineer: Craig Thompson	**Remarks:**
Work Order No.: 22-069	

Run by / Date						
Sample No.		22-069-01	22-069-02	22-069-03	22-069-06	22-069-07
Sample Location		MVAND-21-01	MVAND-21-02	MVAND-21-03	HSVOL-21-03	HSVOL-21-04
Sample Depth		110-130'	310-330'	725-745'	1700-1720'	1850-1870'
Dry Aggregate + Tare		702.7	720.2	965.3	710.3	634.2
Tare Wt		210.8	226.7	472.3	222.3	152.7
Saturated Surface Dry Aggregate	(S)	499.9	500.2	500.8	500.1	500.5
Dry Aggregate	(A)	491.9	493.5	493.0	488.1	481.5
Wt. Of Flask, Aggregate + H2O	(C)	1754.16	1761.70	1752.21	1752.82	1750.67
Calibrated wt. Of Flask + Water	(B)	1435.7	1445.2	1435.7	1445.2	1445.2

Apparent Specific Gravity	(A / (B + A - C))	2.837	2.788	2.794	2.705	2.736
Bulk Specific Gravity, SSD	(S / (B + S - C)	2.756	2.723	2.718	2.598	2.567
Bulk Specific Gravity	(A / (B + S - C))	2.712	2.687	2.675	2.536	2.469
Absorption (%)	[(S-A) / A] x 100	1.6%	1.4%	1.6%	2.5%	3.9%

Remarks:

NewFields

SPECIFIC GRAVITY FINE AGGREGATE (ASTM C128)

LABORATORY WORKSHEET

NF Form #10

Client: South 32	**Test Start Date: 4/26/2022**
Project Title: Hermosa Geotechnical Testing	**Tested By: TF/JW**
Project Number: 475.0014.027	**Checked By: JW**
Project Engineer: Craig Thompson	**Remarks:**
Work Order No.: 22-069	

Run by / Date						
Sample No.		22-069-08	22-069-09	22-069-10	22-069-11	22-069-12
Sample Location		HSVOL-21-05	OLDVOL-21-01	OLDVOL-21-02	OLDVOL-21-03	C1-21-01
Sample Depth		2380-2400'	2650-2670'	2890-2910'	3435-3455'	3905-3925'
Dry Aggregate + Tare		684.8	717.6	1074.6	1061.2	1095.4
Tare Wt		202.3	239.6	588.7	570.7	596.9
Saturated Surface Dry Aggregate	(S)	500.6	500.2	500.0	500.6	500.2
Dry Aggregate	(A)	482.5	478.0	485.9	490.5	498.5
Wt. Of Flask, Aggregate + H2O	(C)	1742.10	1734.18	1750.63	1746.30	1759.17
Calibrated wt. Of Flask + Water	(B)	1435.7	1435.7	1445.2	1435.7	1445.2

Apparent Specific Gravity	(A / (B + A - C))	2.740	2.663	2.693	2.727	2.702
Bulk Specific Gravity, SSD	(S / (B + S - C))	2.578	2.480	2.570	2.635	2.686
Bulk Specific Gravity	(A / (B + S - C))	2.485	2.370	2.497	2.582	2.677
Absorption (%)	[(S-A) / A] x 100	3.8%	4.6%	2.9%	2.1%	0.3%

Remarks:

LOS ANGELES ABRASION (ASTM C131/ASTM C535)

LABORATORY WORKSHEET

NF Form #48

Client:	South 32	**Field Sample ID:**	MVAND-21-01	**Test Start Date:**	4/16/2022
Project Title:	Hermosa Core Lab Testing	**Laboratory Sample ID:**	22-069-01	**Tested By:**	TF
Project Number:	475.0014.027	**Location:**	MVAND-21-01	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	110-130'	**Sample Description:**	

Test Type

ASTM C131	ASTM C535
A	1
B	2
C	3
D	

Remarks:

Sample	**Total Wt. (g)**
Tare ID	
Initial Wt. + Tare	4983.10
Post Wt. + Tare	4243.6
Percent Loss	**15%**

LOS ANGELES ABRASION (ASTM C131/ASTM C535)

LABORATORY WORKSHEET

NF Form #48

Client:	South 32	**Field Sample ID:**	MVAND-21-02	**Test Start Date:**	4/16/2022
Project Title:	Hermosa Core Lab Testing	**Laboratory Sample ID:**	22-069-02	**Tested By:**	EG
Project Number:	475.0014.027	**Location:**	MVAND-21-02	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	310-330'	**Sample Description:**	

Test Type

ASTM C131	ASTM C535
A	1
B	2
C	3
D	

Remarks:

Sample	**Total Wt. (g)**
Tare ID	
Initial Wt. + Tare	4994.00
Post Wt. + Tare	4267.3
Percent Loss	**15%**

NewFields

LOS ANGELES ABRASION (ASTM C131/ASTM C535)

LABORATORY WORKSHEET

NF Form #48

Client:	South 32	**Field Sample ID:**	MVAND-21-03	**Test Start Date:**	4/16/2022
Project Title:	Hermosa Core Lab Testing	**Laboratory Sample ID:**	22-069-03	**Tested By:**	EG
Project Number:	475.0014.027	**Location:**	MVAND-21-03	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	725-745'	**Sample Description:**	

Test Type	
ASTM C131	ASTM C535
A	1
B	2
C	3
D	

Remarks:

Sample	**Total Wt. (g)**
Tare ID	
Initial Wt. + Tare	4994.80
Post Wt. + Tare	4287.5
Percent Loss	**14%**

NewFields

LOS ANGELES ABRASION (ASTM C131/ASTM C535)

LABORATORY WORKSHEET

NF Form #48

Client:	South 32	**Field Sample ID:**	HSVOL-21-03	**Test Start Date:**	4/16/2022
Project Title:	Hermosa Core Lab Testing	**Laboratory Sample ID:**	22-069-06	**Tested By:**	EG
Project Number:	475.0014.027	**Location:**	HSVOL-21-03	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	1700-1720'	**Sample Description:**	

Test Type	
ASTM C131	ASTM C535
A	1
B	2
C	3
D	

Remarks:

Sample	**Total Wt. (g)**
Tare ID	
Initial Wt. + Tare	4975.90
Post Wt. + Tare	4144.8
Percent Loss	**17%**

NewFields

LOS ANGELES ABRASION (ASTM C131/ASTM C535)

LABORATORY WORKSHEET

NF Form #48

Client:	South 32	**Field Sample ID:**	HSVOL-21-04	**Test Start Date:**	4/16/2022
Project Title:	Hermosa Core Lab Testing	**Laboratory Sample ID:**	22-069-07	**Tested By:**	EG
Project Number:	475.0014.027	**Location:**	HSVOL-21-04	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	1850-1870'	**Sample Description:**	

Test Type	
ASTM C131	ASTM C535
A	1
B	2
C	3
D	

Remarks:

Sample	**Total Wt. (g)**
Tare ID	
Initial Wt. + Tare	4952.10
Post Wt. + Tare	3962
Percent Loss	**20%**

NewFields

LOS ANGELES ABRASION (ASTM C131/ASTM C535)

LABORATORY WORKSHEET

NF Form #48

Client:	South 32	**Field Sample ID:**	HSVOL-21-05	**Test Start Date:**	4/16/2022
Project Title:	Hermosa Core Lab Testing	**Laboratory Sample ID:**	22-069-08	**Tested By:**	EG
Project Number:	475.0014.027	**Location:**	HSVOL-21-05	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	2380-2400'	**Sample Description:**	

Test Type	
ASTM C131	ASTM C535
A	1
B	2
C	3
D	

Remarks:

Sample	**Total Wt. (g)**
Tare ID	
Initial Wt. + Tare	4970.30
Post Wt. + Tare	4053.4
Percent Loss	**18%**

LOS ANGELES ABRASION (ASTM C131/ASTM C535)

LABORATORY WORKSHEET

NF Form #48

Client:	South 32	**Field Sample ID:**	OLDVOL-21-01	**Test Start Date:**	4/16/2022
Project Title:	Hermosa Core Lab Testing	**Laboratory Sample ID:**	22-069-09	**Tested By:**	EG
Project Number:	475.0014.027	**Location:**	OLDVOL-21-01	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	2650-2670'	**Sample Description:**	

Test Type	
ASTM C131	ASTM C535
A	1
B	2
C	3
D	

Remarks:

Sample	**Total Wt. (g)**
Tare ID	
Initial Wt. + Tare	4932.80
Post Wt. + Tare	4112.6
Percent Loss	**17%**

NewFields

LOS ANGELES ABRASION (ASTM C131/ASTM C535)

LABORATORY WORKSHEET

NF Form #48

Client:	South 32	**Field Sample ID:**	OLDVOL-21-02	**Test Start Date:**	4/16/2022
Project Title:	Hermosa Core Lab Testing	**Laboratory Sample ID:**	22-069-10	**Tested By:**	EG
Project Number:	475.0014.027	**Location:**	OLDVOL-21-02	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	2890-2910'	**Sample Description:**	

Test Type

ASTM C131	ASTM C535
A	1
B	2
C	3
D	

Remarks:

Sample	**Total Wt. (g)**
Tare ID	
Initial Wt. + Tare	4984.60
Post Wt. + Tare	4128.3
Percent Loss	**17%**

NewFields

LOS ANGELES ABRASION (ASTM C131/ASTM C535)

LABORATORY WORKSHEET

NF Form #48

Client:	South 32	**Field Sample ID:**	OLDVOL-21-03	**Test Start Date:**	4/16/2022
Project Title:	Hermosa Core Lab Testing	**Laboratory Sample ID:**	22-069-11	**Tested By:**	EG
Project Number:	475.0014.027	**Location:**	OLDVOL-21-03	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	3435-3455'	**Sample Description:**	

Test Type

ASTM C131	ASTM C535
A	1
B	2
C	3
D	

Remarks:

Sample	**Total Wt. (g)**
Tare ID	
Initial Wt. + Tare	4973.00
Post Wt. + Tare	4076.4
Percent Loss	**18%**

NewFields

LOS ANGELES ABRASION (ASTM C131/ASTM C535)

LABORATORY WORKSHEET

NF Form #48

Client:	South 32	**Field Sample ID:**	C1-21-01	**Test Start Date:**	4/16/2022
Project Title:	Hermosa Core Lab Testing	**Laboratory Sample ID:**	22-069-12	**Tested By:**	EG
Project Number:	475.0014.027	**Location:**	C1-21-01	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	3905-3925'	**Sample Description:**	

Test Type

ASTM C131	ASTM C535
A	1
B	2
C	3
D	

Remarks:

Sample	**Total Wt. (g)**
Tare ID	
Initial Wt. + Tare	4989.10
Post Wt. + Tare	1763.7
Percent Loss	**65%**

NewFields

Sodium Sulfate Soundness C88

Client:	South 32	**Field Sample ID:**	MVAND-21-01	**Test Start Date:**	4/16/2022
Project Title:	Hermosa Geotechnical Investigation	**Laboratory Sample ID:**	22-069-01	**Tested By:**	ZM
Project Number:	475.0014.027	**Location:**	MVAND-21-01	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	110-130'	**Sample Description:**	

Coarse Aggregate

Size:	Percent Loss:	Weighted % Loss:
1" & 3/4"	5.2	2.8
1/2"	0.2	0.05
3/8"	0.8	0.09
#4	3.1	0.3
	Total:	3.24

Fine Aggregate

Size:	Percent Loss:	Weighted % Loss:
#4	18.6	3.7
#8	4.2	0.8
#16	7	1.4
#30	5.9	1.2
#50	8.7	1.7
	Total:	8.8

Notes:

NewFields

Sodium Sulfate Soundness C88

Client:	South 32	**Field Sample ID:**	MVAND-21-02	**Test Start Date:**	4/16/2022
Project Title:	Hermosa Geotechnical Investigation	**Laboratory Sample ID:**	22-069-02	**Tested By:**	ZM
Project Number:	475.0014.027	**Location:**	MVAND-21-02	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	310-330'	**Sample Description:**	

Coarse Aggregate

Size:	Percent Loss:	Weighted % Loss:
1" & 3/4"	0.7	0.4
1/2"	0	0
3/8"	0.5	0.1
#4	2.4	0.3
	Total:	0.8

Fine Aggregate

Size:	Percent Loss:	Weighted % Loss:
#4	6.2	1.2
#8	4.6	0.9
#16	6.5	1.3
#30	5.8	1.2
#50	9.4	1.9
	Total:	6.5

Notes:

NewFields

Sodium Sulfate Soundness C88

Client:	South 32	**Field Sample ID:**	MVAND-21-03	**Test Start Date:**	4/16/2022
Project Title:	Hermosa Geotechnical Investigation	**Laboratory Sample ID:**	22-069-03	**Tested By:**	ZM
Project Number:	475.0014.027	**Location:**	MVAND-21-03	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	725-745'	**Sample Description:**	

Coarse Aggregate

Size:	Percent Loss:	Weighted % Loss:
1" & 3/4"	0	0
1/2"	0	0
3/8"	0.5	0.1
#4	3.6	0.4
	Total:	0.5

Fine Aggregate

Size:	Percent Loss:	Weighted % Loss:
#4	14.2	2.8
#8	7.5	1.5
#16	8.2	1.6
#30	7.1	1.4
#50	11.1	2.2
	Total:	9.5

Notes:

NewFields

Sodium Sulfate Soundness C88

Client:	South 32	**Field Sample ID:**	HSVOL-21-03	**Test Start Date:**	4/22/2022
Project Title:	Hermosa Geotechnical Investigation	**Laboratory Sample ID:**	22-069-06	**Tested By:**	ZM
Project Number:	475.0014.027	**Location:**	HSVOL-21-03	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	1700-1720'	**Sample Description:**	

Coarse Aggregate

Size:	Percent Loss:	Weighted % Loss:
1" & 3/4"	6.5	3.5
1/2"	7.4	1.8
3/8"	7.9	0.9
#4	6.7	0.7
	Total:	6.9

Fine Aggregate

Size:	Percent Loss:	Weighted % Loss:
#4	22	4.4
#8	18.8	3.8
#16	14	2.8
#30	8.6	1.7
#50	12.2	2.4
	Total:	15.1

Notes:

NewFields

Sodium Sulfate Soundness C88

Client:	South 32	**Field Sample ID:**	HSVOL-21-04	**Test Start Date:**	4/22/2022
Project Title:	Hermosa Geotechnical Investigation	**Laboratory Sample ID:**	22-069-07	**Tested By:**	ZM
Project Number:	475.0014.027	**Location:**	HSVOL-21-04	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	1850-1870'	**Sample Description:**	

Coarse Aggregate

Size:	Percent Loss:	Weighted % Loss:
1" & 3/4"	5.37	3.1
1/2"	4.5	1.1
3/8"	9.9	1.2
#4	11.1	1.2
	Total:	6.6

Fine Aggregate

Size:	Percent Loss:	Weighted % Loss:
#4	32.2	6.4
#8	30.6	6.1
#16	28.7	5.7
#30	20.9	4.2
#50	18.7	3.7
	Total:	26.1

Notes:

NewFields

Sodium Sulfate Soundness C88

Client:	South 32	**Field Sample ID:**	HSVOL-21-05	**Test Start Date:**	4/22/2022
Project Title:	Hermosa Geotechnical Investigation	**Laboratory Sample ID:**	22-069-08	**Tested By:**	ZM
Project Number:	475.0014.027	**Location:**	HSVOL-21-05	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	2380-2400'	**Sample Description:**	

Coarse Aggregate

Size:	Percent Loss:	Weighted % Loss:
1" & 3/4"	17.3	9.3
1/2"	25.6	6.1
3/8"	18.9	2.2
#4	16.1	1.7
	Total:	19.3

Fine Aggregate

Size:	Percent Loss:	Weighted % Loss:
#4	30.9	6.2
#8	31.4	6.3
#16	26.3	5.3
#30	23.4	4.7
#50	20.9	4.2
	Total:	26.7

Notes:

NewFields

Sodium Sulfate Soundness C88

Client:	South 32	**Field Sample ID:**	OLDVOL-21-01	**Test Start Date:**	4/27/2022
Project Title:	Hermosa Geotechnical Investigation	**Laboratory Sample ID:**	22-069-09	**Tested By:**	ZM
Project Number:	475.0014.027	**Location:**	OLDVOL-21-01	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	2650-2670'	**Sample Description:**	

Coarse Aggregate

Size:	Percent Loss:	Weighted % Loss:
1" & 3/4"	8.9	4.8
1/2"	16.2	3.8
3/8"	21.8	2.6
#4	19.1	2
	Total:	13.2

Fine Aggregate

Size:	Percent Loss:	Weighted % Loss:
#4	36.5	7.3
#8	42.4	8.5
#16	24.7	6.9
#30	24.1	4.8
#50	20.2	4
	Total:	31.5

Notes:

NewFields

Sodium Sulfate Soundness C88

Client:	South 32	**Field Sample ID:**	OLDVOL-21-02	**Test Start Date:**	4/27/2022
Project Title:	Hermosa Geotechnical Investigation	**Laboratory Sample ID:**	22-069-10	**Tested By:**	ZM
Project Number:	475.0014.027	**Location:**	OLDVOL-21-02	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	2890-2910'	**Sample Description:**	

Coarse Aggregate

Size:	Percent Loss:	Weighted % Loss:
1" & 3/4"	3.8	2.1
1/2"	4.1	1
3/8"	16.4	1.9
#4	12.2	1.3
	Total:	6.3

Fine Aggregate

Size:	Percent Loss:	Weighted % Loss:
#4	29.9	5.9
#8	23.3	4.7
#16	17.5	3.5
#30	14.2	2.8
#50	13.1	2.6
	Total:	19.5

Notes:

NewFields

Sodium Sulfate Soundness C88

Client:	South 32	**Field Sample ID:**	OLDVOL-21-03	**Test Start Date:**	4/27/2022
Project Title:	Hermosa Geotechnical Investigation	**Laboratory Sample ID:**	22-069-11	**Tested By:**	ZM
Project Number:	475.0014.027	**Location:**	OLDVOL-21-03	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	3435-3455'	**Sample Description:**	

Coarse Aggregate

Size:	Percent Loss:	Weighted % Loss:
1" & 3/4"	1.1	0.6
1/2"	4.7	1.1
3/8"	8.2	0.9
#4	7.4	0.8
	Total:	3.4

Fine Aggregate

Size:	Percent Loss:	Weighted % Loss:
#4	22.3	4.5
#8	20.2	4
#16	19.5	3.9
#30	12.5	2.5
#50	12	2.4
	Total:	17.3

Notes:

NewFields

Sodium Sulfate Soundness C88

Client:	South 32	**Field Sample ID:**	C1-21-01	**Test Start Date:**	5/6/2022
Project Title:	Hermosa Geotechnical Investigation	**Laboratory Sample ID:**	22-069-12	**Tested By:**	ZM
Project Number:	475.0014.027	**Location:**	C1-21-01	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	3905-3925'	**Sample Description:**	

Coarse Aggregate

Size:	Percent Loss:	Weighted % Loss:
1" & 3/4"	3.4	1.8
1/2"	8.2	1.9
3/8"	7.8	0.9
#4	16.2	1.7
	Total:	6.3

Fine Aggregate

Size:	Percent Loss:	Weighted % Loss:
#4	55.6	11.1
#8	58.7	11.7
#16	50.5	10.1
#30	20.3	4.1
#50	8.8	1.8
	Total:	38.8

Notes:

NewFields
Perspective. Vision. Solutions.

STANDARD TEST METHOD FOR SLAKE DURABILITY AND OTHER SIMILAR WEAK ROCKS (ASTM D4644)

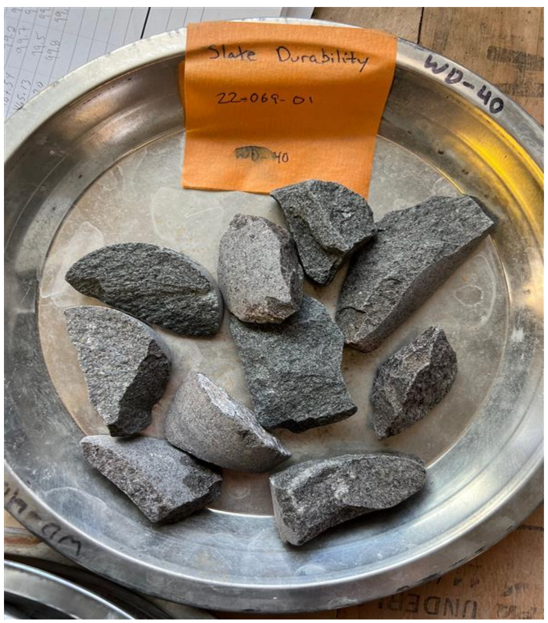
NF Form #4644

Client:	South 32	**Field Sample ID:**	MVAND-21-01	**Test Start Date:**	5/3/2022
Project Title:	Hermosa Geotech Investigation	**Laboratory Sample ID:**	22-069-01	**Tested By:**	BN
Project Number:	475.0014.027	**Location:**	MVAND-21-01	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	110-130'	**Sample Description:**	

Start Date:	5/3/2022
End Date:	5/5/2022

Water Details	
Temperature Range:	1
Temperature Average:	64.5

I_{d1}:	99.7
I_{d2}:	99.7



Post Test

Desription of fragments after cycles:

Type 1 largely unchanged

STANDARD TEST METHOD FOR SLAKE DURABILITY AND OTHER SIMILAR WEAK ROCKS
(ASTM D4644)

NF Form #4644

Client:	South 32	**Field Sample ID:**	MVAND-21-02	**Test Start Date:**	5/3/2022
Project Title:	Hermosa Geotech Investigation	**Laboratory Sample ID:**	22-069-02	**Tested By:**	BN
Project Number:	475.0014.027	**Location:**	MVAND-21-02	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	310-330'	**Sample Description:**	

Start Date:	5/3/2022
End Date:	5/5/2022

Water Details	
Temperature Range:	1
Temperature Average:	67.9

I_{d1}:	99.8
I_{d2}:	99.7

Post Test

Desription of fragments after cycles:

Type 1 largely unchanged

STANDARD TEST METHOD FOR SLAKE DURABILITY AND OTHER SIMILAR WEAK ROCKS (ASTM D4644)

NF Form #4644

Client:	South 32	**Field Sample ID:**	MVAND-21-03	**Test Start Date:**	5/3/2022
Project Title:	Hermosa Geotech Investigation	**Laboratory Sample ID:**	22-069-03	**Tested By:**	BN
Project Number:	475.0014.027	**Location:**	MVAND-21-03	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	725-745'	**Sample Description:**	

Start Date:	5/3/2022
End Date:	5/5/2022

Water Details	
Temperature Range:	1
Temperature Average:	67.9

I_{d1}:	99.8
I_{d2}:	99.8

Post Test

Desription of fragments after cycles:

Type 1 largely unchanged

NewFields Perspective. Vision. Solutions.

STANDARD TEST METHOD FOR SLAKE DURABILITY AND OTHER SIMILAR WEAK ROCKS (ASTM D4644)

NF Form #4644

Client:	South 32	**Field Sample ID:**	HSVOL-21-03	**Test Start Date:**	5/3/2022
Project Title:	Hermosa Geotech Investigation	**Laboratory Sample ID:**	22-069-06	**Tested By:**	BN
Project Number:	475.0014.027	**Location:**	HSVOL-21-03	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	1700-1720'	**Sample Description:**	

Start Date:	5/3/2022
End Date:	5/5/2022

Water Details	
Temperature Range:	1
Temperature Average:	67.9

I_{d1}:	99.3
I_{d2}:	99.3

Post Test

Desription of fragments after cycles:

Type 1 largely unchanged

NewFields Perspective. Vision. Solutions.

STANDARD TEST METHOD FOR SLAKE DURABILITY AND OTHER SIMILAR WEAK ROCKS (ASTM D4644)

NF Form #4644

Client:	South 32	**Field Sample ID:**	HSVOL-21-04	**Test Start Date:**	5/3/2022
Project Title:	Hermosa Geotech Investigation	**Laboratory Sample ID:**	22-069-07	**Tested By:**	BN
Project Number:	475.0014.027	**Location:**	HSVOL-21-04	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	1850-1870'	**Sample Description:**	

Start Date:	5/3/2022
End Date:	5/5/2022

Water Details	
Temperature Range:	1
Temperature Average:	67.9

I_{d1}:	99.2
I_{d2}:	98.9

Post Test

Desription of fragments after cycles:

Type 1 largely unchanged

NewFields Perspective. Vision. Solutions.

STANDARD TEST METHOD FOR SLAKE DURABILITY AND OTHER SIMILAR WEAK ROCKS (ASTM D4644)

NF Form #4644

Client:	South 32	**Field Sample ID:**	HSVOL-21-05	**Test Start Date:**	5/3/2022
Project Title:	Hermosa Geotech Investigation	**Laboratory Sample ID:**	22-069-08	**Tested By:**	BN
Project Number:	475.0014.027	**Location:**	HSVOL-21-05	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	2380-2400'	**Sample Description:**	

Start Date:	5/3/2022
End Date:	5/5/2022

Water Details	
Temperature Range:	1
Temperature Average:	67.9

I_{d1}:	99.5
I_{d2}:	99.4

Post Test

Desription of fragments after cycles:

Type 1 largely unchanged

NewFields Perspective. Vision. Solutions.

STANDARD TEST METHOD FOR SLAKE DURABILITY AND OTHER SIMILAR WEAK ROCKS (ASTM D4644)

NF Form #4644

Client:	South 32	**Field Sample ID:**	OLDVOL-21-01	**Test Start Date:**	5/3/2022
Project Title:	Hermosa Geotech Investigation	**Laboratory Sample ID:**	22-069-09	**Tested By:**	BN
Project Number:	475.0014.027	**Location:**	OLDVOL-21-01	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	2650-2670'	**Sample Description:**	

Start Date:	5/3/2022
End Date:	5/5/2022

Water Details	
Temperature Range:	1
Temperature Average:	67.9

I_{d1}:	95.5
I_{d2}:	95.4

Post Test

Desription of fragments after cycles:

Type 1 largely unchanged

STANDARD TEST METHOD FOR SLAKE DURABILITY AND OTHER SIMILAR WEAK ROCKS
(ASTM D4644)

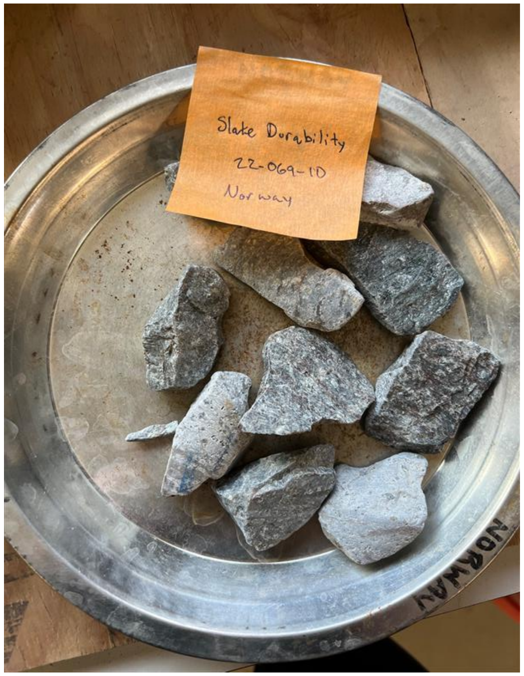
NF Form #4644

Client:	South 32	**Field Sample ID:**	OLDVOL-21-02	**Test Start Date:**	5/3/2022
Project Title:	Hermosa Geotech Investigation	**Laboratory Sample ID:**	22-069-10	**Tested By:**	BN
Project Number:	475.0014.027	**Location:**	OLDVOL-21-02	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	2890-2910'	**Sample Description:**	

Start Date:	5/3/2022
End Date:	5/5/2022

Water Details	
Temperature Range:	1
Temperature Average:	67.9

I_{d1}:	99.2
I_{d2}:	99.1



Post Test

Desription of fragments after cycles:

Type 1 largely unchanged

STANDARD TEST METHOD FOR SLAKE DURABILITY AND OTHER SIMILAR WEAK ROCKS (ASTM D4644)

NF Form #4644

Client:	South 32	**Field Sample ID:**	OLDVOL-21-03	**Test Start Date:**	5/3/2022
Project Title:	Hermosa Geotech Investigation	**Laboratory Sample ID:**	22-069-11	**Tested By:**	BN
Project Number:	475.0014.027	**Location:**	OLDVOL-21-03	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	3435-3455'	**Sample Description:**	

Start Date:	5/3/2022
End Date:	5/5/2022

Water Details	
Temperature Range:	1
Temperature Average:	67.9

I_{d1}:	99.6
I_{d2}:	99.5

Post Test

Desription of fragments after cycles:

Type 1 largely unchanged

NF Form #4644

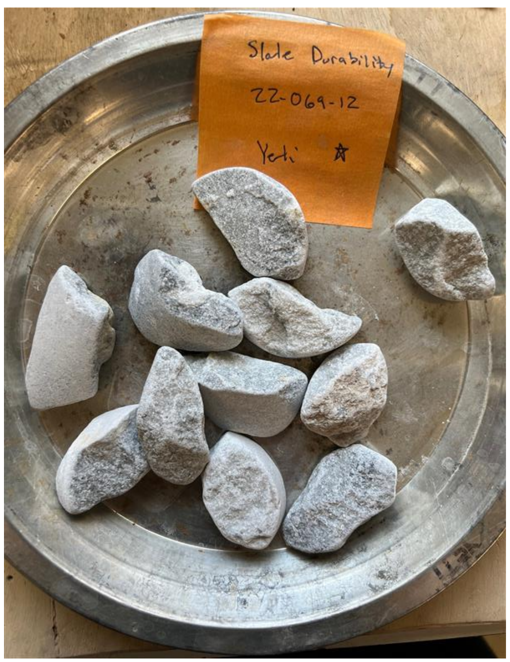
STANDARD TEST METHOD FOR SLAKE DURABILITY AND OTHER SIMILAR WEAK ROCKS (ASTM D4644)

Client:	South 32	**Field Sample ID:**	C1-21-01	**Test Start Date:**	5/3/2022
Project Title:	Hermosa Geotech Investigation	**Laboratory Sample ID:**	22-069-12	**Tested By:**	BN
Project Number:	475.0014.027	**Location:**	C1-21-01	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	3905-3925'	**Sample Description:**	

Start Date:	5/3/2022
End Date:	5/5/2022

Water Details	
Temperature Range:	1
Temperature Average:	67.9

I_{d1}:	99.1
I_{d2}:	98.6



Post Test

Desription of fragments after cycles:

Type 1 largely unchanged

CME CONSTRUCTION MATERIALS ENGINEERS, INC.

ALKALI SILICA REACTIVITY RESULTS

ASTM C 1260

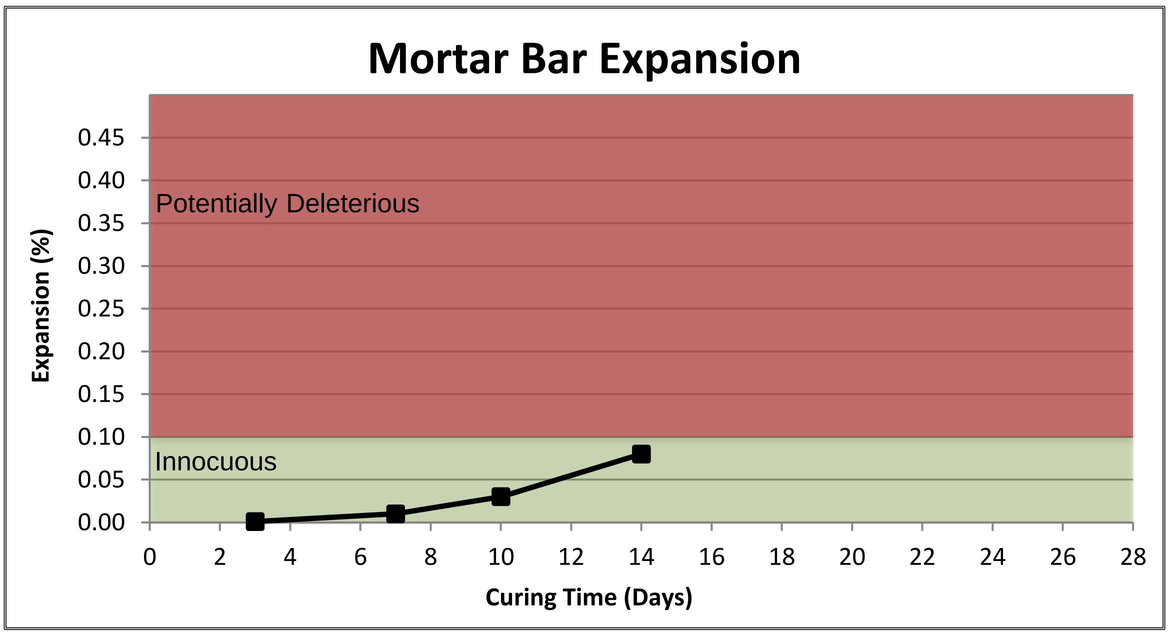
Client:	Newfields
Project Name:	MVAND-21-02 310'-330'
Project Number:	1541
Date:	7/25/2022

AGGREGATES	%
MVAND-21-02 310'-330'	100.0

CEMENTITOUS MATERIALS	%
Nevada Cement Type II	100
Water Cement Ratio	0.47

Date Cast:	7/6/2022					
Sample	**3 Day % Change**	**7 Day % Change**	**10 Day % Change**	**14 Day % Change**	**21 Day % Change**	**28 Day % Change**
Date	7/11/22	7/15/22	7/18/22	7/22/22		
1	0.002	0.009	0.030	0.084		
2	0.001	0.007	0.030	0.088		
3	0.001	0.007	0.025	0.080		
Average	0.00	0.01	0.03	**0.08**		

Note: Number of days is based on zero reading 2 days after cast date



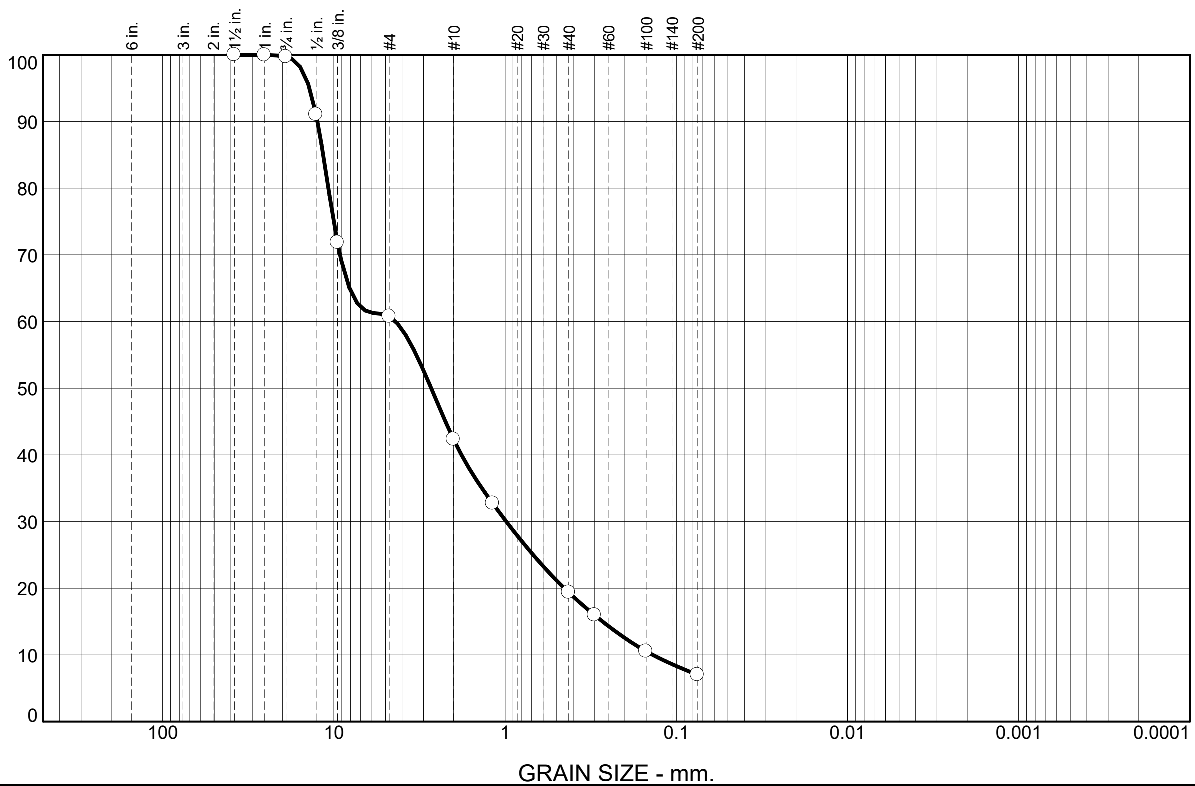
Expansion % 14 days	Classification
<0.10%	Innocuous
>0.10%	Potentially Deleterious

ATTACHMENT A

Attachment A.2

Ventilation Shaft Non-PAG Sample – Laboratory Testing Results

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.3	38.9	18.5	22.9	12.4	7.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5"	100.0		
1"	99.9		
.75"	99.7		
.5"	91.0		
.375"	71.8		
#4	60.8		
#10	42.3		
#16	32.7		
#40	19.4		
#50	16.0		
#100	10.5		
#200	7.0		

* (no specification provided)

Soil Description

Gray well-graded sand with silt and gravel

Atterberg Limits

PL= NP   LL= NP   PI= NP

Coefficients

D_{90}= 12.4701 D_{85}= 11.5457 D_{60}= 4.3661
D_{50}= 2.7039 D_{30}= 0.9844 D_{15}= 0.2696
D_{10}= 0.1376 C_u= 31.73 C_c= 1.61

Classification

USCS= SW-SM   AASHTO= A-1-a

Remarks

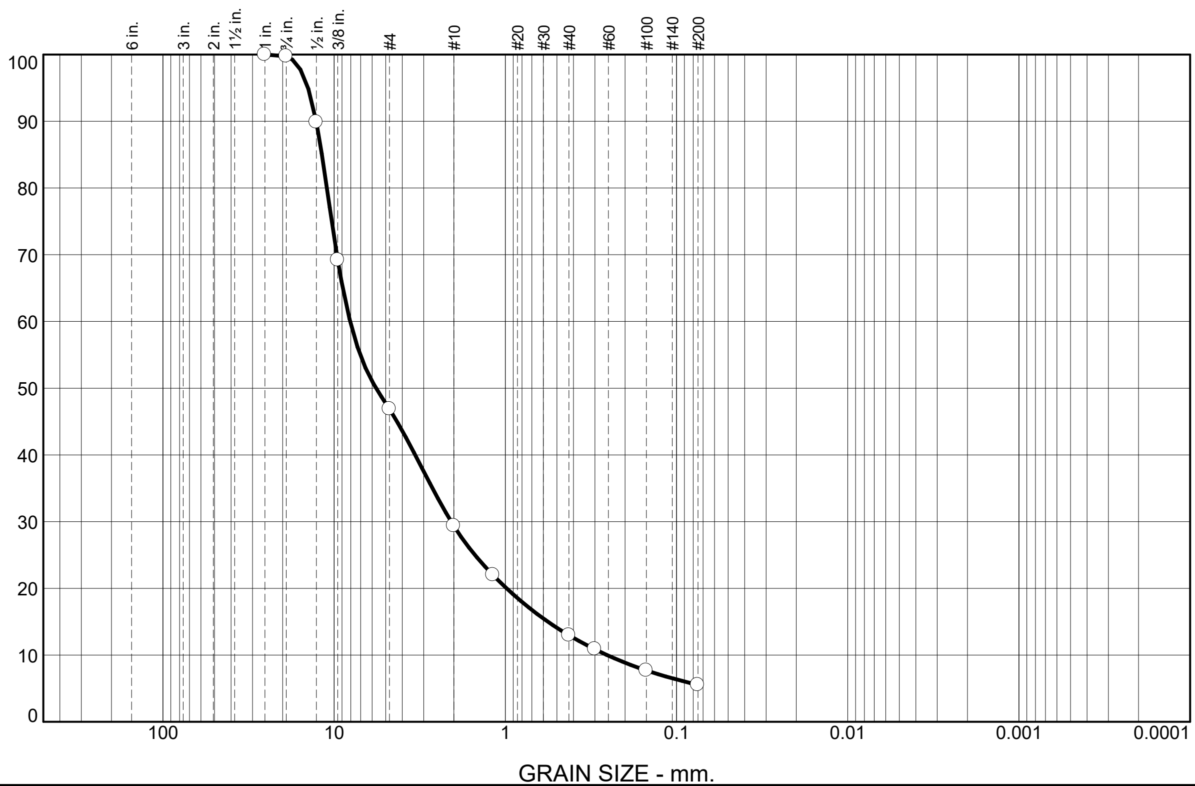
Location: MVAND-21-04
Sample Number: 21-341-01   **Depth:** 115-150'   **Date:** 12/17/2021

NewFields

Client: South 32
Project: Hermosa Geotechnical Lab Testing
Project No: 475.0014.027   **Figure** 21-341-01

Tested By: EG/QH   **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.2	52.9	17.5	16.4	7.5	5.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100.0		
.75"	99.8		
.5"	89.9		
.375"	69.2		
#4	46.9		
#10	29.4		
#16	22.0		
#40	13.0		
#50	10.9		
#100	7.7		
#200	5.5		

* (no specification provided)

Soil Description

Gray well-graded gravel with siltyclay and sand

Atterberg Limits

PL= 15 LL= 19 PI= 4

Coefficients

D_{90}= 12.7318 D_{85}= 11.7845 D_{60}= 8.0601
D_{50}= 5.6904 D_{30}= 2.0734 D_{15}= 0.5643
D_{10}= 0.2547 C_u= 31.65 C_c= 2.09

Classification

USCS= GW-GC AASHTO= A-1-a

Remarks

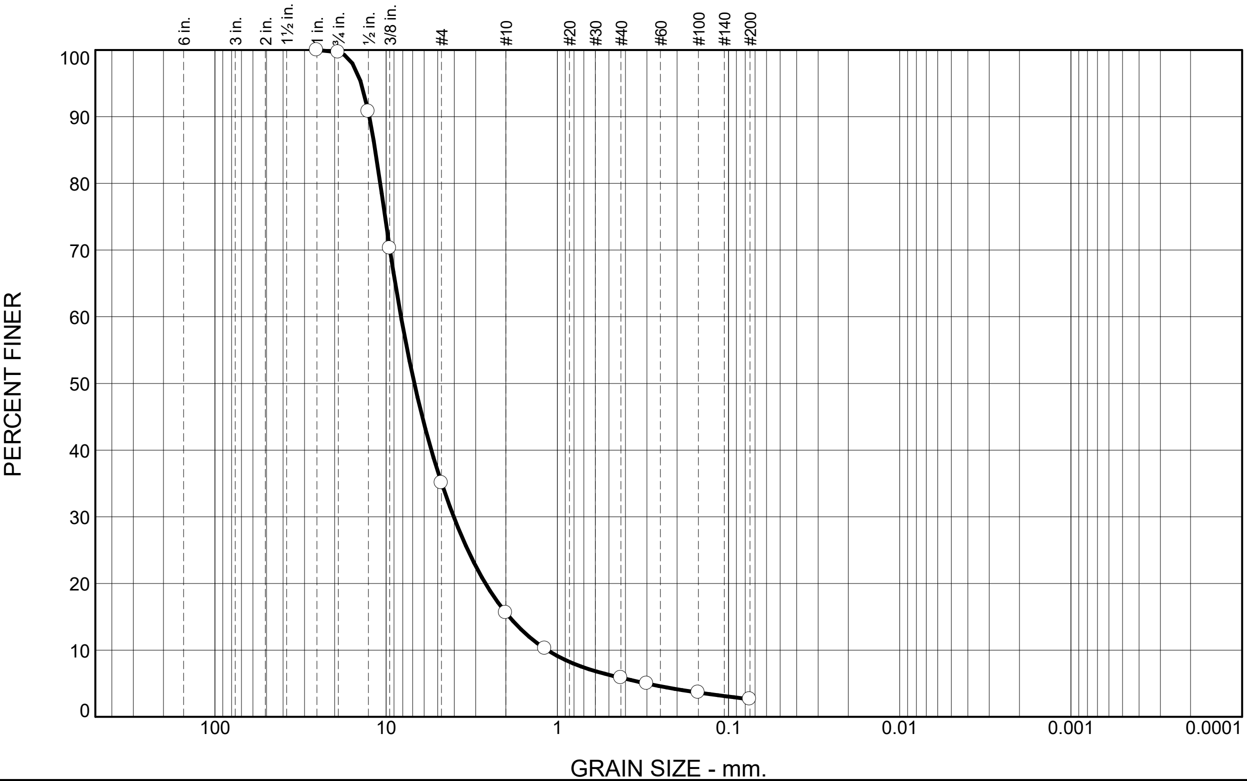
Location: MVAND-21-05
Sample Number: 21-341-02 **Depth:** 300-325' **Date:** 12/17/2022

NewFields

Client: South 32
Project: Hermosa Geotechnical Lab Testing
Project No: 475.0014.027 **Figure** 21-341-02

Tested By: EG/QH **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.3	64.6	19.5	9.7	3.3	2.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100.0		
.75"	99.7		
.5"	90.8		
.375"	70.3		
#4	35.1		
#10	15.6		
#16	10.2		
#40	5.9		
#50	5.0		
#100	3.6		
#200	2.6		

* (no specification provided)

Soil Description

Gray well-graded gravel with sand

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 12.5209 D_{85}= 11.5810 D_{60}= 8.1863
D_{50}= 6.8409 D_{30}= 4.0334 D_{15}= 1.9110
D_{10}= 1.1437 C_u= 7.16 C_c= 1.74

Classification

USCS= GW AASHTO= A-1-a

Remarks

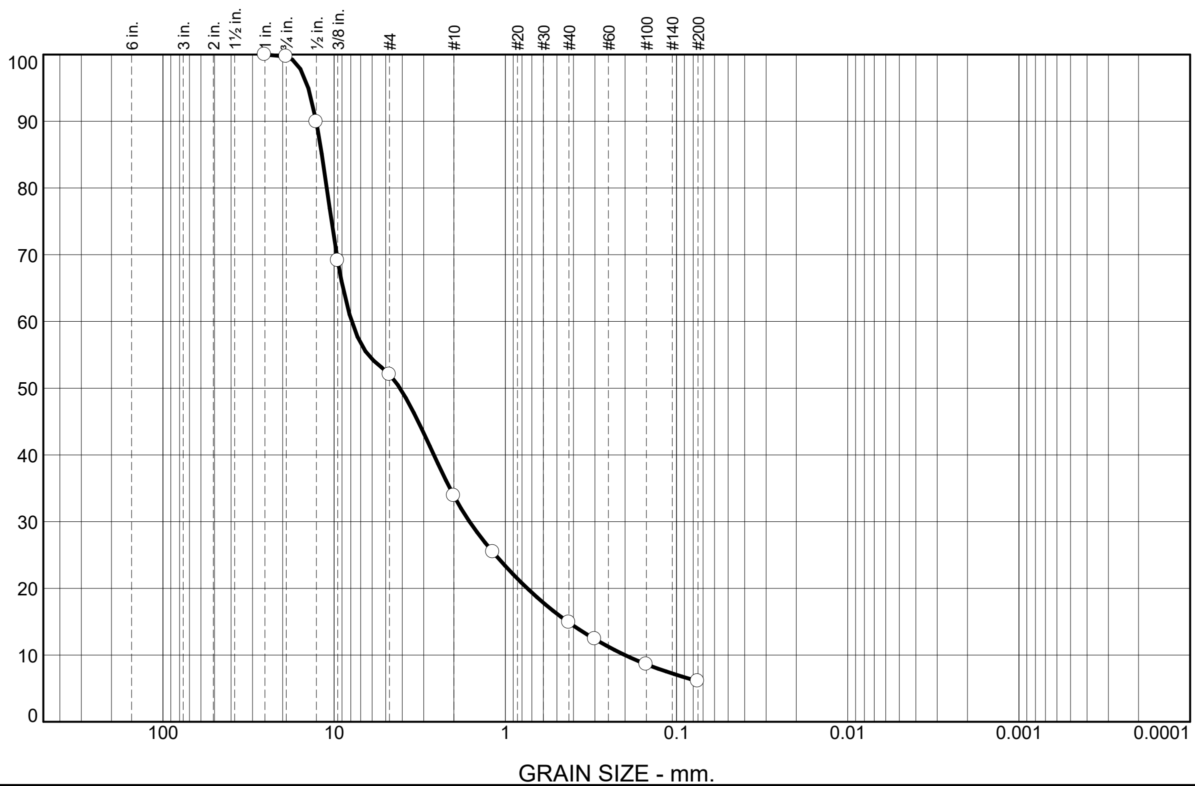
Location: MVAND-21-06
Sample Number: 21-341-03 **Depth:** 745-785' **Date:** 12/17/2021

NewFields

Client: South 32
Project: Hermosa Geotechnical Lab Testing
Project No: 475.0014.027 **Figure** 21-341-03

Tested By: EG/QH **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.3	47.7	18.1	19.0	8.8	6.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100.0		
.75"	99.7		
.5"	89.9		
.375"	69.1		
#4	52.0		
#10	33.9		
#16	25.4		
#40	14.9		
#50	12.4		
#100	8.6		
#200	6.1		

* (no specification provided)

Soil Description

Gray well-graded gravel with silt and sand

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 12.7193 D_{85}= 11.7916 D_{60}= 7.8969
D_{50}= 4.1314 D_{30}= 1.6198 D_{15}= 0.4324
D_{10}= 0.2002 C_u= 39.45 C_c= 1.66

Classification

USCS= GW-GM AASHTO= A-1-a

Remarks

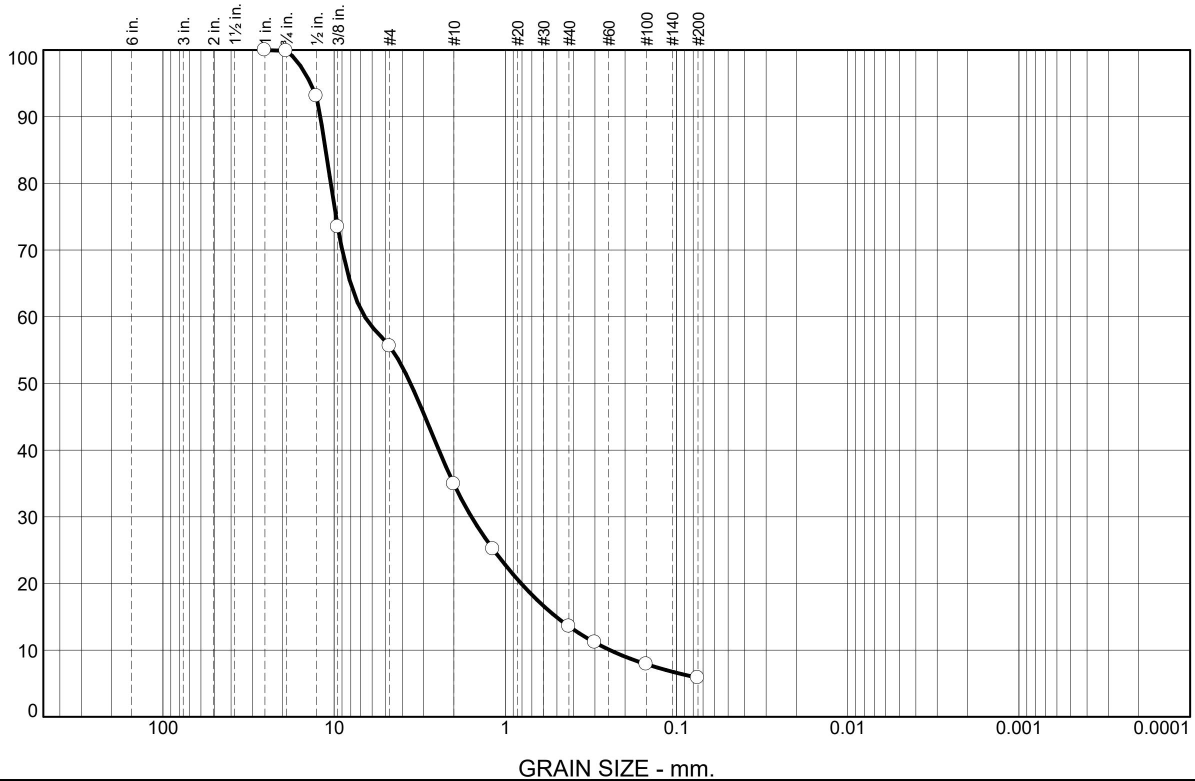
Location: MVAND-21-07
Sample Number: 21-341-04 **Depth:** 895-925' **Date:** 12/17/2021

NewFields

Client: South 32
Project: Hermosa Geotechnical Lab Testing
Project No: 475.0014.027 **Figure** 21-341-04

Tested By: EG/QH **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.1	44.3	20.7	21.4	7.7	5.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100.0		
.75"	99.9		
.5"	93.1		
.375"	73.5		
#4	55.6		
#10	34.9		
#16	25.2		
#40	13.5		
#50	11.1		
#100	7.9		
#200	5.8		

* (no specification provided)

Soil Description

Gray well-graded sand with siltyclay and gravel

Atterberg Limits

PL= 16 LL= 23 PI= 7

Coefficients

D_{90}= 12.0400 D_{85}= 11.1959 D_{60}= 6.6179
D_{50}= 3.5839 D_{30}= 1.5788 D_{15}= 0.5046
D_{10}= 0.2447 C_u= 27.04 C_c= 1.54

Classification

USCS= SW-SC AASHTO= A-2-4(0)

Remarks

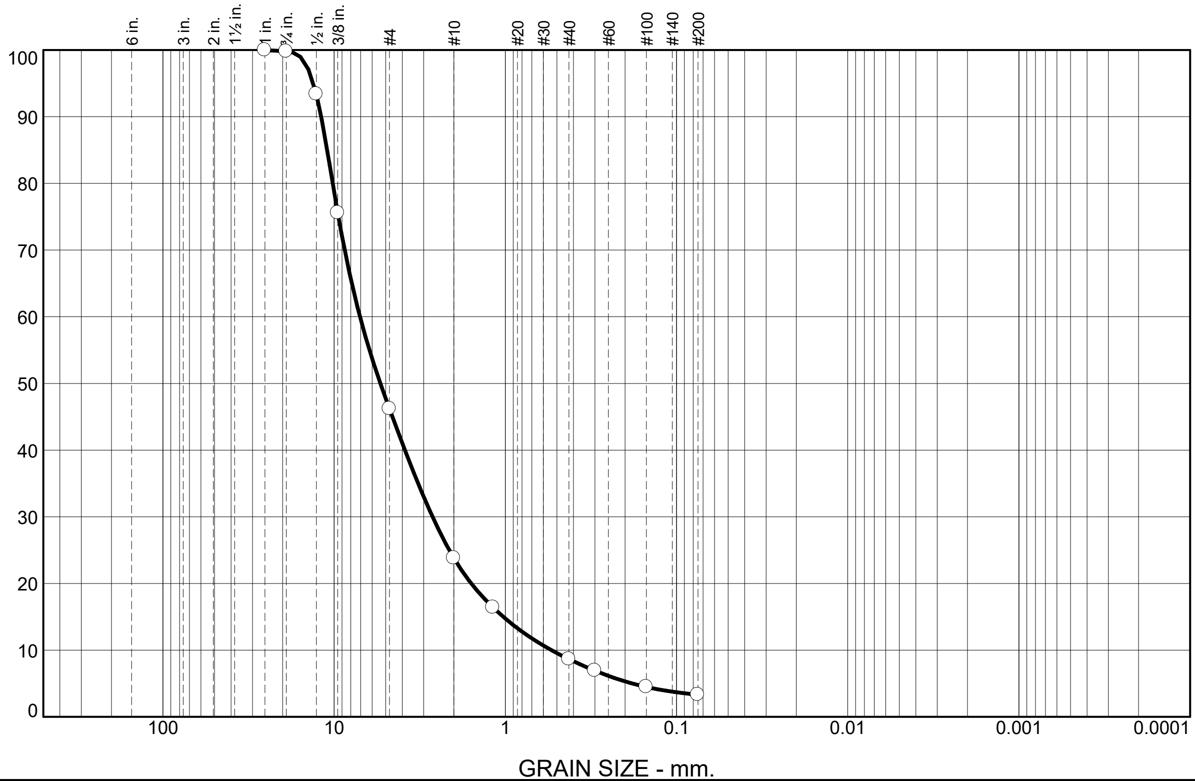
Location: HSVOL-21-06
Sample Number: 21-341-05 **Depth:** 1180-1205' **Date:** 12/20/2021

NewFields

Client: South 32
Project: Hermosa Geotechnical Lab Testing
Project No: 475.0014.027 **Figure** 21-341-05

Tested By: EG/QH **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.2	53.6	22.4	15.2	5.3	3.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100.0		
.75"	99.8		
.5"	93.4		
.375"	75.6		
#4	46.2		
#10	23.8		
#16	16.4		
#40	8.6		
#50	6.9		
#100	4.5		
#200	3.3		

* (no specification provided)

Soil Description

Gray well-graded gravel with sand

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 11.8977 D_{85}= 10.9767 D_{60}= 7.0633
D_{50}= 5.3676 D_{30}= 2.6643 D_{15}= 1.0275
D_{10}= 0.5380 C_u= 13.13 C_c= 1.87

Classification

USCS= GW AASHTO= A-1-a

Remarks

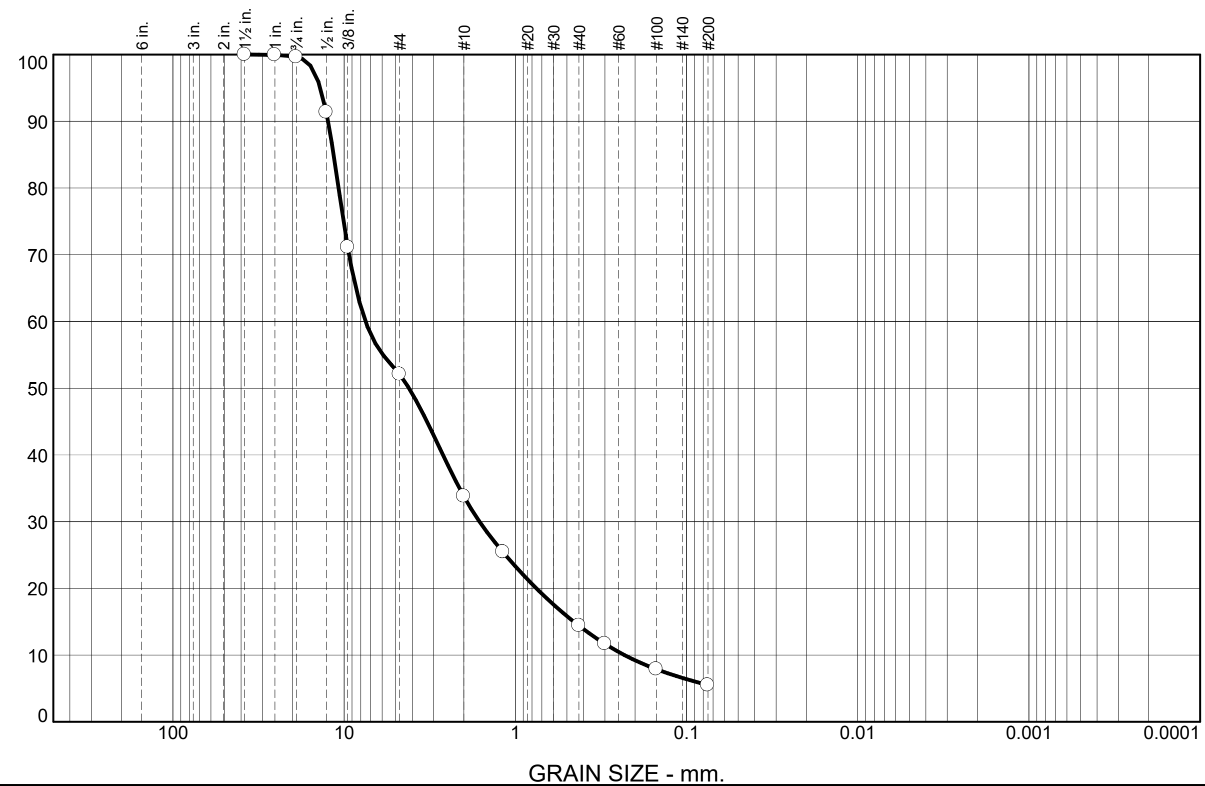
Location: HSVOL-21-07
Sample Number: 21-341-06 **Depth:** 1575-1600' **Date:** 12/20/2021

NewFields

Client: South 32
Project: Hermosa Geotechnical Lab Testing
Project No: 475.0014.027 **Figure** 21-341-06

Tested By: EG/QH **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.4	47.5	18.3	19.4	8.9	5.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5"	100.0		
1"	99.9		
.75"	99.6		
.5"	91.3		
.375"	71.1		
#4	52.1		
#10	33.8		
#16	25.4		
#40	14.4		
#50	11.7		
#100	7.9		
#200	5.5		

* (no specification provided)

Soil Description

Gray well-graded gravel with silt and sand

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 12.4079 D_{85}= 11.5155 D_{60}= 7.5011
D_{50}= 4.1834 D_{30}= 1.6202 D_{15}= 0.4558
D_{10}= 0.2307 C_u= 32.52 C_c= 1.52

Classification

USCS= GW-GM AASHTO= A-1-a

Remarks

Location: HSVOL-21-08
Sample Number: 21-341-07 **Depth:** 1675-1705' **Date:** 12/20/2021

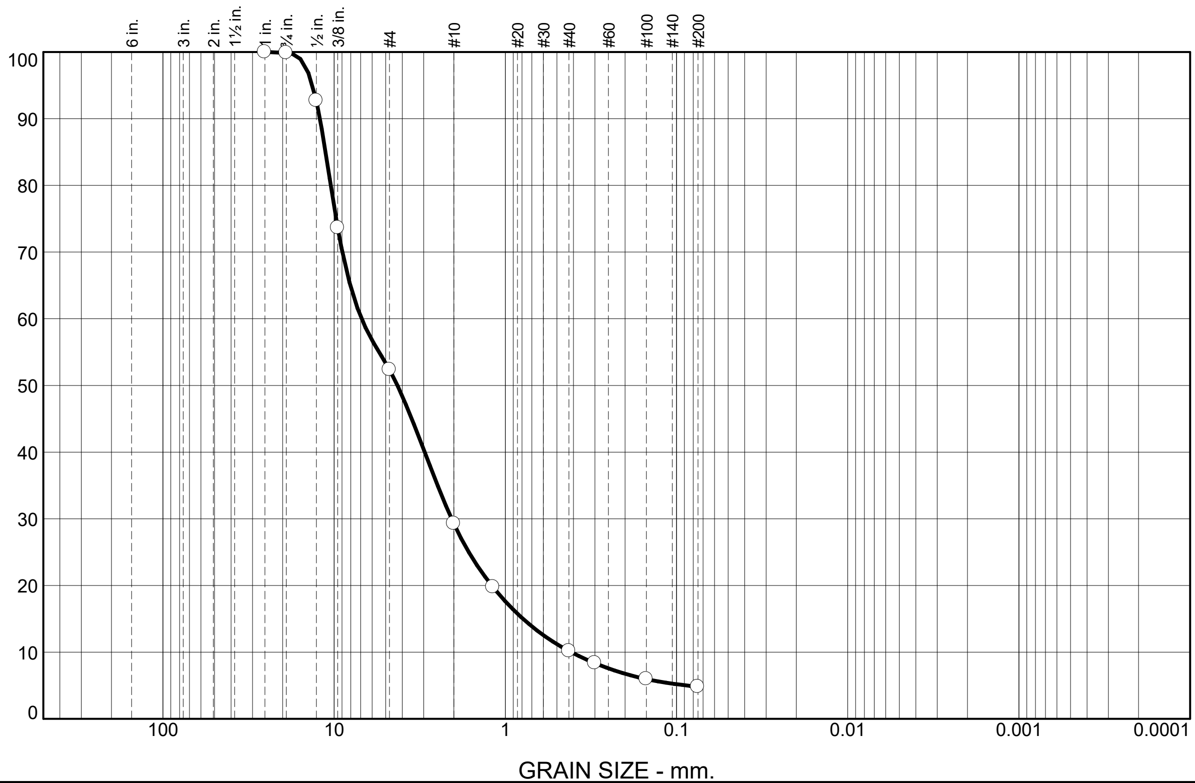
NewFields

Client: South 32
Project: Hermosa Geotechnical Lab Testing

Project No: 475.0014.027 **Figure** 21-341-07

Tested By: EG/QH **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.1	47.5	23.1	19.1	5.4	4.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100.0		
.75"	99.9		
.5"	92.7		
.375"	73.6		
#4	52.4		
#10	29.3		
#16	19.8		
#40	10.2		
#50	8.3		
#100	5.9		
#200	4.8		

* (no specification provided)

Soil Description

Gray well-graded sand with gravel

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 12.1005 D_{85}= 11.2182 D_{60}= 6.9109
D_{50}= 4.2726 D_{30}= 2.0611 D_{15}= 0.7884
D_{10}= 0.4129 C_u= 16.74 C_c= 1.49

Classification

USCS= SW AASHTO= A-1-a

Remarks

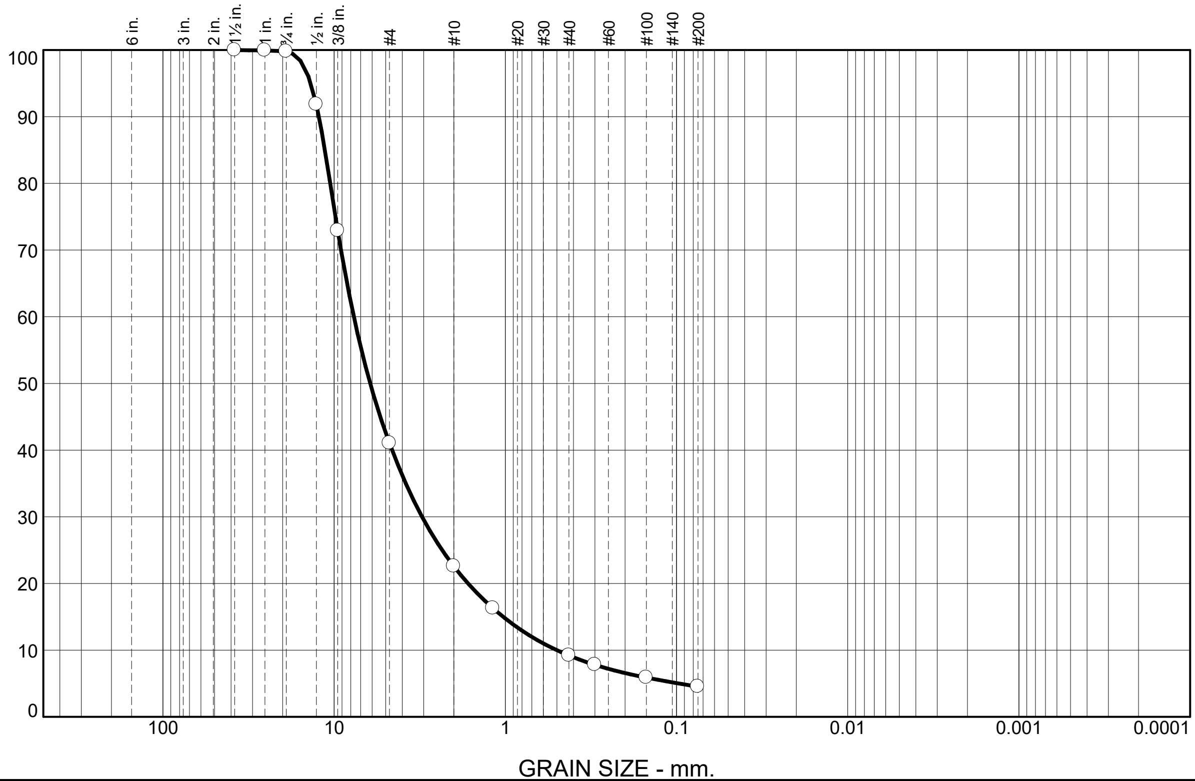
Location: HSVOL-21-09
Sample Number: 21-341-08 **Depth:** 2255-2280' **Date:** 12/20/2021

NewFields

Client: South 32
Project: Hermosa Geotechnical Lab Testing
Project No: 475.0014.027 **Figure** 21-341-08

Tested By: EG/QH **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.2	58.8	18.4	13.4	4.7	4.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5"	100.0		
1"	99.9		
.75"	99.8		
.5"	91.8		
.375"	72.9		
#4	41.0		
#10	22.6		
#16	16.3		
#40	9.2		
#50	7.8		
#100	5.9		
#200	4.5		

* (no specification provided)

Soil Description

Gray well-graded gravel with sand

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 12.2658 D_{85}= 11.3186 D_{60}= 7.6713
D_{50}= 6.1581 D_{30}= 3.0683 D_{15}= 1.0296
D_{10}= 0.5005 C_u= 15.33 C_c= 2.45

Classification

USCS= GW AASHTO= A-1-a

Remarks

Location: HSVOL-21-10
Sample Number: 21-341-09 **Depth:** 2330-2360' **Date:** 12/20/2021

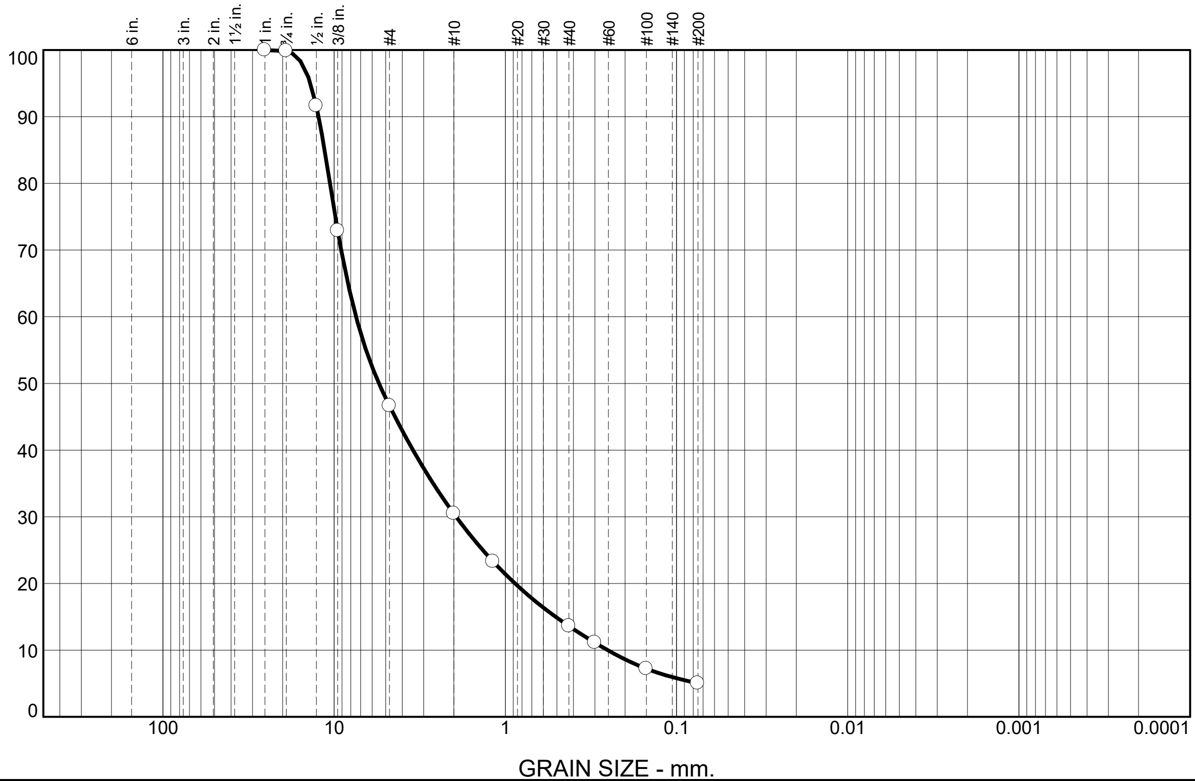
NewFields

Client: South 32
Project: Hermosa Geotechnical Lab Testing

Project No: 475.0014.027 **Figure** 21-341-09

Tested By: EG/QH **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.2	53.2	16.1	16.9	8.6	5.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100.0		
.75"	99.8		
.5"	91.6		
.375"	72.9		
#4	46.6		
#10	30.5		
#16	23.3		
#40	13.6		
#50	11.1		
#100	7.2		
#200	5.0		

* (no specification provided)

Soil Description

Gray well-graded gravel with silt and sand

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 12.3183 D_{85}= 11.3650 D_{60}= 7.4491
D_{50}= 5.4729 D_{30}= 1.9399 D_{15}= 0.5085
D_{10}= 0.2525 C_u= 29.50 C_c= 2.00

Classification

USCS= GW-GM AASHTO= A-1-a

Remarks

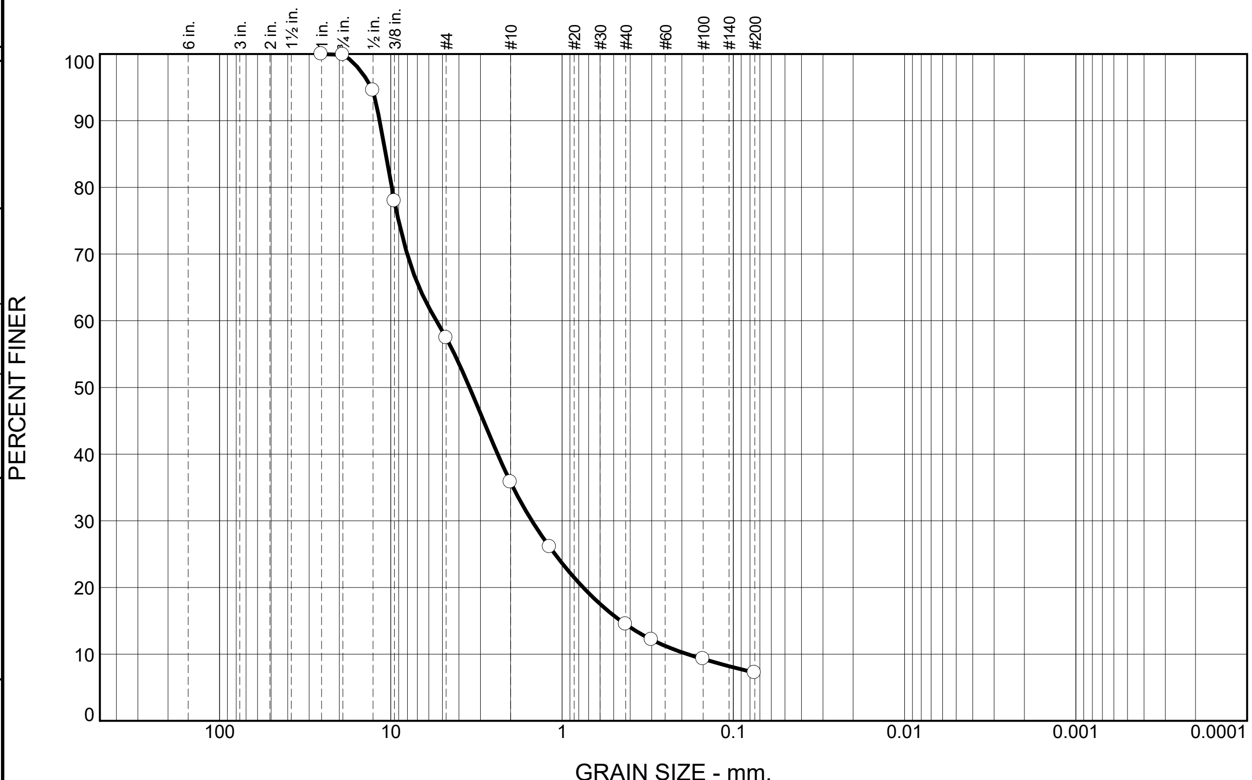
Location: HSVOL-21-11
Sample Number: 21-341-10 **Depth:** 2630-2655' **Date:** 12/20/2021

NewFields

Client: South 32
Project: Hermosa Geotechnical Lab Testing
Project No: 475.0014.027 **Figure** 21-341-10

Tested By: QH/EG **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.1	42.5	21.6	21.3	7.3	7.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100.0		
.75"	99.9		
.5"	94.6		
.375"	78.0		
#4	57.4		
#10	35.8		
#16	26.1		
#40	14.5		
#50	12.2		
#100	9.3		
#200	7.2		

* (no specification provided)

Soil Description

Gray well-graded sand with siltyclay and gravel

Atterberg Limits

PL= 15 LL= 19 PI= 4

Coefficients

D_{90}= 11.6120 D_{85}= 10.6954 D_{60}= 5.4129
D_{50}= 3.4735 D_{30}= 1.5009 D_{15}= 0.4546
D_{10}= 0.1857 C_u= 29.15 C_c= 2.24

Classification

USCS= SW-SC AASHTO= A-1-a

Remarks

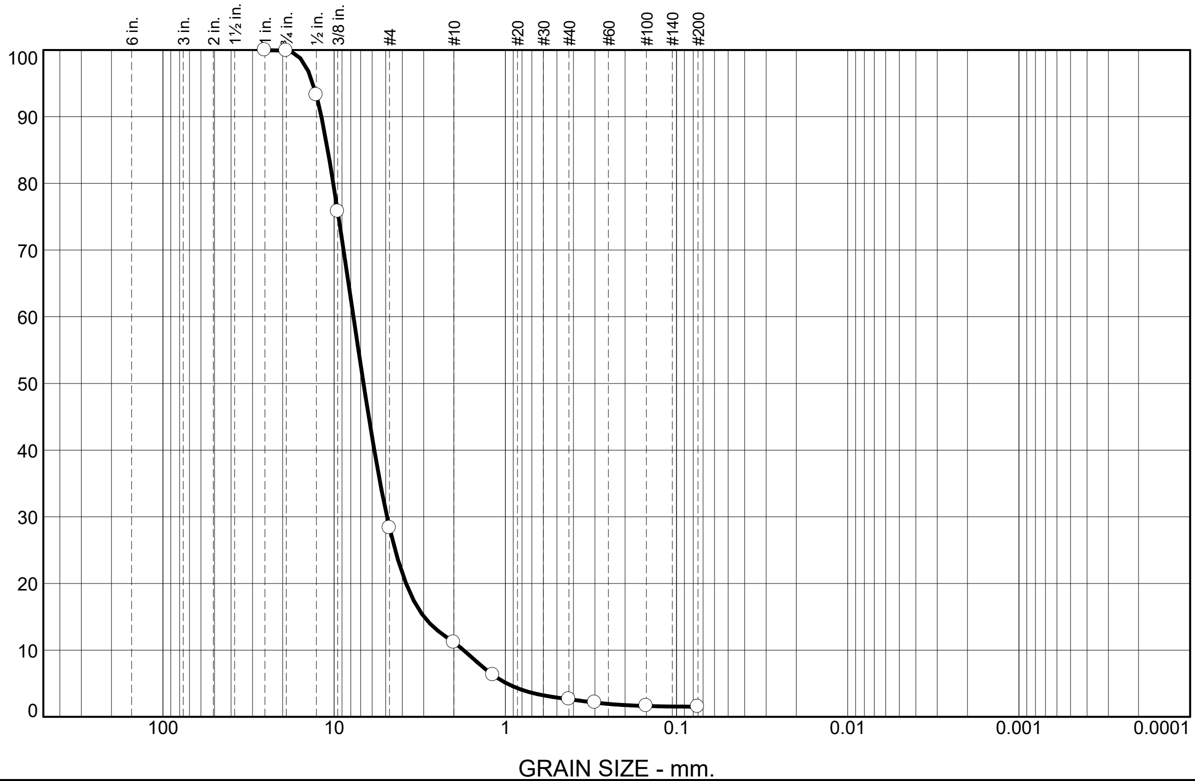
Location: OLDVOL-21-04
Sample Number: 21-341-11 **Depth:** 2690-2710' **Date:** 12/20/2021

NewFields

Client: South 32
Project: Hermosa Geotechnical Lab Testing
Project No: 475.0014.027 **Figure** 21-341-11

Tested By: QH/EG **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.1	71.6	17.1	8.6	1.1	1.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100.0		
.75"	99.9		
.5"	93.3		
.375"	75.8		
#4	28.3		
#10	11.2		
#16	6.3		
#40	2.6		
#50	2.1		
#100	1.6		
#200	1.5		

* (no specification provided)

Soil Description

Gray well-graded gravel with sand

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 11.8593 D_{85}= 10.8904 D_{60}= 7.7099
D_{50}= 6.7347 D_{30}= 4.9119 D_{15}= 2.9876
D_{10}= 1.7559 C_u= 4.39 C_c= 1.78

Classification

USCS= GW AASHTO= A-1-a

Remarks

Location: OLDVOL-21-05
Sample Number: 21-341-12 **Depth:** 2725-2740' **Date:** 12/20/2021

NewFields

Client: South 32
Project: Hermosa Geotechnical Lab Testing
Project No: 475.0014.027 **Figure** 21-341-12

Tested By: EG/QH **Checked By:** JW

NewFields

SPECIFIC GRAVITY COARSE AGGREGATE (ASTM C127)

LABORATORY WORKSHEET

NF Form #8

Client:	South 32	**Location:**	See Below
Project Title:	Hermosa Geotechnical Lab Testing	**Elevation:**	-
Project Number:	475.0014.027	**Test Start Date:**	12/28/21
Project Engineer:	Craig Thompson	**Tested By:**	ZM/QH
Field Sample ID:	See Below	**Checked By:**	JW
Laboratory Sample ID:	21-341		

Run by / Date				
Sample No.		21-341-01	21-341-02	21-341-03
Sample Location		MVAND-21-04	MVAND-21-05	MVAND-21-06
Sample Depth		115-150'	300-325'	745-785'
Saturated Surface Dry Aggregate + Tare		5673.8	5578.4	5558.4
Dry Aggregate + Tare		5636.8	5531.7	5526.4
Tare		621.1	570.9	544.7
Saturated Surface Dry	(B)	5052.7	5007.5	5013.7
Dry Aggregate	(A)	5015.7	4960.8	4981.7
Aggregate Submerged	(C)	3227.1	3195.3	3183.6
Temperature of Water		77.0	77.0	77.0
Apparent Specific Gravity	(A / (A-C))	2.804	2.810	2.771
Bulk Specific Gravity, SSD	(B/ (B-C))	2.768	2.763	2.740
Bulk Specific Gravity	(A / (B-C))	2.747	2.737	2.722
Absorption (%)		0.7%	0.9%	0.6%

Remarks:

NewFields

SPECIFIC GRAVITY COARSE AGGREGATE (ASTM C127)

LABORATORY WORKSHEET

NF Form #8

Client:	South 32	**Location:**	See Below
Project Title:	Hermosa Geotechnical Lab Testing	**Elevation:**	-
Project Number:	475.0014.027	**Test Start Date:**	12/28/21
Project Engineer:	Craig Thompson	**Tested By:**	ZM/QH
Field Sample ID:	See Below	**Checked By:**	JW
Laboratory Sample ID:	21-341		

Run by / Date				
Sample No./ Depth		21-341-04	21-341-05	21-341-06
Sample Description		MVAND-21-07	HSVOL-21-06	HSVOL-21-07
Tare No.		895-925'	1180-1205'	1575-1600'
Saturated Surface Dry Aggregate + Tare		5610.7	5623.6	5617
Dry Aggregate + Tare		5578.7	5534.3	5569.9
Tare		596.8	588.5	590.8
Saturated Surface Dry	(B)	5013.9	5035.1	5026.2
Dry Aggregate	(A)	4981.9	4945.8	4979.1
Aggregate Submerged	(C)	3205.8	3102.8	3123.6
Temperature of Water		77.0	77.0	77.0
Apparent Specific Gravity	(A / (A-C))	2.805	2.684	2.683
Bulk Specific Gravity, SSD	(B/ (B-C))	2.773	2.606	2.642
Bulk Specific Gravity	(A / (B-C))	2.755	2.560	2.617
Absorption (%)		0.6%	1.8%	0.9%

Remarks:

NewFields

SPECIFIC GRAVITY COARSE AGGREGATE (ASTM C127)

LABORATORY WORKSHEET

NF Form #8

Client:	South 32	**Location:**	See Below
Project Title:	Hermosa Geotechnical Lab Testing	**Elevation:**	-
Project Number:	475.0014.027	**Test Start Date:**	12/28/21
Project Engineer:	Craig Thompson	**Tested By:**	ZM/QH
Field Sample ID:	See Below	**Checked By:**	JW
Laboratory Sample ID:	21-341		

Run by / Date				
Sample No./ Depth		21-341-07	21-341-08	21-341-09
Sample Description		HSVOL-21-08	HSVOL-21-09	HSVOL-21-10
Tare No.		1675-1705'	2255-2280'	2330-2360'
Saturated Surface Dry Aggregate + Tare		7209.1	7252.3	7206.3
Dry Aggregate + Tare		7154.3	7182.5	7151.3
Tare		2195.4	2193.9	2194.8
Saturated Surface Dry	(B)	5013.7	5058.4	5011.5
Dry Aggregate	(A)	4958.9	4988.6	4956.5
Aggregate Submerged	(C)	3113.8	3169.9	3249.6
Temperature of Water		77.0	77.0	77.0
Apparent Specific Gravity	(A / (A-C))	2.688	2.743	2.904
Bulk Specific Gravity, SSD	(B/ (B-C))	2.639	2.679	2.844
Bulk Specific Gravity	(A / (B-C))	2.610	2.642	2.813
Absorption (%)		1.1%	1.4%	1.1%

Remarks:

NewFields

SPECIFIC GRAVITY COARSE AGGREGATE (ASTM C127)

LABORATORY WORKSHEET

NF Form #8

Client:	South 32	**Location:**	See Below
Project Title:	Hermosa Geotechnical Lab Testing	**Elevation:**	-
Project Number:	475.0014.027	**Test Start Date:**	12/28/21
Project Engineer:	Craig Thompson	**Tested By:**	ZM/QH
Field Sample ID:	See Below	**Checked By:**	JW

Laboratory Sample ID: 21-341

Run by / Date				
Sample No./ Depth		21-341-10	21-341-11	21-341-12
Sample Description		HSVOL-21-11	OLDVOL-21-04	OLDVOL-21-05
Tare No.		2630-2655'	2690-2710'	2725-2740'
Saturated Surface Dry Aggregate + Tare		7199.6	7331.4	7212.5
Dry Aggregate + Tare		7171.1	7219.6	7160
Tare		2193.5	2294.3	2193.1
Saturated Surface Dry	(B)	5006.1	5037.1	5019.4
Dry Aggregate	(A)	4977.6	4925.3	4966.9
Aggregate Submerged	(C)	3138.5	3177.3	3190.5
Temperature of Water		77.0	77.0	77.0

Apparent Specific Gravity	(A / (A-C))	2.707	2.818	2.796
Bulk Specific Gravity, SSD	(B/ (B-C))	2.680	2.708	2.744
Bulk Specific Gravity	(A / (B-C))	2.665	2.648	2.716
Absorption (%)		0.6%	2.3%	1.1%

Remarks:

NewFields

SPECIFIC GRAVITY FINE AGGREGATE (ASTM C128)

LABORATORY WORKSHEET

NF Form #10

Client: South 32	**Test Start Date: 12/29/2021**
Project Title: Hermosa Geotechnical Lab Testing	**Tested By: ZM/QH**
Project Number: 475.0014.027	**Checked By: JW**
Project Engineer: Craig Thompson	**Remarks:**
Work Order No.: 21-341	

Run by / Date						
Sample No.		21-341-01	21-341-02	21-341-03	21-341-04	21-341-05
Sample Location		MVAND-21-04	MVAND-21-05	MVAND-21-06	MVAND-21-07	HSVOL-21-06
Sample Depth		115-150'	300-325'	745-785'	895-925'	1180-1205'
Dry Aggregate + Tare		703.5	703.3	1081.1	1035.4	1052.1
Tare Wt		210.7	217.7	588.3	544.7	570.6
Saturated Surface Dry Aggregate	(S)	503.9	496.2	500.6	500.3	502.0
Dry Aggregate	(A)	492.8	485.6	492.8	490.7	481.5
Wt. Of Flask, Aggregate + H2O	(C)	1760.49	1757.47	1760.59	1761.20	1744.33
Calibrated wt. Of Flask + Water	(B)	1445.4	1445.4	1445.4	1445.4	1445.4

Apparent Specific Gravity	(A / (B + A - C))	2.773	2.798	2.774	2.805	2.637
Bulk Specific Gravity, SSD	(S / (B + S - C))	2.668	2.694	2.700	2.711	2.472
Bulk Specific Gravity	(A / (B + S - C))	2.609	2.637	2.658	2.659	2.370
Absorption (%)	[(S-A) / A] x 100	2.3%	2.2%	1.6%	2.0%	4.3%

Remarks:

NewFields

SPECIFIC GRAVITY FINE AGGREGATE (ASTM C128)
LABORATORY WORKSHEET

NF Form #10

Client: South 32	**Test Start Date: 12/29/2021**
Project Title: Hermosa Geotechnical Lab Testing	**Tested By: ZM/QH**
Project Number: 475.0014.027	**Checked By: JW**
Project Engineer: Craig Thompson	**Remarks:**
Work Order No.: 21-341	

Run by / Date						
Sample No.		21-341-06	21-341-07	21-341-08	21-341-09	21-341-10
Sample Location		HSVOL-21-07	HSVOL-21-08	HSVOL-21-09	HSVOL-21-10	HSVOL-21-11
Sample Depth		1575-1600'	1675-1705'	2255-2280'	2330-2360'	2630-2655'
Dry Aggregate + Tare		1080.7	1112.2	779.2	720.1	1087.9
Tare Wt		590.7	620.9	295.0	239.4	596.6
Saturated Surface Dry Aggregate	(S)	499.2	501.4	500.1	496.3	501.9
Dry Aggregate	(A)	490.0	491.3	484.2	480.7	491.3
Wt. Of Flask, Aggregate + H2O	(C)	1749.08	1742.08	1743.45	1752.06	1738.05
Calibrated wt. Of Flask + Water	(B)	1447.9	1434.8	1434.8	1445.4	1434.8

Apparent Specific Gravity	(A / (B + A - C))	2.595	2.670	2.758	2.762	2.612
Bulk Specific Gravity, SSD	(S / (B + S - C))	2.521	2.583	2.612	2.617	2.526
Bulk Specific Gravity	(A / (B + S - C))	2.474	2.531	2.529	2.535	2.473
Absorption (%)	[(S-A) / A] x 100	1.9%	2.1%	3.3%	3.2%	2.2%

Remarks:

NewFields

SPECIFIC GRAVITY FINE AGGREGATE (ASTM C128)

LABORATORY WORKSHEET

NF Form #10

Client: South 32	**Test Start Date: 12/29/2021**
Project Title: Hermosa Geotechnical Lab Testing	**Tested By: ZM/QH**
Project Number: 475.0014.027	**Checked By: JW**
Project Engineer: Craig Thompson	**Remarks:**
Work Order No.: 21-341	

Run by / Date						
Sample No.		21-341-11	21-341-12			
Sample Location		OLDVOL-21-04	OLDVOL-21-05			
Sample Depth		2690-2710'	2725-2740'			
Dry Aggregate + Tare		958.5	950.9			
Tare Wt		472.4	462.3			
Saturated Surface Dry Aggregate	(S)	502.4	500.1			
Dry Aggregate	(A)	486.1	488.6			
Wt. Of Flask, Aggregate + H2O	(C)	1749.57	1756.18			
Calibrated wt. Of Flask + Water	(B)	1445.4	1445.4			

Apparent Specific Gravity	(A / (B + A - C))	2.672	2.748			
Bulk Specific Gravity, SSD	(S / (B + S - C)	2.534	2.642			
Bulk Specific Gravity	(A / (B + S - C))	2.452	2.581			
Absorption (%)	[(S-A) / A] x 100	3.3%	2.4%			

Remarks:

LOS ANGELES ABRASION (ASTM C131/ASTM C535)

LABORATORY WORKSHEET

NF Form #48

Client:	South 32	**Field Sample ID:**	MVAND-21-04	**Test Start Date:**	1/3/2022
Project Title:	Hermosa Geotechnical Lab Testing	**Laboratory Sample ID:**	21-341-01	**Tested By:**	ZM
Project Number:	475.0014.027	**Location:**	MVAND-21-04	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	115-150'	**Sample Description:**	

Test Type	
ASTM C131	ASTM C535
A	1
B	2
C	3
D	

Remarks:

Sample	**Total Wt. (g)**
Tare ID	
Initial Wt. + Tare	4988.40
Post Wt. + Tare	4397.8
Percent Loss	**12%**

NewFields

LOS ANGELES ABRASION (ASTM C131/ASTM C535)

LABORATORY WORKSHEET

NF Form #48

Client:	South 32	**Field Sample ID:**	MVAND-21-05	**Test Start Date:**	1/3/2022
Project Title:	Hermosa Geotechnical Lab Testing	**Laboratory Sample ID:**	21-341-02	**Tested By:**	ZM
Project Number:	475.0014.027	**Location:**	MVAND-21-05	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	300-325'	**Sample Description:**	

Test Type

ASTM C131	ASTM C535
A	1
B	2
C	3
D	

Remarks:

Sample	**Total Wt. (g)**
Tare ID	
Initial Wt. + Tare	4976.70
Post Wt. + Tare	4432.1
Percent Loss	**11%**

NewFields

LOS ANGELES ABRASION (ASTM C131/ASTM C535)

LABORATORY WORKSHEET

NF Form #48

Client:	South 32	**Field Sample ID:**	MVAND-21-06	**Test Start Date:**	1/3/2022
Project Title:	Hermosa Geotechnical Lab Testing	**Laboratory Sample ID:**	21-341-03	**Tested By:**	ZM
Project Number:	475.0014.027	**Location:**	MVAND-21-06	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	745-785'	**Sample Description:**	

Test Type

ASTM C131	ASTM C535
A	1
B	2
C	3
D	

Remarks:

Sample	Total Wt. (g)
Tare ID	
Initial Wt. + Tare	4999.70
Post Wt. + Tare	4508.6
Percent Loss	**10%**

NewFields

LOS ANGELES ABRASION (ASTM C131/ASTM C535)

LABORATORY WORKSHEET

NF Form #48

Client:	South 32	**Field Sample ID:**	MVAND-21-07	**Test Start Date:**	1/3/2022
Project Title:	Hermosa Geotechnical Lab Testing	**Laboratory Sample ID:**	21-341-04	**Tested By:**	ZM
Project Number:	475.0014.027	**Location:**	MVAND-21-07	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	895-925'	**Sample Description:**	

Test Type

ASTM C131	ASTM C535
A	1
B	2
C	3
D	

Remarks:

Sample	**Total Wt. (g)**
Tare ID	
Initial Wt. + Tare	4994.00
Post Wt. + Tare	4494.4
Percent Loss	**10%**

NewFields

LOS ANGELES ABRASION (ASTM C131/ASTM C535)

LABORATORY WORKSHEET

NF Form #48

Client:	South 32	**Field Sample ID:**	HSVOL-21-06	**Test Start Date:**	1/3/2022
Project Title:	Hermosa Geotechnical Lab Testing	**Laboratory Sample ID:**	21-341-05	**Tested By:**	ZM
Project Number:	475.0014.027	**Location:**	HSVOL-21-06	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	1180-1205'	**Sample Description:**	

Test Type

ASTM C131	ASTM C535
A	1
B	2
C	3
D	

Remarks:

Sample	**Total Wt. (g)**
Tare ID	
Initial Wt. + Tare	4975.10
Post Wt. + Tare	4328
Percent Loss	**13%**

NewFields

LOS ANGELES ABRASION (ASTM C131/ASTM C535)

LABORATORY WORKSHEET

NF Form #48

Client:	South 32	**Field Sample ID:**	HSVOL-21-07	**Test Start Date:**	1/3/2022
Project Title:	Hermosa Geotechnical Lab Testing	**Laboratory Sample ID:**	21-341-06	**Tested By:**	ZM
Project Number:	475.0014.027	**Location:**	HSVOL-21-07	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	1575-1600'	**Sample Description:**	

Test Type

ASTM C131	ASTM C535
A	1
B	2
C	3
D	

Remarks:

Sample	**Total Wt. (g)**
Tare ID	
Initial Wt. + Tare	4992.50
Post Wt. + Tare	4400.8
Percent Loss	**12%**

NewFields

LOS ANGELES ABRASION (ASTM C131/ASTM C535)

LABORATORY WORKSHEET

NF Form #48

Client:	South 32	**Field Sample ID:**	HSVOL-21-08	**Test Start Date:**	1/3/2022
Project Title:	Hermosa Geotechnical Lab Testing	**Laboratory Sample ID:**	21-341-07	**Tested By:**	ZM
Project Number:	475.0014.027	**Location:**	HSVOL-21-08	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	1675-1705'	**Sample Description:**	

Test Type	
ASTM C131	ASTM C535
A	1
B	2
C	3
D	

Remarks:

Sample	**Total Wt. (g)**
Tare ID	
Initial Wt. + Tare	4995.10
Post Wt. + Tare	4347.4
Percent Loss	**13%**

NewFields

LOS ANGELES ABRASION (ASTM C131/ASTM C535)

LABORATORY WORKSHEET

NF Form #48

Client:	South 32	**Field Sample ID:**	HSVOL-21-09	**Test Start Date:**	1/3/2022
Project Title:	Hermosa Geotechnical Lab Testing	**Laboratory Sample ID:**	21-341-08	**Tested By:**	ZM
Project Number:	475.0014.027	**Location:**	HSVOL-21-09	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	2255-2280'	**Sample Description:**	

Test Type

ASTM C131	ASTM C535
A	1
B	2
C	3
D	

Remarks:

Sample	**Total Wt. (g)**
Tare ID	
Initial Wt. + Tare	5001.60
Post Wt. + Tare	4367.7
Percent Loss	**13%**

LOS ANGELES ABRASION (ASTM C131/ASTM C535)

LABORATORY WORKSHEET

NF Form #48

Client:	South 32	**Field Sample ID:**	HSVOL-21-10	**Test Start Date:**	1/3/2022
Project Title:	Hermosa Geotechnical Lab Testing	**Laboratory Sample ID:**	21-341-09	**Tested By:**	ZM
Project Number:	475.0014.027	**Location:**	HSVOL-21-10	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	2330-2360'	**Sample Description:**	

Test Type	
ASTM C131	ASTM C535
A	1
B	2
C	3
D	

Remarks:

Sample	Total Wt. (g)
Tare ID	
Initial Wt. + Tare	4991.40
Post Wt. + Tare	4464.9
Percent Loss	**11%**

NewFields

LOS ANGELES ABRASION (ASTM C131/ASTM C535)

LABORATORY WORKSHEET

NF Form #48

Client:	South 32	**Field Sample ID:**	HSVOL-21-11	**Test Start Date:**	1/3/2022
Project Title:	Hermosa Geotechnical Lab Testing	**Laboratory Sample ID:**	21-341-10	**Tested By:**	ZM
Project Number:	475.0014.027	**Location:**	HSVOL-21-11	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	2630-2655'	**Sample Description:**	

Test Type

ASTM C131	ASTM C535
A	1
B	2
C	3
D	

Remarks:

Sample	**Total Wt. (g)**
Tare ID	
Initial Wt. + Tare	4999.30
Post Wt. + Tare	4391.3
Percent Loss	**12%**

NewFields

LOS ANGELES ABRASION (ASTM C131/ASTM C535)

LABORATORY WORKSHEET

NF Form #48

Client:	South 32	**Field Sample ID:**	OLDVOL-21-04	**Test Start Date:**	1/3/2022
Project Title:	Hermosa Geotechnical Lab Testing	**Laboratory Sample ID:**	21-341-11	**Tested By:**	ZM
Project Number:	475.0014.027	**Location:**	OLDVOL-21-04	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	2690-2710'	**Sample Description:**	

Test Type	
ASTM C131	ASTM C535
A	1
B	2
C	3
D	

Remarks:

Sample	**Total Wt. (g)**
Tare ID	
Initial Wt. + Tare	4977.40
Post Wt. + Tare	4163.4
Percent Loss	**16%**

NewFields

LOS ANGELES ABRASION (ASTM C131/ASTM C535)

LABORATORY WORKSHEET

NF Form #48

Client:	South 32	**Field Sample ID:**	OLDVOL-21-05	**Test Start Date:**	1/3/2022
Project Title:	Hermosa Geotechnical Lab Testing	**Laboratory Sample ID:**	21-341-12	**Tested By:**	ZM
Project Number:	475.0014.027	**Location:**	OLDVOL-21-05	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	2725-2740'	**Sample Description:**	

Test Type

ASTM C131	ASTM C535
A	1
B	2
C	3
D	

Remarks:

Sample	**Total Wt. (g)**
Tare ID	
Initial Wt. + Tare	4989.90
Post Wt. + Tare	4361.2
Percent Loss	**13%**

NewFields

Sodium Sulfate Soundness C88

Client:	South 32	**Field Sample ID:**	MVAND-21-04		
Project Title:	Hermosa Geotechnical Lab Testing	**Laboratory Sample ID: 21-341-01**		**Tested By:**	ZM
Project Number:	475.0014.027	**Location:**	MVAND-21-04	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	115-150'	**Sample Description:**	

Coarse Aggregate

Size:	Percent Loss:	Weighted % Loss:
1/2"	10.4	5.4
3/8"	5.2	1.3
#4	6.3	1.5
	Total:	8.2

Fine Aggregate

Size:	Percent Loss:	Weighted % Loss:
#4	6.8	1.4
#8	6.3	1.3
#16	10.5	2.1
#30	9.6	1.9
#50	8.7	1.8
	Total:	8.5

Notes:

NewFields

Sodium Sulfate Soundness C88

Client:	South 32	**Field Sample ID:**	MVAND-21-05		
Project Title:	Hermosa Geotechnical Lab Testing	**Laboratory Sample ID:**	**21-341-02**	**Tested By:**	ZM
Project Number:	475.0014.027	**Location:**	MVAND-21-05	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	300-325'	**Sample Description:**	

Coarse Aggregate

Size:	Percent Loss:	Weighted % Loss:
1/2"	1.4	0.7
3/8"	1.8	0.5
#4	6.5	1.5
	Total:	2.7

Fine Aggregate

Size:	Percent Loss:	Weighted % Loss:
#4	5.9	1.2
#8	9.2	1.8
#16	8.8	1.8
#30	6.3	1.3
#50	5	1
	Total:	7.1

Notes:

NewFields

Sodium Sulfate Soundness C88

Client:	South 32	**Field Sample ID:**	MVAND-21-06		
Project Title:	Hermosa Geotechnical Lab Testing	**Laboratory Sample ID:**	**21-341-03**	**Tested By:**	ZM
Project Number:	475.0014.027	**Location:**	MVAND-21-06	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	745-785'	**Sample Description:**	

Coarse Aggregate

Size:	Percent Loss:	Weighted % Loss:
1/2"	0.3	0.2
3/8"	0.5	0.1
#4	1.7	0.4
	Total:	0.7

Fine Aggregate

Size:	Percent Loss:	Weighted % Loss:
#4	2.9	0.6
#8	3.4	0.7
#16	3	0.6
#30	3.1	0.6
#50	4.2	0.8
	Total:	3.3

Notes:

NewFields

Sodium Sulfate Soundness C88

Client:	South 32	**Field Sample ID:**	MVAND-21-07		
Project Title:	Hermosa Geotechnical Lab Testing	**Laboratory Sample ID: 22-341-04**		**Tested By:**	ZM
Project Number:	475.0014.027	**Location:**	MVAND-21-07	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	895-925'	**Sample Description:**	

Coarse Aggregate

Size:	Percent Loss:	Weighted % Loss:
1/2"	1	0.5
3/8"	0.8	0.2
#4	1.8	0.4
	Total:	1.1

Fine Aggregate

Size:	Percent Loss:	Weighted % Loss:
#4	3.5	0.7
#8	2.5	0.5
#16	2.3	0.5
#30	2.6	0.5
#50	3.3	0.7
	Total:	2.8

Notes:

NewFields

Sodium Sulfate Soundness C88

Client:	South 32	**Field Sample ID:**	HSVOL-21-06		
Project Title:	Hermosa Geotechnical Lab Testing	**Laboratory Sample ID: 21-341-05**		**Tested By:**	ZM
Project Number:	475.0014.027	**Location:**	HSVOL-21-06	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	1180-1205'	**Sample Description:**	

Coarse Aggregate

Size:	Percent Loss:	Weighted % Loss:
1/2"	9.6	4.9
3/8"	10.3	2.6
#4	12.6	2.9
	Total:	10.5

Fine Aggregate

Size:	Percent Loss:	Weighted % Loss:
#4	22.9	4.6
#8	25.4	5.1
#16	21.6	4.3
#30	14.7	2.9
#50	9.5	1.9
	Total:	18.8

Notes:

NewFields

Sodium Sulfate Soundness C88

Client:	South 32	**Field Sample ID:**	HSVOL-21-07		
Project Title:	Hermosa Geotechnical Lab Testing	**Laboratory Sample ID:**	21-341-06	**Tested By:**	ZM
Project Number:	475.0014.027	**Location:**	HSVOL-21-07	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	1575-1600'	**Sample Description:**	

Coarse Aggregate

Size:	Percent Loss:	Weighted % Loss:
1/2"	1.9	1.0
3/8"	4.1	1.0
#4	2	0.5
	Total:	2.5

Fine Aggregate

Size:	Percent Loss:	Weighted % Loss:
#4	4.4	0.9
#8	4.5	0.9
#16	3.5	0.7
#30	2.1	0.4
#50	2.2	0.4
	Total:	3.3

Notes:

NewFields

Sodium Sulfate Soundness C88

Client:	South 32	**Field Sample ID:**	HSVOL-21-08		
Project Title:	Hermosa Geotechnical Lab Testing	**Laboratory Sample ID:**	21-341-07	**Tested By:**	ZM
Project Number:	475.0014.027	**Location:**	HSVOL-21-08	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	1675-1705'	**Sample Description:**	

Coarse Aggregate

Size:	Percent Loss:	Weighted % Loss:
1/2"	0.4	0.2
3/8"	1.6	0.4
#4	1.5	0.3
	Total:	1.0

Fine Aggregate

Size:	Percent Loss:	Weighted % Loss:
#4	3.8	0.8
#8	5.9	1.2
#16	4.7	0.9
#30	3.4	0.7
#50	3.1	0.6
	Total:	4.2

Notes:

NewFields

Sodium Sulfate Soundness C88

Client:	South 32	**Field Sample ID:**	HSVOL-21-09		
Project Title:	Hermosa Geotechnical Lab Testing	**Laboratory Sample ID:**	21-341-08	**Tested By:**	ZM
Project Number:	475.0014.027	**Location:**	HSVOL-21-09	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	2255-2280'	**Sample Description:**	

Coarse Aggregate

Size:	Percent Loss:	Weighted % Loss:
1/2"	1	0.5
3/8"	1.3	0.3
#4	0.9	0.2
	Total:	1.1

Fine Aggregate

Size:	Percent Loss:	Weighted % Loss:
#4	3.7	0.7
#8	4.9	1.0
#16	4.4	0.9
#30	3.3	0.7
#50	4.6	0.9
	Total:	4.2

Notes:

NewFields

Sodium Sulfate Soundness C88

Client:	South 32	**Field Sample ID:**	HSVOL-21-10		
Project Title:	Hermosa Geotechnical Lab Testing	**Laboratory Sample ID:**	21-341-09	**Tested By:**	ZM
Project Number:	475.0014.027	**Location:**	HSVOL-21-10	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	2330-2360'	**Sample Description:**	

Coarse Aggregate

Size:	Percent Loss:	Weighted % Loss:
1/2"	2.6	1.3
3/8"	5.7	1.4
#4	8.7	2.0
	Total:	4.8

Fine Aggregate

Size:	Percent Loss:	Weighted % Loss:
#4	4.8	1.0
#8	15.4	3.1
#16	20.4	4.1
#30	20.2	4.0
#50	16.8	3.4
	Total:	15.5

Notes:

NewFields

Sodium Sulfate Soundness C88

Client:	South 32	**Field Sample ID:**	HSVOL-21-11		
Project Title:	Hermosa Geotechnical Lab Testing	**Laboratory Sample ID:**	21-341-10	**Tested By:**	ZM
Project Number:	475.0014.027	**Location:**	HSVOL-21-11	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	2630-2655'	**Sample Description:**	

Coarse Aggregate

Size:	Percent Loss:	Weighted % Loss:
1/2"	1.7	0.9
3/8"	0.7	0.2
#4	0.9	0.2
	Total:	1.3

Fine Aggregate

Size:	Percent Loss:	Weighted % Loss:
#4	1.7	0.3
#8	4.2	0.8
#16	3.8	0.8
#30	2.9	0.6
#50	2.3	0.5
	Total:	3.0

Notes:

NewFields

Sodium Sulfate Soundness C88

Client:	South 32	**Field Sample ID:**	OLDVOL-21-04		
Project Title:	Hermosa Geotechnical Lab Testing	**Laboratory Sample ID:**	21-341-11	**Tested By:**	ZM
Project Number:	475.0014.027	**Location:**	OLDVOL-21-04	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	2690-2710'	**Sample Description:**	

Coarse Aggregate

Size:	Percent Loss:	Weighted % Loss:
3/8"	16.9	8.8
#4	13.7	6.5
	Total:	15.4

Fine Aggregate

Size:	Percent Loss:	Weighted % Loss:
#4	20.1	4.0
#8	20.9	4.2
#16	19.7	3.9
#30	14.7	2.9
#50	8.3	1.7
	Total:	16.7

Notes:

NewFields

Sodium Sulfate Soundness C88

Client:	South 32	**Field Sample ID:**	OLDVOL-21-05		
Project Title:	Hermosa Geotechnical Lab Testing	**Laboratory Sample ID:**	21-341-12	**Tested By:**	ZM
Project Number:	475.0014.027	**Location:**	OLDVOL-21-05	**Checked By:**	JW
Project Engineer:	Craig Thompson	**Elevation:**	2725-2740'	**Sample Description:**	

Coarse Aggregate

Size:	Percent Loss:	Weighted % Loss:
3/8"	1.8	0.9
#4	7.5	3.6
	Total:	4.5

Fine Aggregate

Size:	Percent Loss:	Weighted % Loss:
#4	8.7	1.7
#8	12.8	2.6
#16	10.8	2.2
#30	7.7	1.5
#50	5.4	1.1
	Total:	9.1

Notes:

CONSTRUCTION MATERIALS ENGINEERS, INC.

ALKALI SILICA REACTIVITY RESULTS

ASTM C 1260

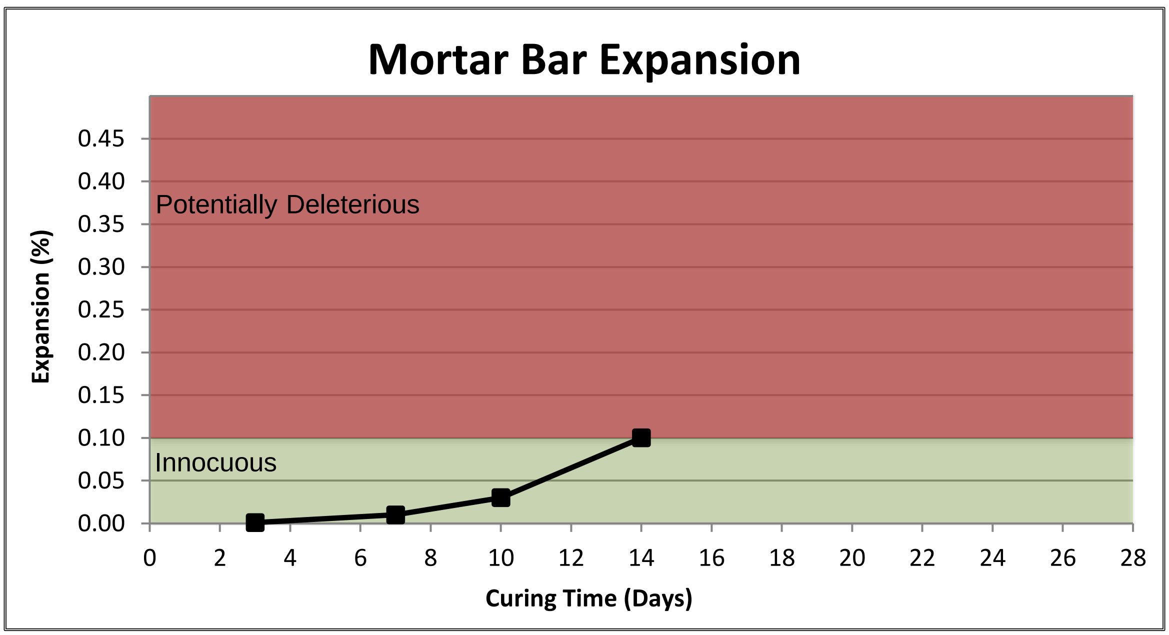
Client:	Newfields
Project Name:	MVAND-21-06 745'-765'
Project Number:	1541
Date:	7/25/2022

AGGREGATES	%
MVAND-21-06 745'-765'	100.0

CEMENTITOUS MATERIALS	%
Nevada Cement Type II	100
Water Cement Ratio	0.47

Date Cast:	7/6/2022					
Sample	**3 Day % Change**	**7 Day % Change**	**10 Day % Change**	**14 Day % Change**	**21 Day % Change**	**28 Day % Change**
Date	7/11/22	7/15/22	7/18/22	7/22/22		
1	0.001	0.010	0.033	0.106		
2	0.001	0.012	0.033	0.103		
3	0.001	0.012	0.031	0.101		
Average	0.00	0.01	0.03	**0.10**		

Note: Number of days is based on zero reading 2 days after cast date



Expansion % 14 days	Classification
<0.10%	Innocuous
>0.10%	Potentially Deleterious

ATTACHMENT A

ALKALI SILICA REACTIVITY RESULTS

ASTM C 1260

Client:	Newfields
Project Name:	HSVOL-21-08 1675'-1705'
Project Number:	1541
Date:	7/25/2022

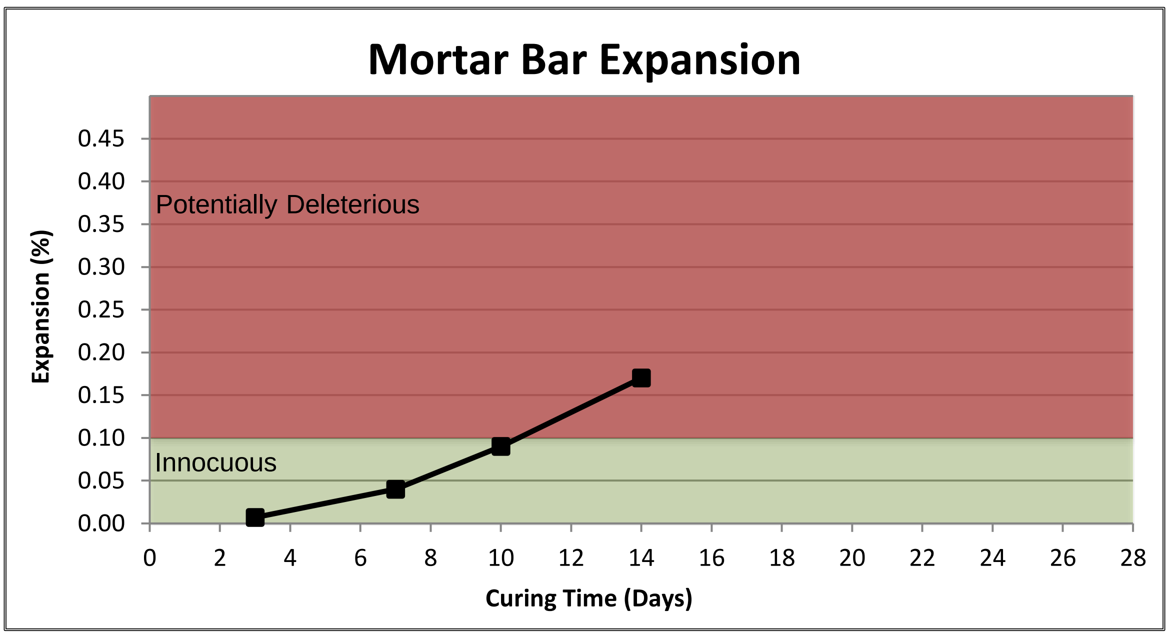
AGGREGATES	%
HSVOL-21-08 1675'-1705'	100.0

CEMENTITOUS MATERIALS	%
Nevada Cement Type II	100
Water Cement Ratio	0.47

Date Cast: 7/6/2022

Sample	3 Day % Change	7 Day % Change	10 Day % Change	14 Day % Change	21 Day % Change	28 Day % Change
Date	7/11/22	7/15/22	7/18/22	7/22/22		
1	0.003	0.032	0.081	0.166		
2	0.012	0.041	0.091	0.171		
3	0.007	0.033	0.088	0.163		
Average	0.01	0.04	0.09	**0.17**		

Note: Number of days is based on zero reading 2 days after cast date



Expansion % 14 days	Classification
<0.10%	Innocuous
>0.10%	Potentially Deleterious

ATTACHMENT A

CONSTRUCTION MATERIALS ENGINEERS, INC.

ALKALI SILICA REACTIVITY RESULTS

ASTM C 1260

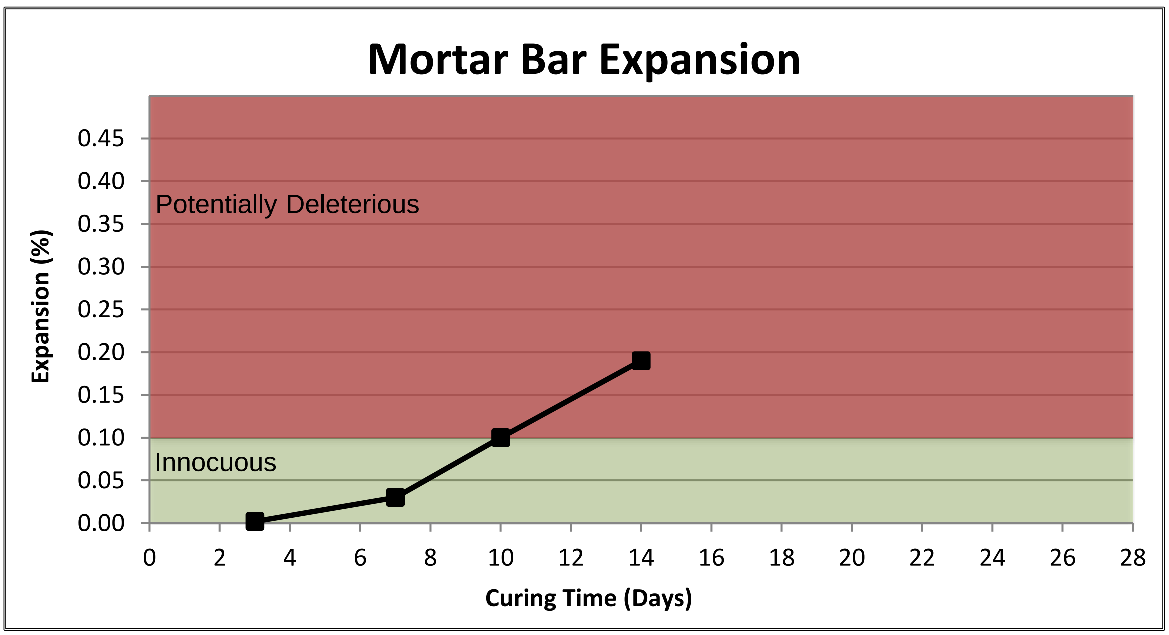
Client:	Newfields
Project Name:	OLDVOL-21-05 2725'-2740'
Project Number:	1541
Date:	7/25/2022

AGGREGATES	%
OLDVOL-21-05 2725'-2740'	100.0

CEMENTITOUS MATERIALS	%
Nevada Cement Type II	100
Water Cement Ratio	0.47

Date Cast: 7/6/2022						
Sample	**3 Day % Change**	**7 Day % Change**	**10 Day % Change**	**14 Day % Change**	**21 Day % Change**	**28 Day % Change**
Date	7/11/22	7/15/22	7/18/22	7/22/22		
1	0.001	0.032	0.099	0.181		
2	0.002	0.034	0.102	0.191		
3	0.002	0.030	0.097	0.183		
Average	0.00	0.03	0.10	**0.19**		

Note: Number of days is based on zero reading 2 days after cast date

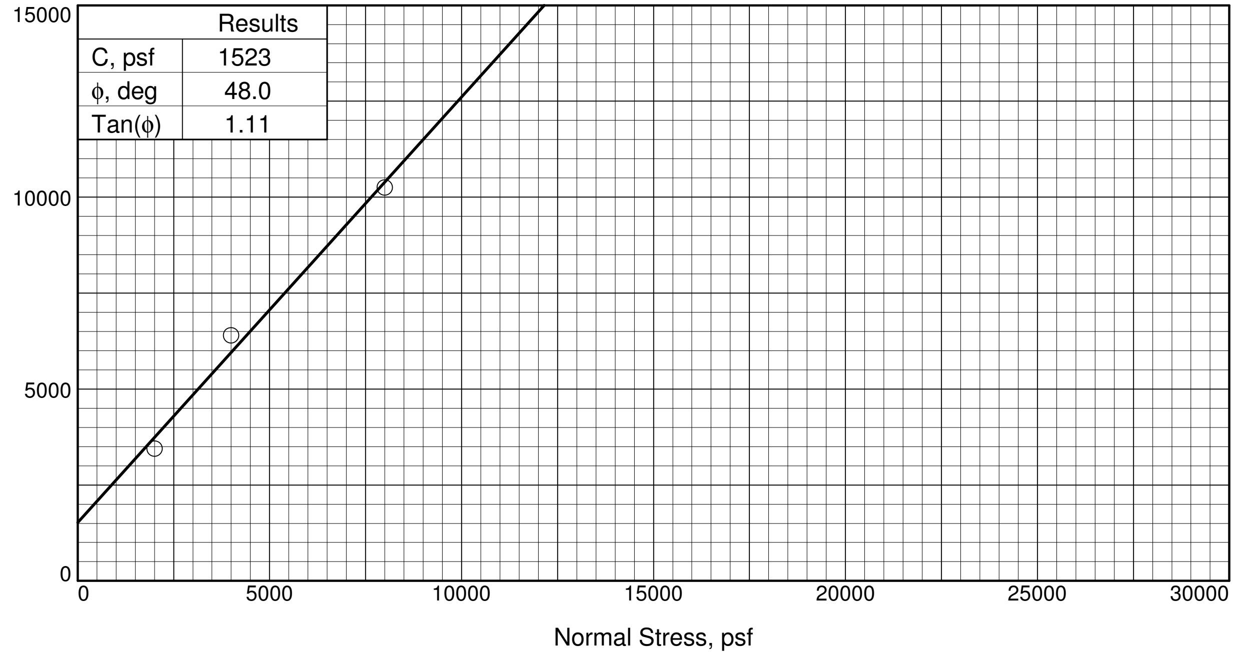


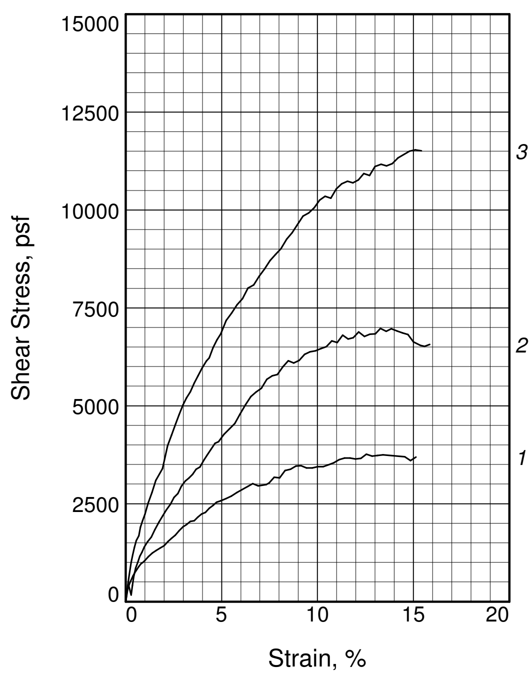
Expansion % 14 days	Classification
<0.10%	Innocuous
>0.10%	Potentially Deleterious

ATTACHMENT A

Attachment A.3

Direct Shear Laboratory Testing Results





Specimen No.		1	2	3
Initial	Water Content, %	1.0	1.0	1.0
	Dry Density, pcf	99.1	99.1	99.1
	Saturation, %	3.9	3.9	3.9
	Void Ratio	0.7004	0.7004	0.7004
	Side Length, in.	8.00	8.00	8.00
	Height, in.	4.00	4.00	4.00
At Test	Water Content, %	24.5	23.8	21.9
	Dry Density, pcf	101.5	102.6	105.8
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.6608	0.6425	0.5925
	Side Length, in.	8.00	8.00	8.00
	Height, in.	3.91	3.86	3.75
Normal Stress, psf		2000	4000	8000
Fail. Stress, psf		3447	6401	10249
Strain, %		10.0	9.9	10.1
Ult. Stress, psf				
Strain, %				
Strain rate, in./min.		0.010	0.010	0.010

Sample Type: Tamped into shear box

Description:

Assumed Specific Gravity= 2.7

Remarks: Failure chosen at 10% strain. Particles larger then .75" were removed and not included prior to test.

Figure ________

Client: Newfields #475.0014.027

Project: Hermosa Geotechnical Lab Testing NF#475.0014.027

Location: HSVOL21-01

Sample Number: 21-069-04 **Depth:** 1005-1025'

Proj. No.: DV106-00038/01 **Date Sampled:** 4/22/22

Knight Piésold CONSULTING

Cursory interpretations provided require review by a professional engineer. Knight Piesold accepts no responsibility in subsequent analyses.

DIRECT SHEAR TEST

4/28/2022

Date: 4/22/22
Client: Newfields #475.0014.027
Project: Hermosa Geotechnical Lab Testing
NF#475.0014.027
Project No.: DV106-00038/01
Location: HSVOL21-01
Depth: 1005-1025' **Sample Number:** 21-069-04
Description:
Remarks: Failure chosen at 10% strain. Particles larger then .75" were removed and not included prior to test.
Type of Sample: Tamped into shear box
Assumed Specific Gravity=2.7 **LL=** **PL=** **PI=**

Parameters for Specimen No. 1

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	6728.000		8292.000
Moisture content: Dry soil+tare, gms.	6661.400		6661.400
Moisture content: Tare, gms.	0.000		0.000
Moisture, %	1.0	24.5	24.5
Moist specimen weight, gms.	6728.0		
Side Length, in.	8.00	8.00	
Area, in.²	64.00	64.00	
Height, in.	4.00	3.91	
Net decrease in height, in.		0.09	
Wet density, pcf	100.1	126.3	
Dry density, pcf	99.1	101.5	
Void ratio	0.7004	0.6608	
Saturation, %	3.9	100.0	

Test Readings for Specimen No. 1

Normal stress = 2000 psf
Strain rate, in./min. = 0.010
Fail. Stress = 3447 psf **at reading no.** 47

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf
0	0.0000	34.000	0.0	0.0	0
1	0.0086	172.000	138.0	0.1	311
2	0.0163	239.000	205.0	0.2	461
3	0.0311	327.000	293.0	0.4	659
4	0.0372	358.000	324.0	0.5	729
5	0.0464	400.000	366.0	0.6	824
6	0.0556	432.000	398.0	0.7	896
7	0.0639	465.000	431.0	0.8	970
8	0.0730	479.000	445.0	0.9	1001
9	0.0817	506.000	472.0	1.0	1062
10	0.0953	545.000	511.0	1.2	1150
11	0.1111	585.000	551.0	1.4	1240
12	0.1270	612.000	578.0	1.6	1301

Test Readings for Specimen No. 1

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf
13	0.1450	641.000	607.0	1.8	1366
14	0.1603	667.000	633.0	2.0	1424
15	0.1759	715.000	681.0	2.2	1532
16	0.1914	750.000	716.0	2.4	1611
17	0.2075	786.000	752.0	2.6	1692
18	0.2230	838.000	804.0	2.8	1809
19	0.2386	881.000	847.0	3.0	1906
20	0.2538	906.000	872.0	3.2	1962
21	0.2698	944.000	910.0	3.4	2048
22	0.2857	950.000	916.0	3.6	2061
23	0.3010	992.000	958.0	3.8	2156
24	0.3168	1028.000	994.0	4.0	2237
25	0.3320	1047.000	1013.0	4.2	2279
26	0.3486	1093.000	1059.0	4.4	2383
27	0.3643	1126.000	1092.0	4.6	2457
28	0.3798	1160.000	1126.0	4.7	2534
29	0.3956	1177.000	1143.0	4.9	2572
30	0.4178	1203.000	1169.0	5.2	2630
31	0.4404	1231.000	1197.0	5.5	2693
32	0.4629	1269.000	1235.0	5.8	2779
33	0.4851	1305.000	1271.0	6.1	2860
34	0.5080	1338.000	1304.0	6.3	2934
35	0.5296	1374.000	1340.0	6.6	3015
36	0.5523	1347.000	1313.0	6.9	2954
37	0.5855	1363.000	1329.0	7.3	2990
38	0.5977	1381.000	1347.0	7.5	3031
39	0.6200	1446.000	1412.0	7.8	3177
40	0.6427	1439.000	1405.0	8.0	3161
41	0.6646	1520.000	1486.0	8.3	3344
42	0.6869	1536.000	1502.0	8.6	3380
43	0.7103	1571.000	1537.0	8.9	3458
44	0.7321	1574.000	1540.0	9.2	3465
45	0.7545	1551.000	1517.0	9.4	3413
46	0.7780	1552.000	1518.0	9.7	3416
47	0.8006	1566.000	1532.0	10.0	3447
48	0.8229	1565.000	1531.0	10.3	3445
49	0.8457	1588.000	1554.0	10.6	3497
50	0.8682	1610.000	1576.0	10.9	3546
51	0.8906	1645.000	1611.0	11.1	3625
52	0.9133	1664.000	1630.0	11.4	3668
53	0.9362	1663.000	1629.0	11.7	3665
54	0.9584	1653.000	1619.0	12.0	3643
55	0.9812	1661.000	1627.0	12.3	3661
56	1.0041	1706.000	1672.0	12.6	3762
57	1.0272	1685.000	1651.0	12.8	3715
58	1.0499	1692.000	1658.0	13.1	3731
59	1.0727	1701.000	1667.0	13.4	3751

Test Readings for Specimen No. 1

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf
60	1.1644	1678.000	1644.0	14.6	3699
61	1.1875	1635.000	1601.0	14.8	3602
62	1.2103	1672.000	1638.0	15.1	3686

Parameters for Specimen No. 2

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	6728.500		8246.000
Moisture content: Dry soil+tare, gms.	6661.400		6661.400
Moisture content: Tare, gms.	0.000		0.000
Moisture, %	1.0	23.8	23.8
Moist specimen weight, gms.	6728.5		
Side Length, in.	8.00	8.00	
Area, in.²	64.00	64.00	
Height, in.	4.00	3.86	
Net decrease in height, in.		0.14	
Wet density, pcf	100.1	127.0	
Dry density, pcf	99.1	102.6	
Void ratio	0.7004	0.6425	
Saturation, %	3.9	100.0	

Test Readings for Specimen No. 2

Normal stress = 4000 psf

Strain rate, in./min. = 0.010

Fail. Stress = 6401 psf **at reading no.** 48

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf
0	0.0000	0.000	0.0	0.0	0
1	0.0044	107.000	107.0	0.1	241
2	0.0120	188.000	188.0	0.1	423
3	0.0236	75.000	75.0	0.3	169
4	0.0283	184.000	184.0	0.4	414
5	0.0341	283.000	283.0	0.4	637
6	0.0422	380.000	380.0	0.5	855
7	0.0508	450.000	450.0	0.6	1013
8	0.0595	515.000	515.0	0.7	1159
9	0.0688	562.000	562.0	0.9	1265
10	0.0775	618.000	618.0	1.0	1391
11	0.0910	676.000	676.0	1.1	1521
12	0.1067	731.000	731.0	1.3	1645
13	0.1222	815.000	815.0	1.5	1834
14	0.1395	903.000	903.0	1.7	2032
15	0.1554	975.000	975.0	1.9	2194
16	0.1704	1040.000	1040.0	2.1	2340
17	0.1866	1106.000	1106.0	2.3	2489
18	0.2017	1184.000	1184.0	2.5	2664
19	0.2173	1225.000	1225.0	2.7	2756
20	0.2323	1309.000	1309.0	2.9	2945
21	0.2480	1369.000	1369.0	3.1	3080

Test Readings for Specimen No. 2

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf
22	0.2637	1400.000	1400.0	3.3	3150
23	0.2789	1442.000	1442.0	3.5	3245
24	0.2943	1501.000	1501.0	3.7	3377
25	0.3099	1529.000	1529.0	3.9	3440
26	0.3257	1605.000	1605.0	4.1	3611
27	0.3408	1666.000	1666.0	4.3	3749
28	0.3560	1729.000	1729.0	4.5	3890
29	0.3722	1796.000	1796.0	4.7	4041
30	0.3875	1814.000	1814.0	4.8	4082
31	0.4100	1898.000	1898.0	5.1	4271
32	0.4324	1958.000	1958.0	5.4	4406
33	0.4548	2020.000	2020.0	5.7	4545
34	0.4768	2125.000	2125.0	6.0	4781
35	0.4990	2233.000	2233.0	6.2	5024
36	0.5214	2327.000	2327.0	6.5	5236
37	0.5436	2376.000	2376.0	6.8	5346
38	0.5660	2419.000	2419.0	7.1	5443
39	0.5887	2523.000	2523.0	7.4	5677
40	0.6112	2564.000	2564.0	7.6	5769
41	0.6328	2578.000	2578.0	7.9	5801
42	0.6558	2664.000	2664.0	8.2	5994
43	0.6785	2733.000	2733.0	8.5	6149
44	0.7008	2706.000	2706.0	8.8	6089
45	0.7235	2737.000	2737.0	9.0	6158
46	0.7464	2804.000	2804.0	9.3	6309
47	0.7692	2834.000	2834.0	9.6	6377
48	0.7918	2845.000	2845.0	9.9	6401
49	0.8142	2872.000	2872.0	10.2	6462
50	0.8364	2893.000	2893.0	10.5	6509
51	0.8590	2959.000	2959.0	10.7	6658
52	0.8816	2940.000	2940.0	11.0	6615
53	0.9044	3022.000	3022.0	11.3	6800
54	0.9273	2981.000	2981.0	11.6	6707
55	0.9495	2994.000	2994.0	11.9	6737
56	0.9717	3061.000	3061.0	12.1	6887
57	0.9950	3008.000	3008.0	12.4	6768
58	1.0180	3033.000	3033.0	12.7	6824
59	1.0406	3039.000	3039.0	13.0	6838
60	1.0624	3100.000	3100.0	13.3	6975
61	1.0860	3066.000	3066.0	13.6	6899
62	1.1083	3096.000	3096.0	13.9	6966
63	1.1313	3070.000	3070.0	14.1	6908
64	1.1541	3048.000	3048.0	14.4	6858
65	1.1775	3031.000	3031.0	14.7	6820
66	1.1997	2947.000	2947.0	15.0	6631
67	1.2290	2909.000	2909.0	15.4	6545
68	1.2459	2895.000	2895.0	15.6	6514

Test Readings for Specimen No. 2

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf
69	1.2682	2917.000	2917.0	15.9	6563

Parameters for Specimen No. 3

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	6728.000		8123.000
Moisture content: Dry soil+tare, gms.	6661.400		6661.400
Moisture content: Tare, gms.	0.000		0.000
Moisture, %	1.0	21.9	21.9
Moist specimen weight, gms.	6728.0		
Side Length, in.	8.00	8.00	
Area, in.²	64.00	64.00	
Height, in.	4.00	3.75	
Net decrease in height, in.		0.25	
Wet density, pcf	100.1	129.1	
Dry density, pcf	99.1	105.8	
Void ratio	0.7004	0.5925	
Saturation, %	3.9	100.0	

Test Readings for Specimen No. 3

Normal stress = 8000 psf

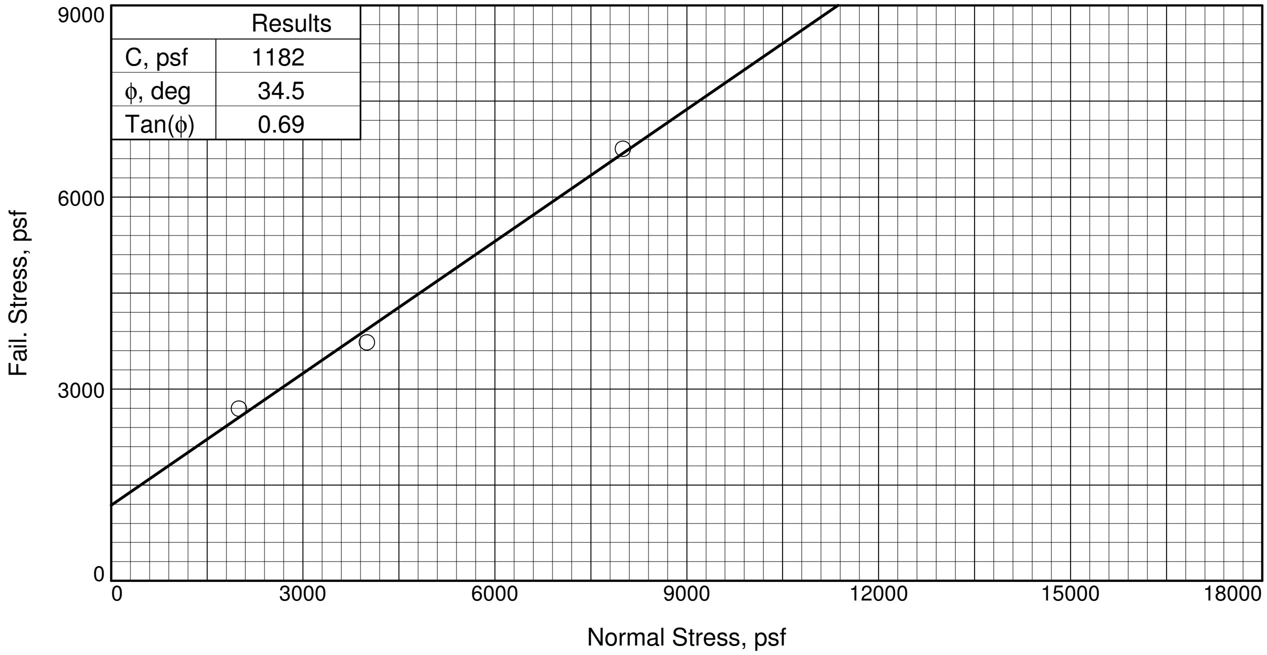
Strain rate, in./min. = 0.010

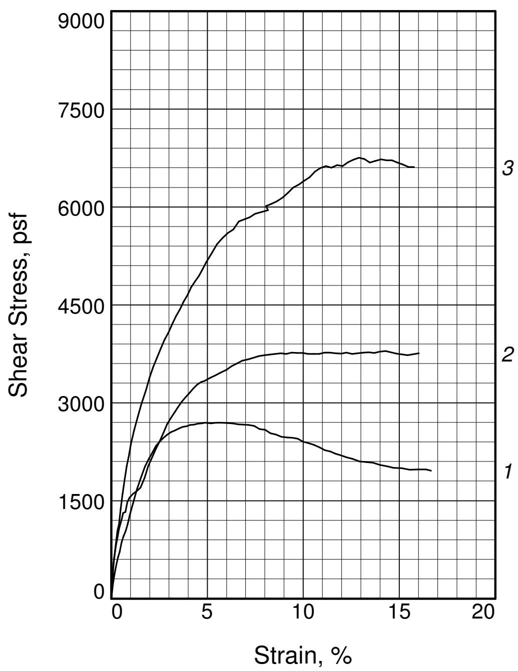
Fail. Stress = 10249 psf **at reading no.** 47

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf
0	0.0000	69.000	0.0	0.0	0
1	0.0079	241.000	172.0	0.1	387
2	0.0151	372.000	303.0	0.2	682
3	0.0227	515.000	446.0	0.3	1004
4	0.0295	600.000	531.0	0.4	1195
5	0.0358	682.000	613.0	0.4	1379
6	0.0448	762.000	693.0	0.6	1559
7	0.0544	815.000	746.0	0.7	1679
8	0.0623	915.000	846.0	0.8	1904
9	0.0713	989.000	920.0	0.9	2070
10	0.0800	1060.000	991.0	1.0	2230
11	0.0938	1184.000	1115.0	1.2	2509
12	0.1099	1306.000	1237.0	1.4	2783
13	0.1255	1445.000	1376.0	1.6	3096
14	0.1538	1578.000	1509.0	1.9	3395
15	0.1754	1839.000	1770.0	2.2	3983
16	0.1910	1954.000	1885.0	2.4	4241
17	0.2073	2075.000	2006.0	2.6	4514
18	0.2230	2192.000	2123.0	2.8	4777
19	0.2387	2301.000	2232.0	3.0	5022
20	0.2540	2381.000	2312.0	3.2	5202
21	0.2700	2448.000	2379.0	3.4	5353
22	0.2859	2547.000	2478.0	3.6	5576
23	0.3016	2632.000	2563.0	3.8	5767

Test Readings for Specimen No. 3

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf
24	0.3175	2714.000	2645.0	4.0	5951
25	0.3370	2799.000	2730.0	4.2	6143
26	0.3491	2834.000	2765.0	4.4	6221
27	0.3651	2951.000	2882.0	4.6	6485
28	0.3807	3037.000	2968.0	4.8	6678
29	0.3966	3108.000	3039.0	5.0	6838
30	0.4192	3261.000	3192.0	5.2	7182
31	0.4415	3343.000	3274.0	5.5	7367
32	0.4645	3436.000	3367.0	5.8	7576
33	0.4875	3508.000	3439.0	6.1	7738
34	0.5106	3627.000	3558.0	6.4	8006
35	0.5339	3664.000	3595.0	6.7	8089
36	0.5561	3760.000	3691.0	7.0	8305
37	0.5791	3845.000	3776.0	7.2	8496
38	0.6019	3938.000	3869.0	7.5	8705
39	0.6252	4007.000	3938.0	7.8	8861
40	0.6479	4073.000	4004.0	8.1	9009
41	0.6713	4181.000	4112.0	8.4	9252
42	0.6940	4253.000	4184.0	8.7	9414
43	0.7169	4350.000	4281.0	9.0	9632
44	0.7398	4444.000	4375.0	9.2	9844
45	0.7632	4480.000	4411.0	9.5	9925
46	0.7861	4537.000	4468.0	9.8	10053
47	0.8093	4624.000	4555.0	10.1	10249
48	0.8321	4668.000	4599.0	10.4	10348
49	0.8556	4646.000	4577.0	10.7	10298
50	0.8780	4752.000	4683.0	11.0	10537
51	0.9011	4812.000	4743.0	11.3	10672
52	0.9248	4839.000	4770.0	11.6	10733
53	0.9475	4821.000	4752.0	11.8	10692
54	0.9707	4853.000	4784.0	12.1	10764
55	0.9935	4927.000	4858.0	12.4	10931
56	1.0169	4906.000	4837.0	12.7	10883
57	1.0401	5005.000	4936.0	13.0	11106
58	1.0644	5032.000	4963.0	13.3	11167
59	1.0878	5014.000	4945.0	13.6	11126
60	1.1119	5039.000	4970.0	13.9	11183
61	1.1358	5103.000	5034.0	14.2	11327
62	1.1844	5182.000	5113.0	14.8	11504
63	1.2083	5197.000	5128.0	15.1	11538
64	1.2327	5186.000	5117.0	15.4	11513





Specimen No.		1	2	3
Initial	Water Content, %	9.4	9.4	9.4
	Dry Density, pcf	120.6	120.6	120.6
	Saturation, %	63.9	63.9	63.9
	Void Ratio	0.3971	0.3971	0.3971
	Side Length, in.	8.00	8.00	8.00
	Height, in.	4.00	4.00	4.00
At Test	Water Content, %	13.8	13.4	10.6
	Dry Density, pcf	122.7	123.8	130.9
	Saturation, %	100.0	100.0	99.9
	Void Ratio	0.3739	0.3615	0.2874
	Side Length, in.	8.00	8.00	8.00
	Height, in.	3.93	3.90	3.69
Normal Stress, psf		2000	4000	8000
Fail. Stress, psf		2696	3728	6755
Strain, %		4.9	8.0	12.9
Ult. Stress, psf				
Strain, %				
Strain rate, in./min.		0.010	0.010	0.010

Sample Type: Reconstituted

Description: Well graded gravel with sand. Target remolding parameters: 95%MDD @ OMC.

Assumed Specific Gravity= 2.7

Remarks: Failure chosen at peak shear stress. Particles larger than .75" were removed prior to test. Test was inundated. Gap = 0.4".

Figure ________

Client: Newfields #475.0014.027

Project: Hermosa Geotechnical Lab Testing NF#475.0014.027

Location: HSVOL-21-02

Sample Number: 21-069-05 **Depth:** 1300-1320'

Proj. No.: DV106-00038/01 **Date Sampled:** 4/26/22

Knight Piésold CONSULTING

DIRECT SHEAR TEST

4/28/2022

Date:	4/26/22
Client:	Newfields #475.0014.027
Project:	Hermosa Geotechnical Lab Testing NF#475.0014.027
Project No.:	DV106-00038/01
Location:	HSVOL-21-02
Depth:	1300-1320' **Sample Number:** 21-069-05
Description:	Well graded gravel with sand. Target remolding parameters: 95%MDD @ OMC.
Remarks:	Failure chosen at peak shear stress. Particles larger than .75" were removed prior to test. Test was inundated. Gap = 0.4".
Type of Sample:	Reconstituted

Assumed Specific Gravity=2.7 **LL=** **PL=** **PI=**

Parameters for Specimen No. 1

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	8869.600		9230.000
Moisture content: Dry soil+tare, gms.	8107.500		8107.500
Moisture content: Tare, gms.	0.000		0.000
Moisture, %	9.4	13.8	13.8
Moist specimen weight, gms.	8869.5		
Side Length, in.	8.00	8.00	
Area, in.^{2}	64.00	64.00	
Height, in.	4.00	3.93	
Net decrease in height, in.		0.07	
Wet density, pcf	132.0	139.7	
Dry density, pcf	120.6	122.7	
Void ratio	0.3971	0.3739	
Saturation, %	63.9	100.0	

Test Readings for Specimen No. 1

Normal stress = 2000 psf

Strain rate, in./min. = 0.010

Fail. Stress = 2696 psf **at reading no.** 30

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf
0	0.0006	8.000	0.0	0.0	0
1	0.0074	105.000	97.0	0.1	218
2	0.0142	174.000	166.0	0.2	374
3	0.0226	243.000	235.0	0.3	529
4	0.0283	291.000	283.0	0.3	637
5	0.0353	325.000	317.0	0.4	713
6	0.0434	390.000	382.0	0.5	860
7	0.0516	431.000	423.0	0.6	952
8	0.0608	469.000	461.0	0.8	1037
9	0.0696	514.000	506.0	0.9	1139
10	0.0784	580.000	572.0	1.0	1287
11	0.0919	659.000	651.0	1.1	1465
12	0.1077	752.000	744.0	1.3	1674

Test Readings for Specimen No. 1

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf
13	0.1232	828.000	820.0	1.5	1845
14	0.1410	906.000	898.0	1.8	2021
15	0.1565	960.000	952.0	1.9	2142
16	0.1724	1004.000	996.0	2.1	2241
17	0.1870	1047.000	1039.0	2.3	2338
18	0.2033	1079.000	1071.0	2.5	2410
19	0.2187	1103.000	1095.0	2.7	2464
20	0.2347	1124.000	1116.0	2.9	2511
21	0.2502	1142.000	1134.0	3.1	2552
22	0.2663	1154.000	1146.0	3.3	2579
23	0.2821	1167.000	1159.0	3.5	2608
24	0.2979	1178.000	1170.0	3.7	2633
25	0.3138	1182.000	1174.0	3.9	2642
26	0.3291	1190.000	1182.0	4.1	2660
27	0.3455	1193.000	1185.0	4.3	2666
28	0.3607	1199.000	1191.0	4.5	2680
29	0.3767	1200.000	1192.0	4.7	2682
30	0.3925	1206.000	1198.0	4.9	2696
31	0.4160	1200.000	1192.0	5.2	2682
32	0.4377	1206.000	1198.0	5.5	2696
33	0.4607	1205.000	1197.0	5.8	2693
34	0.4837	1203.000	1195.0	6.0	2689
35	0.5058	1201.000	1193.0	6.3	2684
36	0.5287	1195.000	1187.0	6.6	2671
37	0.5728	1190.000	1182.0	7.2	2660
38	0.5960	1184.000	1176.0	7.4	2646
39	0.6185	1162.000	1154.0	7.7	2597
40	0.6416	1158.000	1150.0	8.0	2588
41	0.6640	1134.000	1126.0	8.3	2534
42	0.6868	1124.000	1116.0	8.6	2511
43	0.7094	1110.000	1102.0	8.9	2480
44	0.7316	1106.000	1098.0	9.1	2471
45	0.7541	1102.000	1094.0	9.4	2462
46	0.7768	1096.000	1088.0	9.7	2448
47	0.7994	1077.000	1069.0	10.0	2405
48	0.8222	1067.000	1059.0	10.3	2383
49	0.8447	1054.000	1046.0	10.6	2354
50	0.8675	1037.000	1029.0	10.8	2315
51	0.8903	1019.000	1011.0	11.1	2275
52	0.9129	1009.000	1001.0	11.4	2252
53	0.9354	993.000	985.0	11.7	2216
54	0.9580	983.000	975.0	12.0	2194
55	0.9808	970.000	962.0	12.3	2165
56	1.0058	959.000	951.0	12.6	2140
57	1.0350	941.000	933.0	12.9	2099
58	1.0632	937.000	929.0	13.3	2090
59	1.0915	933.000	925.0	13.6	2081

Test Readings for Specimen No. 1

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf
60	1.1198	917.000	909.0	14.0	2045
61	1.1486	908.000	900.0	14.4	2025
62	1.1762	898.000	890.0	14.7	2003
63	1.2092	895.000	887.0	15.1	1996
64	1.2438	886.000	878.0	15.5	1976
65	1.2783	887.000	879.0	16.0	1978
66	1.3123	887.000	879.0	16.4	1978
67	1.3330	879.000	871.0	16.7	1960

Parameters for Specimen No. 2

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	8869.600		9193.000
Moisture content: Dry soil+tare, gms.	8107.500		8107.500
Moisture content: Tare, gms.	0.000		0.000
Moisture, %	9.4	13.4	13.4
Moist specimen weight, gms.	8869.6		
Side Length, in.	8.00	8.00	
Area, in.²	64.00	64.00	
Height, in.	4.00	3.90	
Net decrease in height, in.		0.10	
Wet density, pcf	132.0	140.4	
Dry density, pcf	120.6	123.8	
Void ratio	0.3971	0.3615	
Saturation, %	63.9	100.0	

Test Readings for Specimen No. 2

Normal stress = 4000 psf
Strain rate, in./min. = 0.010
Fail. Stress = 3728 psf **at reading no.** 41

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf
0	0.0002	3.000	0.0	0.0	0
1	0.0071	210.000	207.0	0.1	466
2	0.0123	285.000	282.0	0.2	635
3	0.0201	373.000	370.0	0.2	833
4	0.0268	427.000	424.0	0.3	954
5	0.0329	476.000	473.0	0.4	1064
6	0.0415	532.000	529.0	0.5	1190
7	0.0502	587.000	584.0	0.6	1314
8	0.0586	592.000	589.0	0.7	1325
9	0.0677	660.000	657.0	0.8	1478
10	0.0765	691.000	688.0	1.0	1548
11	0.0907	717.000	714.0	1.1	1607
12	0.1061	735.000	732.0	1.3	1647
13	0.1218	759.000	756.0	1.5	1701
14	0.1398	826.000	823.0	1.7	1852
15	0.1546	904.000	901.0	1.9	2027
16	0.1703	962.000	959.0	2.1	2158

Test Readings for Specimen No. 2

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf
17	0.1859	1022.000	1019.0	2.3	2293
18	0.2017	1073.000	1070.0	2.5	2408
19	0.2174	1133.000	1130.0	2.7	2543
20	0.2332	1189.000	1186.0	2.9	2669
21	0.2486	1234.000	1231.0	3.1	2770
22	0.2642	1272.000	1269.0	3.3	2855
23	0.2795	1309.000	1306.0	3.5	2939
24	0.2951	1346.000	1343.0	3.7	3022
25	0.3109	1376.000	1373.0	3.9	3089
26	0.3265	1402.000	1399.0	4.1	3148
27	0.3421	1433.000	1430.0	4.3	3218
28	0.3578	1459.000	1456.0	4.5	3276
29	0.3736	1477.000	1474.0	4.7	3317
30	0.3898	1486.000	1483.0	4.9	3337
31	0.4117	1506.000	1503.0	5.1	3382
32	0.4339	1524.000	1521.0	5.4	3422
33	0.4571	1542.000	1539.0	5.7	3463
34	0.4794	1561.000	1558.0	6.0	3506
35	0.5023	1587.000	1584.0	6.3	3564
36	0.5242	1604.000	1601.0	6.6	3602
37	0.5468	1623.000	1620.0	6.8	3645
38	0.5702	1632.000	1629.0	7.1	3665
39	0.5923	1642.000	1639.0	7.4	3688
40	0.6149	1654.000	1651.0	7.7	3715
41	0.6383	1660.000	1657.0	8.0	3728
42	0.6608	1665.000	1662.0	8.3	3740
43	0.6834	1668.000	1665.0	8.5	3746
44	0.7064	1673.000	1670.0	8.8	3758
45	0.7287	1670.000	1667.0	9.1	3751
46	0.7515	1678.000	1675.0	9.4	3769
47	0.7744	1676.000	1673.0	9.7	3764
48	0.7968	1675.000	1672.0	10.0	3762
49	0.8204	1669.000	1666.0	10.3	3749
50	0.8434	1670.000	1667.0	10.5	3751
51	0.8663	1669.000	1666.0	10.8	3749
52	0.8893	1677.000	1674.0	11.1	3767
53	0.9119	1677.000	1674.0	11.4	3767
54	0.9349	1673.000	1670.0	11.7	3758
55	0.9580	1671.000	1668.0	12.0	3753
56	0.9805	1678.000	1675.0	12.3	3769
57	1.0039	1669.000	1666.0	12.5	3749
58	1.0270	1674.000	1671.0	12.8	3760
59	1.0505	1677.000	1674.0	13.1	3767
60	1.0732	1679.000	1676.0	13.4	3771
61	1.0963	1675.000	1672.0	13.7	3762
62	1.1186	1685.000	1682.0	14.0	3785
63	1.1424	1689.000	1686.0	14.3	3794

Test Readings for Specimen No. 2

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf
64	1.1884	1671.000	1668.0	14.9	3753
65	1.2346	1661.000	1658.0	15.4	3731
66	1.2808	1673.000	1670.0	16.0	3758

Parameters for Specimen No. 3

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	8869.600		8970.000
Moisture content: Dry soil+tare, gms.	8107.500		8107.500
Moisture content: Tare, gms.	0.000		0.000
Moisture, %	9.4	10.6	10.6
Moist specimen weight, gms.	8869.6		
Side Length, in.	8.00	8.00	
Area, in.²	64.00	64.00	
Height, in.	4.00	3.69	
Net decrease in height, in.		0.31	
Wet density, pcf	132.0	144.9	
Dry density, pcf	120.6	130.9	
Void ratio	0.3971	0.2874	
Saturation, %	63.9	99.9	

Test Readings for Specimen No. 3

Normal stress = 8000 psf

Strain rate, in./min. = 0.010

Fail. Stress = 6755 psf **at reading no.** 57

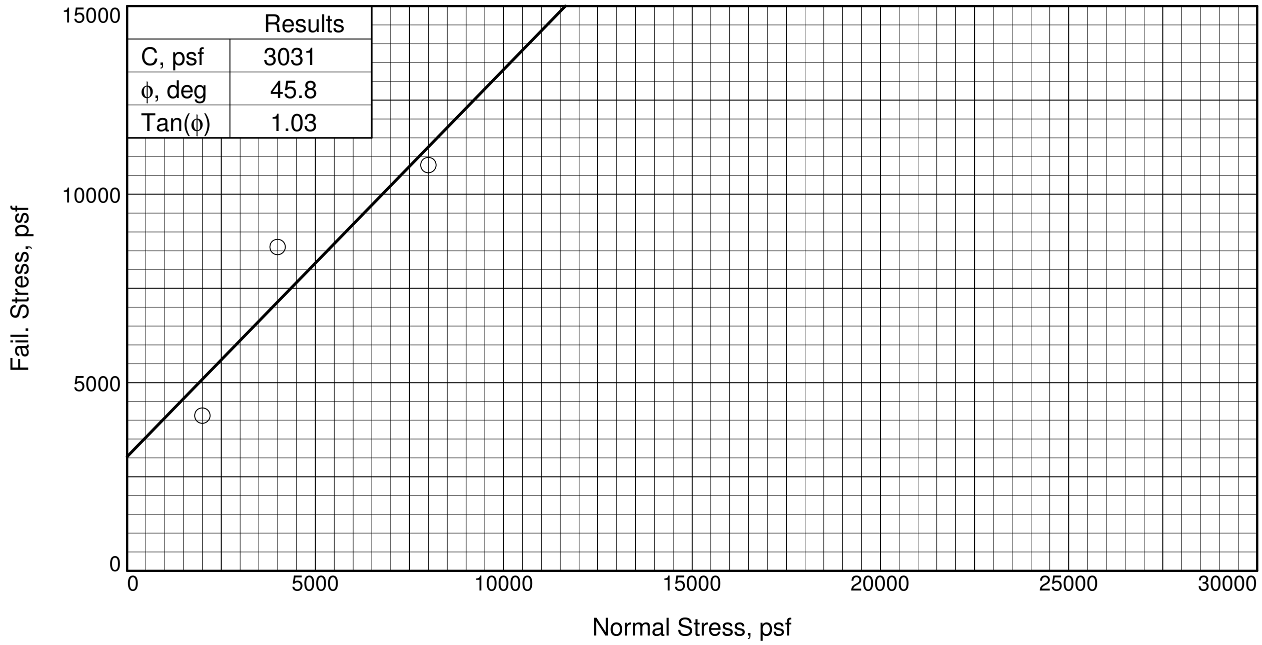
No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf
0	0.0131	324.000	0.0	0.0	0
1	0.0230	557.000	233.0	0.1	524
2	0.0308	677.000	353.0	0.2	794
3	0.0387	785.000	461.0	0.3	1037
4	0.0459	830.000	506.0	0.4	1139
5	0.0520	931.000	607.0	0.5	1366
6	0.0604	1036.000	712.0	0.6	1602
7	0.0689	1140.000	816.0	0.7	1836
8	0.0776	1226.000	902.0	0.8	2030
9	0.0868	1299.000	975.0	0.9	2194
10	0.0954	1375.000	1051.0	1.0	2365
11	0.1082	1469.000	1145.0	1.2	2576
12	0.1238	1565.000	1241.0	1.4	2792
13	0.1390	1649.000	1325.0	1.6	2981
14	0.1570	1741.000	1417.0	1.8	3188
15	0.1725	1826.000	1502.0	2.0	3380
16	0.1881	1903.000	1579.0	2.2	3553
17	0.2038	1965.000	1641.0	2.4	3692
18	0.2192	2024.000	1700.0	2.6	3825
19	0.2353	2085.000	1761.0	2.8	3962
20	0.2510	2133.000	1809.0	3.0	4070
21	0.2673	2193.000	1869.0	3.2	4205

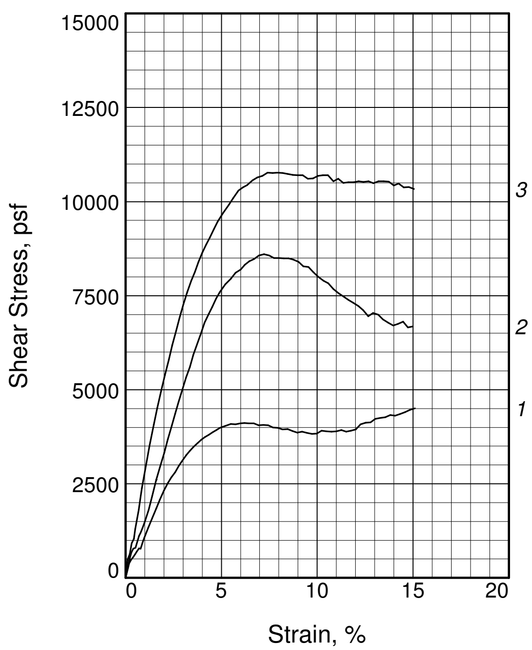
Test Readings for Specimen No. 3

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf
22	0.2833	2247.000	1923.0	3.4	4327
23	0.2984	2293.000	1969.0	3.6	4430
24	0.3145	2348.000	2024.0	3.8	4554
25	0.3304	2391.000	2067.0	4.0	4651
26	0.3452	2443.000	2119.0	4.2	4768
27	0.3617	2483.000	2159.0	4.4	4858
28	0.3776	2520.000	2196.0	4.6	4941
29	0.3927	2564.000	2240.0	4.7	5040
30	0.4090	2613.000	2289.0	4.9	5150
31	0.4311	2675.000	2351.0	5.2	5290
32	0.4540	2738.000	2414.0	5.5	5432
33	0.4768	2779.000	2455.0	5.8	5524
34	0.4993	2813.000	2489.0	6.1	5600
35	0.5220	2838.000	2514.0	6.4	5657
36	0.5439	2892.000	2568.0	6.6	5778
37	0.5900	2921.000	2597.0	7.2	5843
38	0.6124	2944.000	2620.0	7.5	5895
39	0.6655	2968.000	2644.0	8.2	5949
40	0.6582	2996.000	2672.0	8.1	6012
41	0.6804	3013.000	2689.0	8.3	6050
42	0.7035	3030.000	2706.0	8.6	6089
43	0.7260	3054.000	2730.0	8.9	6143
44	0.7485	3085.000	2761.0	9.2	6212
45	0.7715	3124.000	2800.0	9.5	6300
46	0.7940	3142.000	2818.0	9.8	6341
47	0.8170	3169.000	2845.0	10.0	6401
48	0.8399	3193.000	2869.0	10.3	6455
49	0.8619	3232.000	2908.0	10.6	6543
50	0.8848	3256.000	2932.0	10.9	6597
51	0.9073	3268.000	2944.0	11.2	6624
52	0.9303	3259.000	2935.0	11.5	6604
53	0.9534	3275.000	2951.0	11.8	6640
54	0.9765	3268.000	2944.0	12.0	6624
55	0.9990	3296.000	2972.0	12.3	6687
56	1.0223	3313.000	2989.0	12.6	6725
57	1.0452	3326.000	3002.0	12.9	6755
58	1.0681	3317.000	2993.0	13.2	6734
59	1.0906	3293.000	2969.0	13.5	6680
60	1.1132	3305.000	2981.0	13.8	6707
61	1.1365	3314.000	2990.0	14.0	6728
62	1.1596	3308.000	2984.0	14.3	6714
63	1.1824	3309.000	2985.0	14.6	6716
64	1.2051	3293.000	2969.0	14.9	6680
65	1.2280	3281.000	2957.0	15.2	6653
66	1.2511	3263.000	2939.0	15.5	6613
67	1.2743	3262.000	2938.0	15.8	6611

Cursory interpretations provided require review by a professional engineer. Knight Piesold accepts no responsibility in subsequent analyses.

	Results
C, psf	3031
ϕ, deg	45.8
Tan(ϕ)	1.03





	Specimen No.	1	2	3
Initial	Water Content, %	7.3	7.3	7.3
	Dry Density, pcf	133.7	133.1	134.4
	Saturation, %	75.7	74.0	77.6
	Void Ratio	0.2602	0.2664	0.2540
	Side Length, in.	8.00	8.00	8.00
	Height, in.	4.06	4.08	4.04
At Test	Water Content, %	9.1	8.9	8.3
	Dry Density, pcf	135.2	135.8	137.6
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.2463	0.2415	0.2251
	Side Length, in.	8.00	8.00	8.00
	Height, in.	4.01	4.00	3.95
	Normal Stress, psf	2000	4000	8000
	Fail. Stress, psf	4118	8600	10773
	Strain, %	6.2	7.2	7.4
	Ult. Stress, psf			
	Strain, %			
	Strain rate, in./min.	0.010	0.010	0.010

Sample Type: Reconstituted

Description: Well-graded sand with gravel. Target remolding parameters: 95%MDD @ OMC.

Assumed Specific Gravity= 2.7

Remarks: Failure chosen at peak shear stress. Test was inundated. Gap = 0.4".

Figure ________

Client: Newfields #475.0014.027

Project: Hermosa Geotechnical Lab Testing NF#475.0014.027

Location: HSVOL-21-09

Sample Number: 21-341-08 **Depth:** 2255-2280'

Proj. No.: DV106-00038/01 **Date Sampled:** 5/9/22

Knight Piésold CONSULTING

Tested By: MFreund **Checked By:** JBruce

DIRECT SHEAR TEST

5/16/2022

Date: 5/9/22
Client: Newfields #475.0014.027
Project: Hermosa Geotechnical Lab Testing
NF#475.0014.027
Project No.: DV106-00038/01
Location: HSVOL-21-09
Depth: 2255-2280' **Sample Number:** 21-341-08
Description: Well-graded sand with gravel. Target remolding parameters: 95%MDD @ OMC.
Remarks: Failure chosen at peak shear stress. Test was inundated. Gap = 0.4".
Type of Sample: Reconstituted
Assumed Specific Gravity=2.7 **LL=** **PL=** **PI=**

Parameters for Specimen No. 1

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	9788.500		9955.000
Moisture content: Dry soil+tare, gms.	9122.600		9122.600
Moisture content: Tare, gms.	0.000		0.000
Moisture, %	7.3	9.1	9.1
Moist specimen weight, gms.	9788.5		
Side Length, in.	8.00	8.00	
Area, in.²	64.00	64.00	
Height, in.	4.06	4.01	
Net decrease in height, in.		0.04	
Wet density, pcf	143.5	147.6	
Dry density, pcf	133.7	135.2	
Void ratio	0.2602	0.2463	
Saturation, %	75.7	100.0	

Test Readings for Specimen No. 1

Normal stress = 2000 psf
Strain rate, in./min. = 0.010
Fail. Stress = 4118 psf **at reading no.** 35

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf
0	0.0000	5.000	0.0	0.0	0
1	0.0106	128.000	123.0	0.1	277
2	0.0148	177.000	172.0	0.2	387
3	0.0228	218.000	213.0	0.3	479
4	0.0318	252.000	247.0	0.4	556
5	0.0406	287.000	282.0	0.5	635
6	0.0471	317.000	312.0	0.6	702
7	0.0564	355.000	350.0	0.7	788
8	0.0625	350.000	345.0	0.8	776
9	0.0711	423.000	418.0	0.9	941
10	0.0779	476.000	471.0	1.0	1060
11	0.0955	601.000	596.0	1.2	1341
12	0.1105	709.000	704.0	1.4	1584
13	0.1285	826.000	821.0	1.6	1847

Test Readings for Specimen No. 1

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf
14	0.1428	926.000	921.0	1.8	2072
15	0.1604	1038.000	1033.0	2.0	2324
16	0.1759	1125.000	1120.0	2.2	2520
17	0.1913	1194.000	1189.0	2.4	2675
18	0.2071	1252.000	1247.0	2.6	2806
19	0.2226	1332.000	1327.0	2.8	2986
20	0.2380	1394.000	1389.0	3.0	3125
21	0.2535	1456.000	1451.0	3.2	3265
22	0.2686	1507.000	1502.0	3.4	3380
23	0.2847	1555.000	1550.0	3.6	3488
24	0.3004	1597.000	1592.0	3.8	3582
25	0.3159	1638.000	1633.0	3.9	3674
26	0.3314	1668.000	1663.0	4.1	3742
27	0.3472	1695.000	1690.0	4.3	3803
28	0.3631	1726.000	1721.0	4.5	3872
29	0.3789	1753.000	1748.0	4.7	3933
30	0.3943	1776.000	1771.0	4.9	3985
31	0.4165	1799.000	1794.0	5.2	4037
32	0.4390	1824.000	1819.0	5.5	4093
33	0.4588	1820.000	1815.0	5.7	4084
34	0.4789	1829.000	1824.0	6.0	4104
35	0.4965	1835.000	1830.0	6.2	4118
36	0.5146	1829.000	1824.0	6.4	4104
37	0.5350	1829.000	1824.0	6.7	4104
38	0.5550	1809.000	1804.0	6.9	4059
39	0.5754	1812.000	1807.0	7.2	4066
40	0.5957	1808.000	1803.0	7.4	4057
41	0.6159	1780.000	1775.0	7.7	3994
42	0.6355	1779.000	1774.0	7.9	3992
43	0.6556	1760.000	1755.0	8.2	3949
44	0.6764	1762.000	1757.0	8.5	3953
45	0.6967	1738.000	1733.0	8.7	3899
46	0.7171	1722.000	1717.0	9.0	3863
47	0.7373	1733.000	1728.0	9.2	3888
48	0.7577	1718.000	1713.0	9.5	3854
49	0.7780	1705.000	1700.0	9.7	3825
50	0.7985	1710.000	1705.0	10.0	3836
51	0.8185	1742.000	1737.0	10.2	3908
52	0.8392	1736.000	1731.0	10.5	3895
53	0.8595	1732.000	1727.0	10.7	3886
54	0.8795	1737.000	1732.0	11.0	3897
55	0.9003	1752.000	1747.0	11.3	3931
56	0.9205	1733.000	1728.0	11.5	3888
57	0.9407	1744.000	1739.0	11.8	3913
58	0.9615	1760.000	1755.0	12.0	3949
59	0.9812	1819.000	1814.0	12.3	4082
60	1.0020	1837.000	1832.0	12.5	4122

Test Readings for Specimen No. 1

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf
61	1.0229	1843.000	1838.0	12.8	4136
62	1.0428	1883.000	1878.0	13.0	4226
63	1.0637	1896.000	1891.0	13.3	4255
64	1.0843	1904.000	1899.0	13.6	4273
65	1.1050	1927.000	1922.0	13.8	4325
66	1.1254	1921.000	1916.0	14.1	4311
67	1.1456	1940.000	1935.0	14.3	4354
68	1.1663	1961.000	1956.0	14.6	4401
69	1.1869	1988.000	1983.0	14.8	4462
70	1.2074	2008.000	2003.0	15.1	4507

Parameters for Specimen No. 2

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	9788.500		9938.500
Moisture content: Dry soil+tare, gms.	9122.600		9122.600
Moisture content: Tare, gms.	0.000		0.000
Moisture, %	7.3	8.9	8.9
Moist specimen weight, gms.	9788.5		
Side Length, in.	8.00	8.00	
Area, in.²	64.00	64.00	
Height, in.	4.08	4.00	
Net decrease in height, in.		0.08	
Wet density, pcf	142.8	147.9	
Dry density, pcf	133.1	135.8	
Void ratio	0.2664	0.2415	
Saturation, %	74.0	100.0	

Test Readings for Specimen No. 2

Normal stress = 4000 psf
Strain rate, in./min. = 0.010
Fail. Stress = 8600 psf **at reading no.** 38

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf
0	0.0001	2.000	0.0	0.0	0
1	0.0097	144.000	142.0	0.1	320
2	0.0159	217.000	215.0	0.2	484
3	0.0240	300.000	298.0	0.3	671
4	0.0329	346.000	344.0	0.4	774
5	0.0419	358.000	356.0	0.5	801
6	0.0568	499.000	497.0	0.7	1118
7	0.0632	536.000	534.0	0.8	1202
8	0.0718	593.000	591.0	0.9	1330
9	0.0788	653.000	651.0	1.0	1465
10	0.0963	803.000	801.0	1.2	1802
11	0.1114	967.000	965.0	1.4	2171
12	0.1291	1161.000	1159.0	1.6	2608
13	0.1291	1161.000	1159.0	1.6	2608
14	0.1443	1318.000	1316.0	1.8	2961

Test Readings for Specimen No. 2

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf
15	0.1612	1481.000	1479.0	2.0	3328
16	0.1768	1639.000	1637.0	2.2	3683
17	0.1919	1792.000	1790.0	2.4	4028
18	0.2069	1940.000	1938.0	2.6	4361
19	0.2225	2086.000	2084.0	2.8	4689
20	0.2378	2232.000	2230.0	3.0	5018
21	0.2532	2367.000	2365.0	3.2	5321
22	0.2684	2492.000	2490.0	3.4	5603
23	0.2839	2640.000	2638.0	3.5	5936
24	0.3151	2894.000	2892.0	3.9	6507
25	0.3303	3018.000	3016.0	4.1	6786
26	0.3469	3118.000	3116.0	4.3	7011
27	0.3626	3204.000	3202.0	4.5	7205
28	0.3782	3300.000	3298.0	4.7	7421
29	0.3937	3378.000	3376.0	4.9	7596
30	0.4171	3470.000	3468.0	5.2	7803
31	0.4392	3535.000	3533.0	5.5	7949
32	0.4597	3608.000	3606.0	5.7	8114
33	0.4804	3645.000	3643.0	6.0	8197
34	0.4985	3699.000	3697.0	6.2	8318
35	0.5170	3741.000	3739.0	6.5	8413
36	0.5370	3770.000	3768.0	6.7	8478
37	0.5569	3809.000	3807.0	7.0	8566
38	0.5782	3824.000	3822.0	7.2	8600
39	0.5990	3809.000	3807.0	7.5	8566
40	0.6195	3781.000	3779.0	7.7	8503
41	0.6401	3780.000	3778.0	8.0	8501
42	0.6608	3777.000	3775.0	8.3	8494
43	0.6814	3776.000	3774.0	8.5	8492
44	0.7010	3760.000	3758.0	8.8	8456
45	0.7226	3733.000	3731.0	9.0	8395
46	0.7429	3682.000	3680.0	9.3	8280
47	0.7633	3673.000	3671.0	9.5	8260
48	0.7841	3613.000	3611.0	9.8	8125
49	0.8051	3559.000	3557.0	10.1	8003
50	0.8259	3512.000	3510.0	10.3	7898
51	0.8467	3482.000	3480.0	10.6	7830
52	0.8678	3415.000	3413.0	10.8	7679
53	0.8886	3365.000	3363.0	11.1	7567
54	0.9095	3327.000	3325.0	11.4	7481
55	0.9301	3286.000	3284.0	11.6	7389
56	0.9509	3250.000	3248.0	11.9	7308
57	0.9711	3212.000	3210.0	12.1	7223
58	0.9922	3163.000	3161.0	12.4	7112
59	1.0130	3094.000	3092.0	12.7	6957
60	1.0336	3129.000	3127.0	12.9	7036
61	1.0545	3112.000	3110.0	13.2	6998

Test Readings for Specimen No. 2

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf
62	1.0750	3055.000	3053.0	13.4	6869
63	1.0960	3019.000	3017.0	13.7	6788
64	1.1168	2985.000	2983.0	14.0	6712
65	1.1372	3002.000	3000.0	14.2	6750
66	1.1579	3028.000	3026.0	14.5	6809
67	1.1781	2960.000	2958.0	14.7	6656
68	1.1989	2972.000	2970.0	15.0	6683

Parameters for Specimen No. 3

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	9788.500		9883.000
Moisture content: Dry soil+tare, gms.	9122.600		9122.600
Moisture content: Tare, gms.	0.000		0.000
Moisture, %	7.3	8.3	8.3
Moist specimen weight, gms.	9788.5		
Side Length, in.	8.00	8.00	
Area, in.²	64.00	64.00	
Height, in.	4.04	3.95	
Net decrease in height, in.		0.09	
Wet density, pcf	144.2	149.1	
Dry density, pcf	134.4	137.6	
Void ratio	0.2540	0.2251	
Saturation, %	77.6	100.0	

Test Readings for Specimen No. 3

Normal stress = 8000 psf

Strain rate, in./min. = 0.010

Fail. Stress = 10773 psf **at reading no.** 39

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf
0	0.0001	6.000	0.0	0.0	0
1	0.0049	147.000	141.0	0.1	317
2	0.0095	229.000	223.0	0.1	502
3	0.0175	288.000	282.0	0.2	635
4	0.0258	414.000	408.0	0.3	918
5	0.0346	469.000	463.0	0.4	1042
6	0.0401	580.000	574.0	0.5	1292
7	0.0547	809.000	803.0	0.7	1807
8	0.0627	965.000	959.0	0.8	2158
9	0.0691	1070.000	1064.0	0.9	2394
10	0.0855	1340.000	1334.0	1.1	3002
11	0.1002	1572.000	1566.0	1.3	3524
12	0.1174	1812.000	1806.0	1.5	4064
13	0.1327	2014.000	2008.0	1.7	4518
14	0.1500	2228.000	2222.0	1.9	5000
15	0.1650	2403.000	2397.0	2.1	5393
16	0.1807	2581.000	2575.0	2.3	5794
17	0.1956	2757.000	2751.0	2.4	6190

Test Readings for Specimen No. 3

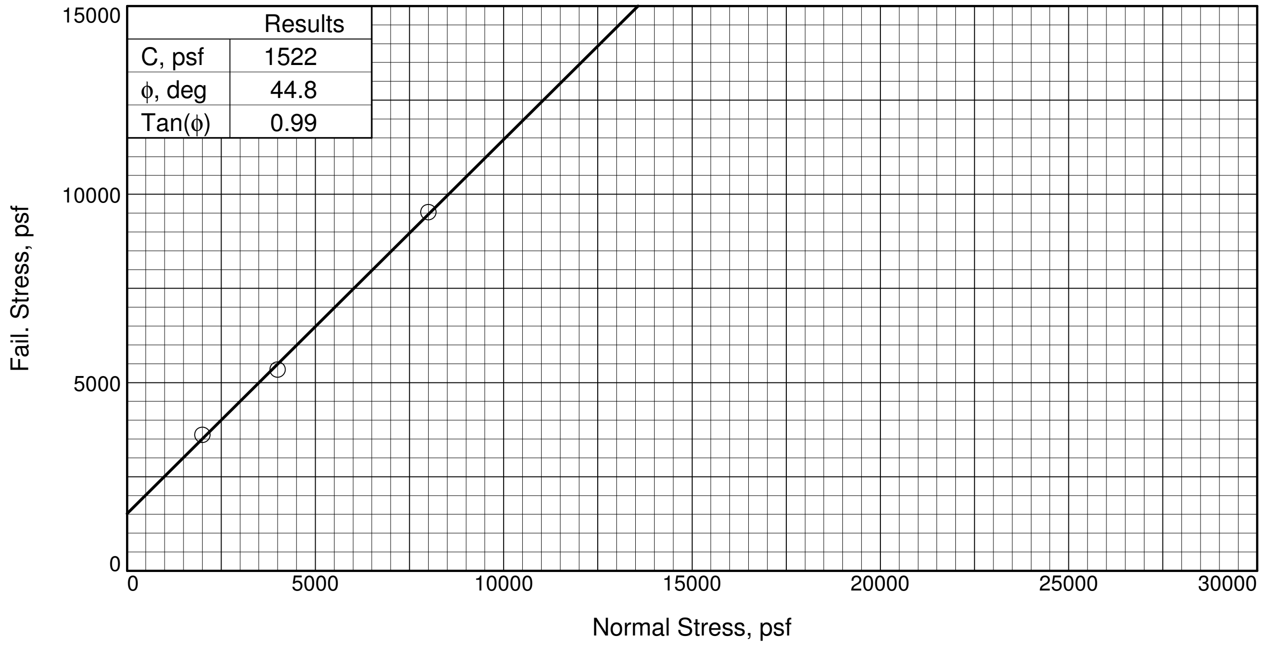
No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf
18	0.2114	2922.000	2916.0	2.6	6561
19	0.2264	3082.000	3076.0	2.8	6921
20	0.2425	3239.000	3233.0	3.0	7274
21	0.2579	3382.000	3376.0	3.2	7596
22	0.2739	3512.000	3506.0	3.4	7889
23	0.2893	3623.000	3617.0	3.6	8138
24	0.3052	3740.000	3734.0	3.8	8402
25	0.3206	3848.000	3842.0	4.0	8645
26	0.3362	3943.000	3937.0	4.2	8858
27	0.3527	4028.000	4022.0	4.4	9050
28	0.3684	4125.000	4119.0	4.6	9268
29	0.3845	4213.000	4207.0	4.8	9466
30	0.4072	4316.000	4310.0	5.1	9698
31	0.4304	4407.000	4401.0	5.4	9902
32	0.4506	4494.000	4488.0	5.6	10098
33	0.4714	4583.000	4577.0	5.9	10298
34	0.4898	4620.000	4614.0	6.1	10382
35	0.5080	4647.000	4641.0	6.3	10442
36	0.5297	4702.000	4696.0	6.6	10566
37	0.5497	4735.000	4729.0	6.9	10640
38	0.5711	4756.000	4750.0	7.1	10688
39	0.5926	4794.000	4788.0	7.4	10773
40	0.6135	4787.000	4781.0	7.7	10757
41	0.6345	4793.000	4787.0	7.9	10771
42	0.6560	4787.000	4781.0	8.2	10757
43	0.6769	4779.000	4773.0	8.5	10739
44	0.6982	4766.000	4760.0	8.7	10710
45	0.7188	4763.000	4757.0	9.0	10703
46	0.7400	4763.000	4757.0	9.2	10703
47	0.7614	4719.000	4713.0	9.5	10604
48	0.7821	4723.000	4717.0	9.8	10613
49	0.8033	4754.000	4748.0	10.0	10683
50	0.8240	4761.000	4755.0	10.3	10699
51	0.8454	4763.000	4757.0	10.6	10703
52	0.8674	4692.000	4686.0	10.8	10544
53	0.8882	4720.000	4714.0	11.1	10607
54	0.9095	4670.000	4664.0	11.4	10494
55	0.9304	4681.000	4675.0	11.6	10519
56	0.9515	4678.000	4672.0	11.9	10512
57	0.9724	4691.000	4685.0	12.2	10541
58	0.9933	4685.000	4679.0	12.4	10528
59	1.0145	4692.000	4686.0	12.7	10544
60	1.0348	4668.000	4662.0	12.9	10490
61	1.0561	4691.000	4685.0	13.2	10541
62	1.0767	4692.000	4686.0	13.5	10544
63	1.0987	4688.000	4682.0	13.7	10535
64	1.1194	4640.000	4634.0	14.0	10427

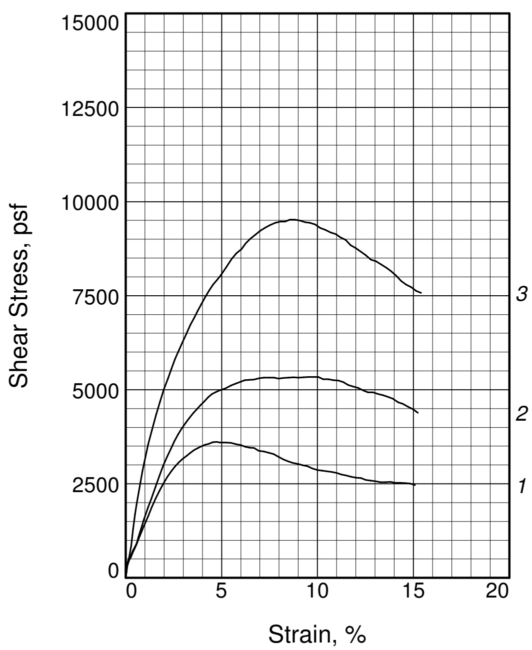
Test Readings for Specimen No. 3

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf
65	1.1401	4664.000	4658.0	14.2	10481
66	1.1615	4620.000	4614.0	14.5	10382
67	1.1822	4623.000	4617.0	14.8	10388
68	1.2034	4601.000	4595.0	15.0	10339

Cursory interpretations provided require review by a professional engineer. Knight Piesold accepts no responsibility in subsequent analyses.

	Results
C, psf	1522
φ, deg	44.8
Tan(φ)	0.99





Specimen No.		1	2	3
Initial	Water Content, %	8.0	8.0	8.0
	Dry Density, pcf	135.2	132.6	135.2
	Saturation, %	87.5	79.6	87.5
	Void Ratio	0.2468	0.2714	0.2468
	Side Length, in.	8.00	8.00	8.00
	Height, in.	4.00	4.06	4.00
At Test	Water Content, %	8.4	9.3	7.5
	Dry Density, pcf	137.3	134.9	140.1
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.2280	0.2498	0.2032
	Side Length, in.	8.00	8.00	8.00
	Height, in.	3.94	3.99	3.86
Normal Stress, psf		2000	4000	8000
Fail. Stress, psf		3611	5344	9522
Strain, %		4.7	9.5	8.6
Ult. Stress, psf				
Strain, %				
Strain rate, in./min.		0.010	0.010	0.010

Sample Type: Reconstituted

Description: well-graded sand with siltyclay and gravel. Target remolding parameters: 95%MDD at

Assumed Specific Gravity= 2.7

Remarks: Failure chosen at peak shear stress. Test was inundated. Gap = 0.4".

Figure ________

Client: Newfields #475.0014.027

Project: Hermosa Geotechnical Lab Testing NF#475.0014.027

Location: OLDVOL-04-21-04

Sample Number: 21-341-11 **Depth:** 2690-2710'

Proj. No.: DV106-00038/01 **Date Sampled:**

Knight Piésold CONSULTING

Tested By: MFreund **Checked By:** JBruce

DIRECT SHEAR TEST

5/16/2022

Date:
Client: Newfields #475.0014.027
Project: Hermosa Geotechnical Lab Testing
NF#475.0014.027
Project No.: DV106-00038/01
Location: OLDVOL-04-21-04
Depth: 2690-2710' **Sample Number:** 21-341-11
Description: well-graded sand with siltyclay and gravel. Target remolding parameters: 95%MDD at OMC.
Remarks: Failure chosen at peak shear stress. Test was inundated. Gap = 0.4".
Type of Sample: Reconstituted
Assumed Specific Gravity=2.7 **LL=** **PL=** **PI=**

Parameters for Specimen No. 1

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	9811.000		9851.200
Moisture content: Dry soil+tare, gms.	9084.300		9084.300
Moisture content: Tare, gms.	0.000		0.000
Moisture, %	8.0	8.4	8.4
Moist specimen weight, gms.	9811.0		
Side Length, in.	8.00	8.00	
Area, in.²	64.00	64.00	
Height, in.	4.00	3.94	
Net decrease in height, in.		0.06	
Wet density, pcf	146.0	148.8	
Dry density, pcf	135.2	137.3	
Void ratio	0.2468	0.2280	
Saturation, %	87.5	100.0	

Test Readings for Specimen No. 1

Normal stress = 2000 psf
Strain rate, in./min. = 0.010
Fail. Stress = 3611 psf **at reading no.** 28

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf
0	0.0000	4.000	0.0	0.0	0
1	0.0067	182.000	178.0	0.1	401
2	0.0217	246.000	242.0	0.3	545
3	0.0302	303.000	299.0	0.4	673
4	0.0388	360.000	356.0	0.5	801
5	0.0453	402.000	398.0	0.6	896
6	0.0540	462.000	458.0	0.7	1031
7	0.0605	507.000	503.0	0.8	1132
8	0.0690	566.000	562.0	0.9	1265
9	0.0757	610.000	606.0	0.9	1364
10	0.0934	730.000	726.0	1.2	1634
11	0.1086	837.000	833.0	1.4	1874
12	0.1264	946.000	942.0	1.6	2120
13	0.1417	1036.000	1032.0	1.8	2322

Test Readings for Specimen No. 1

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf
14	0.1592	1127.000	1123.0	2.0	2527
15	0.1752	1201.000	1197.0	2.2	2693
16	0.1910	1265.000	1261.0	2.4	2837
17	0.2061	1320.000	1316.0	2.6	2961
18	0.2220	1367.000	1363.0	2.8	3067
19	0.2374	1410.000	1406.0	3.0	3164
20	0.2533	1446.000	1442.0	3.2	3245
21	0.2688	1478.000	1474.0	3.4	3317
22	0.2847	1513.000	1509.0	3.6	3395
23	0.2998	1534.000	1530.0	3.7	3443
24	0.3157	1557.000	1553.0	3.9	3494
25	0.3312	1575.000	1571.0	4.1	3535
26	0.3470	1589.000	1585.0	4.3	3566
27	0.3629	1605.000	1601.0	4.5	3602
28	0.3790	1609.000	1605.0	4.7	3611
29	0.3942	1603.000	1599.0	4.9	3598
30	0.4168	1602.000	1598.0	5.2	3596
31	0.4396	1598.000	1594.0	5.5	3587
32	0.4593	1584.000	1580.0	5.7	3555
33	0.4800	1573.000	1569.0	6.0	3530
34	0.4976	1555.000	1551.0	6.2	3490
35	0.5160	1542.000	1538.0	6.5	3461
36	0.5357	1537.000	1533.0	6.7	3449
37	0.5558	1503.000	1499.0	6.9	3373
38	0.5766	1498.000	1494.0	7.2	3362
39	0.5969	1483.000	1479.0	7.5	3328
40	0.6167	1466.000	1462.0	7.7	3290
41	0.6375	1431.000	1427.0	8.0	3211
42	0.6576	1403.000	1399.0	8.2	3148
43	0.6780	1380.000	1376.0	8.5	3096
44	0.6982	1360.000	1356.0	8.7	3051
45	0.7189	1349.000	1345.0	9.0	3026
46	0.7387	1335.000	1331.0	9.2	2995
47	0.7587	1322.000	1318.0	9.5	2966
48	0.7788	1297.000	1293.0	9.7	2909
49	0.7989	1278.000	1274.0	10.0	2867
50	0.8192	1270.000	1266.0	10.2	2849
51	0.8391	1262.000	1258.0	10.5	2831
52	0.8598	1256.000	1252.0	10.7	2817
53	0.8800	1244.000	1240.0	11.0	2790
54	0.8996	1227.000	1223.0	11.2	2752
55	0.9198	1214.000	1210.0	11.5	2723
56	0.9398	1198.000	1194.0	11.7	2687
57	0.9605	1188.000	1184.0	12.0	2664
58	0.9807	1185.000	1181.0	12.3	2657
59	1.0008	1160.000	1156.0	12.5	2601
60	1.0208	1153.000	1149.0	12.8	2585

Test Readings for Specimen No. 1

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf
61	1.0411	1146.000	1142.0	13.0	2570
62	1.0621	1134.000	1130.0	13.3	2543
63	1.0831	1136.000	1132.0	13.5	2547
64	1.1036	1138.000	1134.0	13.8	2552
65	1.1237	1127.000	1123.0	14.0	2527
66	1.1446	1127.000	1123.0	14.3	2527
67	1.1647	1122.000	1118.0	14.6	2516
68	1.1857	1118.000	1114.0	14.8	2507
69	1.2061	1101.000	1097.0	15.1	2468

Parameters for Specimen No. 2

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	9811.000		9925.000
Moisture content: Dry soil+tare, gms.	9084.300		9084.300
Moisture content: Tare, gms.	0.000		0.000
Moisture, %	8.0	9.3	9.3
Moist specimen weight, gms.	9765.5		
Side Length, in.	8.00	8.00	
Area, in.²	64.00	64.00	
Height, in.	4.06	3.99	
Net decrease in height, in.		0.07	
Wet density, pcf	143.2	147.3	
Dry density, pcf	132.6	134.9	
Void ratio	0.2714	0.2498	
Saturation, %	79.6	100.0	

Test Readings for Specimen No. 2

Normal stress = 4000 psf

Strain rate, in./min. = 0.010

Fail. Stress = 5344 psf **at reading no.** 48

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf
0	0.0000	21.000	0.0	0.0	0
1	0.0068	162.000	141.0	0.1	317
2	0.0129	210.000	189.0	0.2	425
3	0.0218	283.000	262.0	0.3	590
4	0.0297	341.000	320.0	0.4	720
5	0.0386	387.000	366.0	0.5	824
6	0.0452	428.000	407.0	0.6	916
7	0.0539	504.000	483.0	0.7	1087
8	0.0599	567.000	546.0	0.7	1229
9	0.0687	638.000	617.0	0.9	1388
10	0.0749	703.000	682.0	0.9	1535
11	0.0924	844.000	823.0	1.2	1852
12	0.1076	954.000	933.0	1.3	2099
13	0.1245	1094.000	1073.0	1.6	2414
14	0.1403	1222.000	1201.0	1.8	2702
15	0.1574	1356.000	1335.0	2.0	3004

Test Readings for Specimen No. 2

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf
16	0.1732	1459.000	1438.0	2.2	3236
17	0.1886	1546.000	1525.0	2.4	3431
18	0.2037	1636.000	1615.0	2.5	3634
19	0.2196	1719.000	1698.0	2.7	3821
20	0.2344	1785.000	1764.0	2.9	3969
21	0.2504	1851.000	1830.0	3.1	4118
22	0.2658	1912.000	1891.0	3.3	4255
23	0.2816	1967.000	1946.0	3.5	4379
24	0.2974	2017.000	1996.0	3.7	4491
25	0.3131	2061.000	2040.0	3.9	4590
26	0.3287	2108.000	2087.0	4.1	4696
27	0.3447	2156.000	2135.0	4.3	4804
28	0.3601	2193.000	2172.0	4.5	4887
29	0.3761	2218.000	2197.0	4.7	4943
30	0.3919	2236.000	2215.0	4.9	4984
31	0.4153	2260.000	2239.0	5.2	5038
32	0.4379	2293.000	2272.0	5.5	5112
33	0.4579	2314.000	2293.0	5.7	5159
34	0.4789	2337.000	2316.0	6.0	5211
35	0.4963	2358.000	2337.0	6.2	5258
36	0.5149	2359.000	2338.0	6.4	5261
37	0.5359	2364.000	2343.0	6.7	5272
38	0.5561	2380.000	2359.0	7.0	5308
39	0.5769	2386.000	2365.0	7.2	5321
40	0.5971	2386.000	2365.0	7.5	5321
41	0.6176	2386.000	2365.0	7.7	5321
42	0.6384	2375.000	2354.0	8.0	5297
43	0.6585	2382.000	2361.0	8.2	5312
44	0.6796	2388.000	2367.0	8.5	5326
45	0.6998	2389.000	2368.0	8.7	5328
46	0.7209	2386.000	2365.0	9.0	5321
47	0.7413	2390.000	2369.0	9.3	5330
48	0.7620	2396.000	2375.0	9.5	5344
49	0.7827	2395.000	2374.0	9.8	5342
50	0.8033	2394.000	2373.0	10.0	5339
51	0.8241	2369.000	2348.0	10.3	5283
52	0.8452	2366.000	2345.0	10.6	5276
53	0.8656	2355.000	2334.0	10.8	5252
54	0.8862	2351.000	2330.0	11.1	5243
55	0.9070	2334.000	2313.0	11.3	5204
56	0.9281	2299.000	2278.0	11.6	5126
57	0.9486	2280.000	2259.0	11.9	5083
58	0.9689	2264.000	2243.0	12.1	5047
59	0.9903	2234.000	2213.0	12.4	4979
60	1.0107	2213.000	2192.0	12.6	4932
61	1.0319	2211.000	2190.0	12.9	4928
62	1.0523	2193.000	2172.0	13.2	4887

Test Readings for Specimen No. 2

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf
63	1.0729	2178.000	2157.0	13.4	4853
64	1.0935	2159.000	2138.0	13.7	4811
65	1.1144	2136.000	2115.0	13.9	4759
66	1.1352	2096.000	2075.0	14.2	4669
67	1.1559	2077.000	2056.0	14.4	4626
68	1.1770	2041.000	2020.0	14.7	4545
69	1.1979	2011.000	1990.0	15.0	4478
70	1.2190	1972.000	1951.0	15.2	4390

Parameters for Specimen No. 3

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	9811.000		9767.900
Moisture content: Dry soil+tare, gms.	9084.300		9084.300
Moisture content: Tare, gms.	0.000		0.000
Moisture, %	8.0	7.5	7.5
Moist specimen weight, gms.	9811.1		
Side Length, in.	8.00	8.00	
Area, in.²	64.00	64.00	
Height, in.	4.00	3.86	
Net decrease in height, in.		0.14	
Wet density, pcf	146.0	150.6	
Dry density, pcf	135.2	140.1	
Void ratio	0.2468	0.2032	
Saturation, %	87.5	100.0	

Test Readings for Specimen No. 3

Normal stress = 8000 psf

Strain rate, in./min. = 0.010

Fail. Stress = 9522 psf **at reading no.** 44

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf
0	0.0000	51.000	0.0	0.0	0
1	0.0078	238.000	187.0	0.1	421
2	0.0148	297.000	246.0	0.2	554
3	0.0236	426.000	375.0	0.3	844
4	0.0314	628.000	577.0	0.4	1298
5	0.0396	801.000	750.0	0.5	1688
6	0.0462	921.000	870.0	0.6	1958
7	0.0549	1073.000	1022.0	0.7	2300
8	0.0613	1176.000	1125.0	0.8	2531
9	0.0695	1305.000	1254.0	0.9	2822
10	0.0762	1397.000	1346.0	1.0	3029
11	0.0935	1626.000	1575.0	1.2	3544
12	0.1096	1797.000	1746.0	1.4	3929
13	0.1268	1977.000	1926.0	1.6	4334
14	0.1425	2128.000	2077.0	1.8	4673
15	0.1596	2277.000	2226.0	2.0	5009
16	0.1758	2404.000	2353.0	2.2	5294

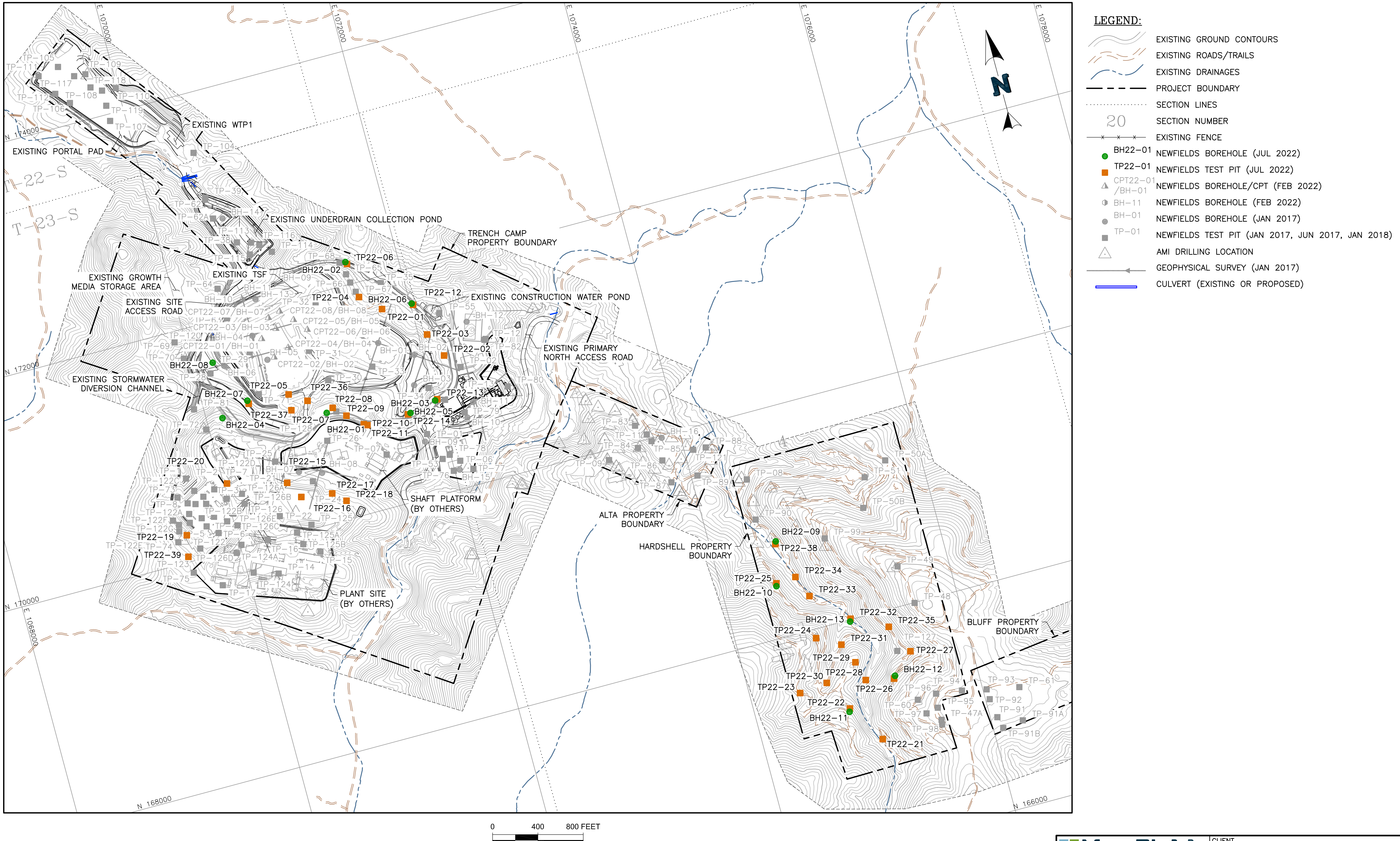
Test Readings for Specimen No. 3

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf
17	0.1907	2524.000	2473.0	2.4	5564
18	0.2060	2634.000	2583.0	2.6	5812
19	0.2219	2739.000	2688.0	2.8	6048
20	0.2382	2838.000	2787.0	3.0	6271
21	0.2536	2939.000	2888.0	3.2	6498
22	0.2695	3041.000	2990.0	3.4	6728
23	0.2854	3124.000	3073.0	3.6	6914
24	0.3009	3207.000	3156.0	3.8	7101
25	0.3166	3290.000	3239.0	4.0	7288
26	0.3325	3371.000	3320.0	4.2	7470
27	0.3489	3446.000	3395.0	4.4	7639
28	0.3647	3516.000	3465.0	4.6	7796
29	0.3806	3568.000	3517.0	4.8	7913
30	0.3965	3624.000	3573.0	5.0	8039
31	0.4195	3718.000	3667.0	5.2	8251
32	0.4425	3818.000	3767.0	5.5	8476
33	0.4623	3886.000	3835.0	5.8	8629
34	0.4835	3936.000	3885.0	6.0	8741
35	0.5013	4002.000	3951.0	6.3	8890
36	0.5199	4054.000	4003.0	6.5	9007
37	0.5397	4101.000	4050.0	6.7	9113
38	0.5605	4150.000	4099.0	7.0	9223
39	0.5819	4187.000	4136.0	7.3	9306
40	0.6023	4218.000	4167.0	7.5	9376
41	0.6233	4244.000	4193.0	7.8	9434
42	0.6443	4260.000	4209.0	8.1	9470
43	0.6649	4259.000	4208.0	8.3	9468
44	0.6854	4283.000	4232.0	8.6	9522
45	0.7059	4282.000	4231.0	8.8	9520
46	0.7274	4270.000	4219.0	9.1	9493
47	0.7485	4252.000	4201.0	9.4	9452
48	0.7692	4244.000	4193.0	9.6	9434
49	0.7901	4224.000	4173.0	9.9	9389
50	0.8119	4186.000	4135.0	10.1	9304
51	0.8327	4160.000	4109.0	10.4	9245
52	0.8544	4131.000	4080.0	10.7	9180
53	0.8749	4111.000	4060.0	10.9	9135
54	0.8964	4070.000	4019.0	11.2	9043
55	0.9171	4043.000	3992.0	11.5	8982
56	0.9381	3980.000	3929.0	11.7	8840
57	0.9591	3948.000	3897.0	12.0	8768
58	1.0010	3865.000	3814.0	12.5	8582
59	1.0219	3812.000	3761.0	12.8	8462
60	1.0435	3792.000	3741.0	13.0	8417
61	1.0645	3752.000	3701.0	13.3	8327
62	1.0862	3717.000	3666.0	13.6	8249
63	1.1070	3675.000	3624.0	13.8	8154

Test Readings for Specimen No. 3

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf
64	1.1275	3622.000	3571.0	14.1	8035
65	1.1492	3559.000	3508.0	14.4	7893
66	1.1695	3515.000	3464.0	14.6	7794
67	1.1909	3487.000	3436.0	14.9	7731
68	1.2112	3441.000	3390.0	15.1	7628
69	1.2324	3416.000	3365.0	15.4	7571

APPENDIX D.3
TSF1 Boreholes



REFERENCE:

EXISTING GROUND TOPOGRAPHY DEVELOPED FROM MARCH 2020 AND APRIL 2023 AERIAL SURVEY DATA PROVIDED BY SOUTH32 (AMI). DATA PROJECTED TO STATE PLANE ARIZONA CENTRAL NAD 83 FEET, NAVD88.

P:\Projects\0014.035 Hermosa TSF1-3 Design ADEQ APP Submittal\A-CAD\FIGS\14.035.017F.dwg-12/7/2023 8:57 AM

NewFields	CLIENT: SOUTH32 HERMOSA INC.
PROJECT	HERMOSA PROJECT AQUIFER PROTECTION PERMIT SIGNIFICANT AMENDMENT (TSF1)
TITLE	TSF1 GEOTECHNICAL SITE INVESTIGATION PLAN VIEW
FILENAME	14.035.017F
FIGURE NO.	1
REVISION	0

NewFields

CLIENT South32
PROJECT NAME Hermosa Project
PROJECT NUMBER 475.0014.033
PROJECT LOCATION Hermosa Mine, Arizona
DATE STARTED 7/12/22 **COMPLETED** 7/12/22
GROUND ELEVATION 5176.67 ft **HOLE SIZE** 7 inch O.D.
DRILLING CONTRACTOR Cascade Drilling
COORDINATES ():
DRILLING METHOD 7 in O.D. Sonic Drill
NORTHING 170956.97 **EASTING** 1071040.26
LOGGED BY F.Lepore **CHECKED BY**
DEPTH TO WATER (FT BGS) No groundwater encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0		poorly graded GRAVEL (GP-GM) with silt and sand, subangular to angular, MPS=4",dense, non-plastic, tan, damp	GB S01-01		30							
5175			some silt, fine to coarse grained sand, MPS=2", subrounded to subangular, loose, dark brown, damp										
			[BEDROCK], ANDESITE, ignous rock, tan, completely to highly weathered, fractured, weak, moderately to strong rock. MPS=7"										bedrock transition zone
	5												
5170													
	10		MPS=6"										
5165			MPS=3", reddish brown										
			MPS=5", tan										
	15												
5160													
	20												

BOREHOLE TERMINATED AT 20'

NewFields

BH22-02

CLIENT South32
PROJECT NAME Hermosa Project
PROJECT NUMBER 475.0014.033
PROJECT LOCATION Hermosa Mine, Arizona
DATE STARTED 8/1/22 **COMPLETED** 8/1/22
GROUND ELEVATION 5153.28 ft **HOLE SIZE** 7 inch O.D.
DRILLING CONTRACTOR Cascade Drilling
COORDINATES ():
DRILLING METHOD 7 in O.D. Sonic Drill
NORTHING 172199.51 **EASTING** 1071543.5
LOGGED BY JES **CHECKED BY**
DEPTH TO WATER (FT BGS) No groundwater encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0		clayey GRAVEL (GC) with sand and cobbles, poorly graded and angular gravel, MPS=4", fine to medium grained sand, low plastic fines, very dense, brown, dry	GB S01-02		30							
5150				SS S02-02	13-12-29 (41)	10							
	5		[BEDROCK], ANDESITE, ignous rock, tan, completely to highly weathered, fractured, tan, weak to moderately strong rock.										
			MPS=6", moist.	MC S03-02	68-65-46 (111)	8							
5145			MPS=2".										
	10												
				NR S04-02	12-10-17 (27)								
5140				GB S05-02		30							
	15			NR S06-02	100								
			yellowish brown	GB S07-02		30							
5135													
				NR S08-02	50								
	20												
5130			tan										
	25		yellowish brown										
5125													
	30		weathered, fractured, moderate strong rock, tan.										
5120													
	35												

BOREHOLE TERMINATED AT 35'

BH22-03

CLIENT South32 | **PROJECT NAME** Hermosa Project

PROJECT NUMBER 475.0014.033 | **PROJECT LOCATION** Hermosa Mine, Arizona

DATE STARTED 7/13/22 **COMPLETED** 7/13/22 | **GROUND ELEVATION** 5125 ft **HOLE SIZE** 7 inch O.D.

DRILLING CONTRACTOR Cascade Drilling | **COORDINATES ():**

DRILLING METHOD 7 in O.D. Sonic Drill | **NORTHING** 170815.25 **EASTING** 1071992.44

LOGGED BY F.Lepore **CHECKED BY** | **DEPTH TO WATER (FT BGS)** No groundwater encountered

NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
5125	0		[FILL], sandy GRAVEL (GP-GM) with silt, trace clay, poorly graded and angular gravel, MPS=2", fine to coarse grained sand, subangular to subrounded, non-plastic to low plastic fines, loose, light brown, dry	GB S01-03		30							
			sandy GRAVEL (GP-GM) with silt and clay, fine grained sand, MPS=1", dense, non-plastic to low plastic fines, tan/black, dry.	SS S02-03	9-7-22 (29)	13							
5120	5		dark brown, moist	GB S03-03		20							4.5' - 12', completely weathered and fractured rock.
			very dense, black	SS S04-03	6-34-50 (84)	14							
5115	10			GB S05-03		30							
			MPS=3", non-plastic, reddish brown	MC S06-03	14-50-50 (100)	15							
			[BEDROCK], ANDESITE, igneous rock, tan, weathered, fractured, moderate strong to strong rock	NR S07-03	50								
5110	15												
				GB S08-03		30							
5105	20		slightly weathered.										
5100	25												
5095	30												

BOREHOLE TERMINATED AT 30'

NewFields

CLIENT South32
PROJECT NAME Hermosa Project
PROJECT NUMBER 475.0014.033
PROJECT LOCATION Hermosa Mine, Arizona
DATE STARTED 7/29/22 **COMPLETED** 7/31/22
GROUND ELEVATION 5163.46 ft **HOLE SIZE** 7 inch O.D.
DRILLING CONTRACTOR Cascade Drilling
COORDINATES ():
DRILLING METHOD 7 in O.D. Sonic Drill
NORTHING 171150.9 **EASTING** 1070140.14
LOGGED BY JES **CHECKED BY**
DEPTH TO WATER (FT BGS) No groundwater encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0												
			sandy SILT(ML) with gravel, fined grained sand, subrounded to subangular, angular gravel, non-plastic fines, stiff, reddish brown, moist	GB S01-04		30							
5160			very stiff.	SS S02-04		13							
	5												
			[BEDROCK], ANTESITE, igneous rock, tan, weathered, slightly fractured, moderately strong to strong	NR S03-04	70								
			reddish tan, highly weathered, fractured, weak to moderately strong.	GB S04-04		30							
5155													
	10												
				SS S05-04	50-50	7							
5150													
	15		tan, slightly weathered and fractured.	NR S06-04	70								
5145													
				NR S07-04									
	20												
5140													
	25												
			reddish/yellowish tan, highly weathered and fractured, weak rock.										
5135			light tan, weathered, fractured.										
	30												
5130													
	35												
			grey, fresh rock, strong.										
5125													
	40												

(Continued Next Page)

NewFields

CLIENT South32 **PROJECT NAME** Hermosa Project
PROJECT NUMBER 475.0014.033 **PROJECT LOCATION** Hermosa Mine, Arizona

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	40		[BEDROCK], ANTESITE, igneous rock, tan, weathered, slightly fractured, moderately strong to strong *(continued)*										
5120	45												
5115	50												
5110	55												
5105	60												
5100	65												
5095	70												
5090	75												

BOREHOLE TERMINATED AT 77'

NewFields

BH22-06

CLIENT South32
PROJECT NAME Hermosa Project
PROJECT NUMBER 475.0014.033
PROJECT LOCATION Hermosa Mine, Arizona
DATE STARTED 7/14/22 **COMPLETED** 7/14/22
GROUND ELEVATION 5167.51 ft **HOLE SIZE** 7 inch O.D.
DRILLING CONTRACTOR Cascade Drilling
COORDINATES ():
DRILLING METHOD 7 in O.D. Sonic Drill
NORTHING 171694.5 **EASTING** 1072013.5
LOGGED BY F.Lepore **CHECKED BY**
DEPTH TO WATER (FT BGS) No groundwater encountered
NOTES

DEPTH (ft)	MATERIAL DESCRIPTION
0–14	[FILL], sandy GRAVEL (GP-GM) with silt and clay, poorly graded and angular gravel, MPS=2", fine grained sand, subrounded to subangular sand, non-plastic to low plastic fines, medium dense, reddish brown, dry
14–30	sandy GRAVEL (GP-GM) with silt and clay, poorly graded and angular gravel, fine grained sand, subrounded to subangular sand, non-plastic to low plastic fines, very dense, reddish brown, moist
30–32	[BEDROCK], ANDESITE, igneous rock, tan, weathered, fractured, moderately strong to strong

SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
GB S01-06		30							
SS S02-06	7-19-19 (38)	15							
GB S03-06									
SS S04-06	18-24-36 (60)	16							
GB S05-06		30							
GB S06-06	7-13-21 (34)	14							
GB S07-06		24							
SS S08-06	20-19-28 (47)	16							
GB S09-06		30							

Elevation scale (ft): 5165, 5160, 5155, 5150, 5145, 5140
Depth scale (ft): 0, 5, 10, 15, 20, 25, 30

BOREHOLE TERMINATED AT 32'

NewFields

CLIENT South32
PROJECT NAME Hermosa Project
PROJECT NUMBER 475.0014.033
PROJECT LOCATION Hermosa Mine, Arizona
DATE STARTED 8/5/22 **COMPLETED** 8/5/22
GROUND ELEVATION 5104.31 ft **HOLE SIZE** 7 inch O.D.
DRILLING CONTRACTOR Cascade Drilling
COORDINATES ():
DRILLING METHOD 7 in O.D. Sonic Drill
NORTHING 171242.12 **EASTING** 1070391.74
LOGGED BY JES **CHECKED BY**
DEPTH TO WATER (FT BGS) No groundwater encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0		[FILL], clayey GRAVEL (GC) with sand and cobbles, angular gravel, MPS=5", fine to medium grained sand, subrounded to subangular, low plastic fines, very dense, brown, dry	GB S01-07									
			[BEDROCK], ANDESITE, igneous rock, greenish tan, slightly weathered, strong	NR S02-07	100								
5100	5												
5095	10												
5090	15		very fresh rock.										hard to drill and can't be pulverized.
5085	20												
5080	25												
5075	30												

BOREHOLE TERMINATED AT 32'

CLIENT South32
PROJECT NAME Hermosa Project
PROJECT NUMBER 475.0014.033
PROJECT LOCATION Hermosa Mine, Arizona
DATE STARTED 8/19/22 **COMPLETED** 7/19/22
GROUND ELEVATION 5065.6 ft **HOLE SIZE** 7 inch O.D.
DRILLING CONTRACTOR Cascade Drilling
COORDINATES ():
DRILLING METHOD 7 in O.D. Sonic Drill
NORTHING 171644.8 **EASTING** 1070183.12
LOGGED BY F.Lepore **CHECKED BY**
DEPTH TO WATER (FT BGS) No groundwater encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
5065	0		[FILL], gravelly CLAY (CL) with silt, trace sand, poorly graded and angular gravel, fine grained sand, subrounded to subangular, low plastic fines, medium stiff, dark brown, moist	GB S01-08		30							
				SS S02-08	7-3-5 (8)	17							
			MPS=2"										
5060	5			GB S03-08									
			MPS=1.5"	SS S04-08	3-2-3 (5)	8							
				GB S05-08		30							
5055	10			SS S06-08	8-7-8 (15)	15							
			MPS=2", stiff, none plastic to low plastic fines	GB S06-08		30							
5050	15		[FILL], clayey GRAVEL (GC) with silt, trace sand, poorly graded and angular gravel, MPS=3", fine grained sand, subrounded to subangular sand, non-plastic to low plastic, medium dense, brown, moist										
				SS S07-08	27-25-24 (49)	16							
5045	20		fine to coarse sand, MPS=8", dark brown	GB S08-08		47							
5040	25			SS S09-08	5-8-11 (19)	12							
5035	30			GB S10-08		6							
			PMS=2", non-plastic fines, dense	SS S11-08	15-20-50 (70)	10							
	35												

(Continued Next Page)

NewFields

CLIENT South32 **PROJECT NAME** Hermosa Project
PROJECT NUMBER 475.0014.033 **PROJECT LOCATION** Hermosa Mine, Arizona

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
5030	35		[FILL], clayey GRAVEL (GC) with silt, trace sand, poorly graded and angular gravel, MPS=3", fine grained sand, subrounded to subangular sand, non-plastic to low plastic, medium dense, brown, moist *(continued)* MPS=1.5", medium dense, damp	SS S12-08	12-8-7 (15)	1.2							
5025	40												
5020	45			GB S13-08		30							
5015	50		[FILL], gravelly CLAY (CL) with silt, trace sand, poorly graded and angular gravel, fine grained sand, subrounded to subangular, low plastic fines, medium stiff, dark brown, moist	SS S14-08	4-3-8 (11)	18							
5010	55												
5005	60												
5000	65												
4995	70												
	75												

(Continued Next Page)

CLIENT South32
PROJECT NUMBER 475.0014.033
PROJECT NAME Hermosa Project
PROJECT LOCATION Hermosa Mine, Arizona

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
4990	75		[FILL], gravelly CLAY (CL) with silt, trace sand, poorly graded and angular gravel, fine grained sand, subrounded to subangular, low plastic fines, medium stiff, dark brown, moist *(continued)*										
4985	80												
			[TAILINGS], gravelly CLAY (CL) with silt, trace sand, poorly graded and angular gravel,, subround to subangular sand, low plastic fines, stiff, tan, moist										
4980	85												
4975	90												
4970	95												
			[TAILINGS], clayey GRAVEL (GC) with silt, trace sand, poorly graded and angular gravel, fine grained sand, subrounded to subangular sand, low plastic fines, medium dense, dark brown to tan, moist										
4965	100												102' - 106' = wooden beam debris
4960	105												

BOREHOLE TERMINATED AT 106'

BH22-09

NewFields

CLIENT South32
PROJECT NAME Hermosa Project
PROJECT NUMBER 475.0014.033
PROJECT LOCATION Hermosa Mine, Arizona
DATE STARTED 8/4/22 **COMPLETED** 8/4/22
GROUND ELEVATION 5129.93 ft **HOLE SIZE** 7 inch O.D.
DRILLING CONTRACTOR Cascade Drilling
COORDINATES ():
DRILLING METHOD 7 in O.D. Sonic Drill
NORTHING 168837.84 **EASTING** 1074573.24
LOGGED BY JES **CHECKED BY**
DEPTH TO WATER (FT BGS) No groundwater encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0		clayey GRAVEL (GC), trace sand, poorly graded and angular gravel, MPS=4", fine grained sand, subrounded to subangular, low plastic fines, medium dense, reddish brown, dry	GB S01-09		30							
			MPS=1", moist	MC S02-09	17-11-9 (20)	8							
5125	5			GB S03-09		30							
			MPS=2.5"	SS S03-09	2-3-8 (11)	11							
5120	10												
			MPS=0.5", dense	MC S04-09	18-29-22 (51)	5							
5115	15		MPS=2.5", medium desnse	SS S05-09	8-17-11 (28)	15							
			[TRANSITION ZONE]	NR S06-09	28-43-36 (79)								18.5' - 20' transition into bedrock zone.
5110	20		[BEDROCK], ANDESITE, igneous rock, tan, weathered and fractured rock, weak to moderately strong rock										
5105	25												
5100	30												

BOREHOLE TERMINATED AT 30'

BH22-10

CLIENT South32	**PROJECT NAME** Hermosa Project
PROJECT NUMBER 475.0014.033	**PROJECT LOCATION** Hermosa Mine, Arizona
DATE STARTED 8/2/22 **COMPLETED** 8/2/02	**GROUND ELEVATION** 5208.76 ft **HOLE SIZE** 7 inch O.D.
DRILLING CONTRACTOR Cascade Drilling	**COORDINATES ():**
DRILLING METHOD 7 in O.D. Sonic Drill	**NORTHING** 168454.73 **EASTING** 1074476.53
LOGGED BY JES **CHECKED BY**	**DEPTH TO WATER (FT BGS)** No groundwater encountered
NOTES	

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0		clayey GRAVEL (GC) with silt and sand, poorly graded and angular gravel, MPS=5", fine grained sand, subround to subangular sand, low plastic fines, dense, low plastic, reddish brown, moist	GB S01-10		30							
5205				MC S02-10	16-26-25 (51)	14							4' - 6.5' transition into bedrock zone.
	5		[TRANSITION ZONE]	GB S03-03		30							
			[BEDROCK], ANDESITE, igneous rock, tan, weathered and fractured rock, weak to moderately strong rock	NR	50								
5200	10												
5195	15												

BOREHOLE TERMINATED AT 16.5

BH22-11

NewFields

CLIENT South32

PROJECT NAME Hermosa Project

PROJECT NUMBER 475.0014.033

PROJECT LOCATION Hermosa Mine, Arizona

DATE STARTED 8/3/22 **COMPLETED** 8/3/22

GROUND ELEVATION 5352.08 ft **HOLE SIZE** 7 inch O.D.

DRILLING CONTRACTOR Cascade Drilling

COORDINATES ():

DRILLING METHOD 7 in O.D. Sonic Drill

NORTHING 167217.66 **EASTING** 1074813.2

LOGGED BY JES **CHECKED BY**

DEPTH TO WATER (FT BGS) No groundwater encountered

NOTES

ELEVATION (ft)	DEPTH (ft)	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
5352.08	0	clayey GRAVEL (GC) with silt and sand, poorly graded and angular gravel, MPS=1.5", fine grained sand, subround to subangular sand, 1.5", low plastic fines, dense, reddish brown, moist	GB S01-11		30							
5350			MC S02-11	17-11-25 (36)	14							
	5	sandy CLAY (SC) with trace gravel, fine grained sand, subrounded to subangular sand, angular gravel, MPS=1", low plastic fines, very stiff, light brown to tan, moist	GB S03-11		30							
5345			SS S04-11	4-7-10 (17)	10							
	10	[TRANSITION ZONE], completely weathered and highly fractured rock, weak, light brown to tan										
5340		[BEDROCK], ANDESITE, igneous rock, tan, weathered rock, strong rock	NR	100								
5335	15											
	20											

BOREHOLE TERMINATED AT 21'

NewFields

CLIENT South32
PROJECT NAME Hermosa Project
PROJECT NUMBER 475.0014.033
PROJECT LOCATION Hermosa Mine, Arizona
DATE STARTED 8/4/22 **COMPLETED** 8/4/22
GROUND ELEVATION 5355.49 ft **HOLE SIZE** 7 inch O.D.
DRILLING CONTRACTOR Cascade Drilling
COORDINATES ():
DRILLING METHOD 7 in O.D. Sonic Drill
NORTHING 167420.51 **EASTING** 1075283.03
LOGGED BY JES **CHECKED BY**
DEPTH TO WATER (FT BGS) No groundwater encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
5355	0		clayey GRAVEL (GC) with silt and sand, poorly graded and angular gravel, MPS=1.5", fine grained sand, subround to subangular sand, 1.5", low plastic fines, very dense, reddish brown, dry	GB S01-12		30							
				MC S02-12	18-31-60 (91)	18							
5350	5		[BEDROCK], ANDESITE, igneous rock, tan, weathered rock, strong rock										
5345	10												

BOREHOLE TERMINATED AT 14'

NewFields

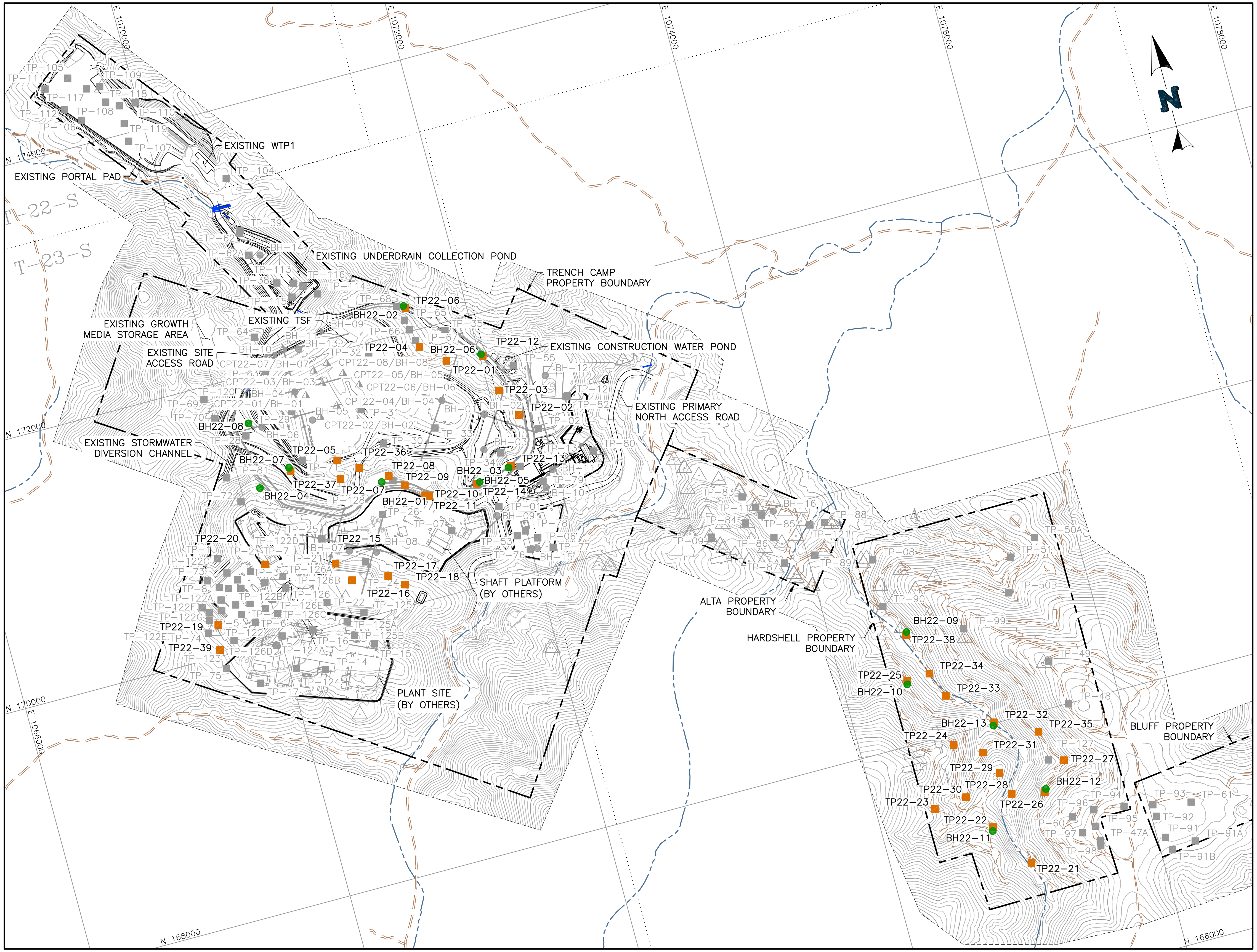
CLIENT	South32	**PROJECT NAME**	Hermosa Project
PROJECT NUMBER	475.0014.033	**PROJECT LOCATION**	Hermosa Mine, Arizona
DATE STARTED	8/3/22 **COMPLETED** 8/3/22	**GROUND ELEVATION**	5184.65 ft **HOLE SIZE** 7 inch O.D.
DRILLING CONTRACTOR	Cascade Drilling	**COORDINATES ():**	
DRILLING METHOD	7 in O.D. Sonic Drill	**NORTHING**	167985.13 **EASTING** 1075023.72
LOGGED BY	JES **CHECKED BY**	**DEPTH TO WATER (FT BGS)**	No groundwater encountered
NOTES			

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0		[TRANSITION ZONE], highly weathered and fractured rock, weak, light brown to tan	GB S01-13		30							
				NR	100								
5180	5		[BEDROCK], **ANDESITE, igneous rock, tan, weathered rock, strong rock**										
5175	10												
5170	15												

BOREHOLE TERMINATED AT 15'

APPENDIX D.4

TSF1 Test Pits



LEGEND:

EXISTING GROUND CONTOURS
EXISTING ROADS/TRAILS
EXISTING DRAINAGES
PROJECT BOUNDARY
SECTION LINES
20 SECTION NUMBER
EXISTING FENCE
BH22-01 NEWFIELDS BOREHOLE (JUL 2022)
TP22-01 NEWFIELDS TEST PIT (JUL 2022)
CPT22-01 /BH-01 NEWFIELDS BOREHOLE/CPT (FEB 2022)
BH-11 NEWFIELDS BOREHOLE (FEB 2022)
BH-01 NEWFIELDS BOREHOLE (JAN 2017)
TP-01 NEWFIELDS TEST PIT (JAN 2017, JUN 2017, JAN 2018)
AMI DRILLING LOCATION
GEOPHYSICAL SURVEY (JAN 2017)
CULVERT (EXISTING OR PROPOSED)

0 400 800 FEET

REFERENCE:

EXISTING GROUND TOPOGRAPHY DEVELOPED FROM MARCH 2020 AND APRIL 2023 AERIAL SURVEY DATA PROVIDED BY SOUTH32 (AMI). DATA PROJECTED TO STATE PLANE ARIZONA CENTRAL NAD 83 FEET, NAVD88.

P:\Projects\0014.035 Hermosa TSF1-3 Design ADEQ APP Submittal\A-CAD\FIGS\14.035.017F.dwg-12/7/2023 8:57 AM

NewFields	CLIENT SOUTH32 HERMOSA INC.
PROJECT	HERMOSA PROJECT AQUIFER PROTECTION PERMIT SIGNIFICANT AMENDMENT (TSF1)
TITLE	TSF1 GEOTECHNICAL SITE INVESTIGATION PLAN VIEW
FILENAME	14.035.017F
FIGURE NO.	1
REVISION	0

TP22-02

NewFields

CLIENT South32

PROJECT NAME Hermosa Project

PROJECT NUMBER 475.0014.033

PROJECT LOCATION Hermosa Mine, Arizona

DATE STARTED 7/18/22 **COMPLETED** 7/18/22

GROUND ELEVATION 5119.75 ft **HOLE SIZE**

EXCAVATION CONTRACTOR RUMCO

COORDINATES (State Plane Arizona Central NAD 83 Int feet):

EXCAVATION METHOD CAT 345

NORTHING 171177.9 **EASTING** 1072171.09

LOGGED BY F.Lepore **CHECKED BY**

DEPTH TO WATER (FT BGS) No groundwater encountered

NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0.0		[TOPSOIL], clayey SAND (SC) with gravel and cobbles, angular gravel, MPS=4", fine grained sand, subrounded to angular sand, medium plastic, medium dense, dark brown, dry										
			[BEDROCK], ANDESITE, igneous rock, tan, highly weathered and highly fractured, weak to moderately strong rock										
5117.5	2.5												
				LD 2-1		12							
5115.0	5.0												
5112.5	7.5												

TEST PIT WAS TERMINATED AT 8' DUE TO PRACTICAL EQUIPMENT REFUSAL

NewFields

TP22-03

CLIENT South32
PROJECT NAME Hermosa Project
PROJECT NUMBER 475.0014.033
PROJECT LOCATION Hermosa Mine, Arizona
DATE STARTED 7/18/22 **COMPLETED** 7/18/22
GROUND ELEVATION 5131.08 ft **HOLE SIZE**
EXCAVATION CONTRACTOR RUMCO
COORDINATES (State Plane Arizona Central NAD 83 Int feet):
EXCAVATION METHOD CAT 345
NORTHING 171396.06 **EASTING** 1072074.06
LOGGED BY F.Lepore **CHECKED BY**
DEPTH TO WATER (FT BGS) No groundwater encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0.0		[TOPSOIL], clayey SAND (SC) with gravel, angular gravel, MPS=2", fine grained sand, subrounded to angular sand, medium plastic, medium dense, brown, damp										
5130.0													
			[BEDROCK], ANDESITE, igneous rock, tan, weathered and fractured, weak to moderately strong rock										
	2.5												
5127.5													
	5.0												
5125.0													

TEST PIT WAS TERMINATED AT 7' DUE TO PRACTICAL EQUIPMENT REFUSAL

NewFields

TP22-05

CLIENT	South32	**PROJECT NAME**	Hermosa Project
PROJECT NUMBER	475.0014.033	**PROJECT LOCATION**	Hermosa Mine, Arizona
DATE STARTED	7/18/22 **COMPLETED** 7/18/22	**GROUND ELEVATION**	5118.32 ft **HOLE SIZE**
EXCAVATION CONTRACTOR	RUMCO	**COORDINATES (State Plane Arizona Central NAD 83 Int feet):**	
EXCAVATION METHOD	CAT 345	**NORTHING** 171200.99	**EASTING** 1070757.88
LOGGED BY	F.Lepore **CHECKED BY**	**DEPTH TO WATER (FT BGS)**	No groundwater encountered
NOTES			

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0.0		[FILL], clayey SAND (SC) with gravel, angular gravel, MPS=1", fine grained sand, subrounded to angular sand, non-plastic, medium dense, dark brown, moist										
5117.5			[BEDROCK], ANDESITE, igneous rock, reddish to dark brown, highly weathered, slightly fractured, moderately strong to strong, oxidyzed rock										
	2.5												
5115.0													
	5.0												
5112.5													

TEST PIT WAS TERMINATED AT 7' DUE TO PRACTICAL EQUIPMENT REFUSAL

TP22-06

PAGE 1 OF 1

NewFields

CLIENT South32

PROJECT NAME Hermosa Project

PROJECT NUMBER 475.0014.033

PROJECT LOCATION Hermosa Mine, Arizona

DATE STARTED 7/18/22 **COMPLETED** 7/18/22

GROUND ELEVATION 5156.37 ft **HOLE SIZE**

EXCAVATION CONTRACTOR RUMCO

COORDINATES (State Plane Arizona Central NAD 83 Int feet):

EXCAVATION METHOD CAT 345

NORTHING 172179.21 **EASTING** 1071552.48

LOGGED BY F.Lepore **CHECKED BY**

DEPTH TO WATER (FT BGS) No grounwater encountered

NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0		[TOPSOIL], clayey SAND (SC) with gravel, angular gravel, MPS=2", fine grained sand, subrounded to angular sand, medium plastic, medium dense, dark brown, dry										
5155			[FILL], clayey SAND (SC) with gravel and cobbles, angular gravel, MPS=5", fine grained sand, subrounded to angular sand, non-plastic, medium dense, dark brown, dry										
	5			LD				27	13	35.1	35.2	12.2	17.5% Cobble
5150			MPS=6"										
	10		boulders, MPS=12"	LD 6-1		204							
5145			MPS=5"										
	15												
5140			boulders, MPS=24"										

TEST PIT TERMINATED AT 18'

NewFields

TP22-07

CLIENT South32
PROJECT NAME Hermosa Project
PROJECT NUMBER 475.0014.033
PROJECT LOCATION Hermosa Mine, Arizona
DATE STARTED 7/16/22 **COMPLETED** 7/18/22
GROUND ELEVATION 5118.99 ft **HOLE SIZE**
EXCAVATION CONTRACTOR RUMCO
COORDINATES (State Plane Arizona Central NAD 83 Int feet):
EXCAVATION METHOD CAT 345
NORTHING 171060.57 **EASTING** 1070745.11
LOGGED BY F.Lepore **CHECKED BY**
DEPTH TO WATER (FT BGS) No groundwater encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0.0		[TOPSOIL], clayey SAND (SC) with gravel, angular gravel, MPS=2", fine grained sand, subrounded to angular sand, medium plastic, medium dense, dark brown, dry										
5117.5			[BEDROCK], ANDESITE, igneous rock, tan, weathered and fractured rock, moderately strong to strong rock										
	2.5												
5115.0													
	5.0												
5112.5													

TEST PIT WAS TERMINATED AT 7' DUE TO PRACTICAL EQUIPMENT REFUSAL

TP22-08

NewFields

CLIENT South32
PROJECT NAME Hermosa Project
PROJECT NUMBER 475.0014.033
PROJECT LOCATION Hermosa Mine, Arizona
DATE STARTED 7/8/22 **COMPLETED** 7/8/22
GROUND ELEVATION 5177.56 ft **HOLE SIZE**
EXCAVATION CONTRACTOR RUMCO
COORDINATES (State Plane Arizona Central NAD 83 Int feet):
EXCAVATION METHOD CAT 345
NORTHING 170986.91 **EASTING** 1071102.7
LOGGED BY F.Lepore **CHECKED BY**
DEPTH TO WATER (FT BGS) No groundwater encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0		[FILL], clayey SAND (SC) with gravel, angular gravel, MPS=1", fine grained sand, subrounded to angular sand, medium plastic, dense, dark brown, dry										
			[BEDROCK], ANDESITE, igneous rock, reddish to dark brown, highly weathered, slightly fractured, moderately strong to strong, oxidyzed rock										
5175				LD		18				41.4	49.6	9	
	5												
5170				LD 8-1		180							
	10												
5165													
	15												

TEST PIT TERMINATED AT 16'

NewFields

TP22-09
PAGE 1 OF 1

CLIENT South32
PROJECT NAME Hermosa Project
PROJECT NUMBER 475.0014.033
PROJECT LOCATION Hermosa Mine, Arizona
DATE STARTED 7/8/22 **COMPLETED** 7/8/22
GROUND ELEVATION 5183.77 ft **HOLE SIZE**
EXCAVATION CONTRACTOR RUMCO
COORDINATES (State Plane Arizona Central NAD 83 Int feet):
EXCAVATION METHOD CAT 345
NORTHING 170888.47 **EASTING** 1071201.72
LOGGED BY F.Lepore **CHECKED BY**
DEPTH TO WATER (FT BGS) No groundwater encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0		[FILL], clayey SAND (SC) with gravel, angular gravel, MPS=1", fine grained sand, subrounded to angular sand, medium plastic, medium dense, dark brown, damp										
			[BEDROCK], ANDESITE, igneous rock, reddish to dark brown, highly weathered, slightly fractured, moderately strong to strong, oxidyzed rock										
5180													
	5			LD		36				26.9	61.8	11.3	
5175													
	10			LD 9-1		234							
5170													
	15												
5165													
	20												

TEST PIT TERMINATED AT 20'

NewFields

CLIENT South32
PROJECT NUMBER 475.0014.033
DATE STARTED 7/8/22 **COMPLETED** 7/8/22
EXCAVATION CONTRACTOR RUMCO
EXCAVATION METHOD CAT 345
LOGGED BY F.Lepore **CHECKED BY**
NOTES

PROJECT NAME Hermosa Project
PROJECT LOCATION Hermosa Mine, Arizona
GROUND ELEVATION 5173.24 ft **HOLE SIZE**
COORDINATES (State Plane Arizona Central NAD 83 Int feet):
NORTHING 170775.7 **EASTING** 1071330.42
DEPTH TO WATER (FT BGS) No groundwater encountered

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0.0		[FILL], clayey SAND (SC) with gravel, angular gravel, MPS=2", fine grained sand, subrounded to angular sand, medium plastic, medium dense, dark brown, dry										
5172.5			clayey SAND (SC) with gravel, angular gravel, MPS=2.5", fine grained sand, subrounded to angular sand, medium plastic, dense, dark brown, dry										
	2.5												
5170.0				LD 10-1		54							
				LD		24		33	14	28.1	54.9	17	
	5.0												
5167.5			[BEDROCK], ANDESITE, igneous rock, reddish to brown, highly weathered, slightly fractured, moderately strong to strong, oxidyzed rock										
	7.5												
5165.0													
	10.0												
5162.5													
	12.5												
5160.0													
	15.0												
5157.5													

TEST PIT TERMINATED AT 16'

TP22-11

NewFields

CLIENT South32

PROJECT NAME Hermosa Project

PROJECT NUMBER 475.0014.033

PROJECT LOCATION Hermosa Mine, Arizona

DATE STARTED 7/8/22 **COMPLETED** 7/8/22

GROUND ELEVATION 5173 ft **HOLE SIZE**

EXCAVATION CONTRACTOR RUMCO

COORDINATES (State Plane Arizona Central NAD 83 Int feet):

EXCAVATION METHOD CAT 345

NORTHING 170760.48 **EASTING** 1071359.44

LOGGED BY F.Lepore **CHECKED BY**

DEPTH TO WATER (FT BGS) No groundwater encountered

NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0		[Fill], clayey SAND (SC) with gravel, angular gravel, MPS=2.5", fine grained sand, subrounded to angular sand, medium plastic, dense, dark brown, dry										
5170													
	5			LD 11-1 LD		108 15				35	52.5	12.5	
			cobbles, MPS=7"										wood debris
5165													
	10		[BEDROCK], ANDESITE, igneous rock, tan, weathered and fractured rock, moderately strong to strong rock										
5160													
	15												
5155													

TEST PIT TERMINATED AT 19'

NewFields

TP22-12

CLIENT South32
PROJECT NAME Hermosa Project
PROJECT NUMBER 475.0014.033
PROJECT LOCATION Hermosa Mine, Arizona
DATE STARTED 7/18/22 **COMPLETED** 7/18/22
GROUND ELEVATION 5165.74 ft **HOLE SIZE**
EXCAVATION CONTRACTOR RUMCO
COORDINATES (State Plane Arizona Central NAD 83 Int feet):
EXCAVATION METHOD CAT 345
NORTHING 171679.92 **EASTING** 1072023.07
LOGGED BY F.Lepore **CHECKED BY**
DEPTH TO WATER (FT BGS) No groundwater encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0												
5165			[Fill], clayey SAND (SC) with gravel, angular gravel, MPS=2.5", fine grained sand, subrounded to angular sand, medium plastic, medium dense, dark brown, dry										
				LD		12				58.2	31	10.8	
	5												
5160			boulders, MPS=12"										
			cobbles, MPS=6"										
			MPS=3"	LD 12-1		228							
	10												
5155													
	15												
5150													
			cobbles, MPS=5"										

TEST PIT TERMINATED AT 19'

NewFields

TP22-13

CLIENT South32
PROJECT NAME Hermosa Project
PROJECT NUMBER 475.0014.033
PROJECT LOCATION Hermosa Mine, Arizona
DATE STARTED 7/8/22 **COMPLETED** 7/8/22
GROUND ELEVATION 5125 ft **HOLE SIZE**
EXCAVATION CONTRACTOR RUMCO
COORDINATES (State Plane Arizona Central NAD 83 Int feet):
EXCAVATION METHOD CAT 345
NORTHING 170821.34 **EASTING** 1072012.81
LOGGED BY F.Lepore **CHECKED BY**
DEPTH TO WATER (FT BGS) No groundwater encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
5125.0	0.0		poorly graded GRAVEL (GP-GM) with silt, angular gravel, MPS=3", fine to coarse grained sand, subrounded to subangular, non-plastic to low plastic, medium dense, brown, dry										
			cobbles, MPS=5"										
5122.5	2.5			LD 13-1		60							
			boulders, MPS=12"	LD		12				62.5	28.8	8.7	
5120.0	5.0		[BEDROCK], ANDESITE, igneous rock, reddish to dark brown, highly weathered, slightly fractured, moderately strong to strong, oxidyzed rock										
			grey, unoxidized rock										
5117.5	7.5												
5115.0	10.0												

TEST PIT TERMINATED AT 12'

TP22-15

NewFields

CLIENT South32
PROJECT NAME Hermosa Project
PROJECT NUMBER 475.0014.033
PROJECT LOCATION Hermosa Mine, Arizona
DATE STARTED 7/8/22 **COMPLETED** 7/8/22
GROUND ELEVATION 5182.58 ft **HOLE SIZE**
EXCAVATION CONTRACTOR RUMCO
COORDINATES (State Plane Arizona Central NAD 83 Int feet):
EXCAVATION METHOD CAT 345
NORTHING 170451.83 **EASTING** 1070543.9
LOGGED BY F.Lepore **CHECKED BY**
DEPTH TO WATER (FT BGS) No groundwater encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0		[TOPSOIL], clayey SAND (SC) with gravel, angular gravel, MPS=2.5", fine grained sand, subrounded to angular sand, medium plastic, medium dense, brown, dry										
			[BEDROCK], ANDESITE, igneous rock, reddish to dark brown, highly weathered, slightly fractured, moderately strong to strong, oxidyzed rock										
5180				LD		12				17.3	64	18.7	
	5												
5175													
				LD 13-1		192							
	10												
5170													
	15												

TEST PIT TERMINATED AT 17'

TP22-15B

NewFields

CLIENT South32
PROJECT NAME Hermosa Project
PROJECT NUMBER 475.0014.033
PROJECT LOCATION Hermosa Mine, Arizona
DATE STARTED 7/15/22 **COMPLETED** 7/15/22
GROUND ELEVATION **HOLE SIZE**
EXCAVATION CONTRACTOR RUMCO
COORDINATES (State Plane Arizona Central NAD 83 Int feet):
EXCAVATION METHOD CAT 345
NORTHING 170327.76 **EASTING** 1070510.43
LOGGED BY F.Lepore **CHECKED BY**
DEPTH TO WATER (FT BGS) No groundwater was encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0		[FILL], clayey SAND (SC) with gravel and cobbles, angular gravel, MPS=3", fine grained sand, subrounded to angular sand, medium plastic, dense, dark brown, dry										
	5			LD		12				24.4	54.1	21.7	
	10			LD 15B-1		228							
	15		MPS=5", moist	LD		12				50.3	29.2	7.9	12.6% cobble
	20												

TEST PIT TERMINATED AT 20'

NewFields

CLIENT South32
PROJECT NAME Hermosa Project
PROJECT NUMBER 475.0014.033
PROJECT LOCATION Hermosa Mine, Arizona
DATE STARTED 7/15/22 **COMPLETED** 7/15/22
GROUND ELEVATION **HOLE SIZE**
EXCAVATION CONTRACTOR RUMCO
COORDINATES (State Plane Arizona Central NAD 83 Int feet):
EXCAVATION METHOD CAT 345
NORTHING 170276.57 **EASTING** 1070618.49
LOGGED BY F.Lepore **CHECKED BY**
DEPTH TO WATER (FT BGS) No groundwater not encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0		[FILL], clayey GRAVEL (GC) with sand, angular gravel, MPS=3", fine grained sand, subrounded to subangular sand, medium plastic, medium dense, reddish brown, damp										
				LD		12				51.3	38	10.7	
	5		MPS=6"										
			subrounded to angular sand, MPS=5"										
				LD 16-1		204							
	10												
	15		MPS=2"										
			MPS=4"										

TEST PIT TERMINATED AT 17'

NewFields

CLIENT South32
PROJECT NAME Hermosa Project
PROJECT NUMBER 475.0014.033
PROJECT LOCATION Hermosa Mine, Arizona
DATE STARTED 7/15/22 COMPLETED 7/15/22
GROUND ELEVATION HOLE SIZE
EXCAVATION CONTRACTOR RUMCO
COORDINATES (State Plane Arizona Central NAD 83 Int feet):
EXCAVATION METHOD CAT 345
NORTHING 170243.82 EASTING 1071046.26
LOGGED BY F.Lepore CHECKED BY
DEPTH TO WATER (FT BGS) No groundwater not encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0		[TOPSOIL], clayey SAND (SC) with gravel, angular gravel, MPS=2", fine grained sand, subrounded to angular sand, high plastic, dense, dark brown, dry	LD 17-1		12		39	22	7.5	47.9	44.6	
			[BEDROCK], ANDESITE, igneous rock, tan, highly weathered, fractured, moderately strong to strong rock										
	5												
	10												
	15												

TEST PIT TERMINATED AT 19'

TP22-18

NewFields

CLIENT South32

PROJECT NAME Hermosa Project

PROJECT NUMBER 475.0014.033

PROJECT LOCATION Hermosa Mine, Arizona

DATE STARTED 7/15/22 **COMPLETED** 7/15/22

GROUND ELEVATION **HOLE SIZE**

EXCAVATION CONTRACTOR RUMCO

COORDINATES (State Plane Arizona Central NAD 83 Int feet):

EXCAVATION METHOD CAT 345

NORTHING 170063.06 **EASTING** 1071144.95

LOGGED BY F.Lepore **CHECKED BY**

DEPTH TO WATER (FT BGS) No groundwater not encountered

NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0.0		[FILL], clayey SAND (SC) with gravel, angular gravel, MPS=2", fine grained sand, subrounded to angular sand, medium plastic, medium dense, dark brown, dry	LD 18-1		12		30	10	13.1	53.6	33.3	
	2.5		[BEDROCK], ANDESITE, igneous rock, reddish to tan, highly weathered and highly fractured, moderately strong rock to strong										
	5.0												
	7.5												
	10.0												
	12.5												

TEST PIT TERMINATED AT 14'

NewFields

CLIENT South32
PROJECT NAME Hermosa Project
PROJECT NUMBER 475.0014.033
PROJECT LOCATION Hermosa Mine, Arizona
DATE STARTED 7/16/22 **COMPLETED** 7/16/22
GROUND ELEVATION **HOLE SIZE**
EXCAVATION CONTRACTOR RUMCO
COORDINATES (State Plane Arizona Central NAD 83 Int feet):
EXCAVATION METHOD CAT 345
NORTHING 170205.15 **EASTING** 1079535.17
LOGGED BY F.Lepore **CHECKED BY**
DEPTH TO WATER (FT BGS) No groundwater encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0.0		clayey GRAVEL (GP) with sand, angular gravel, MPS=3", fine to coarse grained sand, subrounded to subangular, medium to high plastic, medium dense, brown, dry	LD 19-1		12		37	20	35.8	35.8	22	6.4% cobble
			[BEDROCK], ANDESITE, igneous rock, tan, highly weathered and highly fractured, weak to moderately strong rock										
	2.5												
			MPS=4"										
	5.0												
			MPS=12"										
	7.5												
	10.0												
	12.5												
			MPS=24"										

TEST PIT TERMINATED AT 14'

NewFields

TP22-20

CLIENT South32
PROJECT NAME Hermosa Project
PROJECT NUMBER 475.0014.033
PROJECT LOCATION Hermosa Mine, Arizona
DATE STARTED 7/16/22 **COMPLETED** 7/16/22
GROUND ELEVATION 5210.14 ft **HOLE SIZE**
EXCAVATION CONTRACTOR RUMCO
COORDINATES (State Plane Arizona Central NAD 83 Int feet):
EXCAVATION METHOD CAT 345
NORTHING 170583.3 **EASTING** 1070029.38
LOGGED BY F.Lepore **CHECKED BY**
DEPTH TO WATER (FT BGS) No groundwater not encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
5210	0		[FILL], clayey SAND (SC) with gravel and cobbles, angular gravel, MPS=5", fine grained sand, subrounded to angular sand, non-plastic, medium dense, dark brown, damp							39.7	41.5	18.8	
			dark brown										
5205	5			LD 20-1		132							
5200	10												
			[BEDROCK], ANDESITE, igneous rock, yellowish brown, highly weathered and highly fractured, weak to moderately strong rock										
5195	15												
5190	20												

TEST PIT TERMINATED AT 20'

NewFields

CLIENT South32
PROJECT NUMBER 475.0014.033
DATE STARTED 7/9/20 **COMPLETED** 7/9/22
EXCAVATION CONTRACTOR RUMCO
EXCAVATION METHOD CAT 345
LOGGED BY F.Lepore **CHECKED BY**
NOTES

PROJECT NAME Hermosa Project
PROJECT LOCATION Hermosa Mine, Arizona
GROUND ELEVATION 5345.51 ft **HOLE SIZE**
COORDINATES (State Plane Arizona Central NAD 83 Int feet):
NORTHING 167245.76 **EASTING** 1074823.52
DEPTH TO WATER (FT BGS) No groundwater encountered

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
5345.0	0.0		poorly graded GRAVEL (GP) with sand, angular gravel, MPS=8", fine grained sand, subrounded to subangular sand, non-plastic to low plastic, medium dense, brown, dry	LD 22-1		24							
				LD		12				47.1	10.7	3.3	38.9% cobble
5342.5	2.5		[BEDROCK], ANDESITE, igneous rock, tan, slightly weathered and highly and fractured, weak to strong rock										

TEST PIT WAS TERMINATED AT 4' DUE TO PRACTICAL EQUIPMENT REFUSAL

TP22-23

CLIENT South32

PROJECT NAME Hermosa Project

PROJECT NUMBER 475.0014.033

PROJECT LOCATION Hermosa Mine, Arizona

DATE STARTED 7/9/20 **COMPLETED** 7/9/20

GROUND ELEVATION **HOLE SIZE**

EXCAVATION CONTRACTOR RUMCO

COORDINATES (State Plane Arizona Central NAD 83 Int feet):

EXCAVATION METHOD CAT 345

NORTHING 167496.03 **EASTING** 1074416.11

LOGGED BY F.Lepore **CHECKED BY**

DEPTH TO WATER (FT BGS) No groundwater encounted

NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0.0		poorly graded GRAVEL (GP-GM) with silt and sand, angular gravel, MPS=8", fine grained sand, subrounded to subangular sand, non-plastic to low plastic, medium dense, yellowish brown, moist										
			[BEDROCK], ANDESITE, igneous rock, tan, slightly weathered and slighted fractured, strong rock										

TEST PIT WAS TERMINATED AT 1' DUE TO PRACTICAL EQUIPMENT REFUSAL

NewFields

CLIENT South32
PROJECT NAME Hermosa Project
PROJECT NUMBER 475.0014.033
PROJECT LOCATION Hermosa Mine, Arizona
DATE STARTED 7/9/20 **COMPLETED** 7/9/20
GROUND ELEVATION **HOLE SIZE**
EXCAVATION CONTRACTOR RUMCO
COORDINATES (State Plane Arizona Central NAD 83 Int feet):
EXCAVATION METHOD CAT 345
NORTHING 167896.13 **EASTING** 1074688.09
LOGGED BY F.Lepore **CHECKED BY**
DEPTH TO WATER (FT BGS) No groundwater encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0.0		[TOPSOIL], poorly graded GRAVEL (GP-GM) with silt and sand, angular gravel, MPS=4", fine grained sand, subrounded to subangular sand, non-plastic, medium dense, brown, damp										
			[BEDROCK], ANDESITE, igneous rock, tan, weathered, fractured, moderately strong rock to strong										
	2.5												

TEST PIT WAS TERMINATED AT 3.5' DUE TO PRACTICAL EQUIPMENT REFUSAL

NewFields

CLIENT South32
PROJECT NAME Hermosa Project
PROJECT NUMBER 475.0014.033
PROJECT LOCATION Hermosa Mine, Arizona
DATE STARTED 7/9/20 **COMPLETED** 7/9/20
GROUND ELEVATION **HOLE SIZE**
EXCAVATION CONTRACTOR RUMCO
COORDINATES (State Plane Arizona Central NAD 83 Int feet):
EXCAVATION METHOD CAT 345
NORTHING 168490.55 **EASTING** 1074448.36
LOGGED BY F.Lepore **CHECKED BY**
DEPTH TO WATER (FT BGS) No groundwater encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0.0		poorly graded GRAVEL (GP-GM) with silt and sand, angular gravel, MPS=1.5", fine grained sand, subrounded to subangular sand, non-plastic, medium dense, brown, dry	LD 25-1		24							
	2.5		[BEDROCK], ANDESITE, igneous rock, tan, weathered and fractured, weak to moderately strong rock										
	5.0												
	7.5												
	10.0												
	12.5												

TEST PIT TERMINATED AT 13'

TP22-27

NewFields

CLIENT South32

PROJECT NAME Hermosa Project

PROJECT NUMBER 475.0014.033

PROJECT LOCATION Hermosa Mine, Arizona

DATE STARTED 7/18/22 **COMPLETED** 7/18/22

GROUND ELEVATION **HOLE SIZE**

EXCAVATION CONTRACTOR RUMCO

COORDINATES (State Plane Arizona Central NAD 83 Int feet):

EXCAVATION METHOD CAT 345

NORTHING 167596.23 **EASTING** 1075460.93

LOGGED BY F.Lepore **CHECKED BY**

DEPTH TO WATER (FT BGS) No groundwater not encountered

NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0.0		clayey Gravel (GC) with sand and cobbles, angular gravel, MPS=3", fine grained sand, subrounded to angular sand, medium plastic, medium dense, dark brown, dry	LD 12-1		12				59.4	29.7	10.9	
	2.5												
	5.0		[BEDROCK], ANDESITE, igneous rock, tan, weathered and fractured, weak to moderately strong rock										
	7.5		MPS=12'										
			MPS=36"										
	10.0												

TEST PIT WAS TERMINATED AT 10' DUE TO PRACTICAL EQUIPMENT REFUSAL

NewFields

CLIENT South32
PROJECT NAME Hermosa Project
PROJECT NUMBER 475.0014.033
PROJECT LOCATION Hermosa Mine, Arizona
DATE STARTED 7/18/22 **COMPLETED** 7/18/22
GROUND ELEVATION 5237.71 ft **HOLE SIZE**
EXCAVATION CONTRACTOR RUMCO
COORDINATES (State Plane Arizona Central NAD 83 Int feet):
EXCAVATION METHOD CAT 345
NORTHING 167451.31 **EASTING** 1075023.93
LOGGED BY F.Lepore **CHECKED BY**
DEPTH TO WATER (FT BGS) No groundwater encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
5237.5	0.0		[BEDROCK], ANDESITE, igneous rock, tan/grey, highly weathered and highly fractured, weak to moderately strong rock	LD 28-1		36							
5235.0	2.5												

TEST PIT WAS TERMINATED AT 3' DUE TO PRACTICAL EQUIPMENT REFUSAL

TP22-29

CLIENT South32
PROJECT NAME Hermosa Project
PROJECT NUMBER 475.0014.033
PROJECT LOCATION Hermosa Mine, Arizona
DATE STARTED 8/1/22 **COMPLETED** 8/1/22
GROUND ELEVATION 5316.67 ft **HOLE SIZE**
EXCAVATION CONTRACTOR RUMCO
COORDINATES (State Plane Arizona Central NAD 83 Int feet):
EXCAVATION METHOD CAT 345
NORTHING 167626.19 **EASTING** 1074975.96
LOGGED BY F.Lepore **CHECKED BY**
DEPTH TO WATER (FT BGS) No groundwater encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0.0		[TOPSOIL], clayey SAND (SC) with gravel, angular gravel, MPS=2", fine grained sand, subrounded to angular sand, medium plastic, medium dense, dark brown, dry										
5315.0			sandy CLAY (SC) with gravel and cobbles, fine grained sand, subrounded to subangular sand, angular gravel, medium plastic fines, medium stiff, reddish brown, dry										
	2.5		clayey SAND (SC) with gravel and cobbles, angular gravel, MPS=5", fine grained sand, subrounded to angular sand, medium plastic, medium dense, dark brown, dry	LD 29-1		48		32	15	17.6	45.9	15.8	
5312.5	5.0		[BEDROCK], ANDESITE, igneous rock, tan, weathered and fractured, weak to moderately strong rock										

TEST PIT WAS TERMINATED AT 5' DUE TO PRACTICAL EQUIPMENT REFUSAL

NewFields

TP22-30

CLIENT South32
PROJECT NAME Hermosa Project
PROJECT NUMBER 475.0014.033
PROJECT LOCATION Hermosa Mine, Arizona
DATE STARTED 7/9/22 **COMPLETED** 7/9/22
GROUND ELEVATION **HOLE SIZE**
EXCAVATION CONTRACTOR RUMCO
COORDINATES (State Plane Arizona Central NAD 83 Int feet):
EXCAVATION METHOD CAT 345
NORTHING 167521.06 **EASTING** 1074625.43
LOGGED BY F.Lepore **CHECKED BY**
DEPTH TO WATER (FT BGS) No groundwater encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0.0		[FILL], poorly graded GRAVEL (GP) with silt and sand, angular gravel, MPS=3", fine grained sand, subrounded to subangular sand, medium plastic, medium dense, brown, dry	LD 30-1		36							
	2.5					12				40	27.5	14.3	18.2% cobble
			[BEDROCK], ANDESITE, igneous rock, tan, weathered and fractured, weak to moderately strong rock										
	5.0												

TEST PIT TERMINATED AT 6'

NewFields

CLIENT South32
PROJECT NAME Hermosa Project
PROJECT NUMBER 475.0014.033
PROJECT LOCATION Hermosa Mine, Arizona
DATE STARTED 7/9/22 **COMPLETED** 7/9/22
GROUND ELEVATION **HOLE SIZE**
EXCAVATION CONTRACTOR RUMCO
COORDINATES (State Plane Arizona Central NAD 83 Int feet):
EXCAVATION METHOD CAT 345
NORTHING 167823.26 **EASTING** 1074899.51
LOGGED BY F.Lepore **CHECKED BY**
DEPTH TO WATER (FT BGS) No groundwater was encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0.0		poorly graded GRAVEL (GP-GM) with silt and sand, angular gravel, MPS=9", fine grained sand, subrounded to subangular sand, non-plastic, medium dense, brown, dry										
	2.5		[BEDROCK], ANDESITE, igneous rock, tan, highly weathered and highly fractured, weak to moderately strong rock										

TEST PIT WAS TERMINATED AT 3' DUE TO PRACTICAL EQUIPMENT REFUSAL

NewFields

CLIENT South32
PROJECT NAME Hermosa Project
PROJECT NUMBER 475.0014.033
PROJECT LOCATION Hermosa Mine, Arizona
DATE STARTED 7/9/22 **COMPLETED** 7/9/22
GROUND ELEVATION 5186.3 ft **HOLE SIZE**
EXCAVATION CONTRACTOR RUMCO
COORDINATES (State Plane Arizona Central NAD 83 Int feet):
EXCAVATION METHOD CAT 345
NORTHING 168008.48 **EASTING** 1075033.59
LOGGED BY F.Lepore **CHECKED BY**
DEPTH TO WATER (FT BGS) No groundwater was encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0.0		[FILL], poorly graded GRAVEL (GP) with silt and sand, angular gravel, MPS=5", fine grained sand, subrounded to subangular sand, medium plastic, medium dense, brown, dry										pvc pipe
5185.0				LD 32-1		12				52.4	30	7.8	9.8% cobble
	2.5												

TEST PIT WAS TERMINATED AT 3.5' DUE TO PRACTICAL EQUIPMENT REFUSAL

TP22-33

NewFields

CLIENT South32

PROJECT NAME Hermosa Project

PROJECT NUMBER 475.0014.033

PROJECT LOCATION Hermosa Mine, Arizona

DATE STARTED 7/9/22 **COMPLETED** 7/9/22

GROUND ELEVATION **HOLE SIZE**

EXCAVATION CONTRACTOR RUMCO

COORDINATES (State Plane Arizona Central NAD 83 Int feet):

EXCAVATION METHOD CAT 345

NORTHING 168014.63 **EASTING** 1075023.56

LOGGED BY F.Lepore **CHECKED BY**

DEPTH TO WATER (FT BGS) No groundwater was encountered

NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0.0		sand CLAY (SC) with gravel and cobbles, angular gravel, MPS=5", fine grained sand, subrounded to angular sand, non-plastic, medium dense, dark brown, dry										
	2.5			LD 33-1		36				32.2	21	23.5	18.8% cobble

TEST PIT WAS TERMINATED AT 4' DUE TO PRACTICAL EQUIPMENT REFUSAL

TP22-34

NewFields

CLIENT South32

PROJECT NAME Hermosa Project

PROJECT NUMBER 475.0014.033

PROJECT LOCATION Hermosa Mine, Arizona

DATE STARTED 7/9/22 **COMPLETED** 7/9/22

GROUND ELEVATION **HOLE SIZE**

EXCAVATION CONTRACTOR RUMCO

COORDINATES (State Plane Arizona Central NAD 83 Int feet):

EXCAVATION METHOD CAT 345

NORTHING 168486.65 **EASTING** 1074657.87

LOGGED BY F.Lepore **CHECKED BY**

DEPTH TO WATER (FT BGS) No groundwater was encountered

NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0.0		poorly graded GRAVEL (GP) with silt and sand, angular gravel, MPS=3", fine grained sand, subrounded to subangular sand, medium plastic, medium dense, brown, damp										
				LD		12				48.4	34	9.7	7.3% cobble
	2.5												
				LD 34-1		90							
	5.0												
	7.5		boulders, MPS=20"										

TEST PIT WAS TERMINATED AT 7.5' DUE TO PRACTICAL EQUIPMENT REFUSAL

NewFields

TP22-35

CLIENT South32

PROJECT NAME Hermosa Project

PROJECT NUMBER 475.0014.033

PROJECT LOCATION Hermosa Mine, Arizona

DATE STARTED 7/18/22 **COMPLETED** 7/18/22

GROUND ELEVATION **HOLE SIZE**

EXCAVATION CONTRACTOR RUMCO

COORDINATES (State Plane Arizona Central NAD 83 Int feet):

EXCAVATION METHOD CAT 345

NORTHING 167799.02 **EASTING** 1075353.02

LOGGED BY F.Lepore **CHECKED BY**

DEPTH TO WATER (FT BGS) No grondwater was encountered

NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0.0		poorly graded GRAVEL (GP-GM) with silt and sand, angular gravel, MPS=4", fine grained sand, subrounded to subangular sand, medium plastic, medium dense, light brown, dry	LD 35-1		18							
	2.5												
	5.0			LD		12				51.7	33.1	1.2	
	7.5												
			[BEDROCK], ANDESITE, igneous rock, tan, weathered and fractured, strong rock										

TEST PIT WAS TERMINATED AT 9' DUE TO PRACTICAL EQUIPMENT REFUSAL

NewFields

CLIENT South32 **PROJECT NAME** Hermosa Project
PROJECT NUMBER 475.0014.033 **PROJECT LOCATION** Hermosa Mine, Arizona
DATE STARTED 7/8/22 **COMPLETED** 7/8/22 **GROUND ELEVATION** 5138.74 ft **HOLE SIZE**
EXCAVATION CONTRACTOR RUMCO **COORDINATES (State Plane Arizona Central NAD 83 Int feet):**
EXCAVATION METHOD CAT 345 **NORTHING** 171103.78 **EASTING** 1070904.03
LOGGED BY F.Lepore **CHECKED BY** **DEPTH TO WATER (FT BGS)** No groundwater was encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0.0		clayey SAND (SC) with gravel, angular gravel, MPS=2", fine grained sand, subrounded to angular sand, non-plastic, medium dense, dark brown, damp	LD 36-1		6							
5137.5			[BEDROCK], ANDESITE, igneous rock, reddish tan, weathered and fractured, weak to moderately strong rock, oxidized rock										
	2.5			LD		12				40.7	42.3	17	
5135.0													
	5.0												

TEST PIT WAS TERMINATED AT 6' DUE TO PRACTICAL EQUIPMENT REFUSAL

NewFields

CLIENT South32
PROJECT NAME Hermosa Project
PROJECT NUMBER 475.0014.033
PROJECT LOCATION Hermosa Mine, Arizona
DATE STARTED 7/11/22 COMPLETED 7/11/22
GROUND ELEVATION HOLE SIZE
EXCAVATION CONTRACTOR RUMCO
COORDINATES (State Plane Arizona Central NAD 83 Int feet):
EXCAVATION METHOD CAT 345
NORTHING 169112.57 EASTING 1074368.86
LOGGED BY F.Lepore CHECKED BY
DEPTH TO WATER (FT BGS) No groundwater was encountered
NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0.0		[FILL], clayey Brown (GC) with gravel, angular gravel, MPS=2.5", fine grained sand, subrounded to angular sand, non-plastic, medium dense, brown, moist										
	2.5			LD 37-1		60		33	18	59.2	26.5	14.3	0-5' berm materials
	5.0		[BEDROCK], ANDESITE, igneous rock, tan, weathered and fractured, weak to moderately strong rock										
	7.5												
	10.0												
	12.5												

TEST PIT TERMINATED AT 13'

TP22-39

NewFields

CLIENT South32

PROJECT NAME Hermosa Project

PROJECT NUMBER 475.0014.033

PROJECT LOCATION Hermosa Mine, Arizona

DATE STARTED 7/16/22 **COMPLETED** 7/16/22

GROUND ELEVATION **HOLE SIZE**

EXCAVATION CONTRACTOR RUMCO

COORDINATES (State Plane Arizona Central NAD 83 Int feet):

EXCAVATION METHOD CAT 345

NORTHING 170066.99 **EASTING** 10695992.98

LOGGED BY F.Lepore **CHECKED BY**

DEPTH TO WATER (FT BGS) No groundwater was encountered

NOTES

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY (INCHES)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	% GRAVEL	% SAND	% FINES	REMARKS
	0.0		clayey SAND (SC) with gravel and cobbles, angular gravel, MPS=5", fine grained sand, subrounded to angular sand, non-plastic, medium dense, dark brown, damp							34.9	54.7	21.8	
	2.5			LD 39-1		72							
	5.0												

TEST PIT WAS TERMINATED AT 6' DUE TO PRACTICAL EQUIPMENT REFUSAL

APPENDIX D.5

Laboratory Testing Results

APPENDIX D.5.1

Laboratory Testing Results

Test Pit and Borehole Samples

Table D.5.1
South32 (AMI)
Hermosa Project
Laboratory Testing Summary
(Test Pits and Borehole Samples)

Location	Sample Depth	GRAIN SIZE DISTRIBUTION - PERCENT PASSING																USCS	NATURAL MOISTURE CONTENT (%)	ATTERBERG LIMITS		
		GRAVEL									SAND						CLAY/ SILT			LIQUID LIMIT	PLASTIC LIMIT	PLASTIC INDEX
		6"	4.0"	3.0"	2.0"	1.5"	1.0"	0.75"	0.5"	0.375"	#4	#10	#16	#40	#50	#100	#200					
BH22-02	0-2.5	100.0	100.0	100.0	100.0	91.5	79.8	74.4	68.0	65.9	60.1	47.9	42.9	32.6	28.7	21.6	16.1	SC	-	26	15	11
BH22-02	6.5-8	100.0	100.0	100.0	100.0	100.0	82.1	80.1	70.5	65.2	56.5	45.7	40.7	30.7	26.9	20.3	15.2	GC	5.3	24	15	9
BH22-03	2-2.5	100.0	100.0	100.0	92.7	92.7	89.3	84.6	80.5	76.9	69.9	60.6	55.3	43.6	38.3	28.8	21.3	SC	-	26	15	11
BH22-04	0-2.5	100.0	100.0	100.0	100.0	100.0	94.0	90.3	86.8	85.8	85.1	69.0	62.2	47.9	42.1	30.4	22.6	SC	-	32	18	14
BH22-06	2.5-4.5	100.0	100.0	100.0	100.0	100.0	100.0	91.6	84.7	81.4	71.3	58.3	52.2	40.7	36.3	23.6	17.2	SC	-	27	14	13
BH22-06	6.5-7	100.0	100.0	100.0	100.0	100.0	80.5	75.3	69.8	67.1	59.7	50.5	45.7	35.3	31.2	23.2	17.6	SC	6.9	26	15	11
BH22-07	0-2.5	100.0	100.0	100.0	100.0	83.5	66.1	60.3	50.1	47.2	41.5	35.2	32.4	26.5	24.1	19.3	15.4	GC	3.1	25	14	11
BH22-09	0-2.5	100.0	100.0	100.0	100.0	93.0	93.0	88.1	81.3	75.7	64.2	53.2	47.6	38.2	35.4	30.2	26.2	SC	3.6	25	16	9
BH22-09	4-6.5	100.0	100.0	100.0	100.0	94.5	83.5	79.2	72.9	70.1	65.7	51.5	45.8	35.1	31.0	23.8	18.0	SC-SM	5.4	20	15	5
BH22-09	14.5-16	100.0	100.0	100.0	100.0	100.0	94.2	88.2	79.6	72.8	59.7	45.2	39.2	30.1	27.4	22.5	18.9	SC-SM	6.8	20	15	5
BH22-10	3-3.5	100.0	100.0	100.0	100.0	88.5	88.5	86.0	80.7	77.3	72.9	65.4	61.3	49.5	43.9	33.0	24.5	SC	9.7	27	18	9
BH22-10	3.5-4	100.0	100.0	100.0	100.0	100.0	82.2	72.3	61.3	56.7	49.9	41.9	38.1	29.2	25.3	18.8	13.8	GC-GM	6.4	24	18	6
BH22-11	0-2.5	100.0	100.0	100.0	100.0	100.0	90.5	87.8	77.3	71.6	62.8	54.1	50.0	41.0	36.9	28.8	23.0	SC	7.6	36	14	22
BH22-11	4-6.5	100.0	100.0	100.0	100.0	100.0	100.0	96.9	95.4	92.4	87.8	77.1	72.2	61.1	54.9	42.7	33.9	SC	9.4	35	16	19
BH22-12	0-2.5	100.0	100.0	100.0	100.0	100.0	95.5	88.9	77.9	73.8	59.7	43.2	36.4	26.5	23.8	19.1	15.8	SC-SM	4.0	20	14	6
BH22-12	2.5-4	100.0	100.0	100.0	100.0	100.0	100.0	100.0	97.5	96.9	92.4	77.4	68.7	53.3	48.4	39.6	33.1	SC	4.3	18	10	8
BH22-13	0-2.5	100.0	100.0	100.0	100.0	100.0	98.1	94.0	84.2	79.8	68.2	50.0	42.9	32.0	28.5	21.6	16.0	SM	-	NP	NP	NP
TP22-06	5-6	100.0	82.5	82.5	75.5	71.7	65.7	61.5	55.7	53.0	47.4	40.1	35.2	25.7	22.4	16.2	12.2	SC	-	27	14	13
TP22-08	2.5-4	100.0	100.0	100.0	93.8	88.2	83.0	79.9	73.0	70.1	58.6	46.8	37.6	22.9	18.7	12.8	9.0	-	-	-	-	-
TP22-09	4-7	100.0	100.0	100.0	99.2	97.0	94.1	90.1	84.8	82.1	73.1	64.1	55.8	32.3	25.7	16.1	11.3	-	-	-	-	-
TP22-10	3-6	100.0	100.0	100.0	96.2	92.0	87.6	83.8	79.4	76.7	71.9	65.4	57.5	38.8	32.2	22.9	17.0	SC	-	33	19	14
TP22-11	5-10	100.0	100.0	100.0	90.0	85.0	76.9	73.0	69.3	97.6	65.0	60.5	51.8	33.9	27.7	18.5	12.5	-	-	-	-	-
TP22-12	3-4	100.0	100.0	100.0	91.3	82.3	69.9	63.5	52.6	47.9	41.8	33.4	28.7	20.6	18.3	13.9	10.8	-	-	-	-	-
TP22-13	3.5-4.5	100.0	100.0	100.0	85.9	73.7	61.7	54.8	47.3	44.2	37.5	31.7	27.6	19.2	16.3	11.8	8.7	-	-	-	-	-
TP22-15	2-3	100.0	100.0	100.0	100.0	97.8	96.9	95.9	94.2	93.3	82.7	69.8	62.3	45.5	39.8	27.3	18.7	-	-	-	-	-
TP22-15	4-5	100.0	100.0	100.0	98.4	97.4	95.4	93.2	89.2	87.5	75.8	63.2	55.6	41.2	36.4	27.9	21.7	-	-	-	-	-
TP22-15	14-15	100.0	100.0	87.4	80.4	70.5	60.9	55.8	49.0	46.7	37.1	29.8	25.9	18.1	15.6	10.9	7.9	-	-	-	-	-
TP22-16	1-2	100.0	100.0	100.0	98.3	92.1	85.0	80.5	73.2	70.0	48.7	32.2	27.5	20.1	17.8	13.8	10.7	-	-	-	-	-
TP22-17	0-1	100.0	100.0	100.0	98.8	98.1	95.7	94.9	94.2	94.1	92.5	88.1	85.2	76.6	70.9	56.0	44.6	SC	-	39	17	22
TP22-18	0-1	100.0	100.0	100.0	98.8	93.8	91.2	89.9	88.9	88.7	86.9	83.2	80.7	72.2	65.5	48.1	33.3	SC	-	30	20	10
TP22-19	0-1	100.0	100.0	93.6	88.5	78.6	70.7	67.5	64.8	62.8	57.8	52.1	49.3	41.7	37.4	28.1	22.0	GC	-	37	17	20
TP22-20	1-2	100.0	100.0	100.0	89.8	81.9	75.7	72.3	67.5	65.5	60.3	52.5	47.8	37.6	33.5	25.3	18.8	-	-	-	-	-
TP22-22	1-2	100.0	91.7	61.1	45.1	35.9	31.4	27.5	23.8	21.9	14.0	8.8	7.2	5.4	5.0	4.1	3.3	-	-	-	-	-
TP22-26	0-1	100.0	100.0	100.0	94.8	88.6	79.1	71.4	31.1	55.5	48.5	36.6	29.7	19.3	16.6	12.1	9.3	GW-GC	-	21	13	8
TP22-27	0-1	100.0	100.0	100.0	89.7	83.4	70.8	63.5	53.0	48.5	40.6	31.3	26.5	19.1	16.9	13.4	10.9	-	-	-	-	-
TP22-29	0-4	100.0	100.0	100.0	100.0	99.2	99.0	97.4	94.0	92.1	82.4	67.9	61.5	52.3	49.6	43.5	36.5	SC	-	32	17	15
TP22-30	2-3	100.0	100.0	81.8	68.3	64.8	59.5	57.1	52.8	49.6	41.8	33.6	30.0	24.2	22.0	17.6	14.3	-	-	-	-	-

Table D.4
South32 (AMI)
Hermosa Project
Laboratory Testing Summary
(Test Pits and Borehole Samples)

Location	Sample Depth	GRAIN SIZE DISTRIBUTION - PERCENT PASSING																USCS	NATURAL MOISTURE CONTENT (%)	ATTERBERG LIMITS		
		GRAVEL									SAND						CLAY/ SILT			LIQUID LIMIT	PLASTIC LIMIT	PLASTIC INDEX
		6"	4.0"	3.0"	2.0"	1.5"	1.0"	0.75"	0.5"	0.375"	#4	#10	#16	#40	#50	#100	#200					
TP22-32	1-2	100.0	100.0	90.2	76.7	69.1	63.9	59.2	51.3	47.2	37.8	29.0	24.3	16.3	14.0	10.1	7.8	-	-	-	-	-
TP22-33	1-2	100.0	86.4	81.2	76.9	67.6	62.1	59.0	54.7	52.3	49.0	43.5	40.0	33.5	31.2	26.9	23.2	-	-	-	-	-
TP22-34	1-2	100.0	100.0	92.7	88.8	85.3	76.9	70.4	61.2	56.0	44.3	35.0	29.8	20.5	17.6	12.7	9.7	-	-	-	-	-
TP22-35	0.5-1.5	100.0	100.0	100.0	93.1	84.8	75.6	69.8	62.4	57.5	48.3	37.4	31.7	23.5	21.4	18.0	15.2					
TP22-36	2-3	100.0	100.0	100.0	98.9	92.6	84.5	79.3	71.9	69.2	59.3	50.4	45.5	33.2	29.0	21.7	17.0	-	-	-	-	-
TP22-37	0-1	100.0	100.0	100.0	90.1	76.6	63.5	57.8	49.7	46.3	40.8	34.7	31.5	25.0	22.4	17.8	14.3	GC	-	33	15	18
TP22-39	1.5-2.5	100.0	100.0	100.0	98.5	97.6	96.8	95.3	92.6	91.6	76.5	64.9	60.3	48.7	43.0	30.8	21.8	-	-	-	-	-

NewFields **NATURAL DENSITY (ASTM 2937)** NF Form #16

LABORATORY WORKSHEET

Client:	South 32	**Location:**	See Below
Project Title:	Hermosa	**Elevation:**	See Below
Project Number:	475.0014.033	**Test Date:**	9/1/2022
Project Engineer:	Craig Thompson	**Tested By:**	ZM
Field Sample ID:	See Below	**Checked By:**	JW
Laboratory Sample ID:	22-196		

Drying Conditions: 60 deg C / **110 deg C** Method: **Oven (O)** / Microwave (M)

Trail No.		**1**	**2**	**3**	**4**	**5**
Sample No.		22-196-03	22-196-10	22-196-15	22-196-22	22-196-25
Location		BH22-02	BH22-06	BH22-09	BH22-11	BH22-12
Depth		6.5-8'	6.5-7'	3-3.5'	3-3.5'	2.5-4'
Soil Description						
(USCS)						
Soil + Liner Wt., g.	**A**	951.7	1066.1	897.1	934.1	1031.6
Liner Wt., g.	**B**	209.7	209.5	210.0	209.9	209.5
Soil Wt., g.	**C= A-B**	742.0	856.6	687.1	724.2	822.1
Liner Length, in.	**D_1**	5.999	5.995	6.012	5.981	5.988
Sample Length, in.	**D_2**	5.659	5.76	5.34	5.265	5.988
Liner Diameter, in.	**E**	2.436	2.437	2.420	2.433	2.443
Liner Area, in^2	**$F= (E^2/4)*pi$**	4.66	4.66	4.60	4.65	4.69
Sample Volume, in^3	**$G= D_2*F$**	26.37	26.87	24.56	24.48	28.07
Sample Wet Density, pcf	**H= (C/G)*3.81**	107.2	121.5	106.6	112.7	111.6
Sample Dry Density, pcf	**H/(1+(N/100))**	101.8	113.7	102.7	102.3	107.0
Tare No.						
Tare + Wet Soil	**I**	1013.2	1026.26	917.76	953.3	1092.37
Tare + Dry Soil	**J**	975.8	971.3	892.7	886.6	1058.4
Tare	**K**	271.6	170	230.84	229.21	270.33
Wt. of Water	**L= I-J**	37.4	55.0	25.1	66.7	34.0
Dry Soil, Ws	**M=-J-K**	704.2	801.3	661.9	657.4	788.1
Moisture Content, (%)	**N= (L/M) x100**	5.3%	6.9%	3.8%	10.1%	4.3%

Remarks:

NewFields

MOISTURE CONTENT
(ASTM D 2216 / ASTM D 4643)
LABORATORY WORKSHEET

NF Form #15

Client:	South 32	**Location:**	See Below
Project Title:	Hermosa	**Elevation:**	See Below
Project Number:	475.0014.033	**Test Date:**	9/1/2022
Project Engineer:	Craig Thompson	**Tested By:**	ZM
Field Sample ID:	See Below	**Checked By:**	JW

Drying Conditions: 60 deg C / **110 deg C** Method: **Oven (O)** / Microwave (M) / Hot Plate (H)

Sample No.		22-196-02	22-196-04	22-196-07	22-196-08	22-196-11
Location		BH22-02	BH22-02	BH22-04	BH22-06	BH22-06
Depth		2.5-4'	12-14.5'	2.5-4'	2-2.5'	14-15.5'
Soil Description						
(USCS)						
Trial No.		**1**	**2**	**3**	**4**	**5**
Tare No.						
Tare + Wet Soil	A	695.72	2316.7	660.68	3069.61	961.54
Tare + Dry Soil	B	682.1	2238.5	619.9	2948.6	906.9
Tare	C	132.58	134.82	133.45	132.69	133.91
Wt. of Water	D= A-B	13.62	78.2	40.78	121.01	54.64
Dry Soil, Ws	E= B-C	549.52	2103.68	486.45	2815.91	772.99
Moisture Content, (%)	**(D/E) x100**	**2.5%**	**3.7%**	**8.4%**	**4.3%**	**7.1%**

Sample No.		22-196-12	22-196-13	22-196-14	22-196-16	22-196-17
Location		BH22-06	BH22-07	BH22-09	BH22-09	BH22-09
Depth		24-26'	0-2.5'	0-2.5'	4-6.5'	10.5-12'
Soil Description						
(USCS)						
Trial No.		**6**	**7**	**8**	**9**	**10**
Tare No.						
Tare + Wet Soil	A	875.65	2877.99	2136.65	1990.44	603.47
Tare + Dry Soil	B	822.4	2796.1	2066.7	1895.5	585.8
Tare	C	132.82	132.26	132.13	133.22	131.83
Wt. of Water	D= A-B	53.25	81.89	69.95	94.94	17.67
Dry Soil, Ws	E= B-C	689.58	2663.84	1934.57	1762.28	453.97
Moisture Content, (%)	**(D/E) x100**	**7.7%**	**3.1%**	**3.6%**	**5.4%**	**3.9%**

Remarks:

NewFields

MOISTURE CONTENT
(ASTM D 2216 / ASTM D 4643)
LABORATORY WORKSHEET

NF Form #15

Client:	South 32	**Location:**	See Below
Project Title:	Hermosa	**Elevation:**	See Below
Project Number:	475.0014.033	**Test Date:**	9/1/2022
Project Engineer:	Craig Thompson	**Tested By:**	ZM
Field Sample ID:	See Below	**Checked By:**	JW

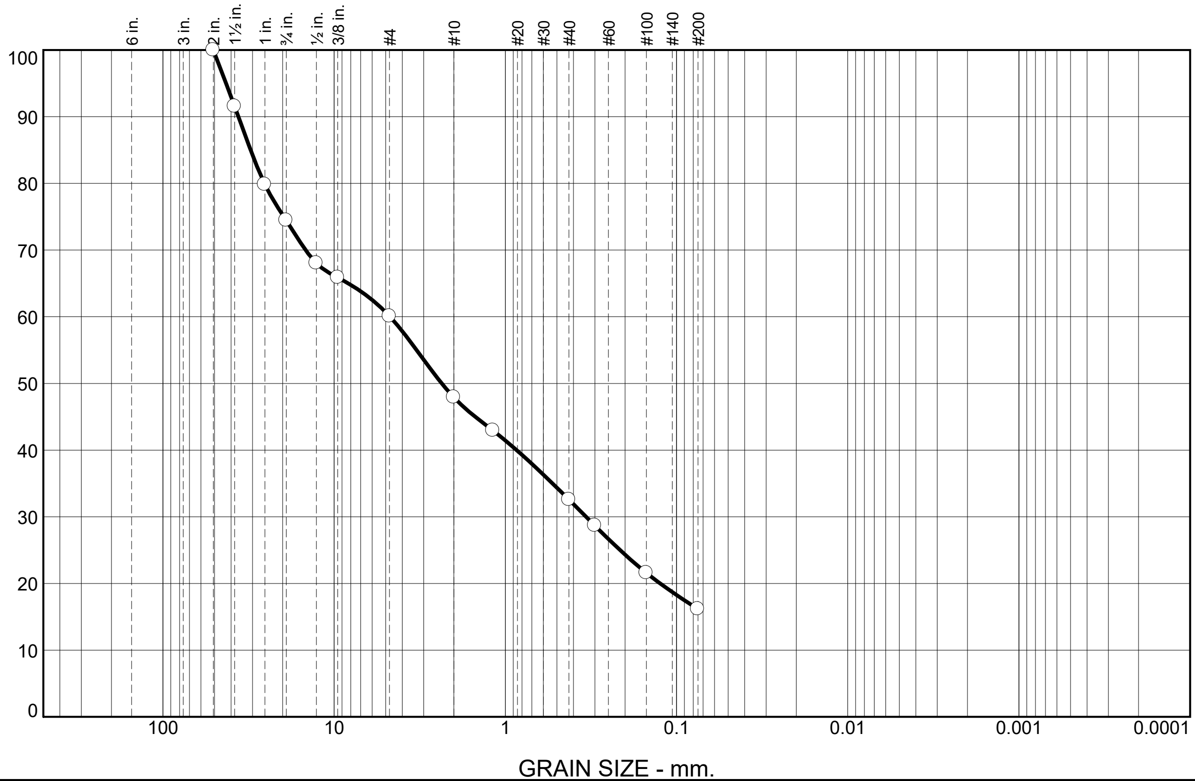
Drying Conditions: 60 deg C / **110 deg C** Method: **Oven (O)** / Microwave (M) / Hot Plate (H)

Sample No.		22-196-18	22-196-19	22-196-20	22-196-21	22-196-23
Location		BH22-09	BH22-10	BH22-10	BH22-11	BH22-11
Depth		14.5-16'	3-3.5'	3.5-4'	0-2.5'	4-6.5'
Soil Description						
(USCS)						
Trial No.		**11**	**12**	**13**	**14**	**15**
Tare No.						
Tare + Wet Soil	**A**	941.43	1006.32	987.31	1482.9	1972
Tare + Dry Soil	**B**	889.8	929.1	936	1387.4	1814.8
Tare	**C**	132.64	132.88	132.34	132.5	133.75
Wt. of Water	**D= A-B**	51.63	77.22	51.31	95.5	157.2
Dry Soil, Ws	**E= B-C**	757.16	796.22	803.66	1254.9	1681.05
Moisture Content, (%)	**(D/E) x100**	**6.8%**	**9.7%**	**6.4%**	**7.6%**	**9.4%**

Sample No.		22-196-24				
Location		BH22-12				
Depth		0-2.5'				
Soil Description						
(USCS)						
Trial No.		**16**	**17**	**18**	**19**	**20**
Tare No.						
Tare + Wet Soil	**A**	1976.2				
Tare + Dry Soil	**B**	1905.9				
Tare	**C**	131.21				
Wt. of Water	**D= A-B**	70.3				
Dry Soil, Ws	**E= B-C**	1774.69				
Moisture Content, (%)	**(D/E) x100**	**4.0%**				

Remarks:

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	25.6	14.3	12.2	15.3	16.5	16.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2"	100.0		
1.5"	91.5		
1"	79.8		
.75"	74.4		
.5"	68.0		
.375"	65.9		
#4	60.1		
#10	47.9		
#16	42.9		
#40	32.6		
#50	28.7		
#100	21.6		
#200	16.1		

* (no specification provided)

Soil Description

Brown clayey sand with gravel

Atterberg Limits

PL= 15 LL= 26 PI= 11

Coefficients

D_{90}= 36.2489 D_{85}= 30.7950 D_{60}= 4.7179
D_{50}= 2.3535 D_{30}= 0.3381 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO= A-2-6(0)

Remarks

Location: BH22-02
Sample Number: 22-196-01 **Depth:** 0-2.5' **Date:** 9/8/2022

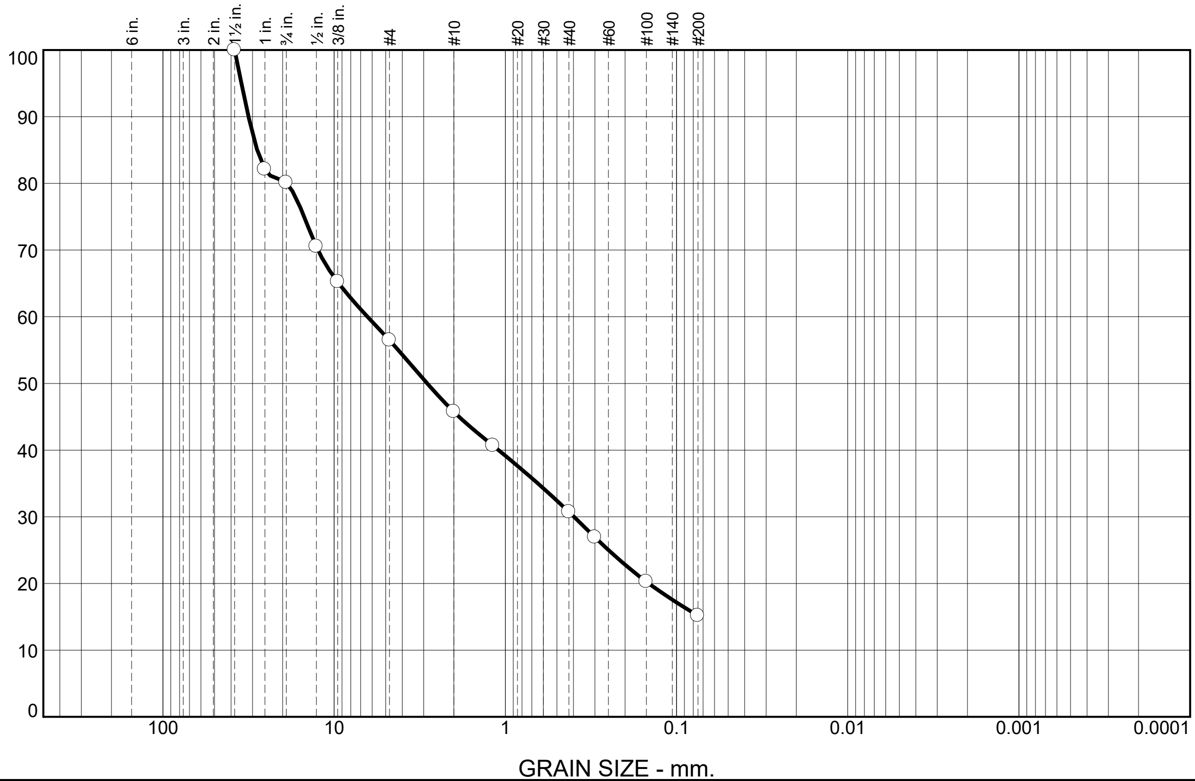
NewFields

Client: South 32
Project: Hermosa

Project No: 475.0014.033 **Figure** 22-196-01

Tested By: AR **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	19.9	23.6	10.8	15.0	15.5	15.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5"	100.0		
1"	82.1		
.75"	80.1		
.5"	70.5		
.375"	65.2		
#4	56.5		
#10	45.7		
#16	40.7		
#40	30.7		
#50	26.9		
#100	20.3		
#200	15.2		

* (no specification provided)

Soil Description

Dark brown clayey gravel with sand

Atterberg Limits

PL= 15 LL= 24 PI= 9

Coefficients

D_{90}= 31.6690 D_{85}= 28.1796 D_{60}= 6.3820
D_{50}= 2.8606 D_{30}= 0.3976 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= GC AASHTO= A-2-4(0)

Remarks

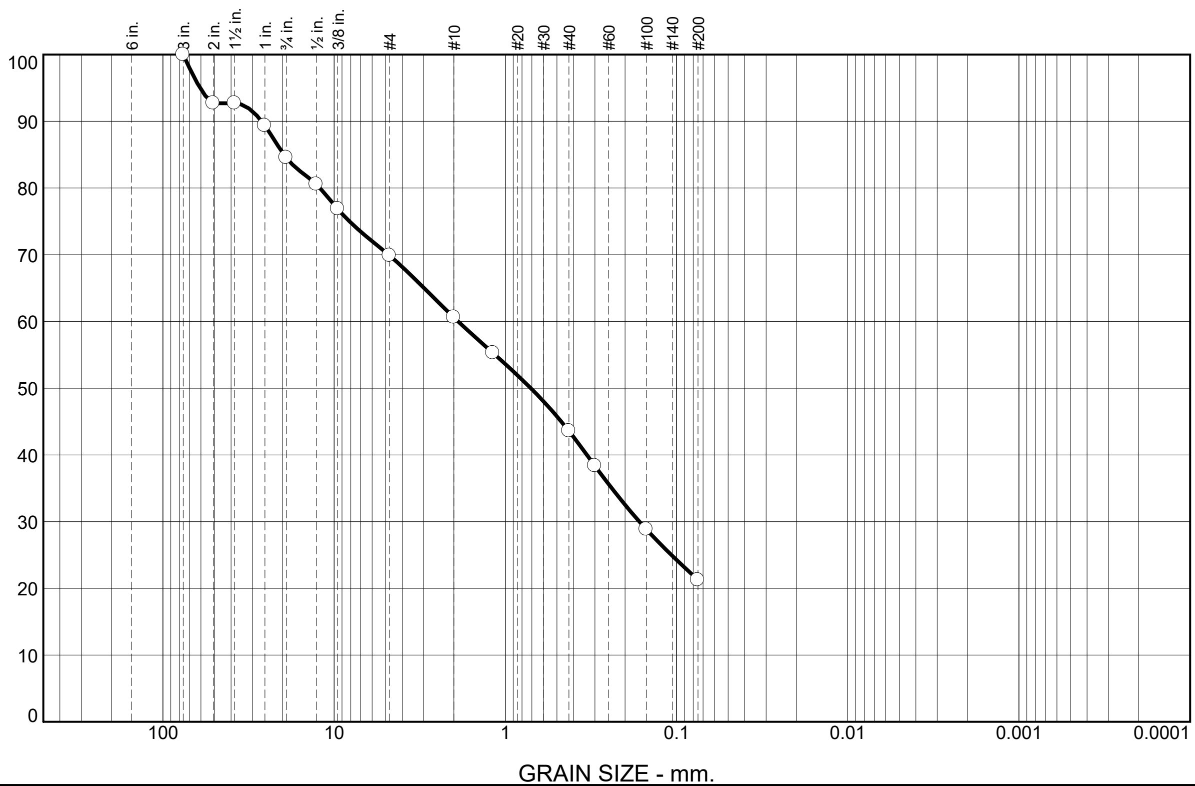
Location: BH22-02
Sample Number: 22-196-03 **Depth:** 6.5-8' **Date:** 9/2/2022

NewFields

Client: South 32
Project: Hermosa
Project No: 475.0014.033 **Figure** 22-196-03

Tested By: AR **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	15.4	14.7	9.3	17.0	22.3	21.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100.0		
2"	92.7		
1.5"	92.7		
1"	89.3		
.75"	84.6		
.5"	80.5		
.375"	76.9		
#4	69.9		
#10	60.6		
#16	55.3		
#40	43.6		
#50	38.3		
#100	28.8		
#200	21.3		

* (no specification provided)

Soil Description

Red clayey sand with gravel

Atterberg Limits

PL= 15 LL= 26 PI= 11

Coefficients

D_{90}= 26.5340 D_{85}= 19.6392 D_{60}= 1.8876
D_{50}= 0.7101 D_{30}= 0.1648 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO= A-2-6(0)

Remarks

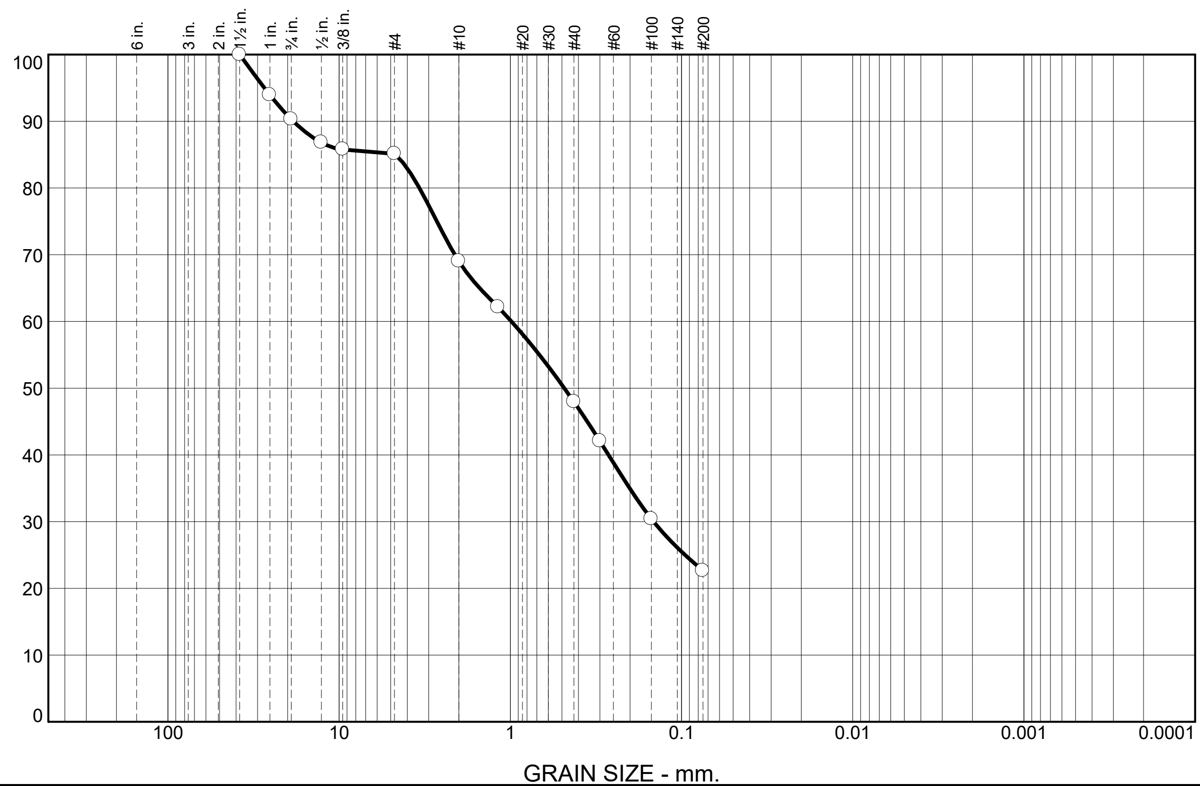
Location: BH22-03
Sample Number: 22-196-05 **Depth:** 2-2.5' **Date:** 9/8/2022

NewFields

Client: South 32
Project: Hermosa
Project No: 475.0014.033 **Figure** 22-196-05

Tested By: AR **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	9.7	5.2	16.1	21.1	25.3	22.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5"	100.0		
1"	94.0		
.75"	90.3		
.5"	86.8		
.375"	85.8		
#4	85.1		
#10	69.0		
#16	62.2		
#40	47.9		
#50	42.1		
#100	30.4		
#200	22.6		

* (no specification provided)

Soil Description

Brown clayey sand

Atterberg Limits

PL= 18 LL= 32 PI= 14

Coefficients

D_{90}= 18.5352 D_{85}= 4.6875 D_{60}= 0.9853
D_{50}= 0.4837 D_{30}= 0.1458 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO= A-2-6(0)

Remarks

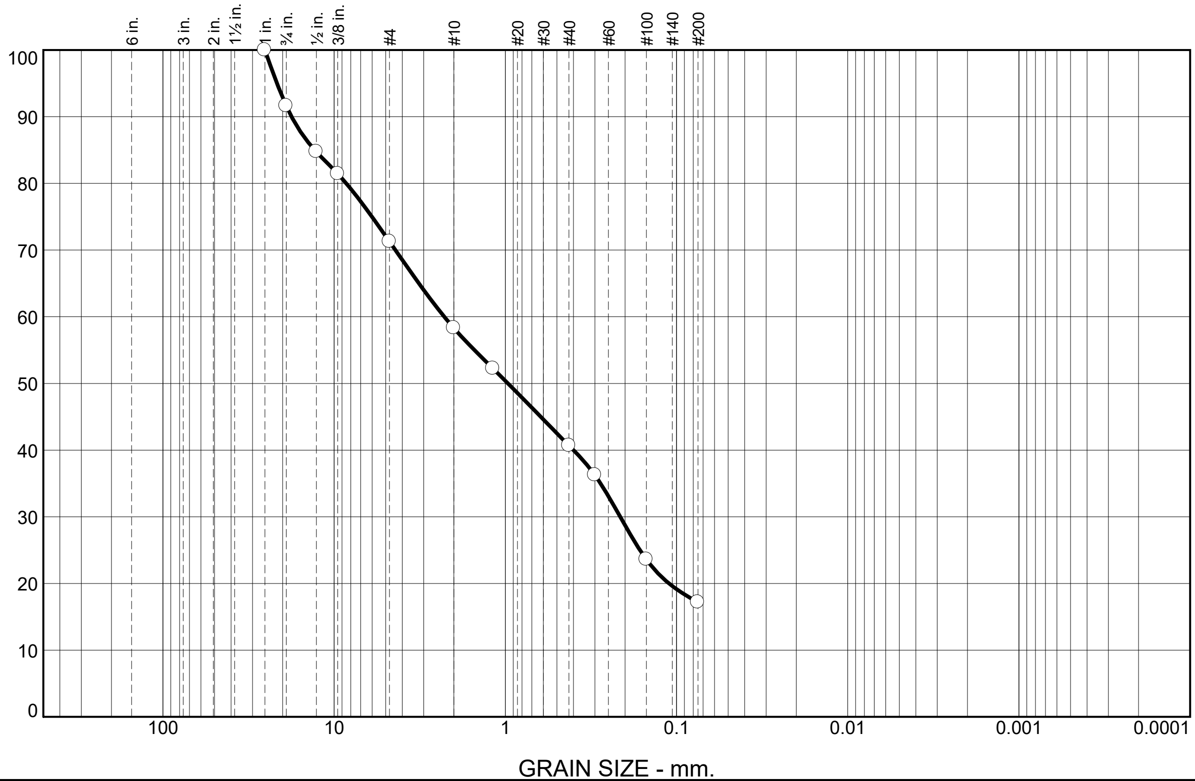
Location: BH22-04
Sample Number: 22-196-06 **Depth:** 0-2.5' **Date:** 9/8/2022

NewFields

Client: South 32
Project: Hermosa
Project No: 475.0014.033 **Figure** 22-196-06

Tested By: AR **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	8.4	20.3	13.0	17.6	23.5	17.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100.0		
.75"	91.6		
.5"	84.7		
.375"	81.4		
#4	71.3		
#10	58.3		
#16	52.2		
#40	40.7		
#50	36.3		
#100	23.6		
#200	17.2		

* (no specification provided)

Soil Description

Brown clayey sand with gravel

Atterberg Limits

PL= 14 LL= 27 PI= 13

Coefficients

D_{90}= 17.7413 D_{85}= 12.9791 D_{60}= 2.2743
D_{50}= 0.9652 D_{30}= 0.2133 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO= A-2-6(0)

Remarks

Location: BH22-06
Sample Number: 22-196-09 **Depth:** 2.5-4.5' **Date:** 9/8/2022

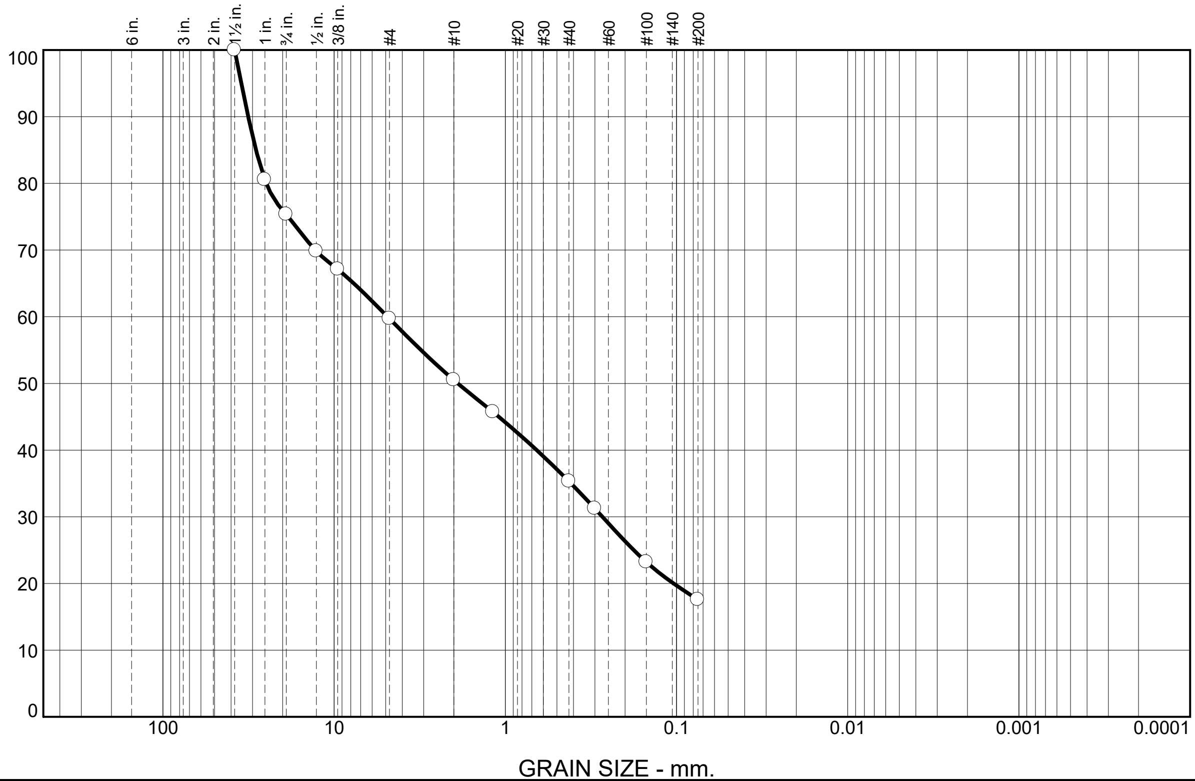
NewFields

Client: South 32
Project: Hermosa

Project No: 475.0014.033 **Figure** 22-196-09

Tested By: AR **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	24.7	15.6	9.2	15.2	17.7	17.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5"	100.0		
1"	80.5		
.75"	75.3		
.5"	69.8		
.375"	67.1		
#4	59.7		
#10	50.5		
#16	45.7		
#40	35.3		
#50	31.2		
#100	23.2		
#200	17.6		

* (no specification provided)

Soil Description

Dark brown clayey sand with gravel

Atterberg Limits

PL= 15 LL= 26 PI= 11

Coefficients

D_{90}= 31.7869 D_{85}= 28.6377 D_{60}= 4.8761
D_{50}= 1.8973 D_{30}= 0.2710 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO= A-2-6(0)

Remarks

Location: BH22-06
Sample Number: 22-196-10 **Depth:** 6.5-7' **Date:** 9/2/2022

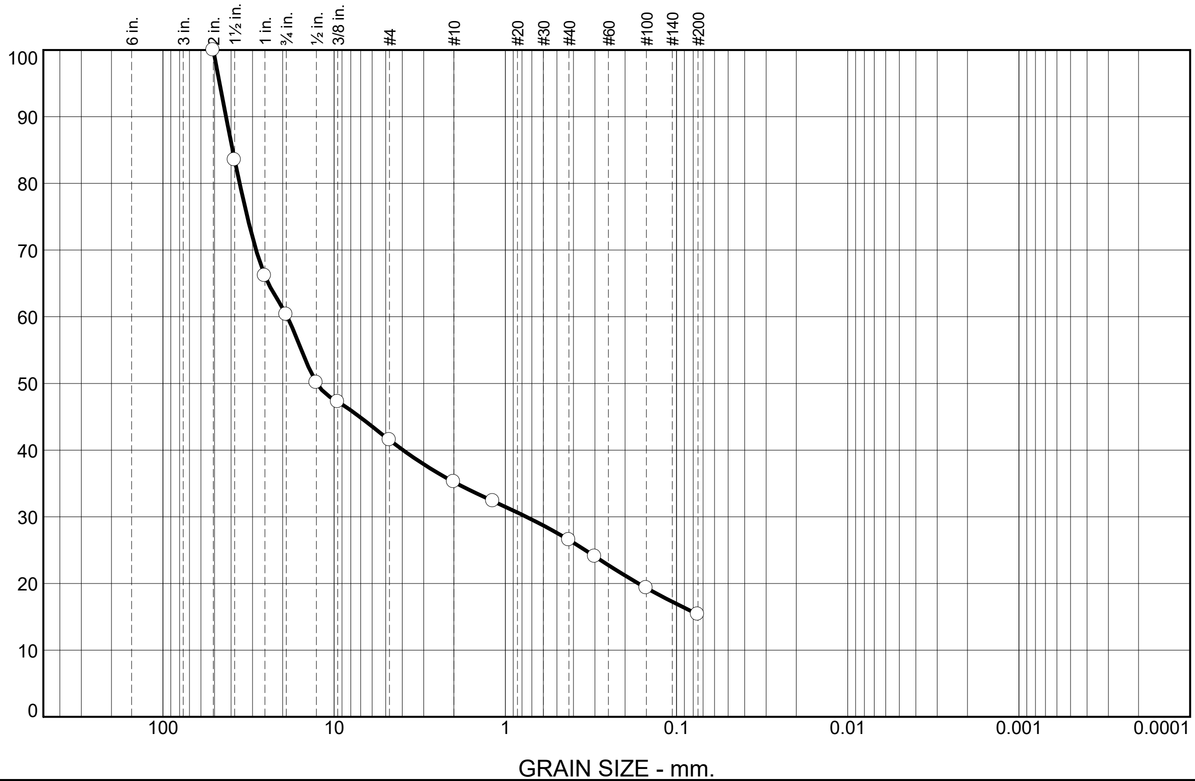
NewFields

Client: South 32
Project: Hermosa

Project No: 475.0014.033 **Figure** 22-196-10

Tested By: AR **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	39.7	18.8	6.3	8.7	11.1	15.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2"	100.0		
1.5"	83.5		
1"	66.1		
.75"	60.3		
.5"	50.1		
.375"	47.2		
#4	41.5		
#10	35.2		
#16	32.4		
#40	26.5		
#50	24.1		
#100	19.3		
#200	15.4		

* (no specification provided)

Soil Description

Brown clayey gravel with sand

Atterberg Limits

PL= 14 LL= 25 PI= 11

Coefficients

D_{90}= 42.8009 D_{85}= 39.1596 D_{60}= 18.7693
D_{50}= 12.6086 D_{30}= 0.7549 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= GC AASHTO= A-2-6(0)

Remarks

Location: BH22-07
Sample Number: 22-196-13 **Depth:** 0-2.5' **Date:** 9/2/2022

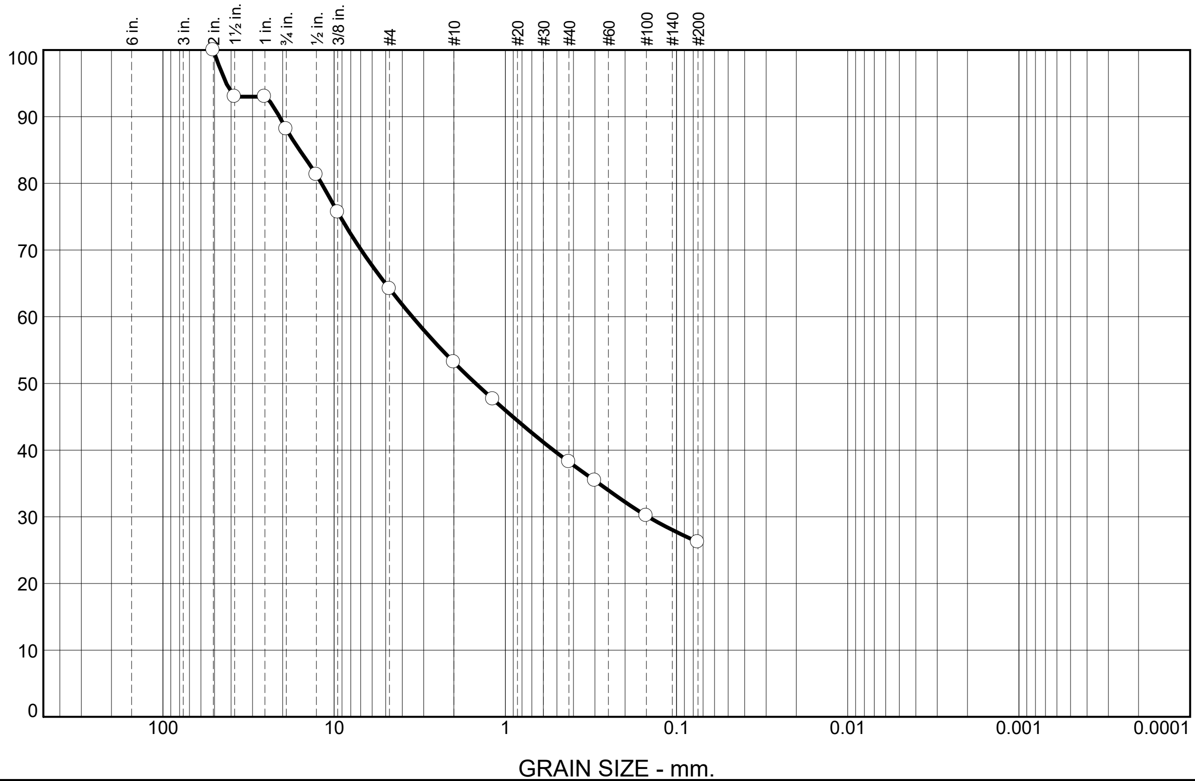
NewFields

Client: South 32
Project: Hermosa

Project No: 475.0014.033 **Figure** 22-196-13

Tested By: AR **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	11.9	23.9	11.0	15.0	12.0	26.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2"	100.0		
1.5"	93.0		
1"	93.0		
.75"	88.1		
.5"	81.3		
.375"	75.7		
#4	64.2		
#10	53.2		
#16	47.6		
#40	38.2		
#50	35.4		
#100	30.2		
#200	26.2		

* (no specification provided)

Soil Description

Dark brown clayey sand with gravel

Atterberg Limits

PL= 16 LL= 25 PI= 9

Coefficients

D_{90}= 20.8703 D_{85}= 15.9168 D_{60}= 3.4989
D_{50}= 1.4903 D_{30}= 0.1466 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO= A-2-4(0)

Remarks

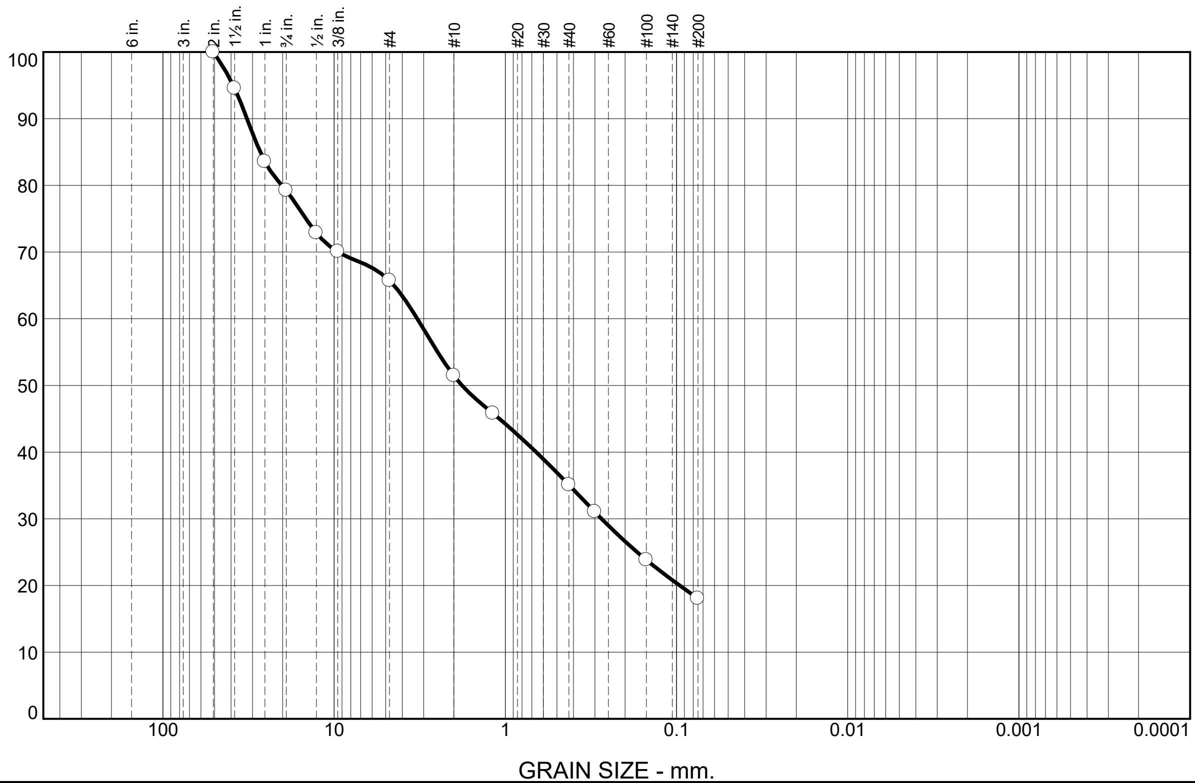
Location: BH22-09
Sample Number: 22-196-14 **Depth:** 0-2.5' **Date:** 9/2/2022

NewFields

Client: South 32
Project: Hermosa
Project No: 475.0014.033 **Figure** 22-196-14

Tested By: AR **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	20.8	13.5	14.2	16.4	17.1	18.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2"	100.0		
1.5"	94.5		
1"	83.5		
.75"	79.2		
.5"	72.9		
.375"	70.1		
#4	65.7		
#10	51.5		
#16	45.8		
#40	35.1		
#50	31.0		
#100	23.8		
#200	18.0		

* (no specification provided)

Soil Description

Brown silty, clayey sand with gravel

Atterberg Limits

PL= 15 LL= 20 PI= 5

Coefficients

D_{90}= 32.3320 D_{85}= 27.0517 D_{60}= 3.2683
D_{50}= 1.7922 D_{30}= 0.2741 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC-SM AASHTO= A-1-b

Remarks

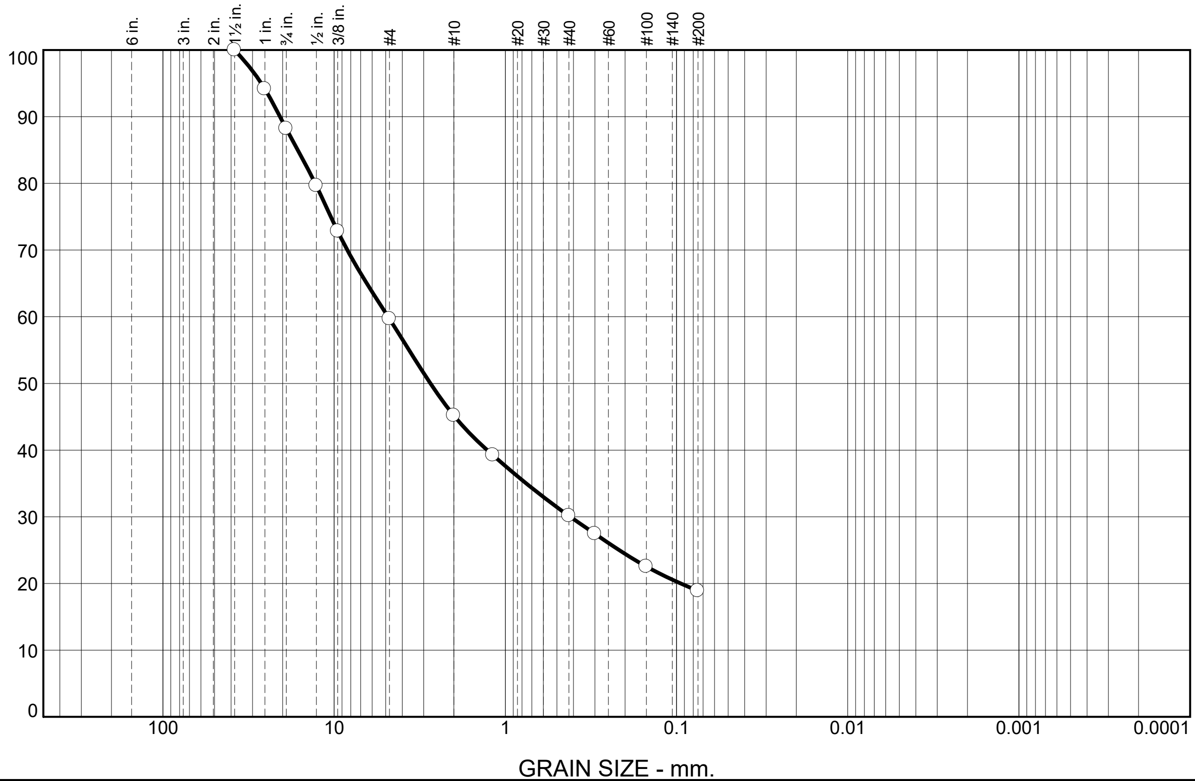
Location: BH22-09
Sample Number: 22-196-16 **Depth:** 4-6.5' **Date:** 9/2/2022

NewFields

Client: South 32
Project: Hermosa
Project No: 475.0014.033 **Figure** 22-196-16

Tested By: AR **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	11.8	28.5	14.5	15.1	11.2	18.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5"	100.0		
1"	94.2		
.75"	88.2		
.5"	79.6		
.375"	72.8		
#4	59.7		
#10	45.2		
#16	39.2		
#40	30.1		
#50	27.4		
#100	22.5		
#200	18.9		

* (no specification provided)

Soil Description

Brown silty, clayey sand with gravel

Atterberg Limits

PL= 15 LL= 20 PI= 5

Coefficients

D_{90}= 20.7131 D_{85}= 16.3167 D_{60}= 4.8412
D_{50}= 2.7407 D_{30}= 0.4178 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC-SM AASHTO= A-1-b

Remarks

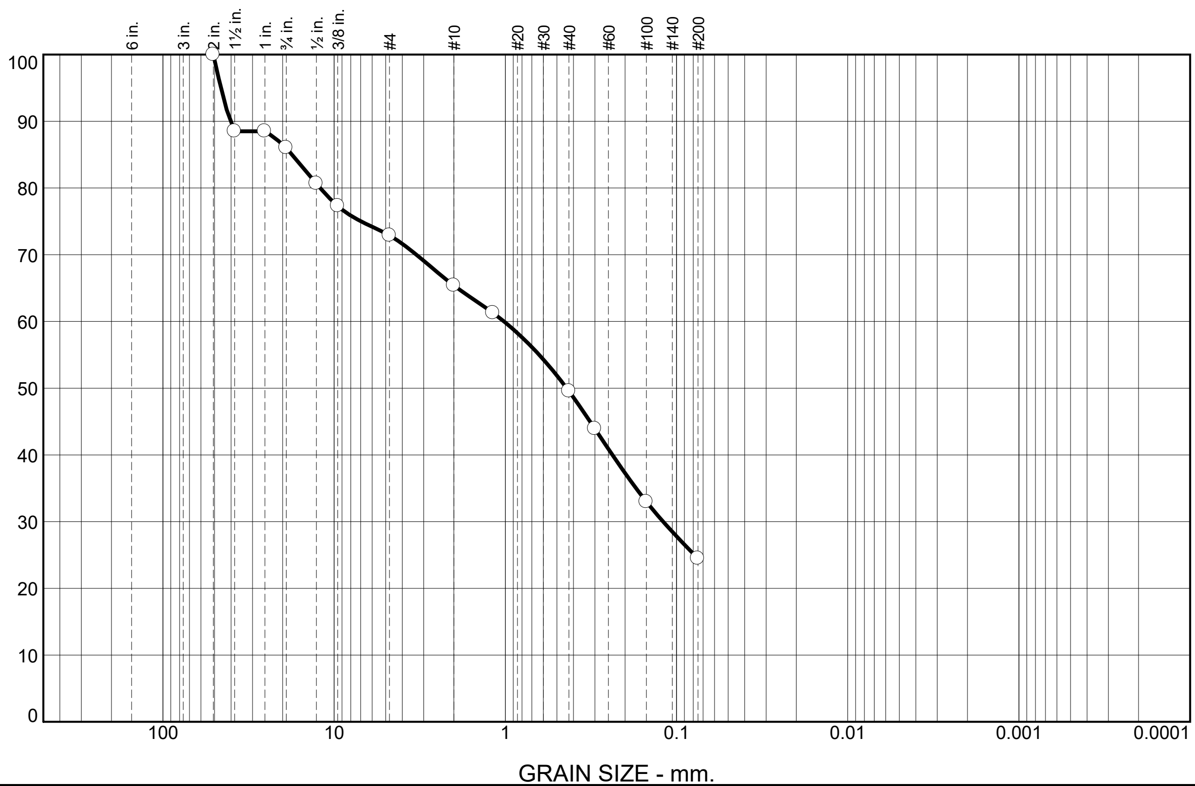
Location: BH22-09
Sample Number: 22-196-18 **Depth:** 14.5-16' **Date:** 9/2/2022

NewFields

Client: South 32
Project: Hermosa
Project No: 475.0014.033 **Figure** 22-196-18

Tested By: AR **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	14.0	13.1	7.5	15.9	25.0	24.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2"	100.0		
1.5"	88.5		
1"	88.5		
.75"	86.0		
.5"	80.7		
.375"	77.3		
#4	72.9		
#10	65.4		
#16	61.3		
#40	49.5		
#50	43.9		
#100	33.0		
#200	24.5		

* (no specification provided)

Soil Description

Brown clayey sand with gravel

Atterberg Limits

PL= 18 LL= 27 PI= 9

Coefficients

D_{90}= 40.3442 D_{85}= 17.6236 D_{60}= 1.0177
D_{50}= 0.4383 D_{30}= 0.1199 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO= A-2-4(0)

Remarks

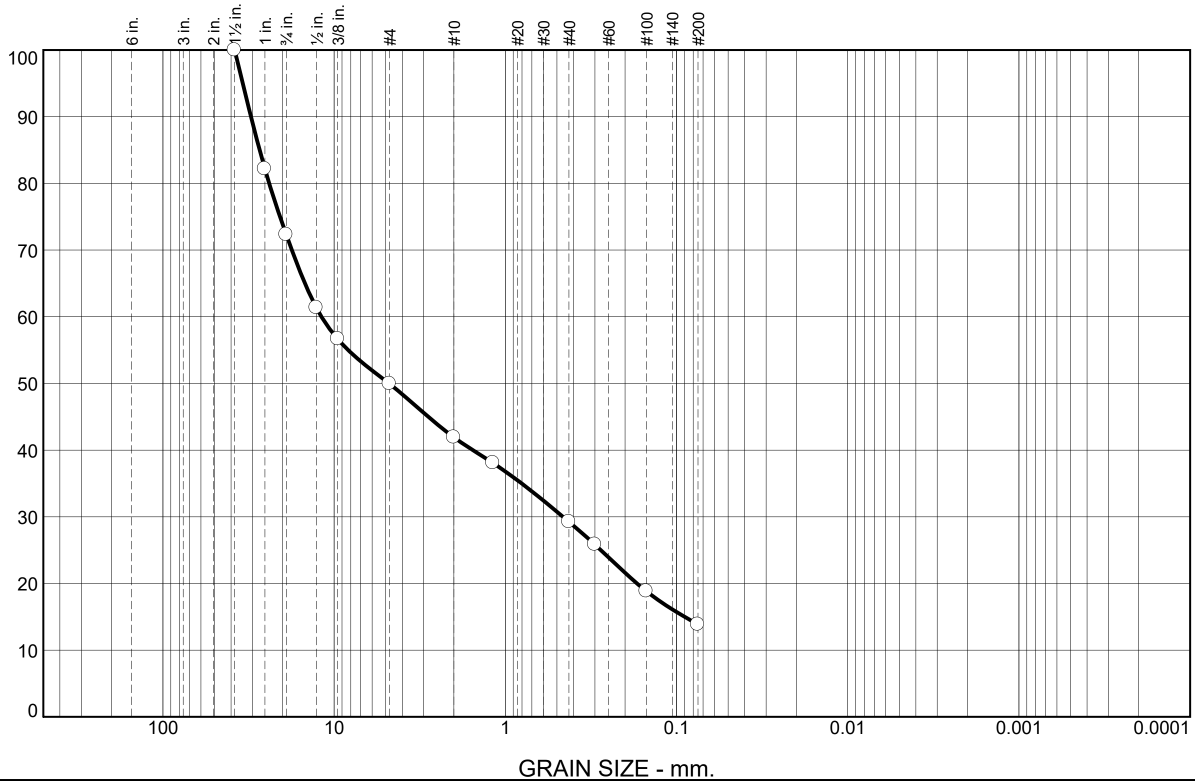
Location: BH22-10
Sample Number: 22-196-19 **Depth:** 3-3.5' **Date:** 9/2/2022

NewFields

Client: South 32
Project: Hermosa
Project No: 475.0014.033 **Figure** 22-196-19

Tested By: AR **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	27.7	22.4	8.0	12.7	15.4	13.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5"	100.0		
1"	82.2		
.75"	72.3		
.5"	61.3		
.375"	56.7		
#4	49.9		
#10	41.9		
#16	38.1		
#40	29.2		
#50	25.8		
#100	18.8		
#200	13.8		

* (no specification provided)

Soil Description

Brown silty clayey gravel with sand

Atterberg Limits

PL= 18 LL= 24 PI= 6

Coefficients

D_{90}= 30.6415 D_{85}= 27.2680 D_{60}= 11.8564
D_{50}= 4.7804 D_{30}= 0.4607 D_{15}= 0.0898
D_{10}= C_u= C_c=

Classification

USCS= GC-GM AASHTO= A-1-a

Remarks

Location: BH22-10
Sample Number: 22-196-20 **Depth:** 3.5-4' **Date:** 9/2/2022

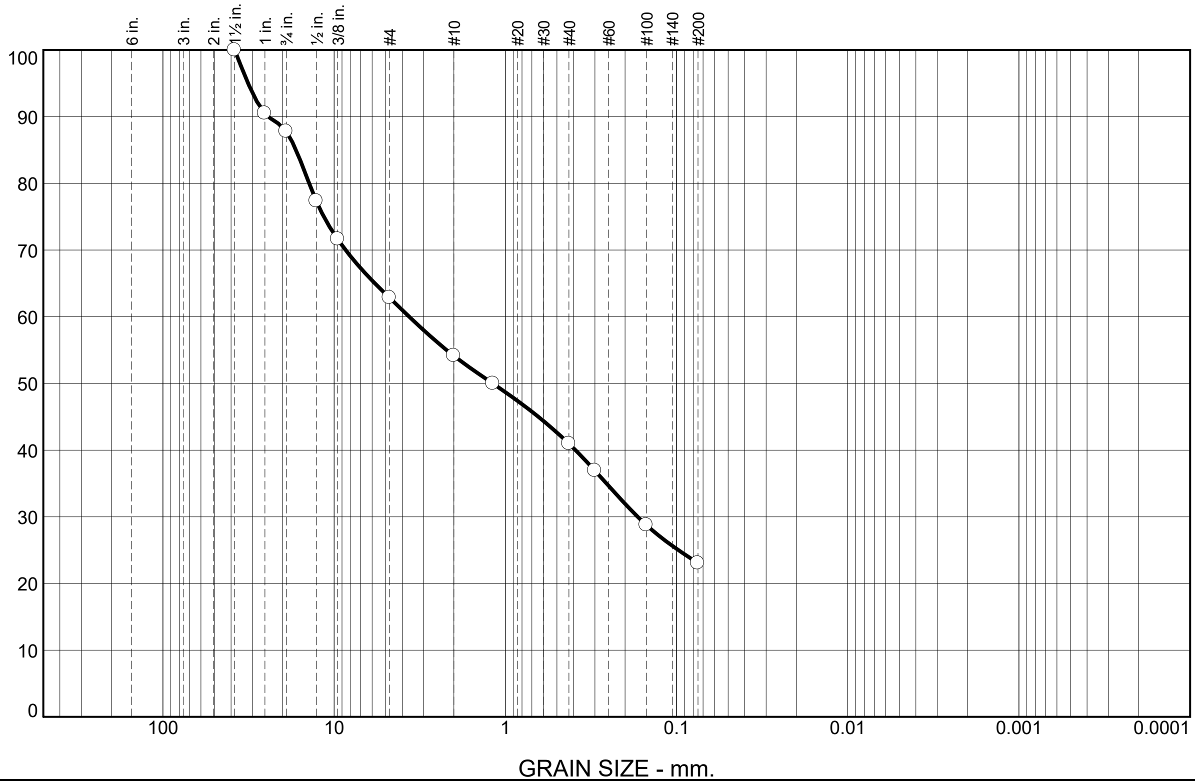
NewFields

Client: South 32
Project: Hermosa

Project No: 475.0014.033 **Figure** 22-196-20

Tested By: AR **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	12.2	25.0	8.7	13.1	18.0	23.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5"	100.0		
1"	90.5		
.75"	87.8		
.5"	77.3		
.375"	71.6		
#4	62.8		
#10	54.1		
#16	50.0		
#40	41.0		
#50	36.9		
#100	28.8		
#200	23.0		

* (no specification provided)

Soil Description

Dark brown clayey sand with gravel

Atterberg Limits

PL= 14 LL= 36 PI= 22

Coefficients

D_{90}= 24.2159 D_{85}= 16.6950 D_{60}= 3.6437
D_{50}= 1.1842 D_{30}= 0.1687 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO= A-2-6(1)

Remarks

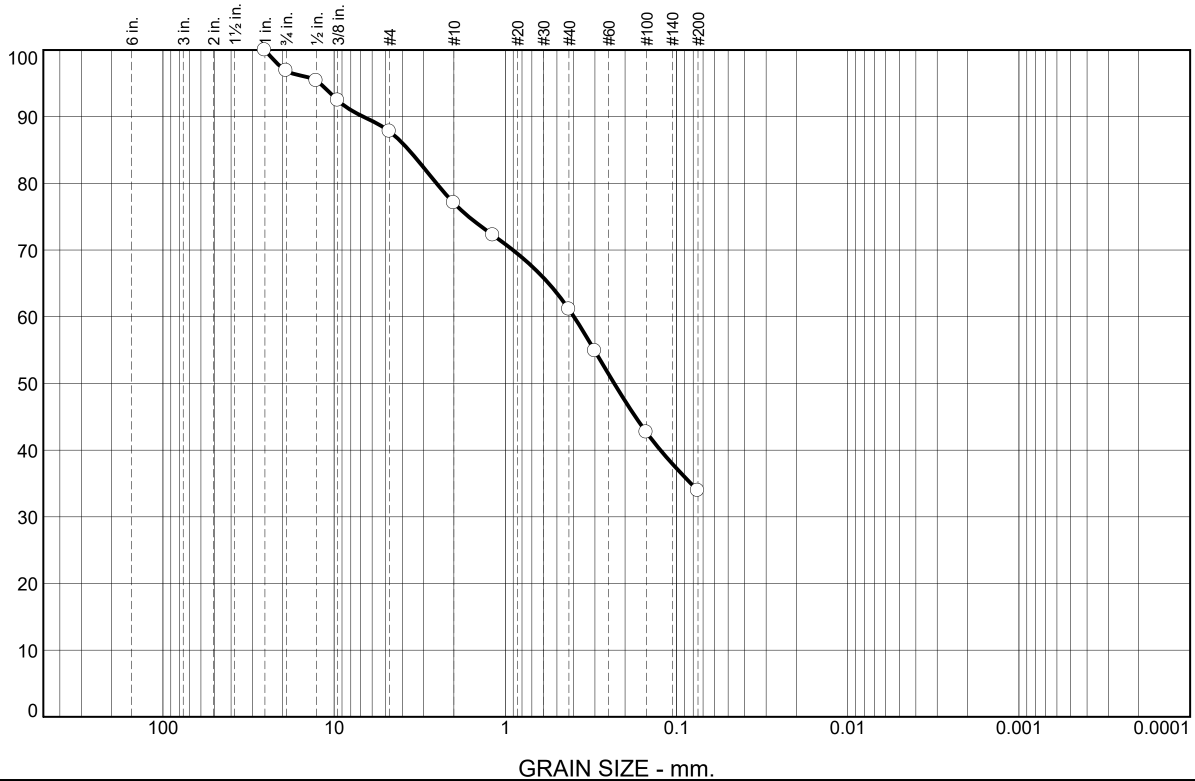
Location: BH22-11
Sample Number: 22-196-21 **Depth:** 0-2.5' **Date:** 9/2/2022

NewFields

Client: South 32
Project: Hermosa
Project No: 475.0014.033 **Figure** 22-196-21

Tested By: AR **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	3.1	9.1	10.7	16.0	27.2	33.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100.0		
.75"	96.9		
.5"	95.4		
.375"	92.4		
#4	87.8		
#10	77.1		
#16	72.2		
#40	61.1		
#50	54.9		
#100	42.7		
#200	33.9		

* (no specification provided)

Soil Description

Brown clayey sand

Atterberg Limits

PL= 16 LL= 35 PI= 19

Coefficients

D_{90}= 6.7440 D_{85}= 3.6623 D_{60}= 0.3976
D_{50}= 0.2312 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO= A-2-6(2)

Remarks

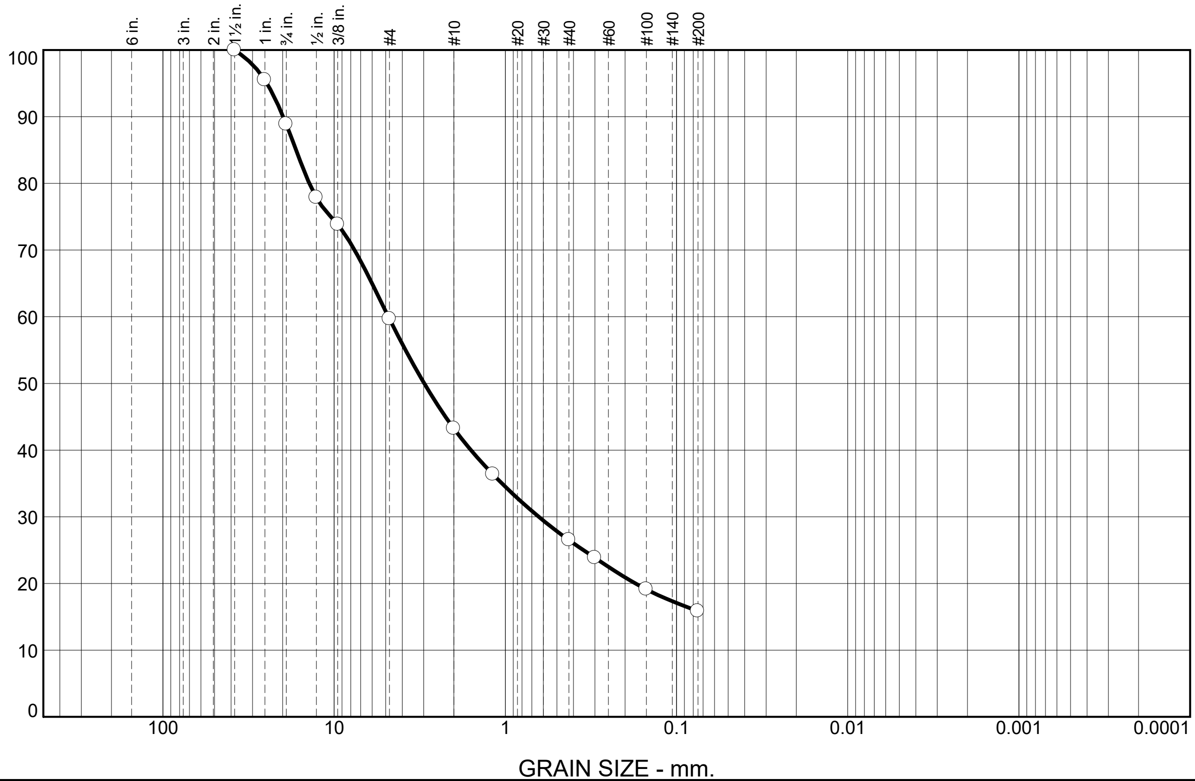
Location: BH22-11
Sample Number: 22-196-23 **Depth:** 4-6.5' **Date:** 9/2/2022

NewFields

Client: South 32
Project: Hermosa
Project No: 475.0014.033 **Figure** 22-196-23

Tested By: AR **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	11.1	29.2	16.5	16.7	10.7	15.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5"	100.0		
1"	95.5		
.75"	88.9		
.5"	77.9		
.375"	73.8		
#4	59.7		
#10	43.2		
#16	36.4		
#40	26.5		
#50	23.8		
#100	19.1		
#200	15.8		

* (no specification provided)

Soil Description

Light brown silty, clayey sand with gravel

Atterberg Limits

PL= 14 LL= 20 PI= 6

Coefficients

D_{90}= 19.8510 D_{85}= 16.6886 D_{60}= 4.8221
D_{50}= 2.9783 D_{30}= 0.6378 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC-SM AASHTO= A-1-b

Remarks

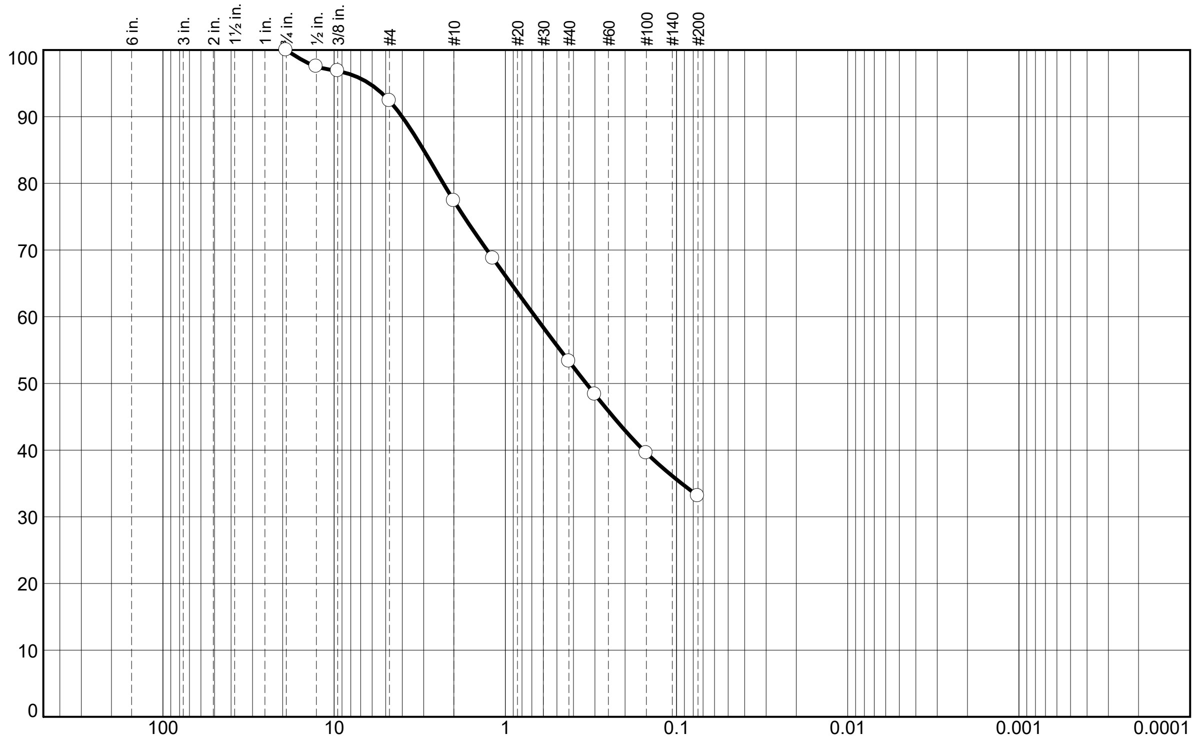
Location: BH22-12
Sample Number: 22-196-24 **Depth:** 0-2.5' **Date:** 9/2/2022

NewFields

Client: South 32
Project: Hermosa
Project No: 475.0014.033 **Figure** 22-196-24

Tested By: AR **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	7.6	15.0	24.1	20.2	33.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75"	100.0		
.5"	97.5		
.375"	96.9		
#4	92.4		
#10	77.4		
#16	68.7		
#40	53.3		
#50	48.4		
#100	39.6		
#200	33.1		

* (no specification provided)

Soil Description

Brown clayey sand

Atterberg Limits

PL= 10 LL= 18 PI= 8

Coefficients

D_{90}= 4.0088 D_{85}= 3.0015 D_{60}= 0.6675
D_{50}= 0.3373 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO= A-2-4(0)

Remarks

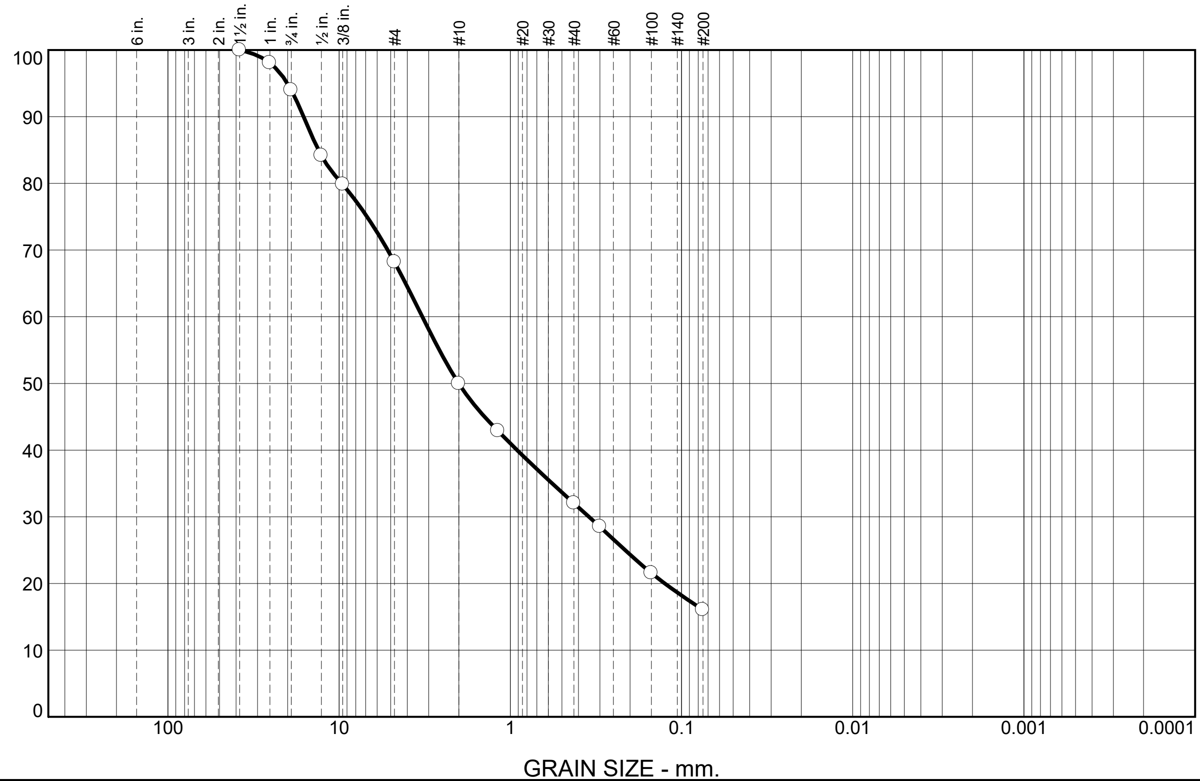
Location: BH22-12
Sample Number: 22-196-25 **Depth:** 2.5-4' **Date:** 9/2/2022

NewFields

Client: South 32
Project: Hermosa
Project No: 475.0014.033 **Figure** 22-196-25

Tested By: AR **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	6.0	25.8	18.2	18.0	16.0	16.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5"	100.0		
1"	98.1		
.75"	94.0		
.5"	84.2		
.375"	79.8		
#4	68.2		
#10	50.0		
#16	42.9		
#40	32.0		
#50	28.5		
#100	21.6		
#200	16.0		

* (no specification provided)

Soil Description

Brown silty sand with gravel

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 16.1277 D_{85}= 13.2084 D_{60}= 3.2692
D_{50}= 2.0048 D_{30}= 0.3478 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-1-b

Remarks

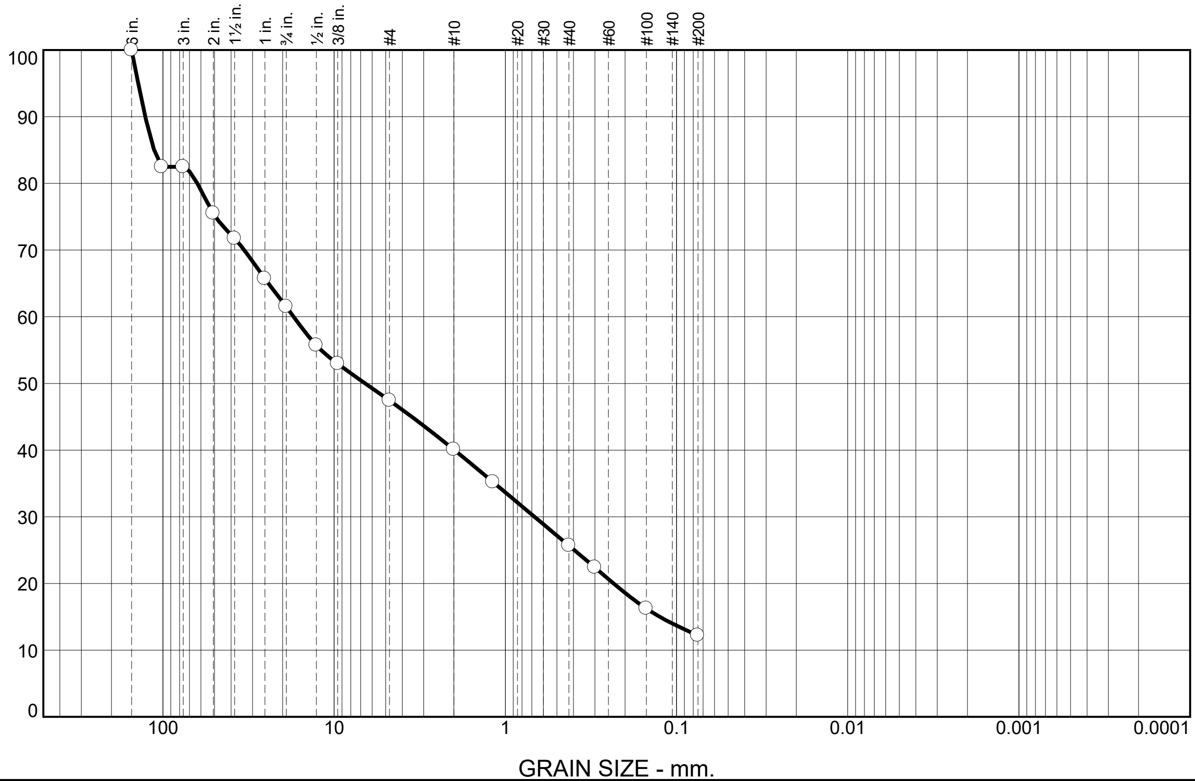
Location: BH22-13
Sample Number: 22-196-26 **Depth:** 0-2.5' **Date:** 9/8/2022

NewFields

Client: South 32
Project: Hermosa
Project No: 475.0014.033 **Figure** 22-196-26

Tested By: AR **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
17.5	21.0	14.1	7.3	14.4	13.5	12.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
6"	100.0		
4"	82.5		
3"	82.5		
2"	75.5		
1.5"	71.7		
1"	65.7		
.75"	61.5		
.5"	55.7		
.375"	53.0		
#4	47.4		
#10	40.1		
#16	35.2		
#40	25.7		
#50	22.4		
#100	16.2		
#200	12.2		

* (no specification provided)

Soil Description

Dark brown clayey sand with gravel

Atterberg Limits

PL= 14 LL= 27 PI= 13

Coefficients

D_{90}= 126.9961 D_{85}= 112.7108 D_{60}= 17.2436
D_{50}= 6.5811 D_{30}= 0.6755 D_{15}= 0.1255
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO= A-2-6(0)

Remarks

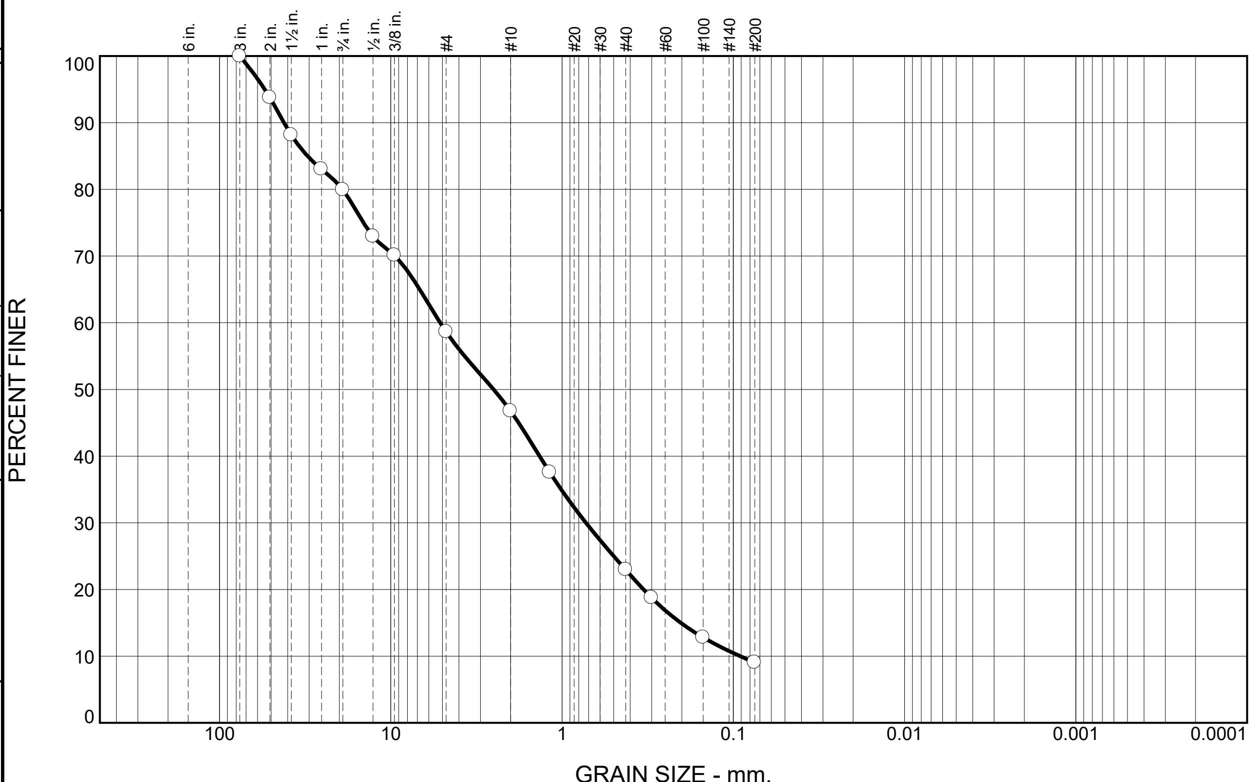
Location: TP22-06
Sample Number: 22-185-01 **Depth:** 5-6' **Date:** 8/22/2022

NewFields

Client: South 32
Project: Hermosa
Project No: 475.0014.033 **Figure** 22-185-01

Tested By: ZM/EG **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	20.1	21.3	11.8	23.9	13.9	9.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100.0		
2"	93.8		
1.5"	88.2		
1"	83.0		
.75"	79.9		
.5"	73.0		
.375"	70.1		
#4	58.6		
#10	46.8		
#16	37.6		
#40	22.9		
#50	18.7		
#100	12.8		
#200	9.0		

* (no specification provided)

Soil Description

Dark brown

Atterberg Limits

PL= - LL= - PI= -

Coefficients

D_{90}= 42.0231 D_{85}= 30.6933 D_{60}= 5.1460
D_{50}= 2.5126 D_{30}= 0.7252 D_{15}= 0.2028
D_{10}= 0.0913 C_u= 56.34 C_c= 1.12

Classification

USCS= AASHTO=

Remarks

Location: TP22-08
Sample Number: 22-185-02 **Depth:** 2.5-4' **Date:** 8/22/2022

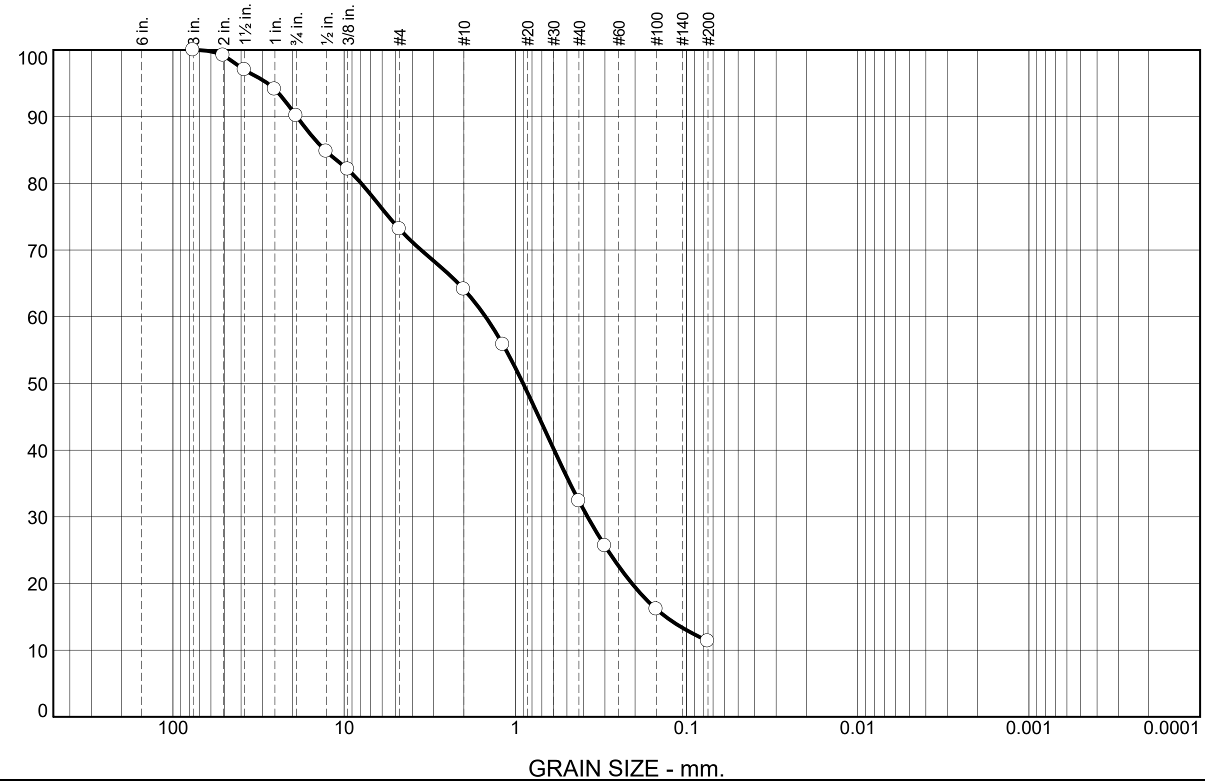
NewFields

Client: South 32
Project: Hermosa

Project No: 475.0014.033 **Figure** 22-185-02

Tested By: EG/ZM **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	9.9	17.0	9.0	31.8	21.0	11.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100.0		
2"	99.2		
1.5"	97.0		
1"	94.1		
.75"	90.1		
.5"	84.8		
.375"	82.1		
#4	73.1		
#10	64.1		
#16	55.8		
#40	32.3		
#50	25.7		
#100	16.1		
#200	11.3		

* (no specification provided)

Soil Description

Gray

Atterberg Limits

PL= - LL= - PI= -

Coefficients

D_{90}= 18.8773 D_{85}= 12.9603 D_{60}= 1.4926
D_{50}= 0.9007 D_{30}= 0.3792 D_{15}= 0.1323
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

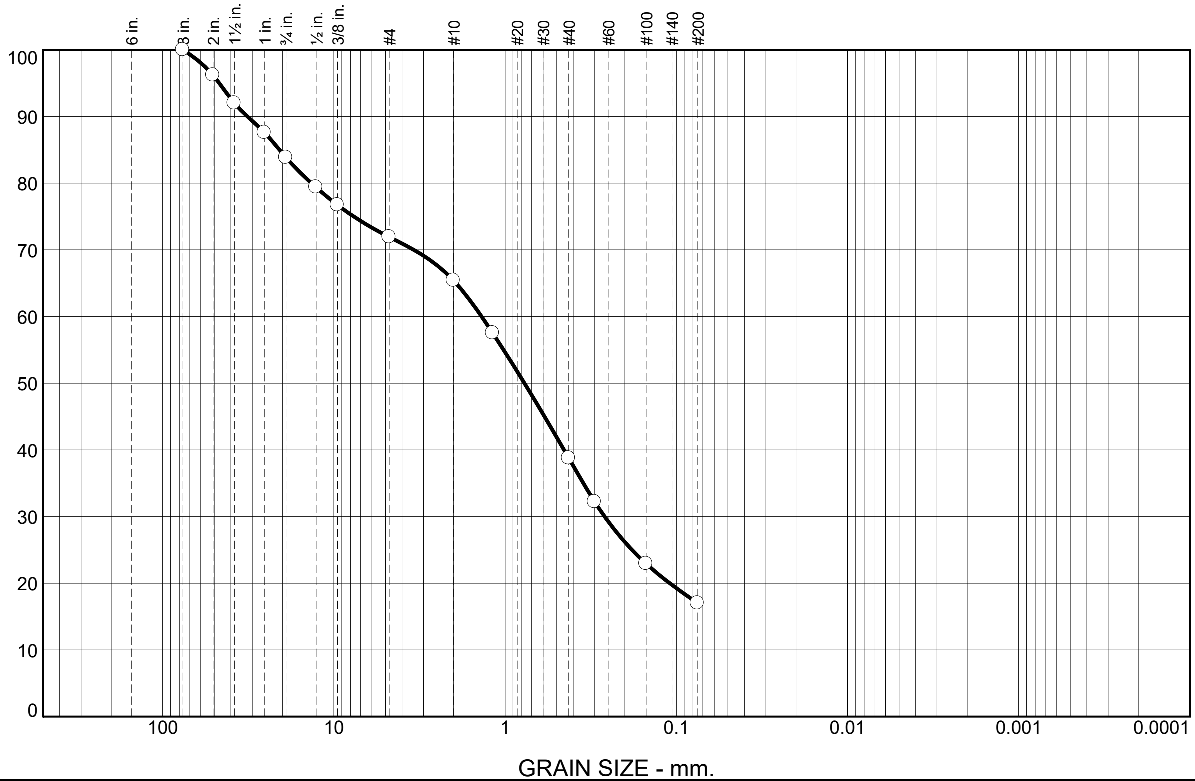
Location: TP22-09
Sample Number: 22-185-03 **Depth:** 4-7' **Date:** 8/22/2022

NewFields

Client: South 32
Project: Hermosa
Project No: 475.0014.033 **Figure** 22-185-03

Tested By: EG/ZM **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	16.2	11.9	6.5	26.6	21.8	17.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100.0		
2"	96.2		
1.5"	92.0		
1"	87.6		
.75"	83.8		
.5"	79.4		
.375"	76.7		
#4	71.9		
#10	65.4		
#16	57.5		
#40	38.8		
#50	32.2		
#100	22.9		
#200	17.0		

* (no specification provided)

Soil Description

Dark brown clayey sand with gravel

Atterberg Limits

PL= 19 LL= 33 PI= 14

Coefficients

D_{90}= 32.0718 D_{85}= 20.8065 D_{60}= 1.3722
D_{50}= 0.7708 D_{30}= 0.2623 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO= A-2-6(0)

Remarks

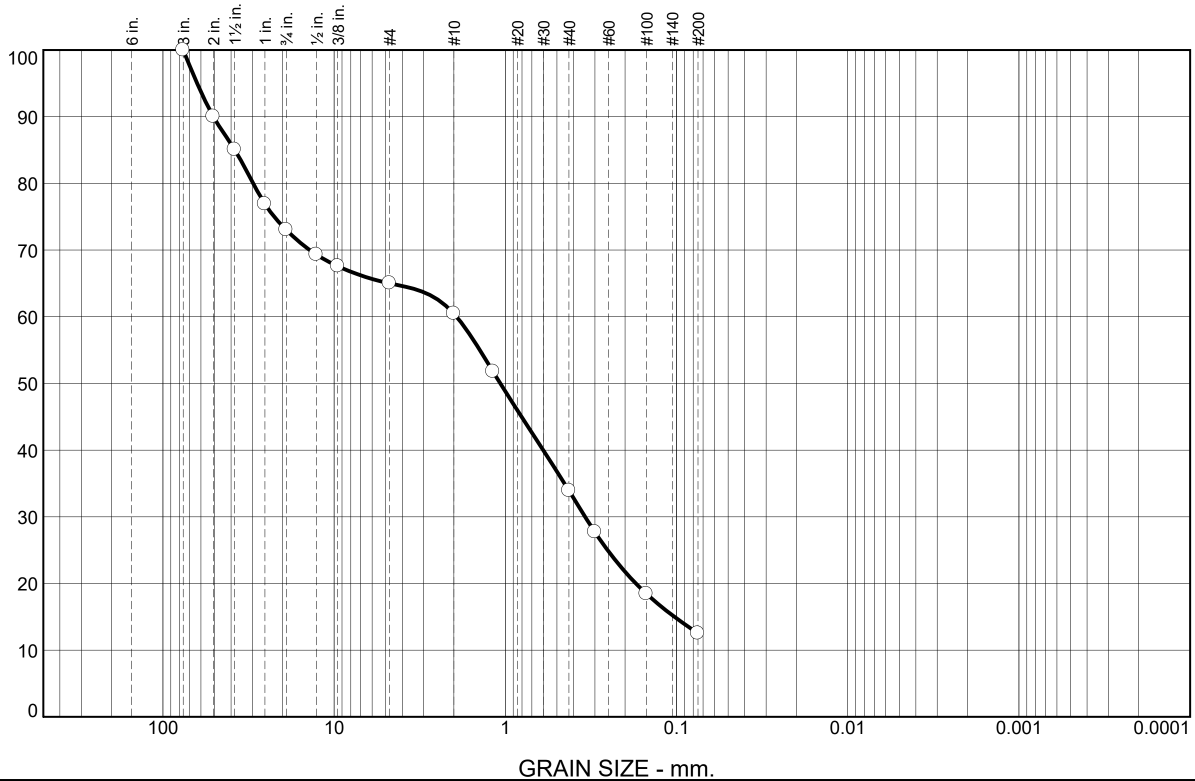
Location: TP22-10
Sample Number: 22-185-04 **Depth:** 3-6' **Date:** 8/22/2022

NewFields

Client: South 32
Project: Hermosa
Project No: 475.0014.033 **Figure** 22-185-04

Tested By: EG/ZM **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	27.0	8.0	4.5	26.6	21.4	12.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100.0		
2"	90.0		
1.5"	85.0		
1"	76.9		
.75"	73.0		
.5"	69.3		
.375"	67.6		
#4	65.0		
#10	60.5		
#16	51.8		
#40	33.9		
#50	27.7		
#100	18.5		
#200	12.5		

* (no specification provided)

Soil Description

Brown

Atterberg Limits

PL= - LL= - PI= -

Coefficients

D_{90}= 50.7486 D_{85}= 37.9990 D_{60}= 1.9274
D_{50}= 1.0694 D_{30}= 0.3424 D_{15}= 0.1030
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

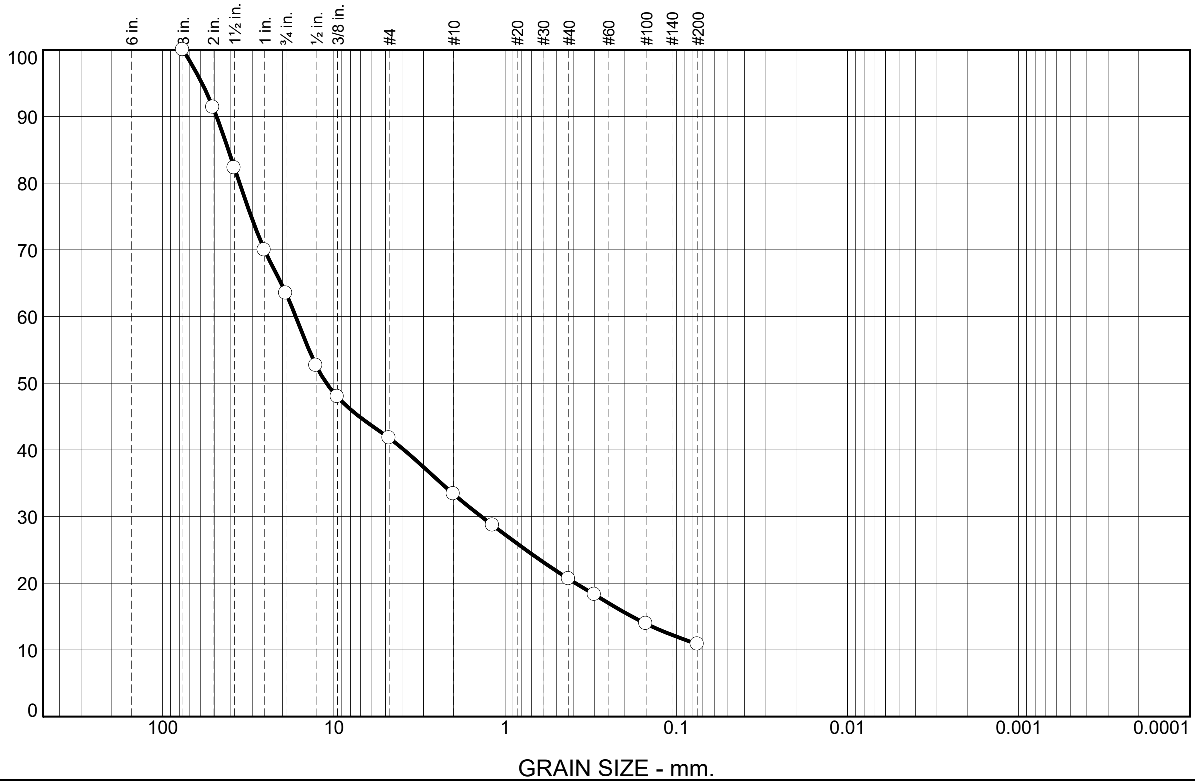
Location: TP22-11
Sample Number: 22-185-05 **Depth:** 5-10' **Date:** 8/22/2022

NewFields

Client: South 32
Project: Hermosa
Project No: 475.0014.033 **Figure** 22-185-05

Tested By: EG/ZM **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	36.5	21.7	8.4	12.8	9.8	10.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100.0		
2"	91.3		
1.5"	82.3		
1"	69.9		
.75"	63.5		
.5"	52.6		
.375"	47.9		
#4	41.8		
#10	33.4		
#16	28.7		
#40	20.6		
#50	18.3		
#100	13.9		
#200	10.8		

* (no specification provided)

Soil Description

Dark brown

Atterberg Limits

PL= - LL= - PI= -

Coefficients

D_{90}= 48.4361 D_{85}= 41.3312 D_{60}= 16.7171
D_{50}= 11.0506 D_{30}= 1.3765 D_{15}= 0.1815
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

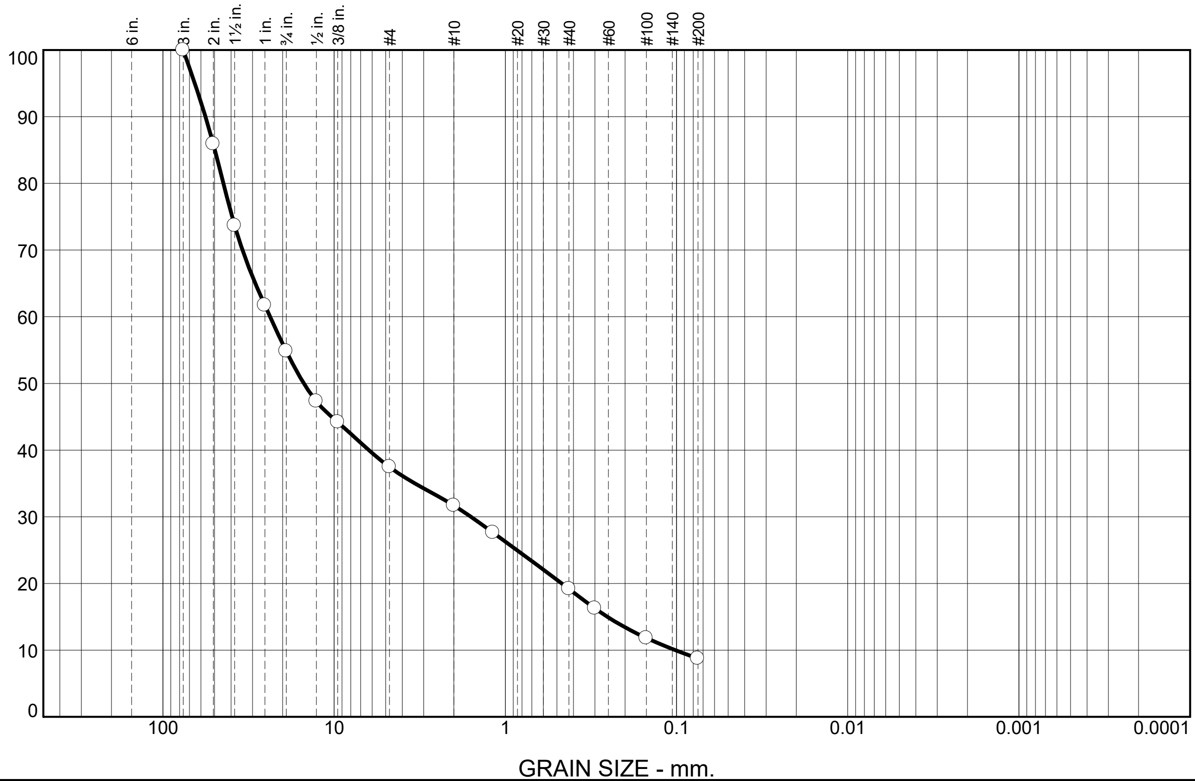
Location: TP22-12
Sample Number: 22-185-06 **Depth:** 3-4' **Date:** 8/22/2022

NewFields

Client: South 32
Project: Hermosa
Project No: 475.0014.033 **Figure** 22-185-06

Tested By: ZM **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	45.2	17.3	5.8	12.5	10.5	8.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100.0		
2"	85.9		
1.5"	73.7		
1"	61.7		
.75"	54.8		
.5"	47.3		
.375"	44.2		
#4	37.5		
#10	31.7		
#16	27.6		
#40	19.2		
#50	16.3		
#100	11.8		
#200	8.7		

* (no specification provided)

Soil Description

Brown

Atterberg Limits

PL= - LL= - PI= -

Coefficients

D_{90}= 56.4441 D_{85}= 49.7149 D_{60}= 23.6814
D_{50}= 15.0402 D_{30}= 1.5895 D_{15}= 0.2536
D_{10}= 0.1017 C_u= 232.84 C_c= 1.05

Classification

USCS= AASHTO=

Remarks

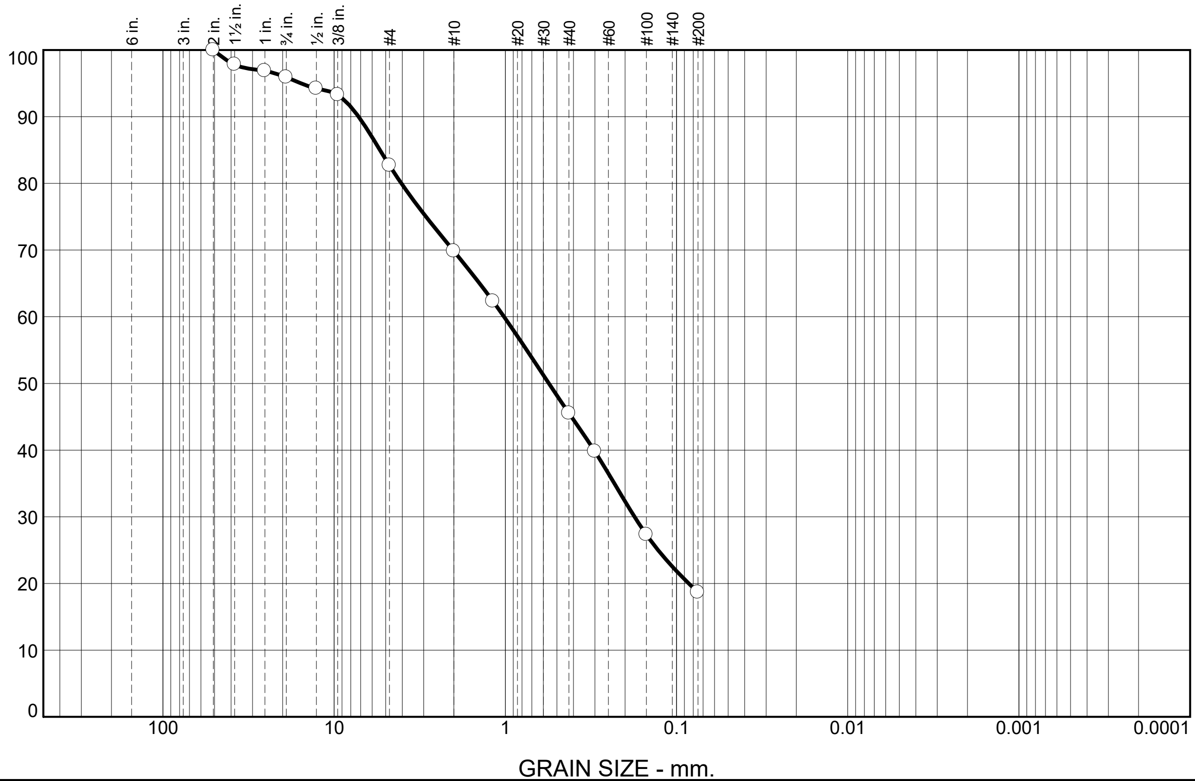
Location: TP22-13
Sample Number: 22-185-07 **Depth:** 3.5-4.5' **Date:** 8/22/2022

NewFields

Client: South 32
Project: Hermosa
Project No: 475.0014.033 **Figure** 22-185-07

Tested By: EG/ZM **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	4.1	13.2	12.9	24.3	26.8	18.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2"	100.0		
1.5"	97.8		
1"	96.9		
.75"	95.9		
.5"	94.2		
.375"	93.3		
#4	82.7		
#10	69.8		
#16	62.3		
#40	45.5		
#50	39.8		
#100	27.3		
#200	18.7		

* (no specification provided)

Soil Description

Brown

Atterberg Limits

PL= - LL= - PI= -

Coefficients

D_{90}= 7.1934 D_{85}= 5.3978 D_{60}= 1.0170
D_{50}= 0.5567 D_{30}= 0.1760 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

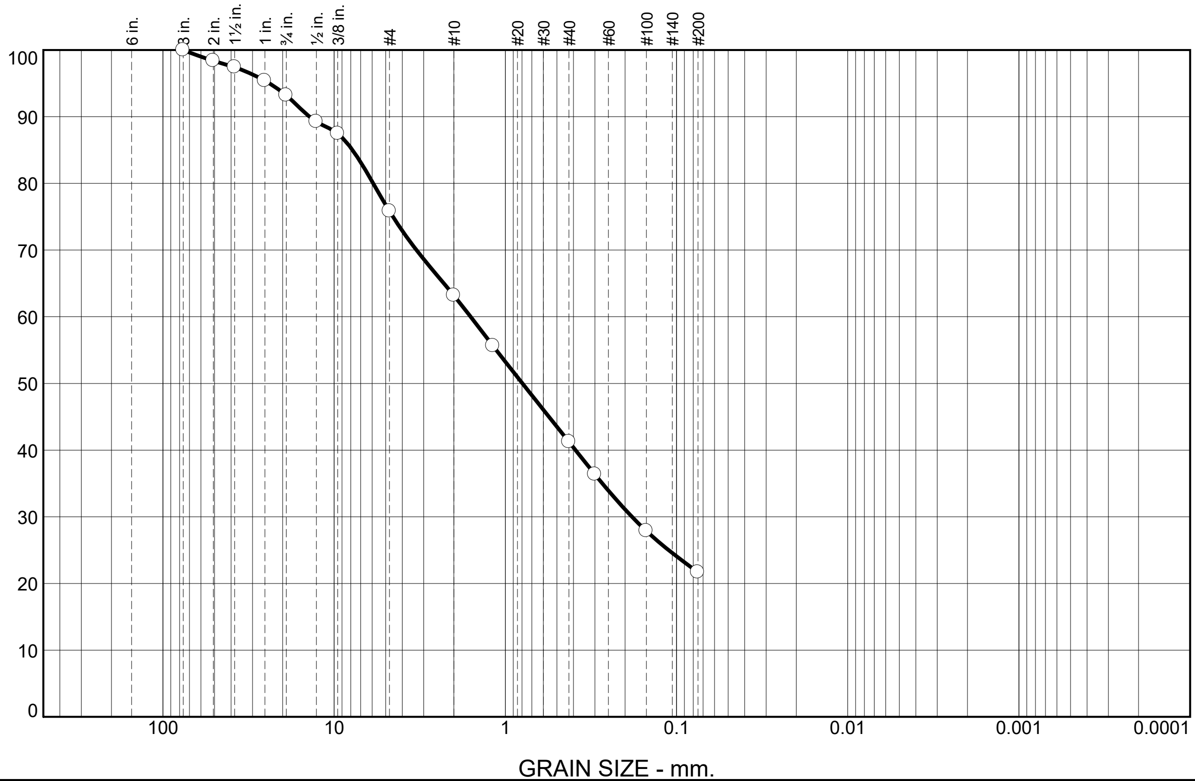
Location: TP22-15
Sample Number: 22-185-08 **Depth:** 2-3' **Date:** 8/23/2022

NewFields

Client: South 32
Project: Hermosa
Project No: 475.0014.033 **Figure** 22-185-08

Tested By: AR **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	6.8	17.4	12.6	22.0	19.5	21.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100.0		
2"	98.4		
1.5"	97.4		
1"	95.4		
.75"	93.2		
.5"	89.2		
.375"	87.5		
#4	75.8		
#10	63.2		
#16	55.6		
#40	41.2		
#50	36.4		
#100	27.9		
#200	21.7		

* (no specification provided)

Soil Description

Red

Atterberg Limits

PL= - LL= - PI= -

Coefficients

D_{90}= 13.9305 D_{85}= 7.8040 D_{60}= 1.5952
D_{50}= 0.7945 D_{30}= 0.1821 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

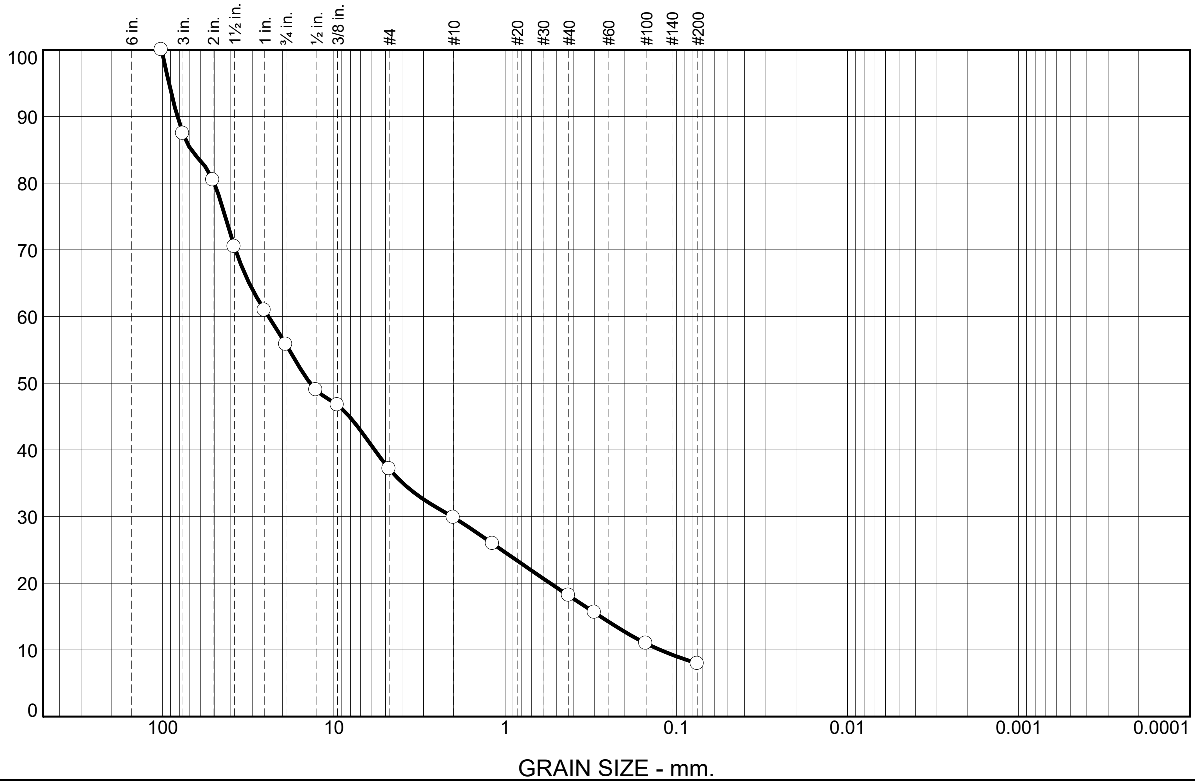
Location: TP22-15
Sample Number: 22-185-09 **Depth:** 4-5' **Date:** 8/23/2022

NewFields

Client: South 32
Project: Hermosa
Project No: 475.0014.033 **Figure** 22-185-09

Tested By: AR **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
12.6	31.6	18.7	7.3	11.7	10.2	7.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
4"	100.0		
3"	87.4		
2"	80.4		
1.5"	70.5		
1"	60.9		
.75"	55.8		
.5"	49.0		
.375"	46.7		
#4	37.1		
#10	29.8		
#16	25.9		
#40	18.1		
#50	15.6		
#100	10.9		
#200	7.9		

* (no specification provided)

Soil Description

Brown

Atterberg Limits

PL= - LL= - PI= -

Coefficients

D_{90}= 82.1686 D_{85}= 68.1806 D_{60}= 24.1085
D_{50}= 13.7621 D_{30}= 2.0456 D_{15}= 0.2768
D_{10}= 0.1245 C_u= 193.57 C_c= 1.39

Classification

USCS= AASHTO=

Remarks

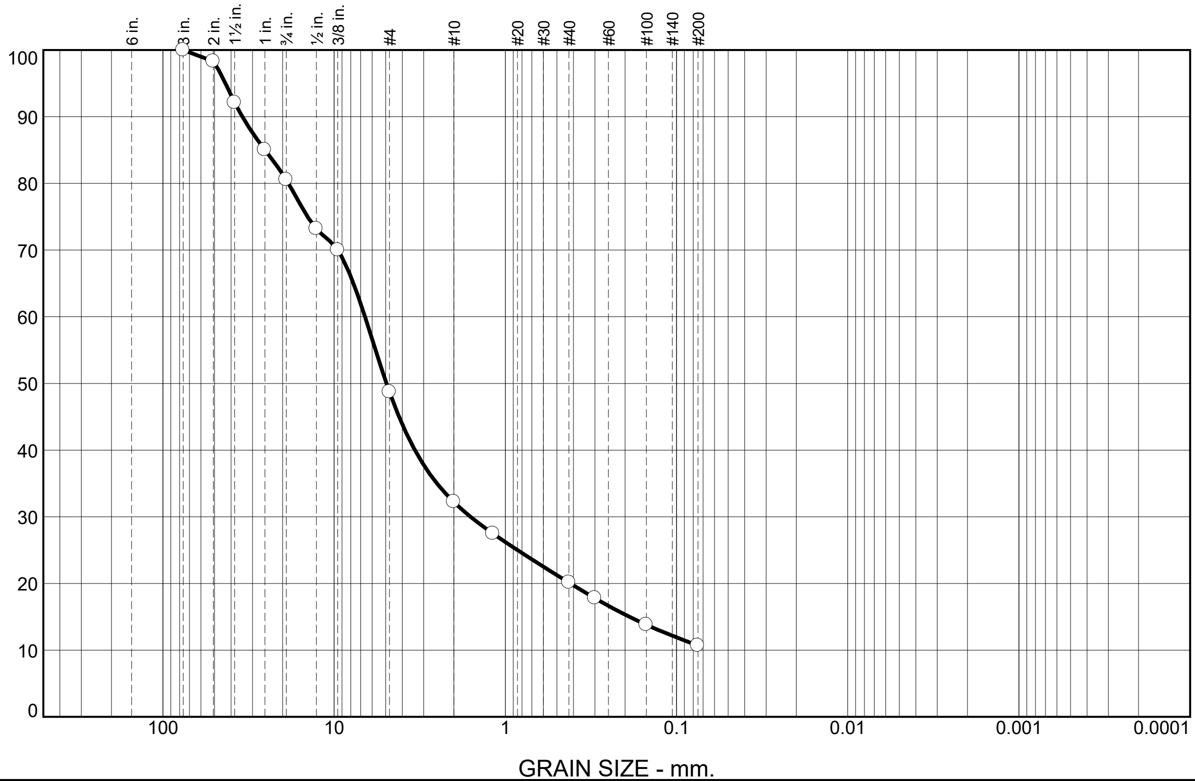
Location: TP22-15
Sample Number: 22-185-10 **Depth:** 14-15' **Date:** 8/23/2022

NewFields

Client: South 32
Project: Hermosa
Project No: 475.0014.033 **Figure** 22-185-10

Tested By: AR **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	19.5	31.8	16.5	12.1	9.4	10.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100.0		
2"	98.3		
1.5"	92.1		
1"	85.0		
.75"	80.5		
.5"	73.2		
.375"	70.0		
#4	48.7		
#10	32.2		
#16	27.5		
#40	20.1		
#50	17.8		
#100	13.8		
#200	10.7		

* (no specification provided)

Soil Description

Brown

Atterberg Limits

PL= - LL= - PI= -

Coefficients

D_{90}= 34.3979 D_{85}= 25.3487 D_{60}= 6.6000
D_{50}= 4.9479 D_{30}= 1.5971 D_{15}= 0.1885
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

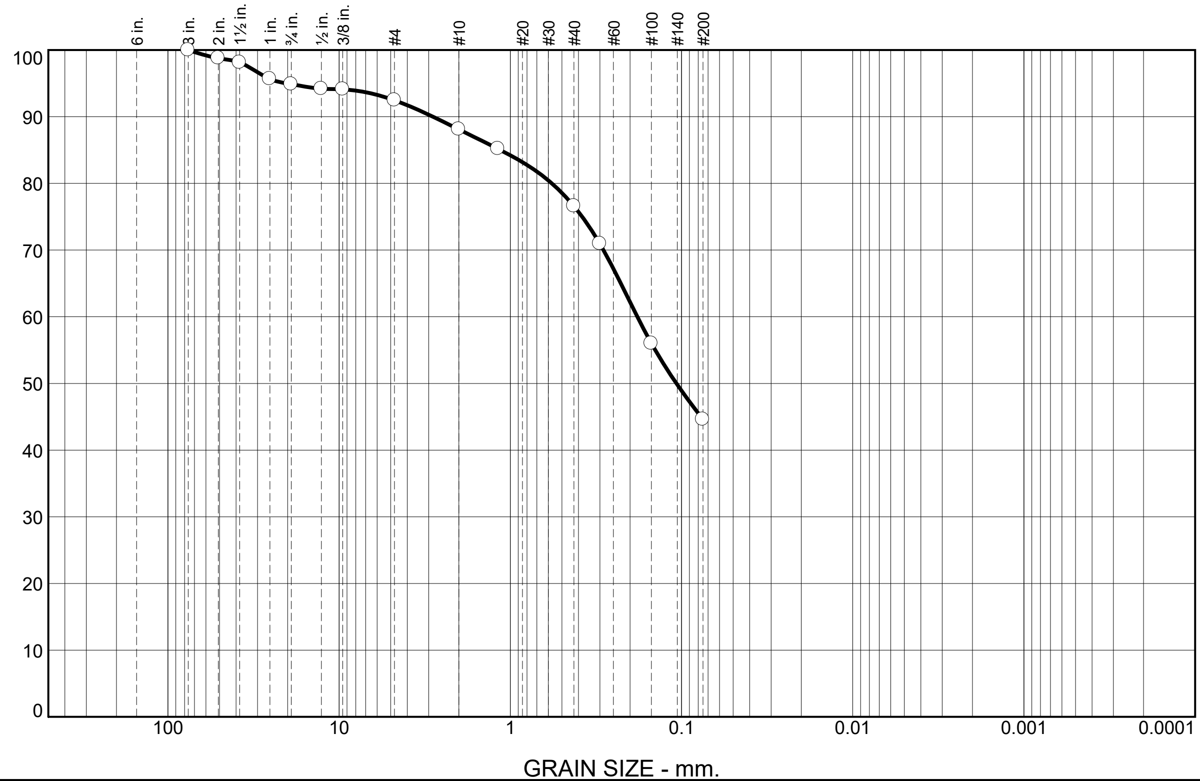
Location: TP22-16
Sample Number: 22-185-11 **Depth:** 1-2' **Date:** 8/23/2022

NewFields

Client: South 32
Project: Hermosa
Project No: 475.0014.033 **Figure** 22-185-11

Tested By: AR **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	5.1	2.4	4.4	11.5	32.0	44.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100.0		
2"	98.8		
1.5"	98.1		
1"	95.7		
.75"	94.9		
.5"	94.2		
.375"	94.1		
#4	92.5		
#10	88.1		
#16	85.2		
#40	76.6		
#50	70.9		
#100	56.0		
#200	44.6		

* (no specification provided)

Soil Description

Brown clayey sand

Atterberg Limits

PL= 17 LL= 39 PI= 22

Coefficients

D_{90}= 2.8322 D_{85}= 1.1442 D_{60}= 0.1811
D_{50}= 0.1072 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO= A-6(6)

Remarks

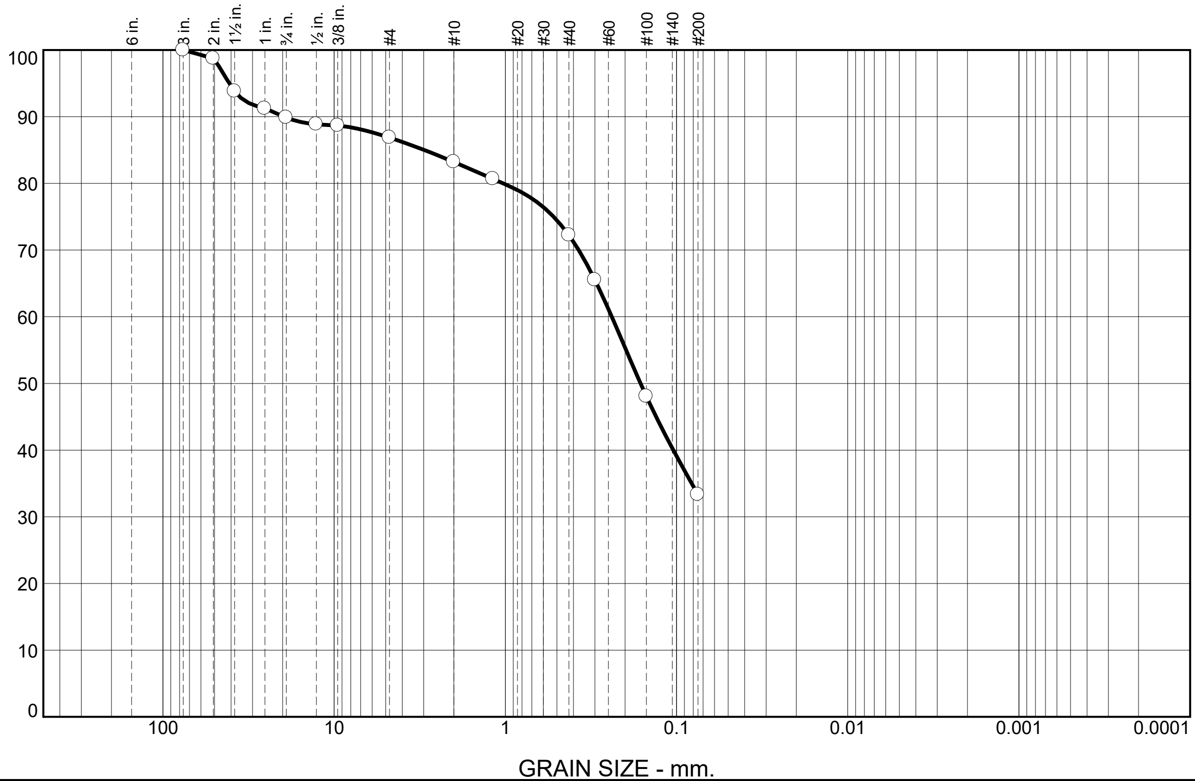
Location: TP22-17
Sample Number: 22-185-12 **Depth:** 0-1' **Date:** 8/23/2022

NewFields

Client: South 32
Project: Hermosa
Project No: 475.0014.033 **Figure** 22-185-12

Tested By: AR **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	10.1	3.0	3.7	11.0	38.9	33.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100.0		
2"	98.8		
1.5"	93.8		
1"	91.2		
.75"	89.9		
.5"	88.9		
.375"	88.7		
#4	86.9		
#10	83.2		
#16	80.7		
#40	72.2		
#50	65.5		
#100	48.1		
#200	33.3		

* (no specification provided)

Soil Description

Brown clayey sand

Atterberg Limits

PL= 20 LL= 30 PI= 10

Coefficients

D_{90}= 19.5949 D_{85}= 2.9762 D_{60}= 0.2389
D_{50}= 0.1623 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO= A-2-4(0)

Remarks

Location: TP22-18
Sample Number: 22-185-13 **Depth:** 0-1' **Date:** 8/25/2022

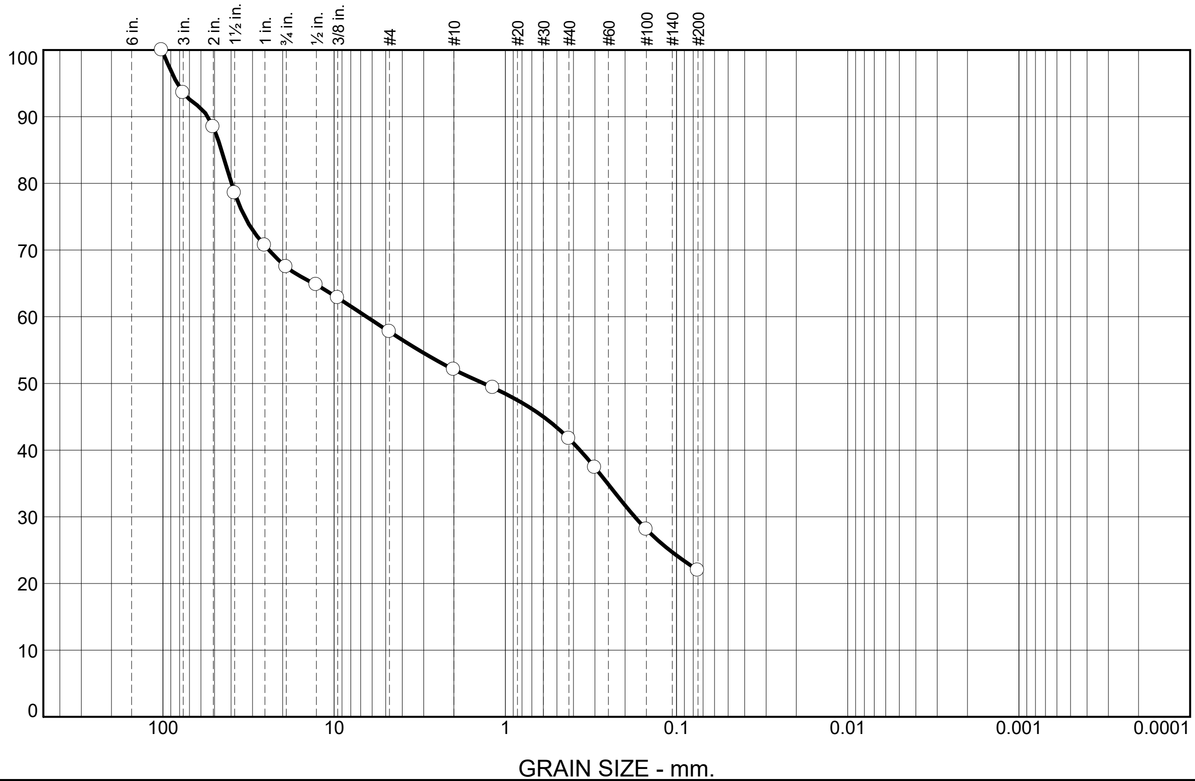
NewFields

Client: South 32
Project: Hermosa

Project No: 475.0014.033 **Figure** 22-185-13

Tested By: AR/ZM **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
6.4	26.1	9.7	5.7	10.4	19.7	22.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
4"	100.0		
3"	93.6		
2"	88.5		
1.5"	78.6		
1"	70.7		
.75"	67.5		
.5"	64.8		
.375"	62.8		
#4	57.8		
#10	52.1		
#16	49.3		
#40	41.7		
#50	37.4		
#100	28.1		
#200	22.0		

* (no specification provided)

Soil Description

Brown clayey gravel with sand

Atterberg Limits

PL= 17 LL= 37 PI= 20

Coefficients

D_{90}= 54.6048 D_{85}= 45.5239 D_{60}= 6.4575
D_{50}= 1.3398 D_{30}= 0.1754 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= GC AASHTO= A-2-6(1)

Remarks

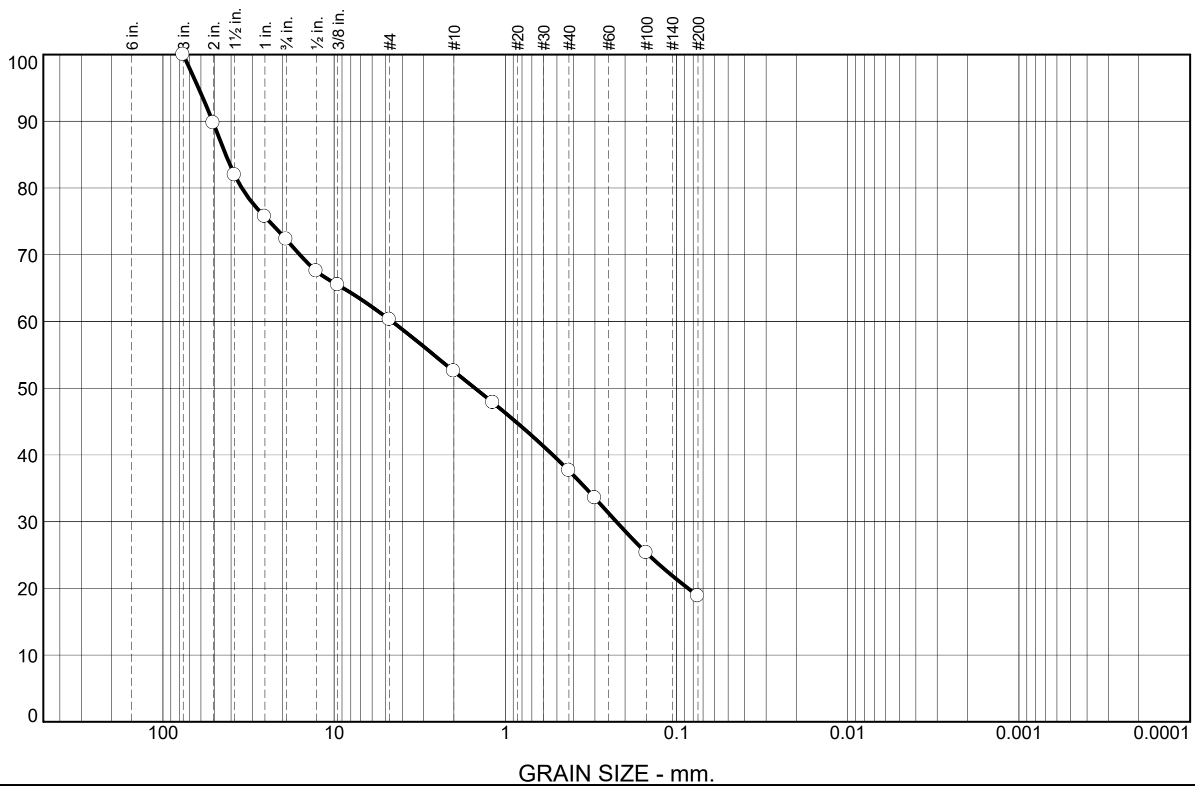
Location: TP22-19
Sample Number: 22-185-14 **Depth:** 0-1' **Date:** 8/25/2022

NewFields

Client: South 32
Project: Hermosa
Project No: 475.0014.033 **Figure** 22-185-14

Tested By: AR/ZM **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	27.7	12.0	7.8	14.9	18.8	18.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100.0		
2"	89.8		
1.5"	81.9		
1"	75.7		
.75"	72.3		
.5"	67.5		
.375"	65.5		
#4	60.3		
#10	52.5		
#16	47.8		
#40	37.6		
#50	33.5		
#100	25.3		
#200	18.8		

* (no specification provided)

Soil Description

Dark red

Atterberg Limits

PL= - LL= - PI= -

Coefficients

D_{90}= 51.2448 D_{85}= 42.9596 D_{60}= 4.5908
D_{50}= 1.5060 D_{30}= 0.2247 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

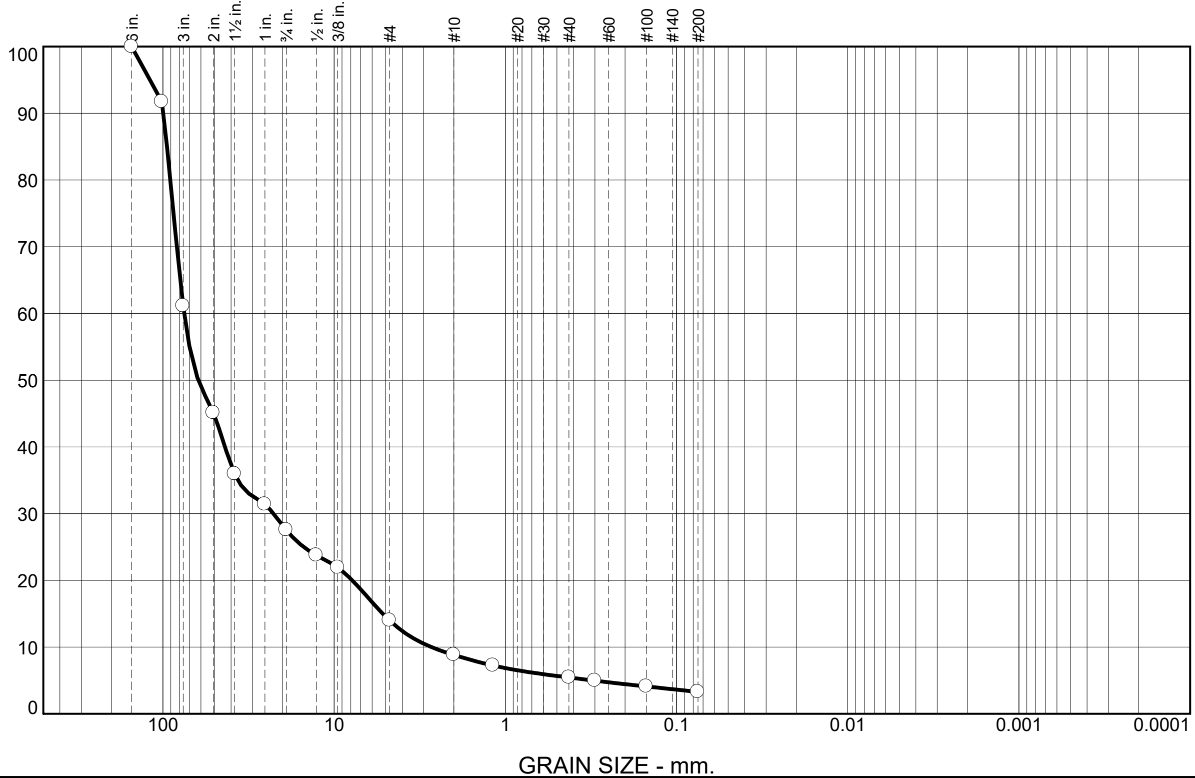
Location: TP22-20
Sample Number: 22-185-15 **Depth:** 1-2' **Date:** 8/25/2022

NewFields

Client: South 32
Project: Hermosa
Project No: 475.0014.033 **Figure** 22-185-15

Tested By: AR/ZM **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
38.9	33.6	13.5	5.2	3.4	2.1	3.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
6"	100.0		
4"	91.7		
3"	61.1		
2"	45.1		
1.5"	35.9		
1"	31.4		
.75"	27.5		
.5"	23.8		
.375"	21.9		
#4	14.0		
#10	8.8		
#16	7.2		
#40	5.4		
#50	5.0		
#100	4.1		
#200	3.3		

* (no specification provided)

Soil Description

Brown

Atterberg Limits

PL= - LL= - PI= -

Coefficients

D_{90}= 99.6009 D_{85}= 94.7264 D_{60}= 75.2010
D_{50}= 62.1999 D_{30}= 22.6216 D_{15}= 5.2027
D_{10}= 2.7082 C_u= 27.77 C_c= 2.51

Classification

USCS= AASHTO=

Remarks

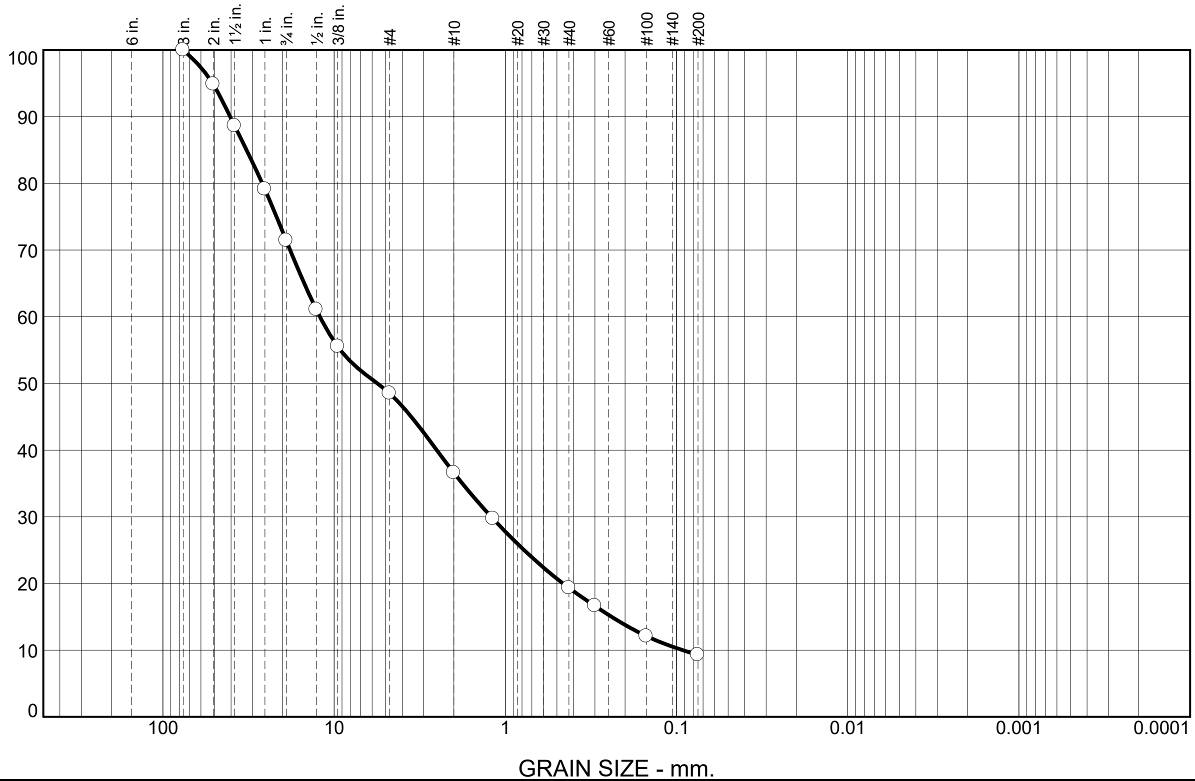
Location: TP22-22
Sample Number: 22-185-19 **Depth:** 1-2' **Date:** 8/25/2022

NewFields

Client: South 32
Project: Hermosa
Project No: 475.0014.033 **Figure** 22-185-19

Tested By: AR **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	28.6	22.9	11.9	17.3	10.0	9.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100.0		
2"	94.8		
1.5"	88.6		
1"	79.1		
.75"	71.4		
.5"	61.1		
.375"	55.5		
#4	48.5		
#10	36.6		
#16	29.7		
#40	19.3		
#50	16.6		
#100	12.1		
#200	9.3		

* (no specification provided)

Soil Description

Light brown well-graded gravel with clay and sand

Atterberg Limits

PL= 13 LL= 21 PI= 8

Coefficients

D_{90}= 40.4510 D_{85}= 32.5156 D_{60}= 12.1045
D_{50}= 5.5792 D_{30}= 1.2083 D_{15}= 0.2393
D_{10}= 0.0922 C_u= 131.24 C_c= 1.31

Classification

USCS= GW-GC AASHTO= A-2-4(0)

Remarks

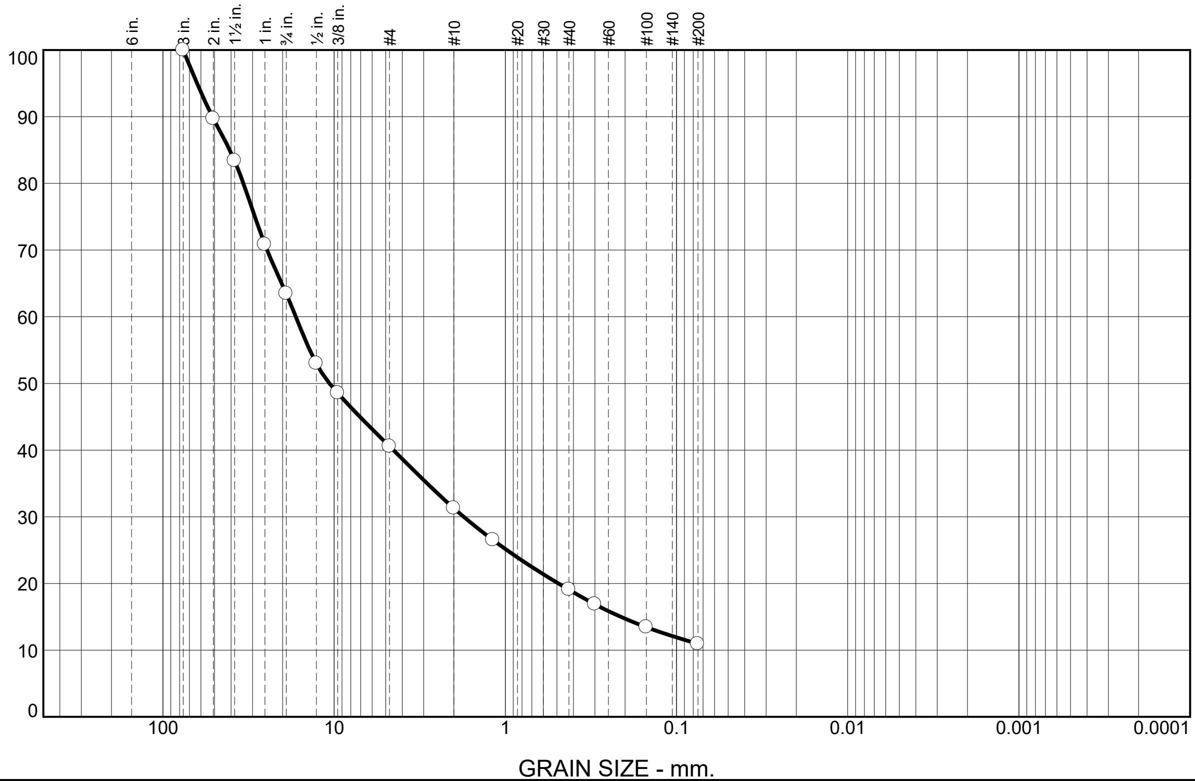
Location: TP22-26
Sample Number: 22-185-20 **Depth:** 0-1' **Date:** 8/25/2022

NewFields

Client: South 32
Project: Hermosa
Project No: 475.0014.033 **Figure** 22-185-20

Tested By: ZM **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	36.5	22.9	9.3	12.2	8.2	10.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100.0		
2"	89.7		
1.5"	83.4		
1"	70.8		
.75"	63.5		
.5"	53.0		
.375"	48.5		
#4	40.6		
#10	31.3		
#16	26.5		
#40	19.1		
#50	16.9		
#100	13.4		
#200	10.9		

* (no specification provided)

Soil Description

Light brown

Atterberg Limits

PL= - LL= - PI= -

Coefficients

D_{90}= 51.4466 D_{85}= 40.6942 D_{60}= 16.7534
D_{50}= 10.6471 D_{30}= 1.7519 D_{15}= 0.2119
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

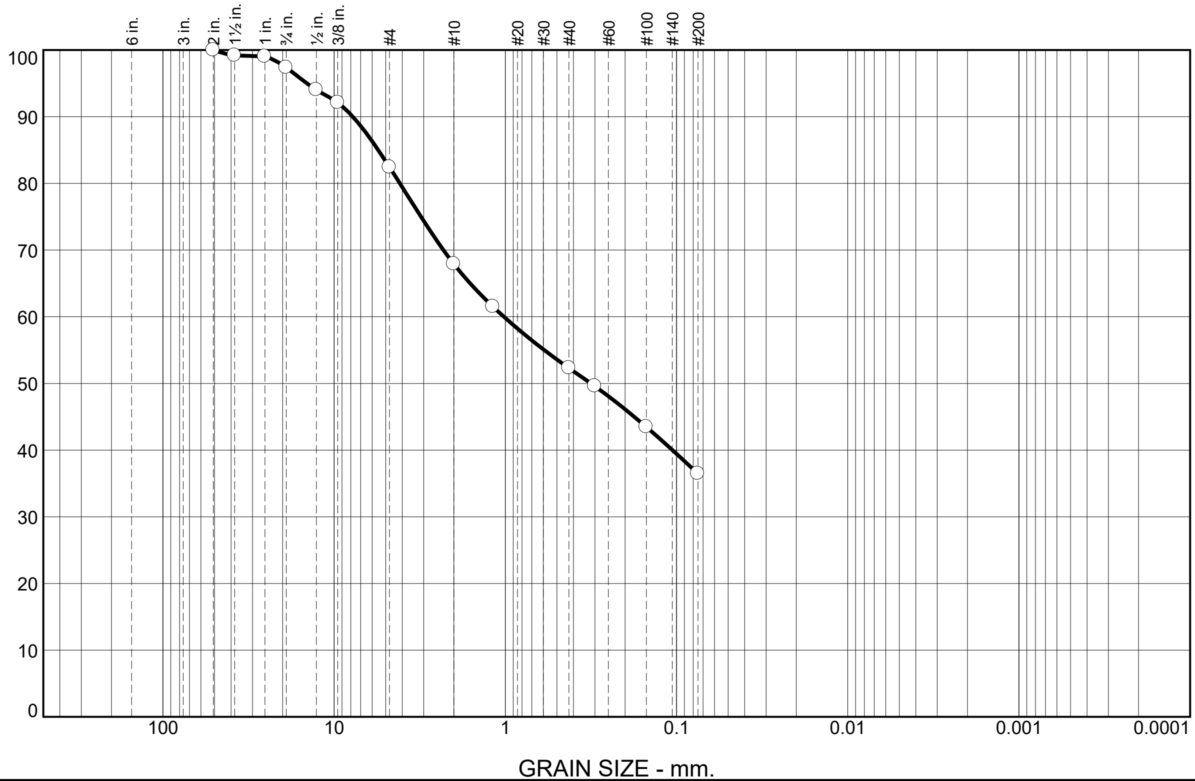
Location: TP22-27
Sample Number: 22-185-21 **Depth:** 0-1' **Date:** 8/25/2022

NewFields

Client: South 32
Project: Hermosa
Project No: 475.0014.033 **Figure** 22-185-21

Tested By: ZM **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	2.6	15.0	14.5	15.6	15.8	36.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2"	100.0		
1.5"	99.2		
1"	99.0		
.75"	97.4		
.5"	94.0		
.375"	92.1		
#4	82.4		
#10	67.9		
#16	61.5		
#40	52.3		
#50	49.6		
#100	43.5		
#200	36.5		

* (no specification provided)

Soil Description

Brown clayey sand with gravel

Atterberg Limits

PL= 17 LL= 32 PI= 15

Coefficients

D_{90}= 7.7704 D_{85}= 5.5262 D_{60}= 1.0194
D_{50}= 0.3164 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO= A-6(1)

Remarks

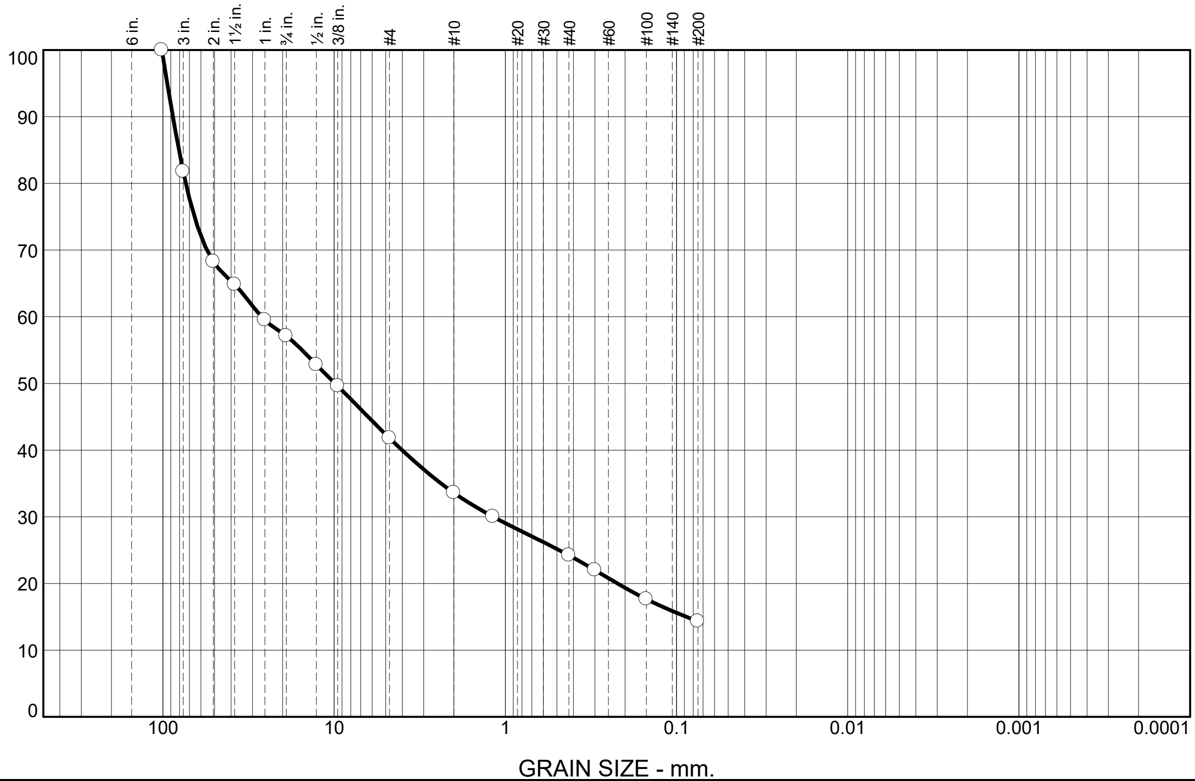
Location: TP22-29
Sample Number: 22-185-22 **Depth:** 0-4' **Date:** 8/25/2022

NewFields

Client: South 32
Project: Hermosa
Project No: 475.0014.033 **Figure** 22-185-22

Tested By: ZM **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
18.2	24.7	15.3	8.2	9.4	9.9	14.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
4"	100.0		
3"	81.8		
2"	68.3		
1.5"	64.8		
1"	59.5		
.75"	57.1		
.5"	52.8		
.375"	49.6		
#4	41.8		
#10	33.6		
#16	30.0		
#40	24.2		
#50	22.0		
#100	17.6		
#200	14.3		

* (no specification provided)

Soil Description

Brown

Atterberg Limits

PL= - LL= - PI= -

Coefficients

D_{90}= 87.5517 D_{85}= 80.7286 D_{60}= 26.5424
D_{50}= 9.8663 D_{30}= 1.1769 D_{15}= 0.0876
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

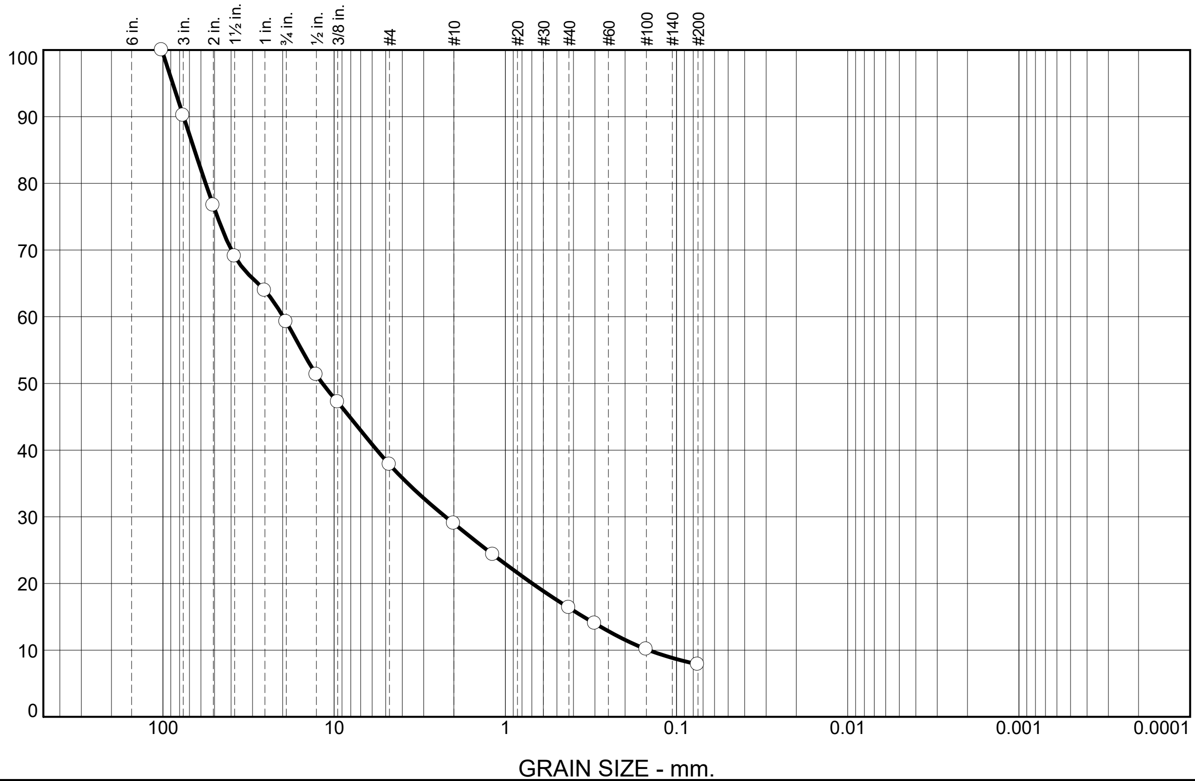
Location: TP22-30
Sample Number: 22-185-23 **Depth:** 2-3' **Date:** 8/25/2022

NewFields

Client: South 32
Project: Hermosa
Project No: 475.0014.033 **Figure** 22-185-23

Tested By: ZM **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
9.8	31.0	21.4	8.8	12.7	8.5	7.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
4"	100.0		
3"	90.2		
2"	76.7		
1.5"	69.1		
1"	63.9		
.75"	59.2		
.5"	51.3		
.375"	47.2		
#4	37.8		
#10	29.0		
#16	24.3		
#40	16.3		
#50	14.0		
#100	10.1		
#200	7.8		

* (no specification provided)

Soil Description

Dark brown

Atterberg Limits

PL= - LL= - PI= -

Coefficients

D_{90}= 75.7812 D_{85}= 65.4606 D_{60}= 19.8320
D_{50}= 11.6980 D_{30}= 2.2360 D_{15}= 0.3493
D_{10}= 0.1461 C_u= 135.79 C_c= 1.73

Classification

USCS= AASHTO=

Remarks

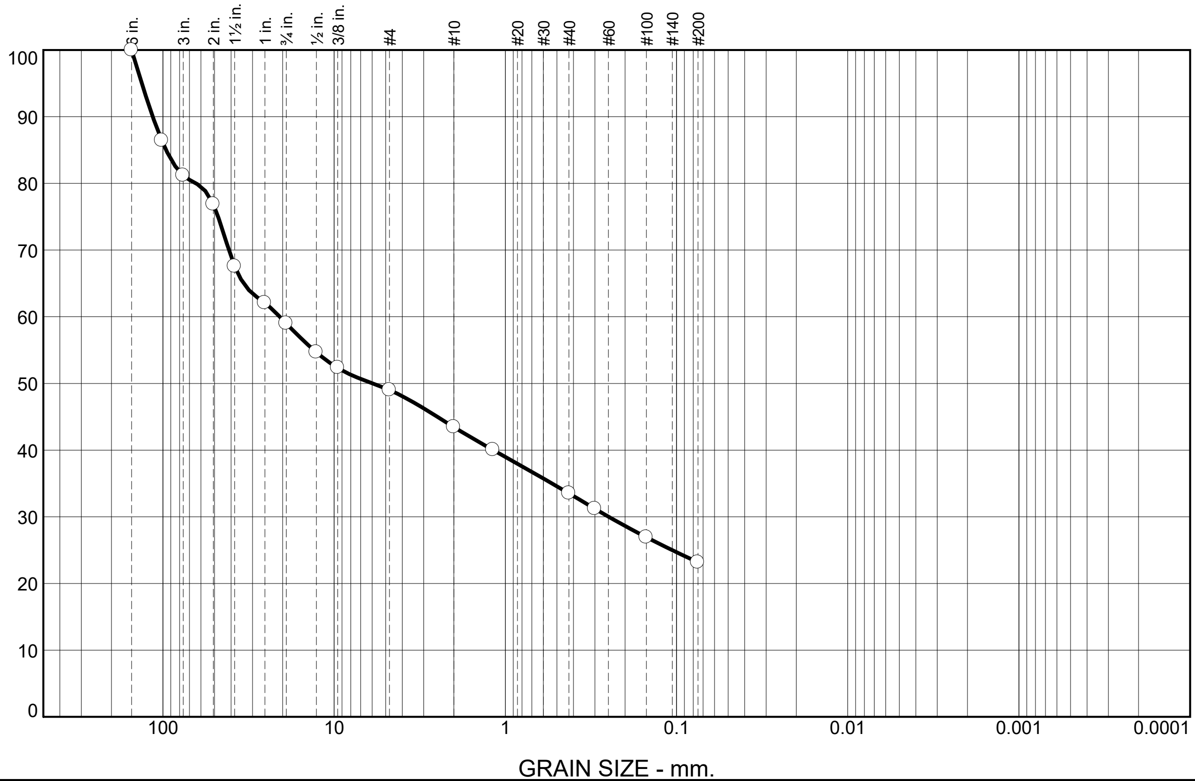
Location: TP22-32
Sample Number: 22-185-24 **Depth:** 1-2' **Date:** 8/25/2022

NewFields

Client: South 32
Project: Hermosa
Project No: 475.0014.033 **Figure** 22-185-24

Tested By: ZM **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
18.8	22.2	10.0	5.5	10.0	10.3	23.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
6"	100.0		
4"	86.4		
3"	81.2		
2"	76.9		
1.5"	67.6		
1"	62.1		
.75"	59.0		
.5"	54.7		
.375"	52.3		
#4	49.0		
#10	43.5		
#16	40.0		
#40	33.5		
#50	31.2		
#100	26.9		
#200	23.2		

* (no specification provided)

Soil Description

Brown

Atterberg Limits

PL= - LL= - PI= -

Coefficients

D_{90}= 114.8530 D_{85}= 95.9347 D_{60}= 20.7968
D_{50}= 5.9530 D_{30}= 0.2491 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Location: TP22-33
Sample Number: 22-185-25 **Depth:** 1-2' **Date:** 8/25/2022

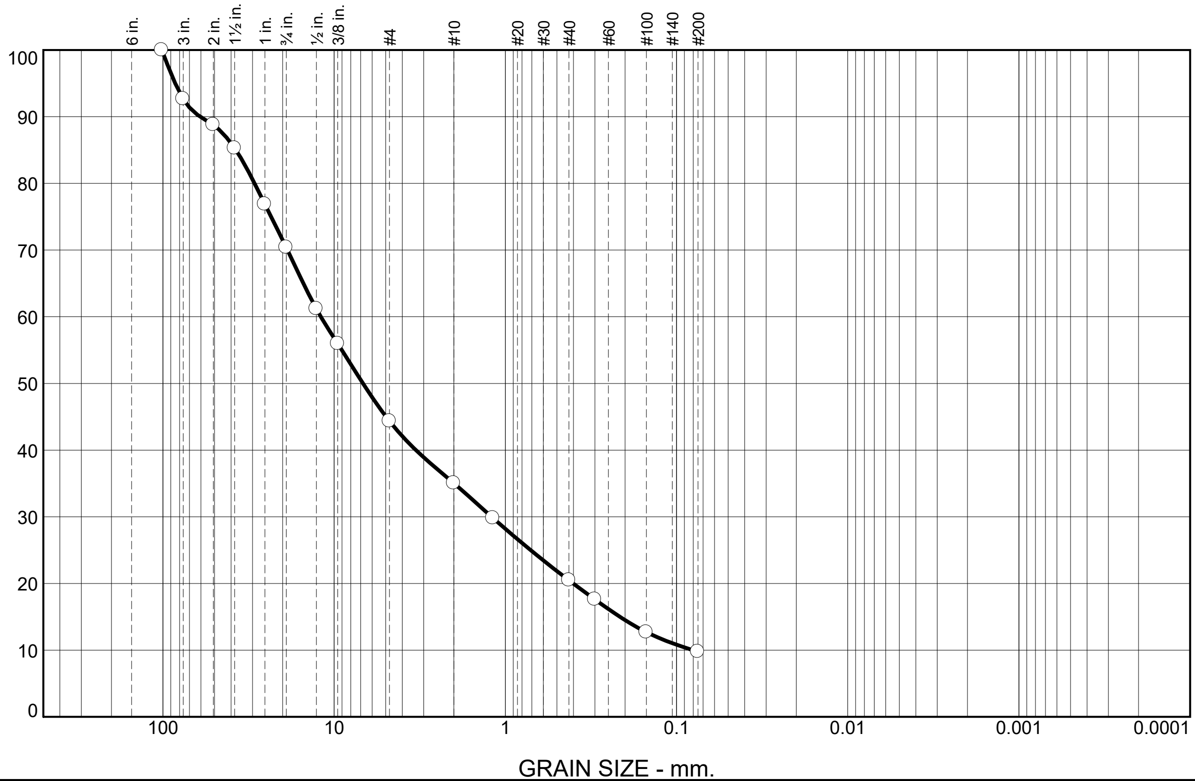
NewFields

Client: South 32
Project: Hermosa

Project No: 475.0014.033 **Figure** 22-185-25

Tested By: ZM **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
7.3	22.3	26.1	9.3	14.5	10.8	9.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
4"	100.0		
3"	92.7		
2"	88.8		
1.5"	85.3		
1"	76.9		
.75"	70.4		
.5"	61.2		
.375"	56.0		
#4	44.3		
#10	35.0		
#16	29.8		
#40	20.5		
#50	17.6		
#100	12.7		
#200	9.7		

* (no specification provided)

Soil Description

Brown

Atterberg Limits

PL= - LL= - PI= -

Coefficients

D_{90}= 60.5363 D_{85}= 37.4671 D_{60}= 11.9543
D_{50}= 6.7800 D_{30}= 1.2028 D_{15}= 0.2141
D_{10}= 0.0805 C_u= 148.58 C_c= 1.50

Classification

USCS= AASHTO=

Remarks

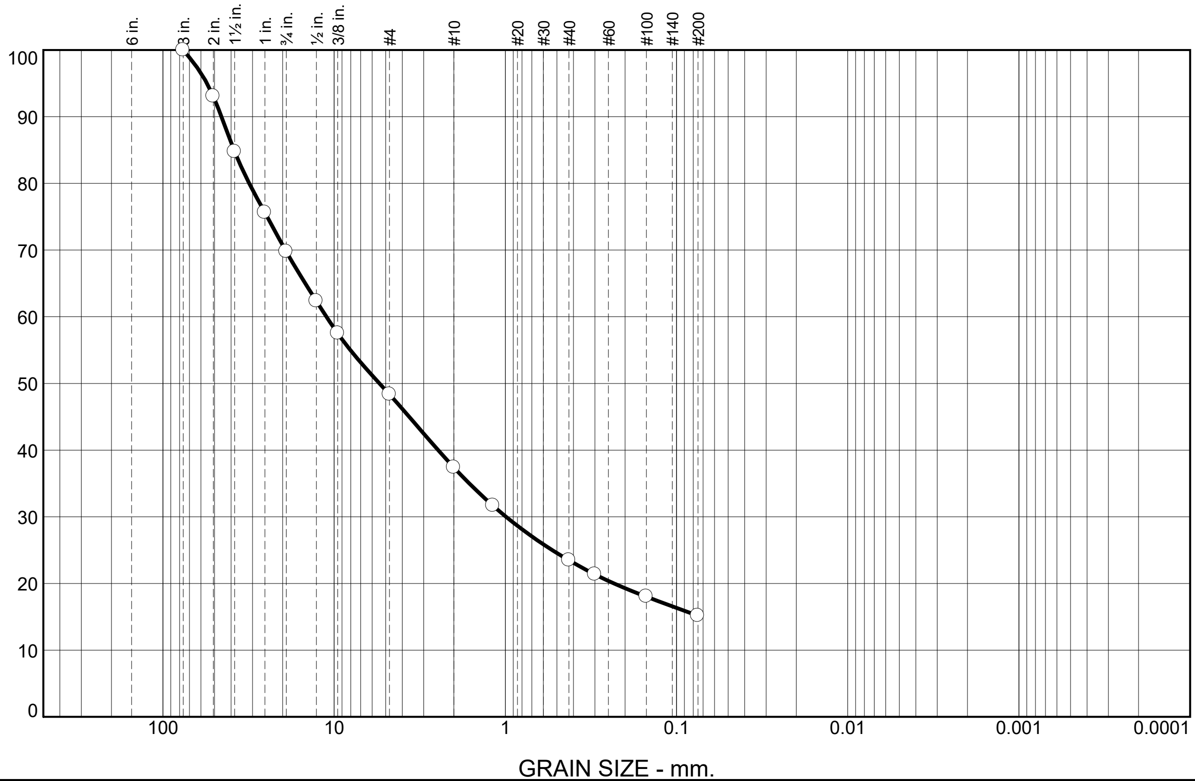
Location: TP22-34
Sample Number: 22-185-26 **Depth:** 1-2' **Date:** 8/26/2022

NewFields

Client: South 32
Project: Hermosa
Project No: 475.0014.033 **Figure** 22-185-26

Tested By: ZM **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	30.2	21.5	10.9	13.9	8.3	15.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100.0		
2"	93.1		
1.5"	84.8		
1"	75.6		
.75"	69.8		
.5"	62.4		
.375"	57.5		
#4	48.3		
#10	37.4		
#16	31.7		
#40	23.5		
#50	21.4		
#100	18.0		
#200	15.2		

* (no specification provided)

Soil Description

Light brown

Atterberg Limits

PL= - LL= - PI= -

Coefficients

D_{90}= 45.4781 D_{85}= 38.4402 D_{60}= 11.0871
D_{50}= 5.4350 D_{30}= 0.9903 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Location: TP22-35
Sample Number: 22-185-27 **Depth:** .5-1.5' **Date:** 8/26/2022

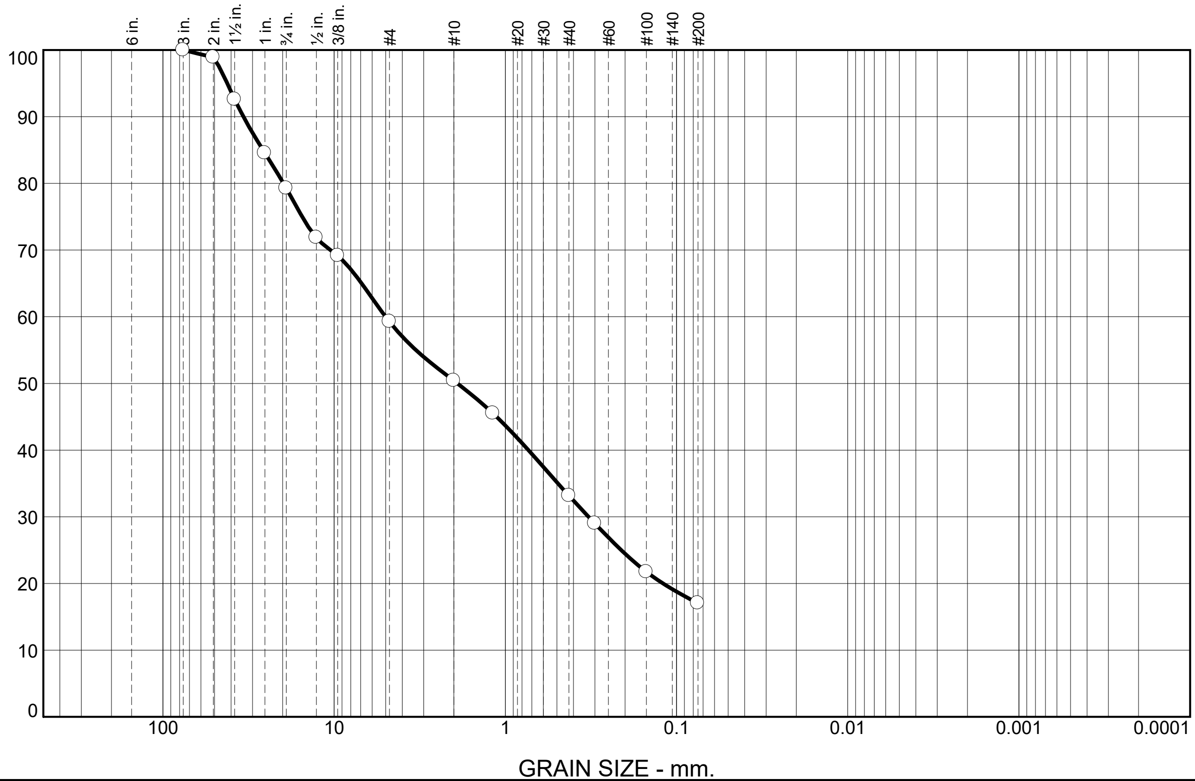
NewFields

Client: South 32
Project: Hermosa

Project No: 475.0014.033 **Figure** 22-185-27

Tested By: ZM **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	20.7	20.0	8.9	17.2	16.2	17.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100.0		
2"	98.9		
1.5"	92.6		
1"	84.5		
.75"	79.3		
.5"	71.9		
.375"	69.2		
#4	59.3		
#10	50.4		
#16	45.5		
#40	33.2		
#50	29.0		
#100	21.7		
#200	17.0		

* (no specification provided)

Soil Description

Dark brown

Atterberg Limits

PL= - LL= - PI= -

Coefficients

D_{90}= 33.9103 D_{85}= 26.0575 D_{60}= 5.0025
D_{50}= 1.9068 D_{30}= 0.3268 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

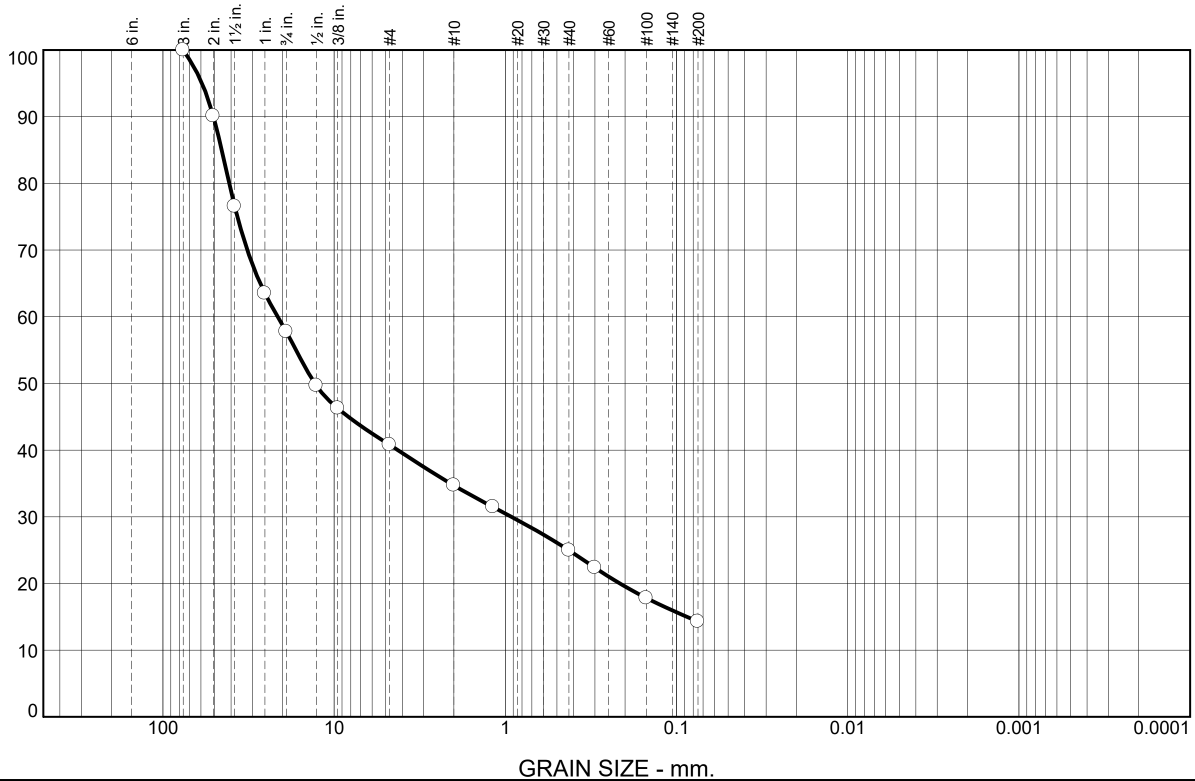
Location: TP22-36
Sample Number: 22-185-16 **Depth:** 2-3' **Date:** 8/25/2022

NewFields

Client: South 32
Project: Hermosa
Project No: 475.0014.033 **Figure** 22-185-16

Tested By: ZM **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	42.2	17.0	6.1	9.7	10.7	14.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100.0		
2"	90.1		
1.5"	76.6		
1"	63.5		
.75"	57.8		
.5"	49.7		
.375"	46.3		
#4	40.8		
#10	34.7		
#16	31.5		
#40	25.0		
#50	22.4		
#100	17.8		
#200	14.3		

* (no specification provided)

Soil Description

Brown clayey gravel with sand

Atterberg Limits

PL= 15 LL= 33 PI= 18

Coefficients

D_{90}= 50.6504 D_{85}= 45.3388 D_{60}= 21.3665
D_{50}= 12.9649 D_{30}= 0.9226 D_{15}= 0.0871
D_{10}= C_u= C_c=

Classification

USCS= GC AASHTO= A-2-6(0)

Remarks

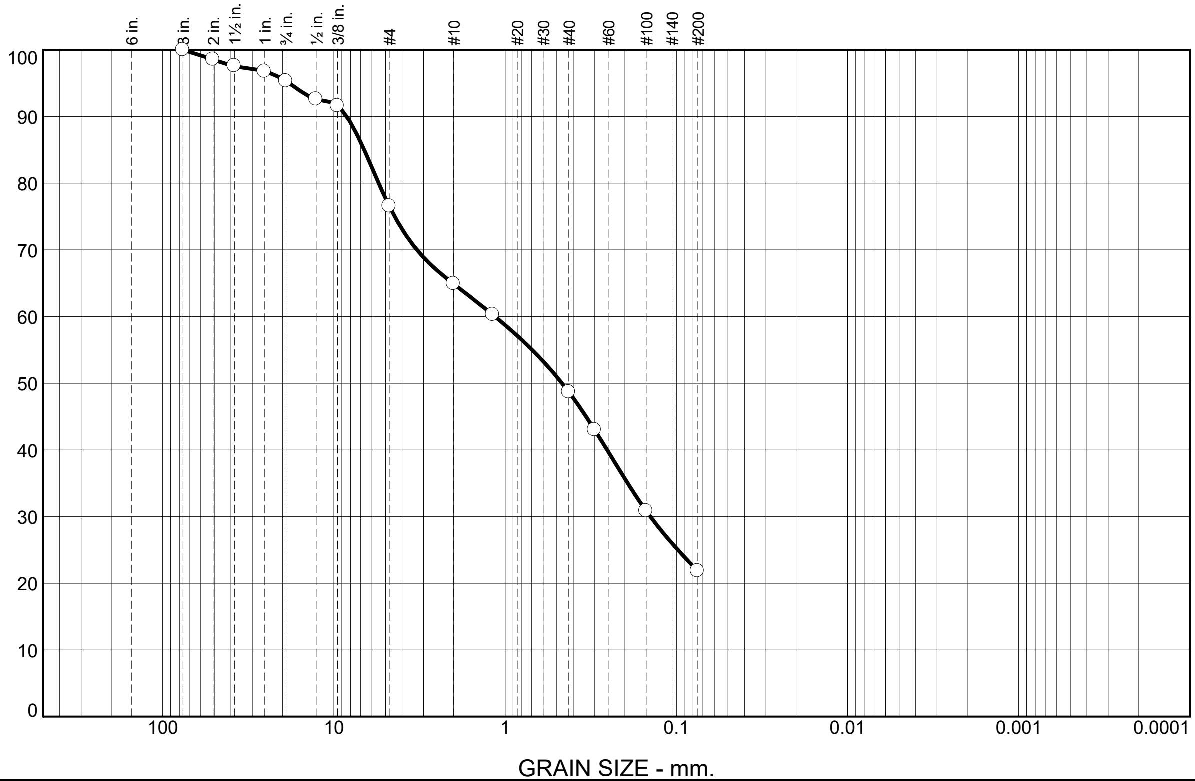
Location: TP22-37
Sample Number: 22-185-17 **Depth:** 0-1' **Date:** 8/25/2022

NewFields

Client: South 32
Project: Hermosa
Project No: 475.0014.033 **Figure** 22-185-17

Tested By: ZM **Checked By:** JW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	4.7	18.8	11.6	16.2	26.9	21.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100.0		
2"	98.5		
1.5"	97.6		
1"	96.8		
.75"	95.3		
.5"	92.6		
.375"	91.6		
#4	76.5		
#10	64.9		
#16	60.3		
#40	48.7		
#50	43.0		
#100	30.8		
#200	21.8		

* (no specification provided)

Soil Description

Brown

Atterberg Limits

PL= - LL= - PI= -

Coefficients

D_{90}= 8.4081 D_{85}= 6.6518 D_{60}= 1.1467
D_{50}= 0.4654 D_{30}= 0.1420 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Location: TP22-39
Sample Number: 22-185-18 **Depth:** 1.5-2.5' **Date:** 8/25/2022

NewFields

Client: South 32
Project: Hermosa
Project No: 475.0014.033 **Figure** 22-185-18

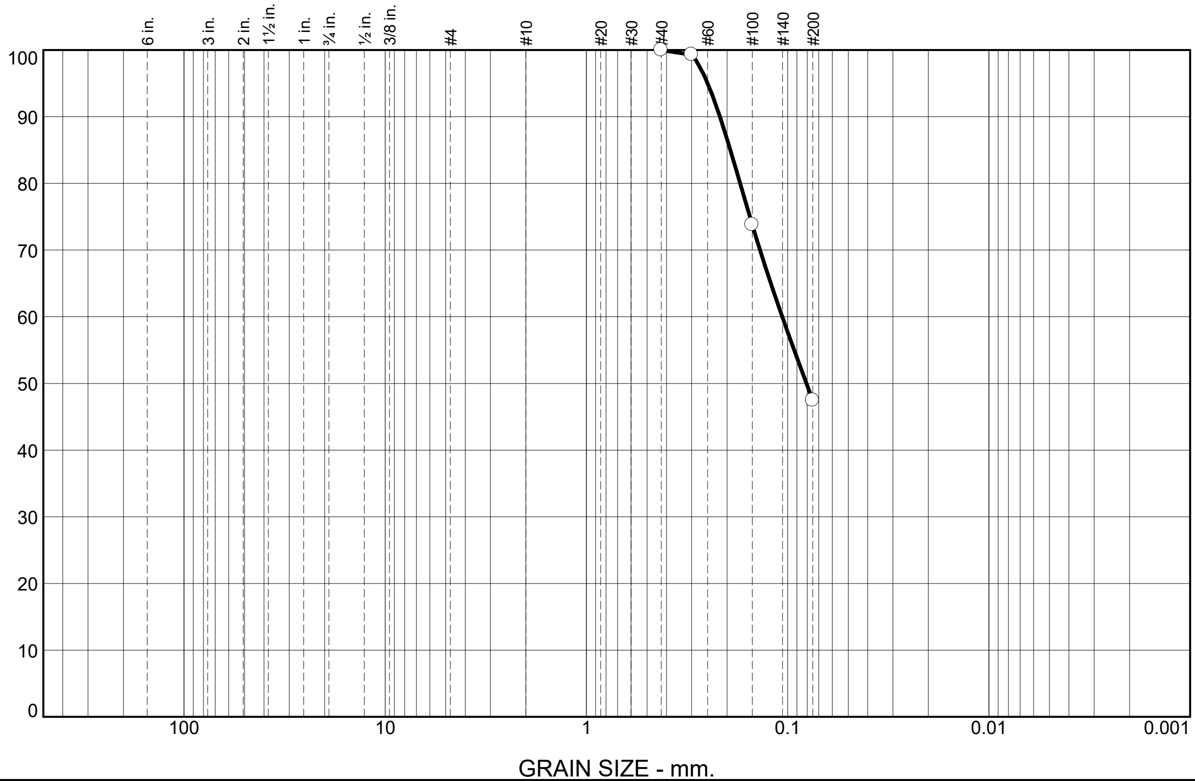
Tested By: AR/ZM **Checked By:** JW

APPENDIX D.5.2

Laboratory Testing Results
Filtered Tailings Samples

NEWFIELDS (2018)

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.0	52.6	47.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#40	100.0		
#50	99.3		
#100	73.8		
#200	47.4		

* (no specification provided)

Material Description

Gray silty sand

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 0.2171 D_{85}= 0.1927 D_{60}= 0.1064
D_{50}= 0.0806 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-4(0)

Remarks

Location: 73703
Sample Number: 18-324-01

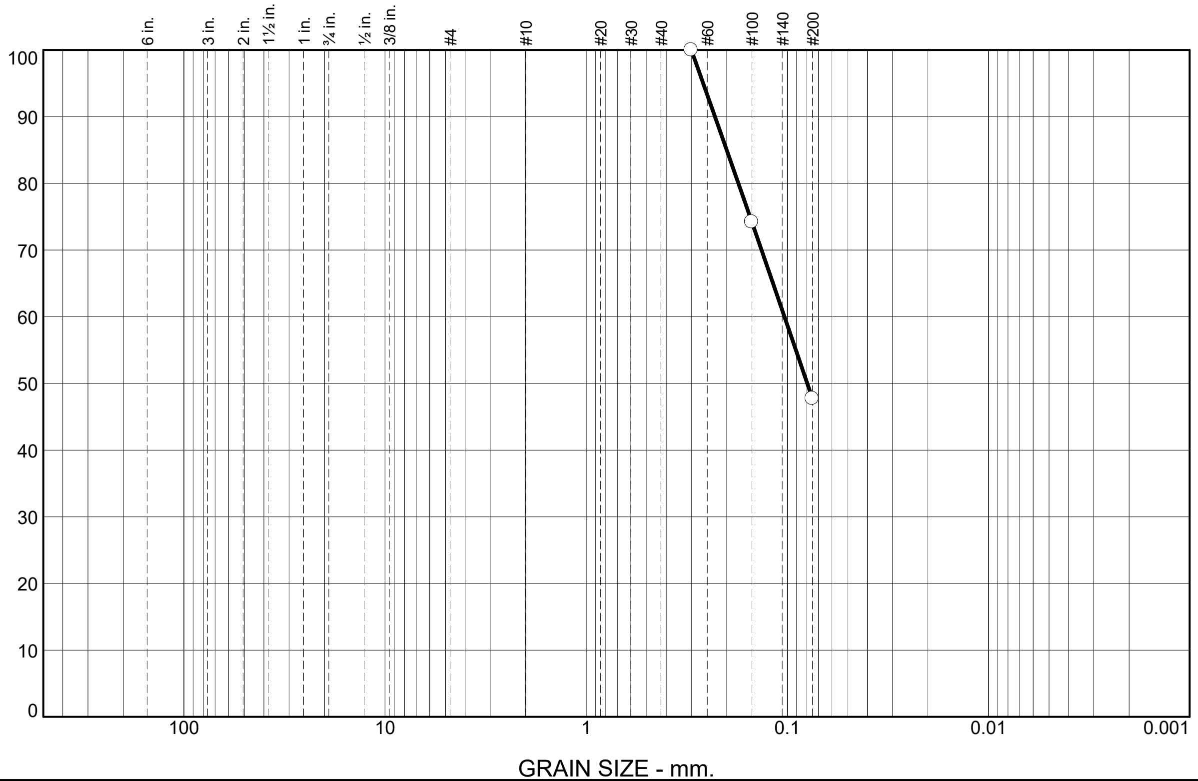
Date: 9/10/2018

NewFields

Client: Arizona Minerals Inc.
Project: Hermosa TSF CQA
Project No: 475.0014.011 **Figure** 18-324-01

Tested By: JH **Checked By:** JH

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.0	52.3	47.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#50	100.0		
#100	74.2		
#200	47.7		

* (no specification provided)

Material Description

Gray silty sand

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 0.2291 D_{85}= 0.2002 D_{60}= 0.1033
D_{50}= 0.0796 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-4(0)

Remarks

Location: 73704
Sample Number: 18-324-02

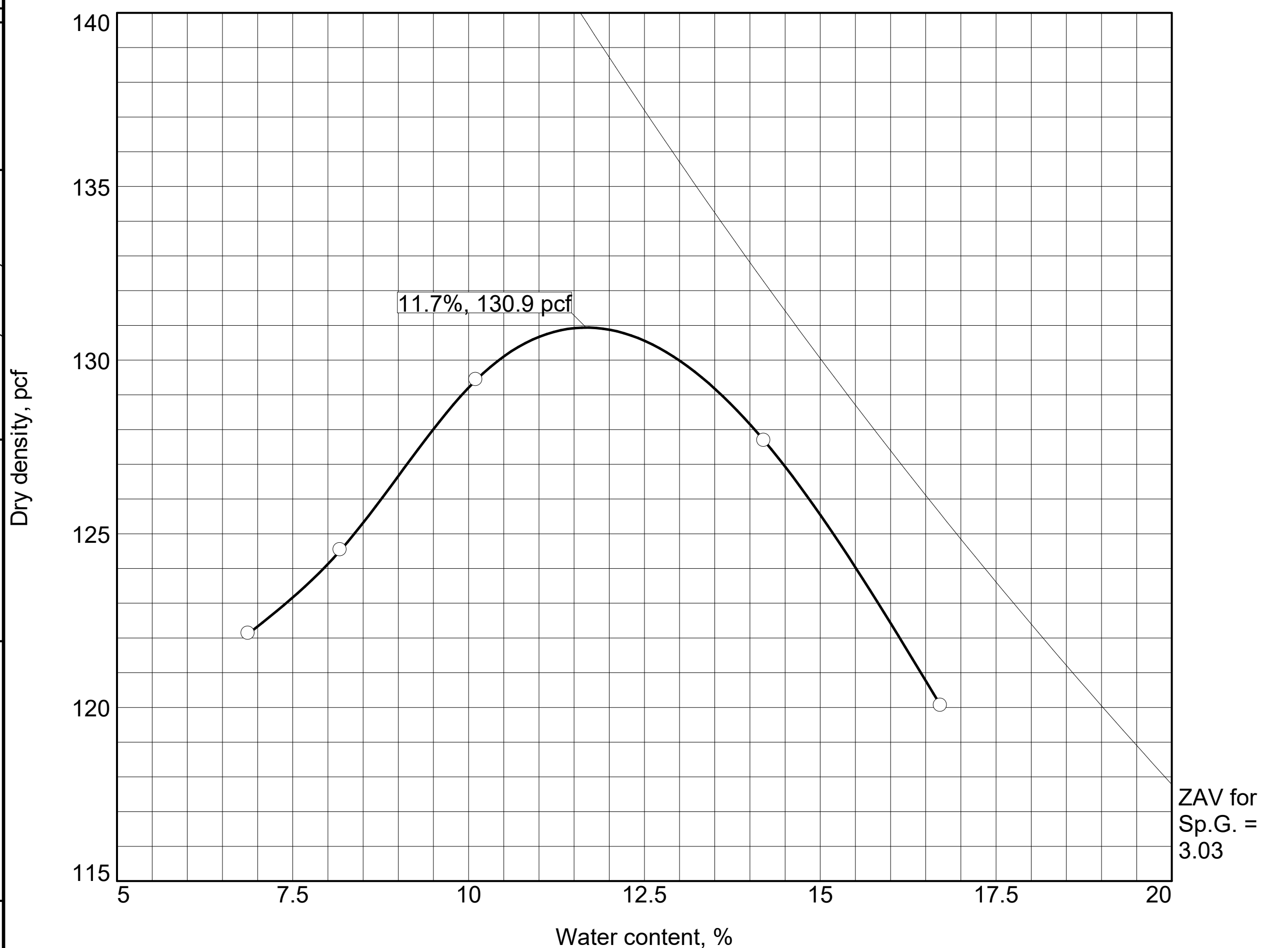
Date: 9/10/2018

NewFields

Client: Arizona Minerals Inc.
Project: Hermosa TSF CQA
Project No: 475.0014.011 **Figure** 18-324-02

Tested By: JH **Checked By:** JH

COMPACTION TEST REPORT



Test specification: ASTM D 698-12 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
	SM	A-4(0)		3.03	NP	NP	0.0	47.7

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 130.9 pcf Optimum moisture = 11.7 %	Gray silty sand

Project No. 475.0014.011 **Client:** Arizona Minerals Inc.
Project: Hermosa TSF CQA

Location: 73704 **Sample Number:** 18-324-02

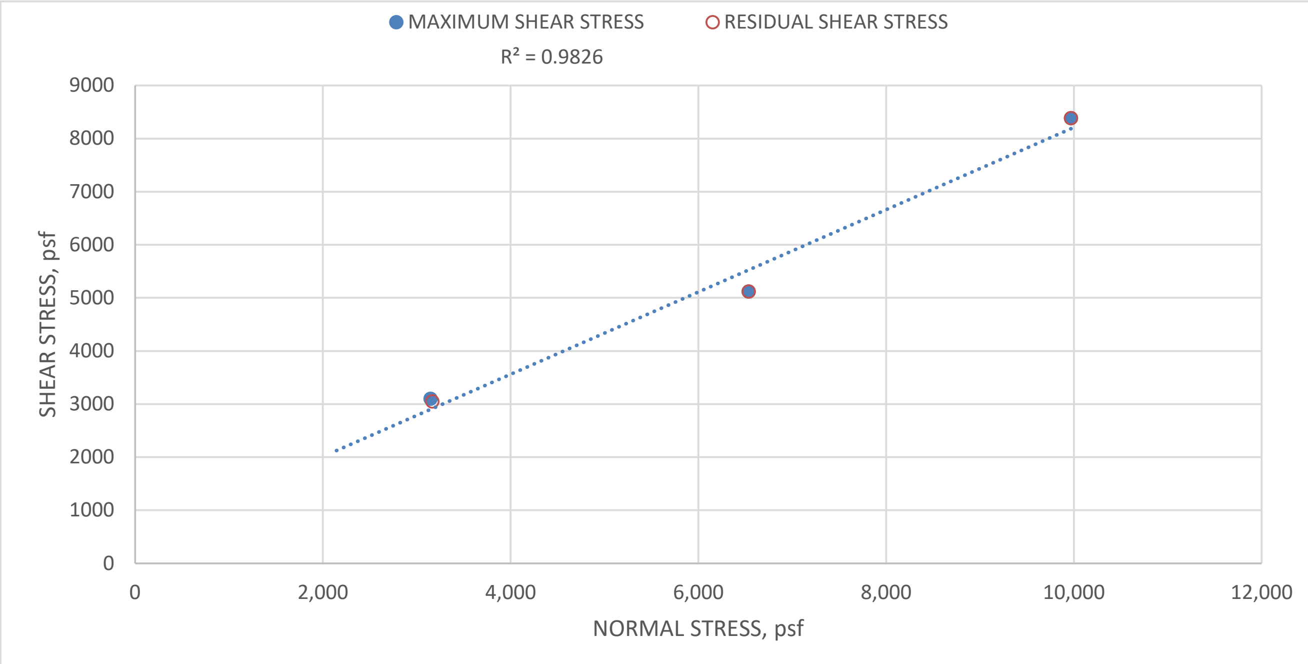
NewFields

Remarks:
*Assumed Specific Gravity Composite of both tailings samples

Figure 18-324-02

Tested By: KS **Checked By:** JH

DIRECT SHEAR TEST OF SOILS UNDER CONSOLIDATED DRAINED CONDITIONS
ASTM D3080/3080M-11



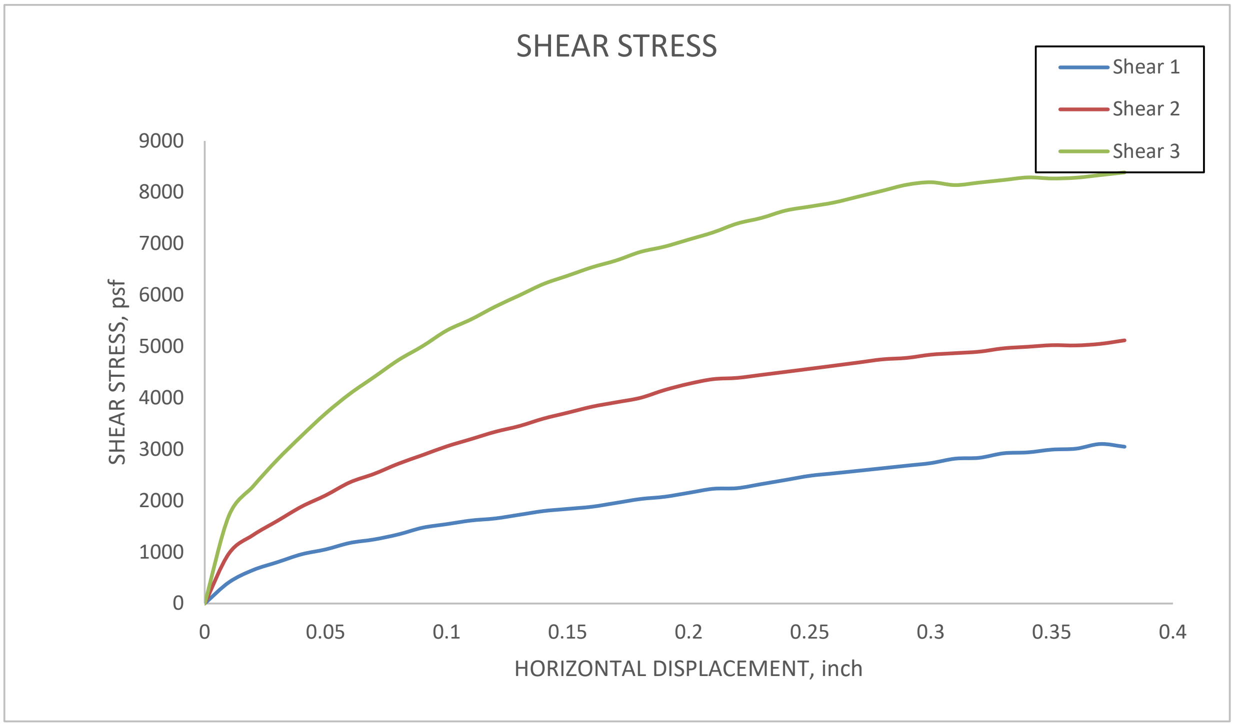
	FRICTION ANGLE		COHESION		SHEAR 1	SHEAR 2	SHEAR 3
AT MAXIMUM SHEAR STRESS	37.8	deg	462	psf			
AT RESIDUAL SHEAR STRESS[3]	38.1	deg	373	psf			

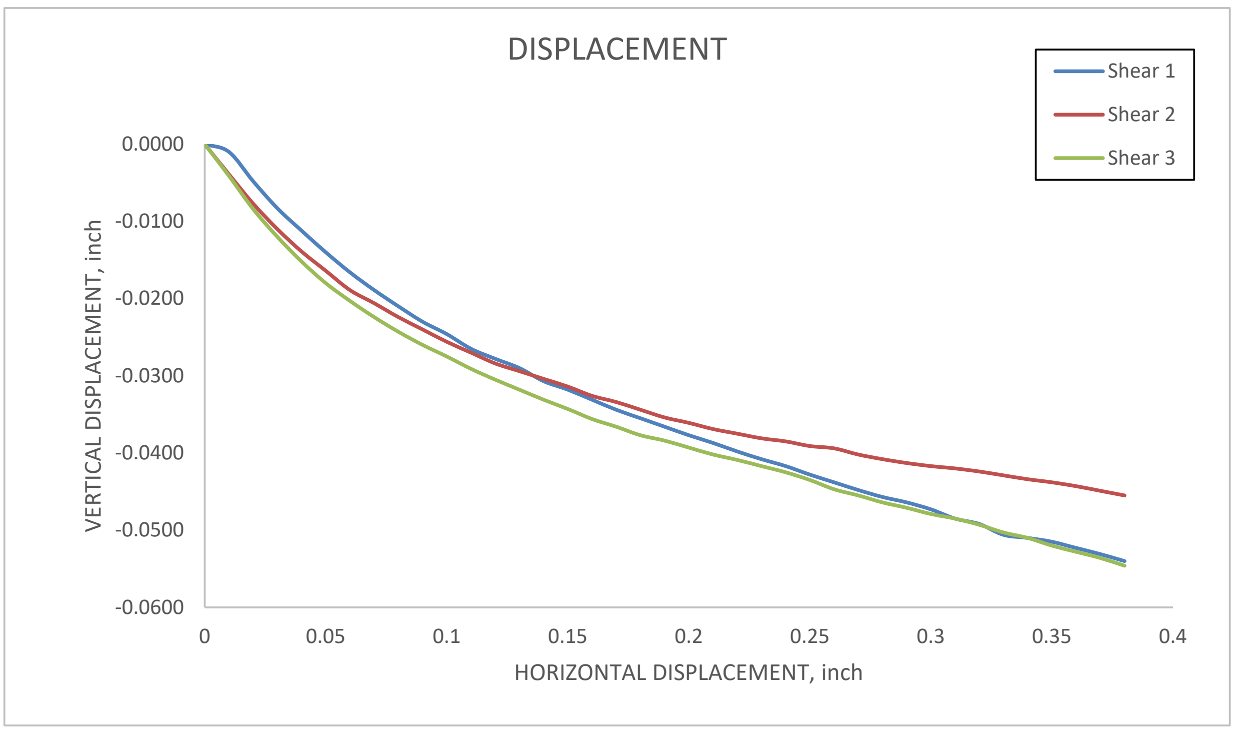
INITIAL AREA, sq.in.	4.94	INITIAL NORMAL STRESS (psf)	2540	5280	8040
SG ASSUMED	3.03	NORMAL STRESS AT PEAK STRESS[6] (psf)	3145	6535	9969
SG TESTED[1]	N/R	NORMAL STRESS @ RESIDUAL STRESS[6] (psf)	3165	6535	9969
LIQUID LIMIT	NP	REMOLDED MOISTURE, %	9.6%	9.6%	9.6%
PLASTIC LIMIT	NP	REMOLDED DRY DENSITY, pcf	115.0	117.5	120.1
PLASTICITY INDEX	NP	REMOLDED SATURATION, %	45%	48%	51%
SAMPLE TYPE	Bulk	REMOLDED VOID RATIO[2]	0.644	0.610	0.574
		FINAL MOISTURE, %	17.3%	16.7%	18.8%
		FINAL SATURATION, %	100%	100%	100%
		FINAL VOIL RATIO	0.435	0.414	0.371
		MAXIMUM SHEAR STRESS, psf	3103	5120	8387
		RESIDUALSHEAR STRESS[3],psf	3050	5120	8387
		RATE OF LOADING, in/min	0.01	0.01	0.01

DESCRIPTION[5]: SAND (SM), Silty, Gray

Note:
[1]N/R = Not reported
[2]Remolded sample consolidated at 100psf
[3]Residual shear stress obtained at 15% horizontal strain
[4] Direct shear testing performed on material passing #4 sieve only
[5] Laboratory Classification. ASTM D6913
[6] Area Correction Applied

PROJECT NAME:	Hermosa	BORING NO.:	N/R
LOCATION:	N/R	SAMPLE NO.:	18-324-02
JOB NO.:	475.0014.014	DEPTH, feet:	N/R
DATE:	10/10/2018		





PROJECT NAME:	Hermosa	BORING NO.:	N/R
LOCATION:	N/R	SAMPLE NO.:	18-324-02
JOB NO.:	475.0014.014	DEPTH, feet:	N/R
DATE:	10/10/2018		

KNIGHT PIESOLD CONSULTING (2020)

TRANSMITTAL

March 29, 2021

Matthew Novak, Senior Metallurgist
South 32 - Hermosa Project
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E tucson@knightpiesold.com
www.knightpiesold.com

Project No.: TU101-00777/03
Doc. No.: TU-21-0375

**Re: Hermosa Project - Supplemental Tails Testing
Process Tails Tests Results**

The following enclosed items are issued via:

☒ E-mail ☐ US Mail ☐ FedEx ☐ UPS ☐ Courier ☐ Hand ☐ Other: ______
☐ Posted on FTP site: ______

Document Description	Document Name	Rev
DSS @ 2 ksf Trial 2	Hermosa Combined Bulk DSS @ 2 ksf Trial 2 Rev 1	1
DSS @ 20 ksf	Hermosa Combined Bulk DSS @ 20 ksf Rev 1	1
Flexible Wall Permeability	L2020-035 Hermosa FWPs Rev 0	0
Index	L2020-035 Hermosa Index Rev 1	1
Consolidation	L2020-035 Hermosa TCs Rev 1	1
TXCD @ 90%MDD	L2020-035 Hermosa TXCD @ 90%MDD Rev 2	2
TXCD @ 95%MDD	L2020-035 Hermosa TXCD @ 90%MDD Rev 1	1
TXCU @ 90%MDD	L2020-035 Hermosa TXCU @ 90%MDD Rev 0	0
TXCU @ 95%MDD	L2020-035 Hermosa TXCU @ 95%MDD Rev 1	1

TXCU @ 98%MDD	L2020-035 Hermosa TXCU @ 98%MDD Rev 1	1

Remarks

For your use.

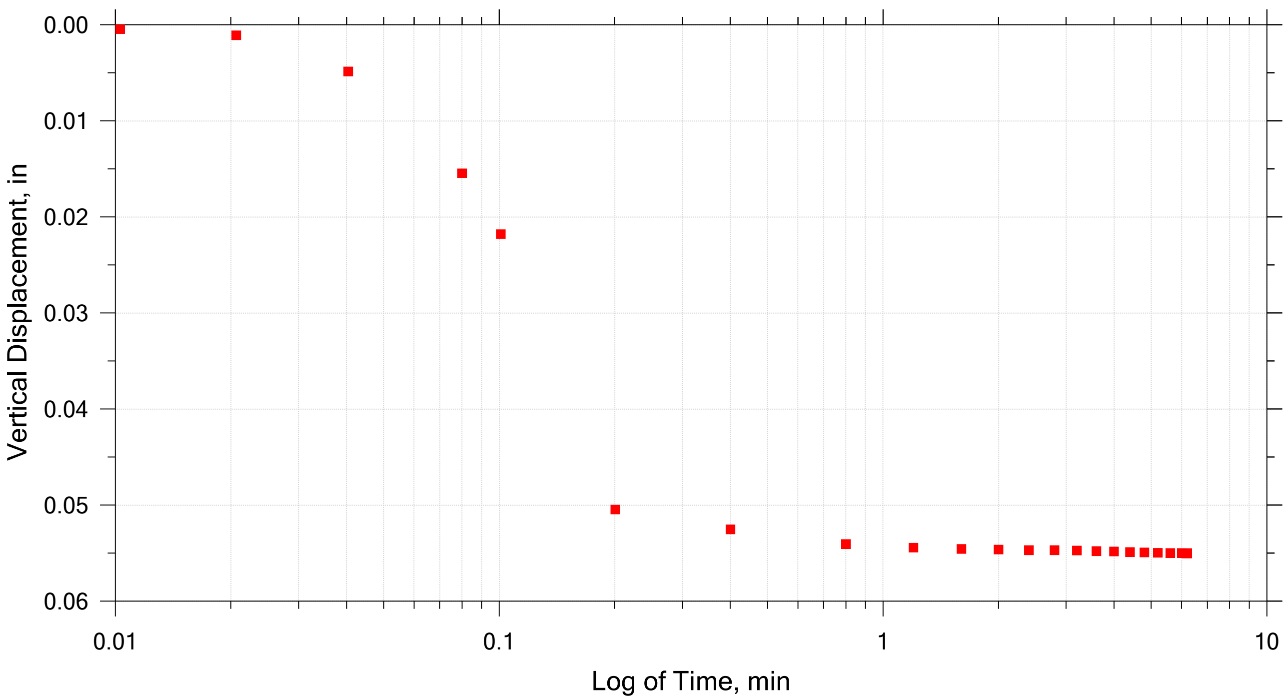
Jeffrey Coffin, P.E., Ph.D.
Senior Geotechnical Engineer

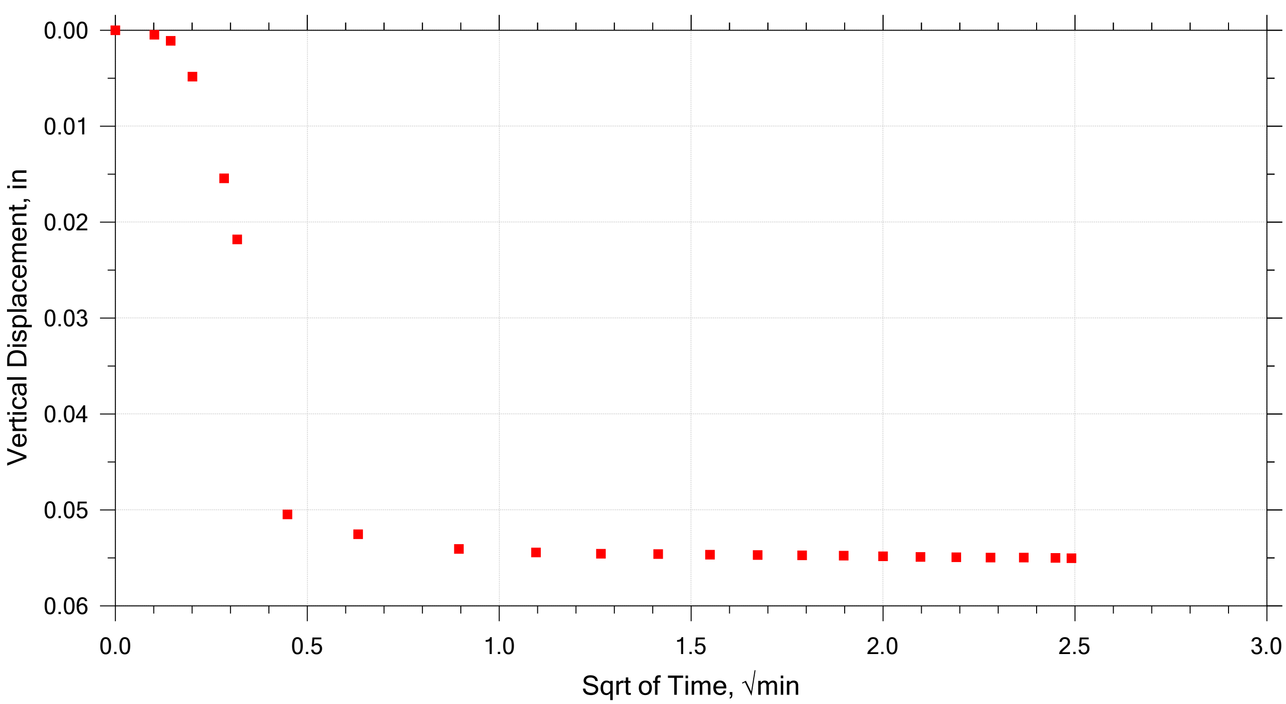
Copy To: Craig Hunt, Nicola Semler

M:\Tucson\Projects\101\00777.03\Deliverables\Transmittals\TU-21-0375_LabTestingResults_Final\TU-21-0375.docx

Direct Simple Shear Test

Consolidation Time Curve 1 of 3
Constant Load Step
Stress: 500 psf





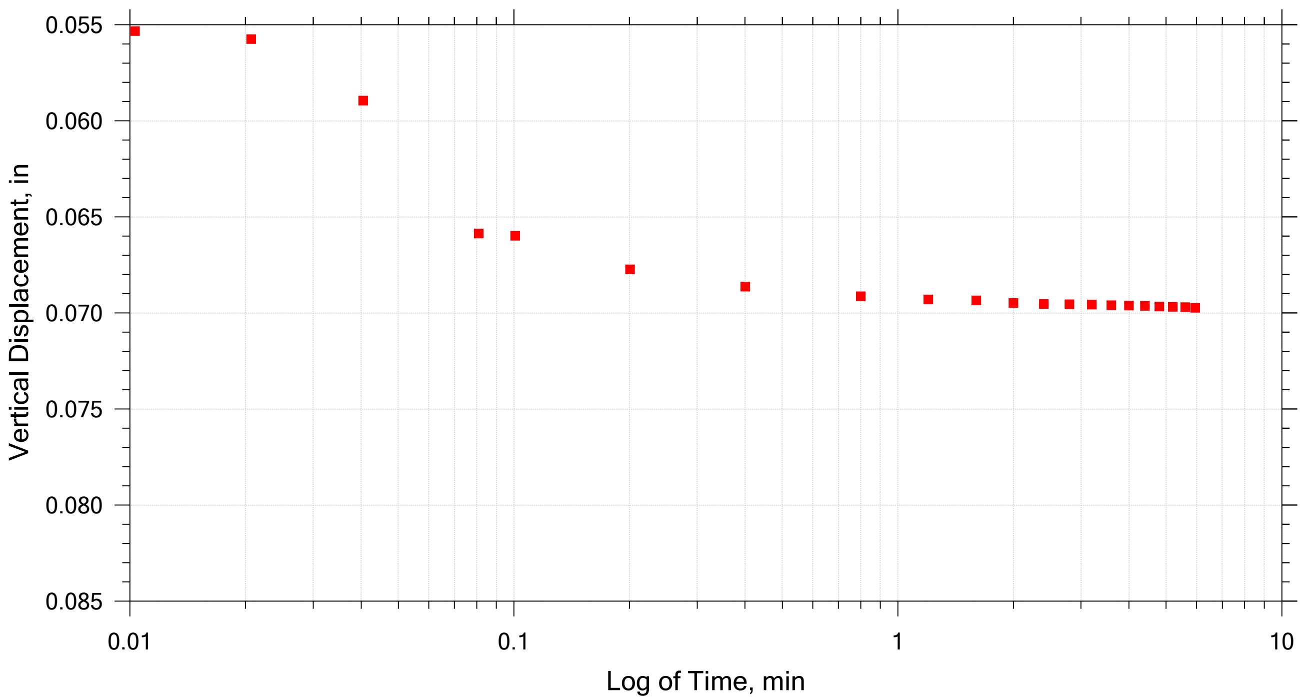
	Project Name: Hermosa	Location:	Project Number: TU201-00777/03
	Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
	Sample Number:	Test Date: 8/12/20	Depth:
	Test Number: 2	Preparation: reconstituted	Elevation:
	Description:		
	Remarks:		

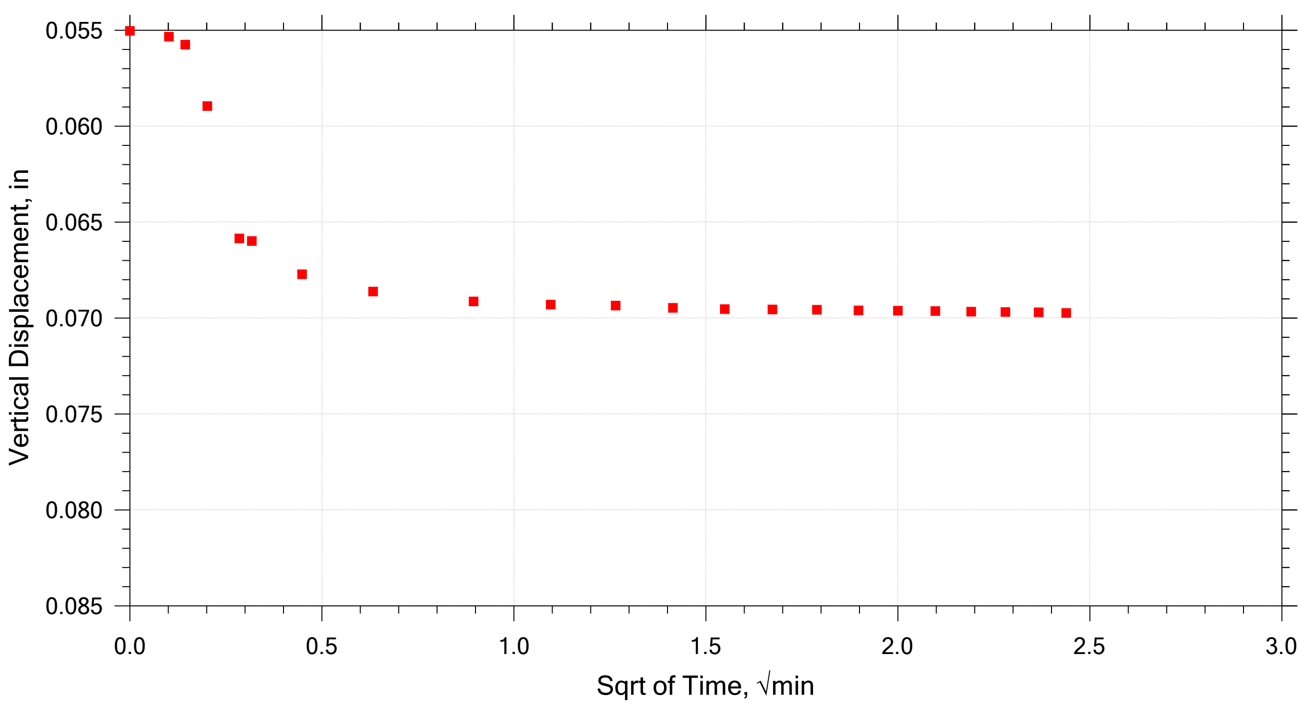
Direct Simple Shear Test

Consolidation Time Curve 2 of 3

Constant Load Step

Stress: 1e+03 psf





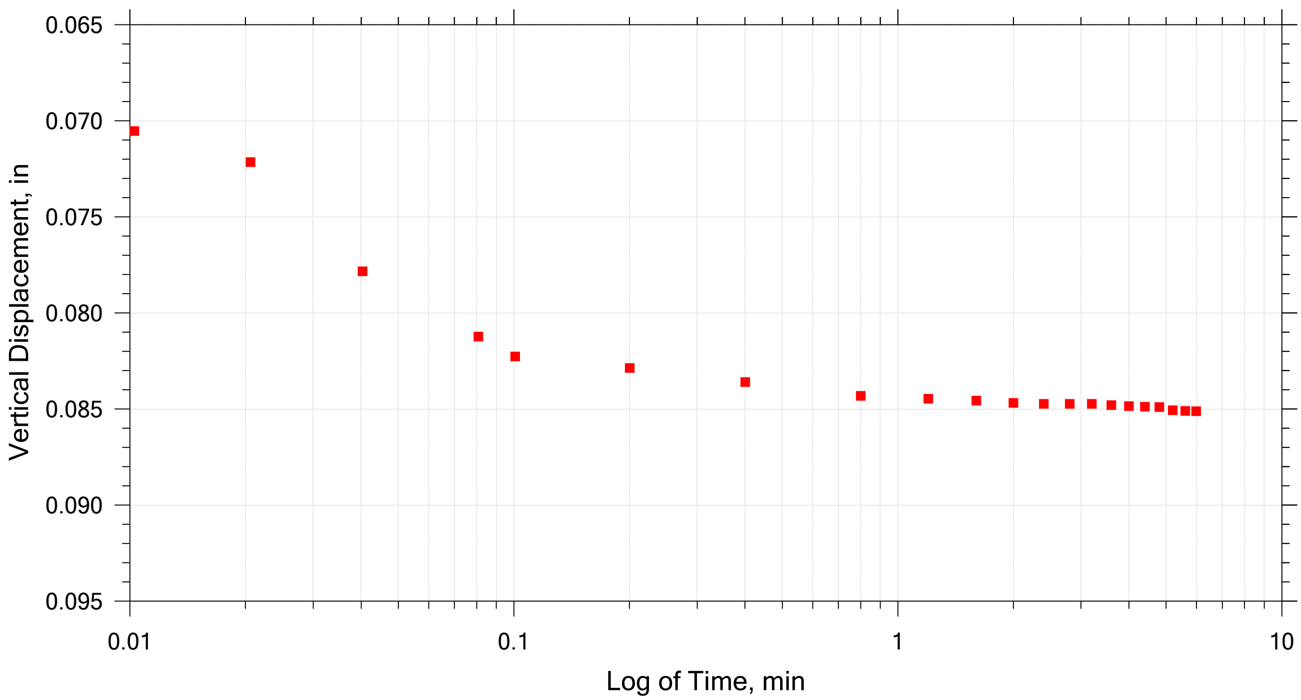
	Project Name: Hermosa	Location:	Project Number: TU201-00777/03
	Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
	Sample Number:	Test Date: 8/12/20	Depth:
	Test Number: 2	Preparation: reconstituted	Elevation:
	Description:		
	Remarks:		

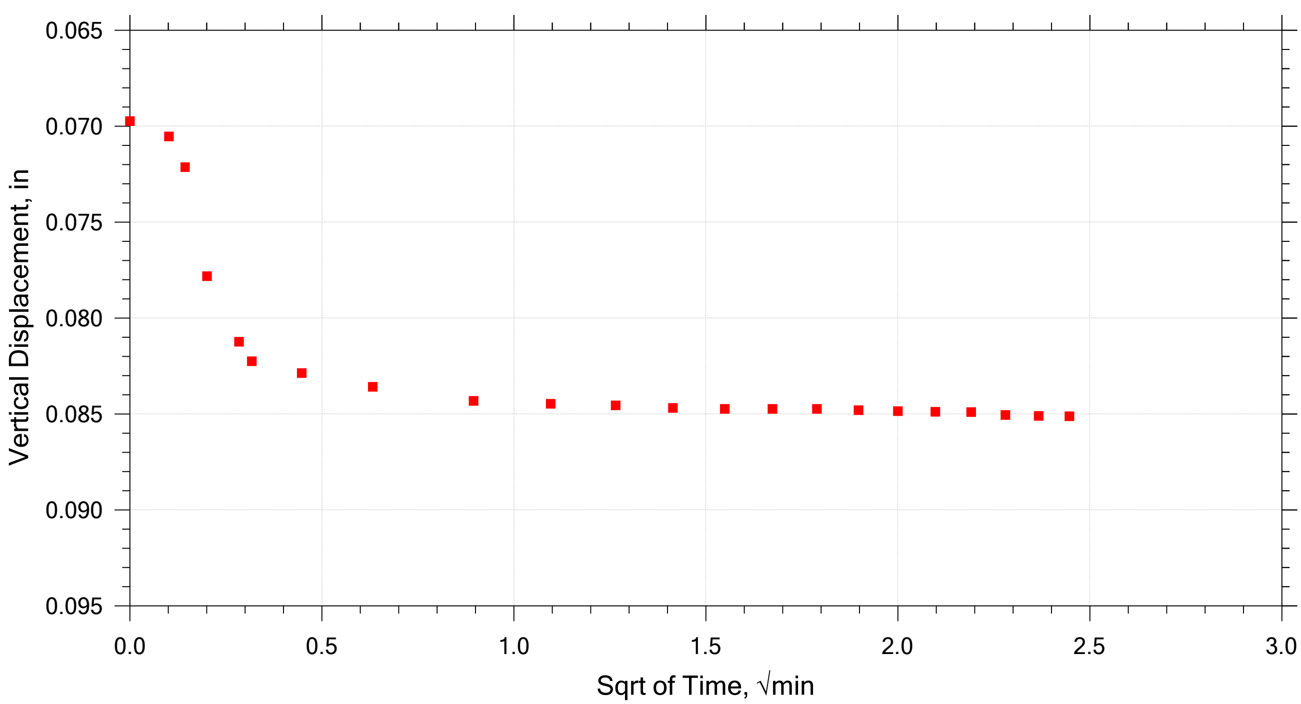
Direct Simple Shear Test

Consolidation Time Curve 3 of 3

Constant Load Step

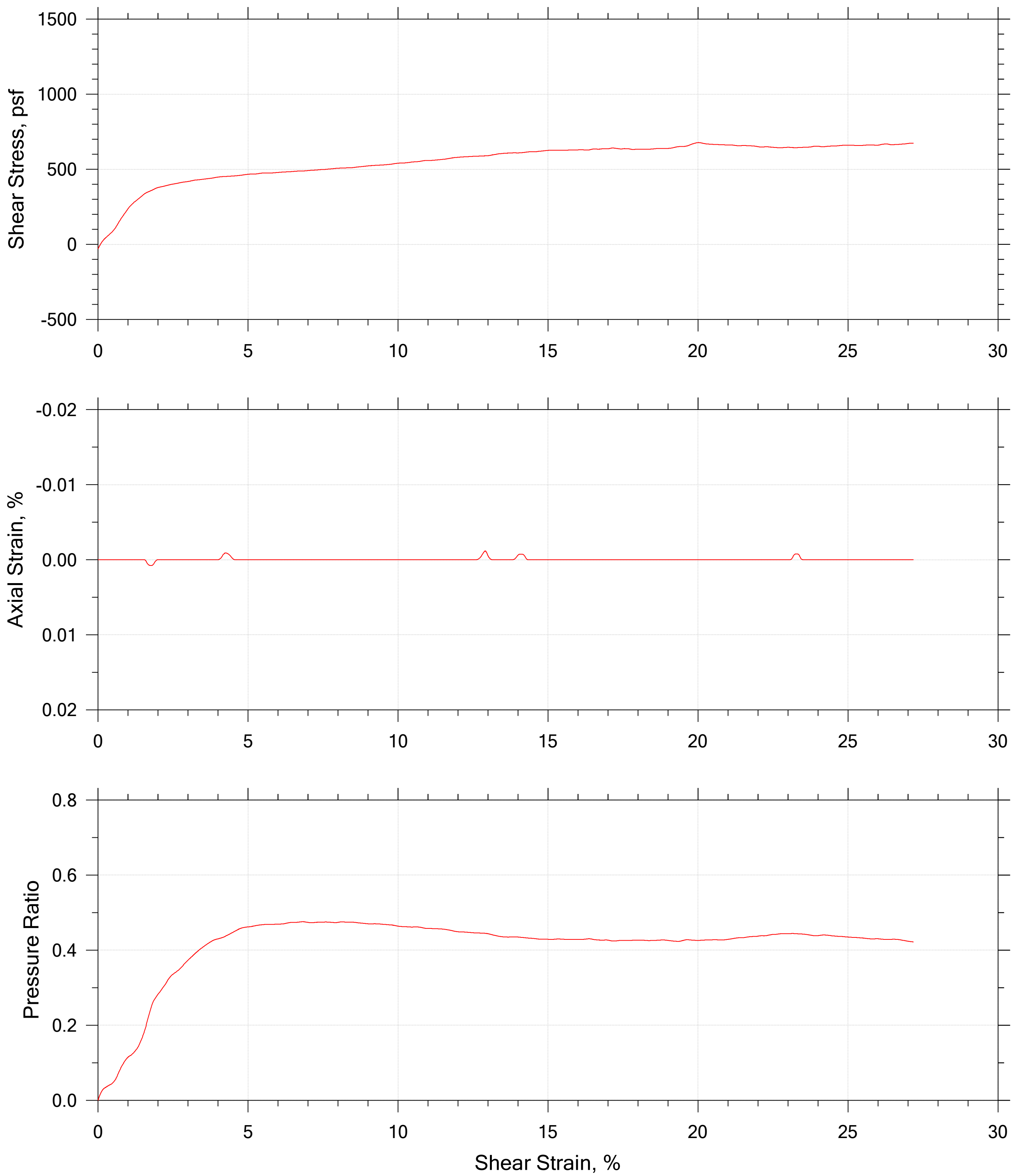
Stress: 2e+03 psf





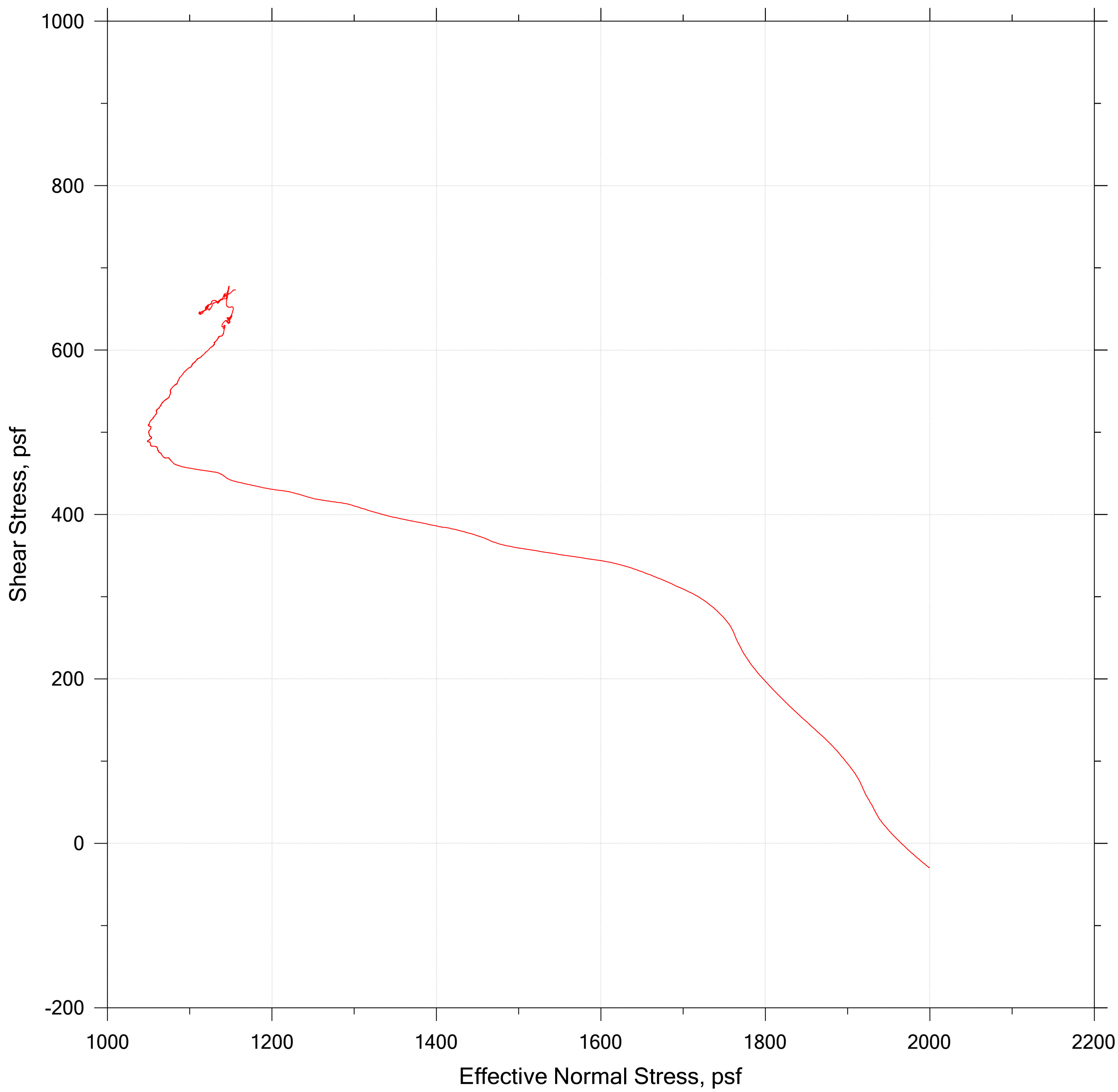
Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test



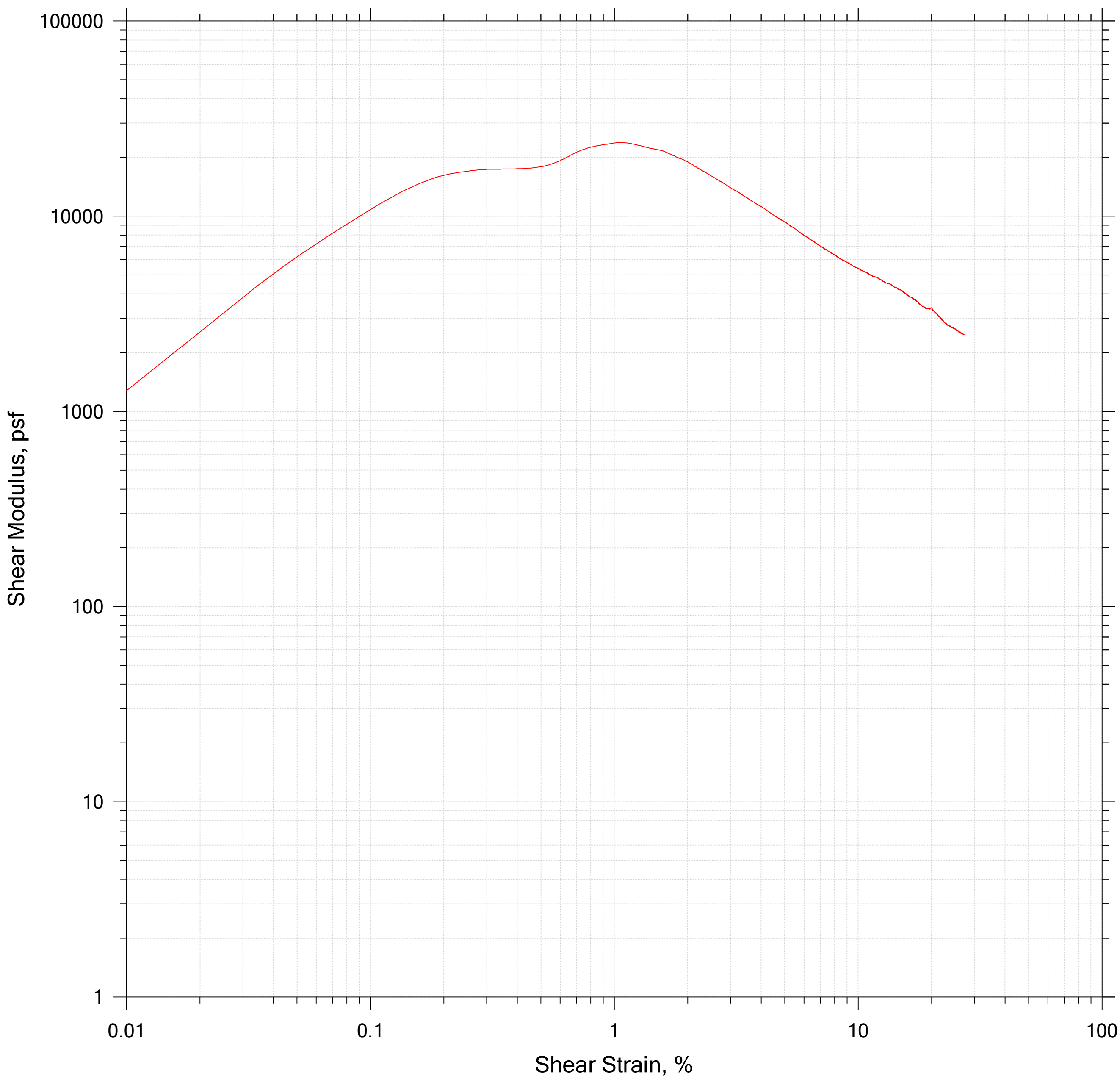
	Project Name: Hermosa	Location:	Project Number: TU201-00777/03
	Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
	Sample Number:	Test Date: 8/12/20	Depth:
	Test Number: 2	Preparation: reconstituted	Elevation:
	Description:		
	Remarks:		

Direct Simple Shear Test



	Project Name: Hermosa	Location:	Project Number: TU201-00777/03
	Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
	Sample Number:	Test Date: 8/12/20	Depth:
	Test Number: 2	Preparation: reconstituted	Elevation:
	Description:		
	Remarks:		

Direct Simple Shear Test



	Project Name: Hermosa	Location:	Project Number: TU201-00777/03
	Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
	Sample Number:	Test Date: 8/12/20	Depth:
	Test Number: 2	Preparation: reconstituted	Elevation:
	Description:		
	Remarks:		

Direct Simple Shear Test

Specimen Dimension, in: 2.50	Specific Gravity: 2.87 (Measured)	Liquid Limit: Non-Plastic
Specimen Height, in: 1.00	Initial Void Ratio: 0.574	Plastic Limit: Non-Plastic
Final Height, in: 0.91	Final Void Ratio: 0.44	Plasticity Index: Non-Plastic

	Before Test Trimmings	Before Test Specimen	After Test Specimen	After Test Trimmings
Container ID		---		
Mass Container, kg	0	0	0	0
Mass Container + Wet Soil, kg	0.163	0.163	0.169	0.169
Mass Container + Dry Soil, kg	0.14645	0.14645	0.14645	0.14645
Mass Dry Soil, kg	0.14645	0.14645	0.14645	0.14645
Water Content, %	11.30	11.30	15.40	15.40
Void Ratio	---	0.57	0.44	---
Degree of Saturation, %	---	56.41	100.25	---
Dry Unit Weight, pcf	---	113.66	124.23	---

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Consolidation Time Curve 1 of 3

Constant Load Step

Elapsed Time min	Sq.Rt. of Time min	Stress psf	Displacement Correction in	Corrected Displacement in	Strain %	Void Ratio
0.000	0.000	6.84	0.0000	0.0000	0.000	0.574
0.010	0.101	21.7	0.0000	0.0004676	0.0468	0.573
0.021	0.144	49.1	0.0000	0.001091	0.109	0.572
0.040	0.201	105.	0.0000	0.004849	0.485	0.567
0.080	0.283	206.	0.0000	0.01545	1.54	0.550
0.101	0.318	228.	0.0000	0.02180	2.18	0.540
0.201	0.448	443.	0.0000	0.05048	5.05	0.495
0.400	0.633	497.	0.0000	0.05254	5.25	0.491
0.801	0.895	495.	0.0000	0.05406	5.41	0.489
1.200	1.096	496.	0.0000	0.05443	5.44	0.489
1.600	1.265	497.	0.0000	0.05457	5.46	0.488
2.001	1.415	498.	0.0000	0.05462	5.46	0.488
2.400	1.549	498.	0.0000	0.05469	5.47	0.488
2.800	1.673	498.	0.0000	0.05470	5.47	0.488
3.201	1.789	497.	0.0000	0.05474	5.47	0.488
3.600	1.897	498.	0.0000	0.05479	5.48	0.488
4.001	2.000	501.	0.0000	0.05484	5.48	0.488
4.401	2.098	498.	0.0000	0.05489	5.49	0.488
4.800	2.191	500.	0.0000	0.05493	5.49	0.488
5.201	2.281	500.	0.0000	0.05496	5.50	0.488
5.600	2.366	498.	0.0000	0.05498	5.50	0.488
6.000	2.450	500.	0.0000	0.05500	5.50	0.488
6.203	2.491	498.	0.0000	0.05503	5.50	0.488

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Consolidation Time Curve 2 of 3

Constant Load Step

Elapsed Time min	Sq.Rt. of Time min	Stress psf	Displacement Correction in	Corrected Displacement in	Strain %	Void Ratio
0.000	0.000	498.	0.0000	0.05503	5.50	0.488
0.010	0.102	562.	0.0000	0.05533	5.53	0.487
0.021	0.144	617.	0.0000	0.05574	5.57	0.486
0.040	0.201	727.	0.0000	0.05895	5.89	0.481
0.081	0.285	945.	0.0000	0.06586	6.59	0.471
0.101	0.317	914.	0.0000	0.06598	6.60	0.470
0.201	0.448	999.	0.0000	0.06773	6.77	0.468
0.401	0.633	989.	0.0000	0.06863	6.86	0.466
0.800	0.895	998.	0.0000	0.06913	6.91	0.465
1.201	1.096	996.	0.0000	0.06930	6.93	0.465
1.601	1.265	997.	0.0000	0.06935	6.94	0.465
2.001	1.414	998.	0.0000	0.06948	6.95	0.465
2.400	1.549	997.	0.0000	0.06953	6.95	0.465
2.800	1.673	999.	0.0000	0.06955	6.95	0.465
3.200	1.789	998.	0.0000	0.06956	6.96	0.465
3.601	1.898	998.	0.0000	0.06960	6.96	0.465
4.001	2.000	997.	0.0000	0.06961	6.96	0.465
4.401	2.098	999.	0.0000	0.06963	6.96	0.465
4.800	2.191	997.	0.0000	0.06967	6.97	0.465
5.201	2.281	999.	0.0000	0.06968	6.97	0.464
5.600	2.366	998.	0.0000	0.06970	6.97	0.464
5.946	2.438	998.	0.0000	0.06974	6.97	0.464

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Consolidation Time Curve 3 of 3

Constant Load Step

Elapsed Time min	Sq.Rt. of Time min	Stress psf	Displacement Correction in	Corrected Displacement in	Strain %	Void Ratio
0.000	0.000	997.	0.0000	0.06974	6.97	0.464
0.010	0.101	1.18e+03	0.0000	0.07053	7.05	0.463
0.021	0.144	1.33e+03	0.0000	0.07214	7.21	0.461
0.040	0.201	1.72e+03	0.0000	0.07782	7.78	0.452
0.081	0.284	1.91e+03	0.0000	0.08123	8.12	0.446
0.101	0.317	1.99e+03	0.0000	0.08226	8.23	0.445
0.200	0.448	1.99e+03	0.0000	0.08286	8.29	0.444
0.400	0.633	1.99e+03	0.0000	0.08359	8.36	0.443
0.801	0.895	2.00e+03	0.0000	0.08432	8.43	0.441
1.201	1.096	2.00e+03	0.0000	0.08447	8.45	0.441
1.601	1.265	2.00e+03	0.0000	0.08456	8.46	0.441
2.000	1.414	2.00e+03	0.0000	0.08468	8.47	0.441
2.400	1.549	2.00e+03	0.0000	0.08473	8.47	0.441
2.801	1.674	2.00e+03	0.0000	0.08473	8.47	0.441
3.200	1.789	2.00e+03	0.0000	0.08473	8.47	0.441
3.600	1.897	2.00e+03	0.0000	0.08480	8.48	0.441
4.001	2.000	2.00e+03	0.0000	0.08485	8.49	0.441
4.400	2.098	2.00e+03	0.0000	0.08489	8.49	0.441
4.801	2.191	2.00e+03	0.0000	0.08491	8.49	0.441
5.200	2.280	2.00e+03	0.0000	0.08506	8.51	0.440
5.600	2.366	2.00e+03	0.0000	0.08510	8.51	0.440
5.987	2.447	2.00e+03	0.0000	0.08511	8.51	0.440

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
0.00000	0.00000	-29.694	0.00000	0.00000	1999.7	0.00000
0.040000	0.00020072	-29.646	25.644	0.00000	1999.5	6.5484e-05
0.080000	0.00060334	-29.515	77.083	0.00000	1999.3	0.00017833
0.12000	0.0012079	-29.298	154.32	0.00000	1999.0	0.00033853
0.16000	0.0020143	-28.998	257.34	0.00000	1998.6	0.00054609
0.20000	0.0030226	-28.613	386.16	0.00000	1998.1	0.00080101
0.24000	0.0042328	-28.143	540.78	0.00000	1997.5	0.0011033
0.28000	0.0056449	-27.589	721.19	0.00000	1996.8	0.0014529
0.32000	0.0072589	-26.950	927.40	0.00000	1996.0	0.0018499
0.36000	0.0090749	-26.227	1159.4	0.00000	1995.1	0.0022943
0.40000	0.011093	-25.419	1417.2	0.00000	1994.1	0.0027860
0.44000	0.013312	-24.527	1700.8	0.00000	1993.0	0.0033250
0.48000	0.015734	-23.550	2010.2	0.00000	1991.8	0.0039115
0.52000	0.018358	-22.489	2345.3	0.00000	1990.6	0.0045453
0.56000	0.021183	-21.343	2706.3	0.00000	1989.2	0.0052264
0.60000	0.024210	-20.113	3093.1	0.00000	1987.8	0.0059549
0.64000	0.027439	-18.798	3505.6	0.00000	1986.2	0.0067308
0.68000	0.030871	-17.399	3944.0	0.00000	1984.6	0.0075540
0.72000	0.034505	-15.920	4405.7	0.00000	1982.8	0.0084204
0.76000	0.038355	-14.398	4873.1	0.00000	1981.1	0.0092992
0.80000	0.042419	-12.833	5346.1	0.00000	1979.3	0.010191
0.84000	0.046698	-11.225	5824.7	0.00000	1977.5	0.011094
0.88000	0.051192	-9.5734	6309.0	0.00000	1975.6	0.012011
0.92000	0.055901	-7.8790	6798.9	0.00000	1973.8	0.012939
0.96000	0.060824	-6.1416	7294.5	0.00000	1971.9	0.013880
1.0000	0.065963	-4.3610	7795.6	0.00000	1970.0	0.014834
1.0400	0.071316	-2.5373	8302.5	0.00000	1968.1	0.015800
1.0800	0.076884	-0.67048	8814.9	0.00000	1966.1	0.016779
1.1200	0.082667	1.2394	9333.0	0.00000	1964.1	0.017770
1.1600	0.088665	3.1924	9856.8	0.00000	1962.1	0.018773
1.2000	0.094878	5.1886	10386.	0.00000	1960.1	0.019789
1.2400	0.10131	7.2278	10921.	0.00000	1958.0	0.020818
1.2800	0.10775	9.2630	11436.	0.00000	1956.1	0.021793
1.3200	0.11420	11.257	11931.	0.00000	1954.2	0.022734
1.3600	0.12067	13.209	12406.	0.00000	1952.4	0.023639
1.4000	0.12715	15.117	12856.	0.00000	1950.7	0.024507
1.4400	0.13363	16.981	13282.	0.00000	1949.0	0.025336
1.4800	0.14012	18.800	13684.	0.00000	1947.4	0.026127
1.5200	0.14663	20.575	14061.	0.00000	1945.9	0.026879
1.5600	0.15314	22.305	14413.	0.00000	1944.5	0.027592
1.6000	0.15966	23.991	14741.	0.00000	1943.1	0.028268
1.6400	0.16619	25.633	15044.	0.00000	1941.9	0.028904
1.6800	0.17272	27.229	15322.	0.00000	1940.7	0.029503
1.7200	0.17927	28.782	15576.	0.00000	1939.5	0.030062
1.7600	0.18582	30.290	15805.	0.00000	1938.5	0.030584
1.8000	0.19239	31.753	16010.	0.00000	1937.5	0.031067
1.8400	0.19896	33.172	16190.	0.00000	1936.7	0.031511
1.8800	0.20554	34.546	16346.	0.00000	1935.8	0.031917
1.9200	0.21213	35.876	16477.	0.00000	1935.1	0.032284
1.9600	0.21872	37.166	16586.	0.00000	1934.4	0.032617

	Project Name: Hermosa	Location:	Project Number: TU201-00777/03
	Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
	Sample Number:	Test Date: 8/12/20	Depth:
	Test Number: 2	Preparation: reconstituted	Elevation:
	Description:		
	Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
2.0000	0.22531	38.454	16690.	0.00000	1933.8	0.032947
2.0400	0.23192	39.739	16789.	0.00000	1933.1	0.033276
2.0800	0.23861	41.027	16881.	0.00000	1932.5	0.033610
2.1200	0.24538	42.315	16965.	0.00000	1931.8	0.033949
2.1600	0.25223	43.606	17043.	0.00000	1931.1	0.034294
2.2000	0.25915	44.898	17113.	0.00000	1930.4	0.034645
2.2400	0.26615	46.192	17176.	0.00000	1929.7	0.035001
2.2800	0.27322	47.487	17231.	0.00000	1929.0	0.035362
2.3200	0.28037	48.784	17279.	0.00000	1928.2	0.035729
2.3600	0.28760	50.083	17320.	0.00000	1927.5	0.036101
2.4000	0.29491	51.383	17354.	0.00000	1926.7	0.036478
2.4400	0.30230	52.685	17381.	0.00000	1926.0	0.036861
2.4800	0.30976	53.988	17400.	0.00000	1925.2	0.037249
2.5200	0.31730	55.293	17412.	0.00000	1924.4	0.037643
2.5600	0.32497	56.625	17420.	0.00000	1923.6	0.038028
2.6000	0.33277	57.984	17425.	0.00000	1922.9	0.038404
2.6400	0.34070	59.374	17430.	0.00000	1922.1	0.038775
2.6800	0.34878	60.795	17436.	0.00000	1921.4	0.039140
2.7200	0.35699	62.246	17443.	0.00000	1920.7	0.039500
2.7600	0.36533	63.729	17450.	0.00000	1920.0	0.039855
2.8000	0.37382	65.242	17459.	0.00000	1919.3	0.040204
2.8400	0.38244	66.786	17468.	0.00000	1918.6	0.040548
2.8800	0.39119	68.361	17478.	0.00000	1917.9	0.040887
2.9200	0.40008	69.966	17489.	0.00000	1917.2	0.041220
2.9600	0.40903	71.603	17503.	0.00000	1916.5	0.041571
3.0000	0.41796	73.271	17521.	0.00000	1915.8	0.041958
3.0400	0.42688	74.969	17544.	0.00000	1914.9	0.042382
3.0800	0.43579	76.699	17570.	0.00000	1914.0	0.042842
3.1200	0.44468	78.460	17601.	0.00000	1913.0	0.043339
3.1600	0.45355	80.252	17637.	0.00000	1911.9	0.043871
3.2000	0.46242	82.076	17676.	0.00000	1910.8	0.044440
3.2400	0.47127	83.930	17720.	0.00000	1909.6	0.045046
3.2800	0.48008	85.814	17769.	0.00000	1908.3	0.045684
3.3200	0.48880	87.724	17825.	0.00000	1907.0	0.046351
3.3600	0.49742	89.661	17889.	0.00000	1905.6	0.047044
3.4000	0.50595	91.624	17959.	0.00000	1904.1	0.047765
3.4400	0.51438	93.613	18036.	0.00000	1902.7	0.048513
3.4800	0.52272	95.629	18121.	0.00000	1901.1	0.049289
3.5200	0.53096	97.671	18213.	0.00000	1899.5	0.050091
3.5600	0.53910	99.740	18311.	0.00000	1897.8	0.050922
3.6000	0.54715	101.83	18417.	0.00000	1896.1	0.051779
3.6400	0.55513	103.96	18530.	0.00000	1894.4	0.052662
3.6800	0.56307	106.13	18648.	0.00000	1892.5	0.053567
3.7200	0.57096	108.33	18772.	0.00000	1890.7	0.054495
3.7600	0.57881	110.58	18902.	0.00000	1888.8	0.055445
3.8000	0.58656	112.83	19034.	0.00000	1886.8	0.056432
3.8400	0.59421	115.10	19168.	0.00000	1884.8	0.057455
3.8800	0.60176	117.39	19304.	0.00000	1882.6	0.058516
3.9200	0.60921	119.68	19443.	0.00000	1880.5	0.059613
3.9600	0.61657	121.99	19584.	0.00000	1878.2	0.060748

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
4.0000	0.62382	124.31	19726.	0.00000	1875.8	0.061919
4.0400	0.63098	126.64	19871.	0.00000	1873.4	0.063127
4.0800	0.63803	128.99	20018.	0.00000	1870.9	0.064372
4.1200	0.64499	131.35	20167.	0.00000	1868.4	0.065654
4.1600	0.65185	133.72	20318.	0.00000	1865.7	0.066972
4.2000	0.65869	136.10	20470.	0.00000	1863.1	0.068305
4.2400	0.66559	138.48	20617.	0.00000	1860.4	0.069630
4.2800	0.67255	140.86	20760.	0.00000	1857.8	0.070948
4.3200	0.67956	143.23	20899.	0.00000	1855.2	0.072258
4.3600	0.68663	145.60	21033.	0.00000	1852.6	0.073560
4.4000	0.69376	147.97	21163.	0.00000	1850.0	0.074855
4.4400	0.70095	150.33	21288.	0.00000	1847.4	0.076142
4.4800	0.70819	152.69	21409.	0.00000	1844.8	0.077421
4.5200	0.71549	155.04	21526.	0.00000	1842.3	0.078693
4.5600	0.72285	157.39	21638.	0.00000	1839.8	0.079957
4.6000	0.73027	159.74	21746.	0.00000	1837.3	0.081214
4.6400	0.73774	162.08	21849.	0.00000	1834.8	0.082463
4.6800	0.74527	164.42	21948.	0.00000	1832.3	0.083704
4.7200	0.75286	166.75	22043.	0.00000	1829.8	0.084938
4.7600	0.76051	169.08	22133.	0.00000	1827.4	0.086161
4.8000	0.76819	171.41	22219.	0.00000	1825.0	0.087364
4.8400	0.77591	173.73	22301.	0.00000	1822.6	0.088544
4.8800	0.78365	176.05	22380.	0.00000	1820.3	0.089706
4.9200	0.79138	178.34	22455.	0.00000	1818.0	0.090850
4.9600	0.79910	180.63	22528.	0.00000	1815.7	0.091979
5.0000	0.80681	182.89	22598.	0.00000	1813.5	0.093090
5.0400	0.81451	185.15	22665.	0.00000	1811.3	0.094185
5.0800	0.82220	187.38	22729.	0.00000	1809.2	0.095263
5.1200	0.82988	189.60	22790.	0.00000	1807.0	0.096325
5.1600	0.83755	191.80	22848.	0.00000	1805.0	0.097370
5.2000	0.84521	193.99	22903.	0.00000	1802.9	0.098398
5.2400	0.85285	196.16	22956.	0.00000	1800.9	0.099410
5.2800	0.86049	198.32	23006.	0.00000	1798.9	0.10040
5.3200	0.86812	200.46	23052.	0.00000	1796.9	0.10138
5.3600	0.87571	202.58	23096.	0.00000	1795.0	0.10234
5.4000	0.88327	204.68	23136.	0.00000	1793.2	0.10327
5.4400	0.89078	206.75	23174.	0.00000	1791.4	0.10416
5.4800	0.89823	208.81	23210.	0.00000	1789.6	0.10504
5.5200	0.90564	210.86	23247.	0.00000	1787.9	0.10588
5.5600	0.91299	212.90	23283.	0.00000	1786.3	0.10670
5.6000	0.92030	214.93	23319.	0.00000	1784.7	0.10749
5.6400	0.92755	216.95	23355.	0.00000	1783.2	0.10826
5.6800	0.93475	218.97	23391.	0.00000	1781.7	0.10900
5.7200	0.94190	220.97	23427.	0.00000	1780.3	0.10972
5.7600	0.94899	222.97	23462.	0.00000	1778.9	0.11041
5.8000	0.95604	224.96	23497.	0.00000	1777.5	0.11108
5.8400	0.96303	226.93	23533.	0.00000	1776.3	0.11171
5.8800	0.96997	228.90	23568.	0.00000	1775.0	0.11233
5.9200	0.97686	230.87	23602.	0.00000	1773.9	0.11291
5.9600	0.98370	232.82	23637.	0.00000	1772.8	0.11347

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
6.0000	0.99049	234.76	23671.	0.00000	1771.7	0.11401
6.0400	0.99725	236.69	23705.	0.00000	1770.6	0.11453
6.0800	1.0040	238.62	23739.	0.00000	1769.6	0.11505
6.1200	1.0108	240.53	23770.	0.00000	1768.6	0.11555
6.1600	1.0177	242.43	23796.	0.00000	1767.7	0.11603
6.2000	1.0248	244.32	23818.	0.00000	1766.7	0.11649
6.2400	1.0320	246.20	23835.	0.00000	1765.8	0.11693
6.2800	1.0394	248.06	23848.	0.00000	1765.0	0.11736
6.3200	1.0470	249.91	23857.	0.00000	1764.2	0.11777
6.3600	1.0547	251.75	23860.	0.00000	1763.4	0.11817
6.4000	1.0625	253.58	23859.	0.00000	1762.6	0.11854
6.4400	1.0706	255.40	23854.	0.00000	1761.9	0.11890
6.4800	1.0787	257.20	23845.	0.00000	1761.1	0.11929
6.5200	1.0870	258.98	23831.	0.00000	1760.3	0.11970
6.5600	1.0954	260.75	23814.	0.00000	1759.4	0.12015
6.6000	1.1039	262.50	23793.	0.00000	1758.4	0.12063
6.6400	1.1127	264.24	23768.	0.00000	1757.4	0.12116
6.6800	1.1216	265.98	23739.	0.00000	1756.3	0.12173
6.7200	1.1306	267.71	23707.	0.00000	1755.0	0.12234
6.7600	1.1398	269.43	23672.	0.00000	1753.7	0.12299
6.8000	1.1492	271.15	23632.	0.00000	1752.3	0.12369
6.8400	1.1587	272.85	23590.	0.00000	1750.9	0.12442
6.8800	1.1683	274.55	23546.	0.00000	1749.4	0.12518
6.9200	1.1779	276.24	23501.	0.00000	1747.8	0.12596
6.9600	1.1876	277.92	23454.	0.00000	1746.2	0.12677
7.0000	1.1973	279.60	23406.	0.00000	1744.5	0.12761
7.0400	1.2071	281.26	23356.	0.00000	1742.8	0.12847
7.0800	1.2170	282.92	23304.	0.00000	1741.0	0.12935
7.1200	1.2269	284.57	23251.	0.00000	1739.2	0.13027
7.1600	1.2369	286.21	23197.	0.00000	1737.3	0.13121
7.2000	1.2470	287.84	23140.	0.00000	1735.4	0.13217
7.2400	1.2571	289.47	23082.	0.00000	1733.4	0.13316
7.2800	1.2672	291.09	23023.	0.00000	1731.3	0.13418
7.3200	1.2775	292.70	22962.	0.00000	1729.3	0.13522
7.3600	1.2877	294.29	22901.	0.00000	1727.1	0.13630
7.4000	1.2977	295.88	22843.	0.00000	1724.8	0.13743
7.4400	1.3076	297.44	22786.	0.00000	1722.5	0.13861
7.4800	1.3174	298.98	22731.	0.00000	1720.0	0.13985
7.5200	1.3271	300.51	22679.	0.00000	1717.4	0.14114
7.5600	1.3366	302.02	22628.	0.00000	1714.7	0.14249
7.6000	1.3459	303.51	22580.	0.00000	1711.9	0.14388
7.6400	1.3551	304.98	22533.	0.00000	1709.0	0.14533
7.6800	1.3642	306.43	22488.	0.00000	1706.0	0.14684
7.7200	1.3732	307.87	22445.	0.00000	1703.0	0.14835
7.7600	1.3820	309.30	22404.	0.00000	1700.0	0.14987
7.8000	1.3908	310.71	22363.	0.00000	1696.9	0.15140
7.8400	1.3994	312.11	22325.	0.00000	1693.9	0.15293
7.8800	1.4079	313.50	22287.	0.00000	1690.8	0.15447
7.9200	1.4163	314.87	22252.	0.00000	1687.7	0.15600
7.9600	1.4245	316.23	22218.	0.00000	1684.6	0.15754

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
8.0000	1.4325	317.57	22187.	0.00000	1681.6	0.15906
8.0400	1.4404	318.90	22158.	0.00000	1678.5	0.16059
8.0800	1.4482	320.22	22130.	0.00000	1675.5	0.16211
8.1200	1.4559	321.51	22102.	0.00000	1672.4	0.16365
8.1600	1.4635	322.80	22075.	0.00000	1669.3	0.16520
8.2000	1.4711	324.07	22047.	0.00000	1666.2	0.16675
8.2400	1.4786	325.33	22019.	0.00000	1663.1	0.16833
8.2800	1.4861	326.57	21992.	0.00000	1659.9	0.16991
8.3200	1.4935	327.79	21965.	0.00000	1656.7	0.17150
8.3600	1.5009	329.01	21938.	0.00000	1653.5	0.17311
8.4000	1.5082	330.20	21911.	0.00000	1650.3	0.17473
8.4400	1.5154	331.39	21884.	0.00000	1647.0	0.17636
8.4800	1.5226	332.55	21857.	0.00000	1643.7	0.17800
8.5200	1.5297	333.71	21830.	0.00000	1640.4	0.17965
8.5600	1.5368	334.85	21804.	0.00000	1637.1	0.18132
8.6000	1.5438	335.98	21777.	0.00000	1633.7	0.18299
8.6400	1.5508	337.07	21748.	4.7873e-06	1630.3	0.18472
8.6800	1.5580	338.12	21717.	1.5398e-05	1626.7	0.18653
8.7200	1.5652	339.14	21682.	3.1832e-05	1622.9	0.18842
8.7600	1.5725	340.11	21644.	5.4089e-05	1619.0	0.19038
8.8000	1.5799	341.04	21603.	8.2170e-05	1614.9	0.19242
8.8400	1.5874	341.93	21559.	0.00011607	1610.6	0.19454
8.8800	1.5949	342.78	21512.	0.00015580	1606.3	0.19674
8.9200	1.6026	343.59	21462.	0.00020135	1601.7	0.19901
8.9600	1.6103	344.35	21409.	0.00025273	1597.0	0.20136
9.0000	1.6181	345.08	21353.	0.00030993	1592.2	0.20378
9.0400	1.6259	345.78	21295.	0.00036954	1587.2	0.20625
9.0800	1.6337	346.48	21238.	0.00042488	1582.3	0.20870
9.1200	1.6415	347.18	21181.	0.00047593	1577.5	0.21112
9.1600	1.6494	347.89	21125.	0.00052271	1572.7	0.21353
9.2000	1.6573	348.60	21069.	0.00056520	1567.9	0.21592
9.2400	1.6652	349.31	21013.	0.00060342	1563.1	0.21831
9.2800	1.6731	350.02	20957.	0.00063735	1558.4	0.22068
9.3200	1.6811	350.74	20901.	0.00066701	1553.7	0.22304
9.3600	1.6891	351.46	20844.	0.00069238	1549.0	0.22538
9.4000	1.6972	352.18	20788.	0.00071348	1544.3	0.22772
9.4400	1.7053	352.91	20732.	0.00073029	1539.7	0.23004
9.4800	1.7135	353.64	20676.	0.00074283	1535.0	0.23235
9.5200	1.7216	354.37	20620.	0.00075108	1530.4	0.23465
9.5600	1.7299	355.11	20564.	0.00075506	1525.9	0.23694
9.6000	1.7381	355.85	20507.	0.00075506	1521.3	0.23921
9.6400	1.7465	356.58	20450.	0.00075506	1516.8	0.24146
9.6800	1.7549	357.30	20393.	0.00075506	1512.4	0.24369
9.7200	1.7633	358.02	20334.	0.00075506	1508.0	0.24589
9.7600	1.7719	358.73	20275.	0.00075506	1503.6	0.24807
9.8000	1.7805	359.44	20215.	0.00075506	1499.3	0.25022
9.8400	1.7892	360.14	20154.	0.00075506	1495.0	0.25235
9.8800	1.7979	360.86	20096.	0.00075027	1491.0	0.25438
9.9200	1.8064	361.62	20040.	0.00073966	1487.2	0.25630
9.9600	1.8150	362.41	19988.	0.00072323	1483.5	0.25811

	Project Name: Hermosa	Location:	Project Number: TU201-00777/03
	Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
	Sample Number:	Test Date: 8/12/20	Depth:
	Test Number: 2	Preparation: reconstituted	Elevation:
	Description:		
	Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
10.000	1.8235	363.23	19938.	0.00070097	1480.1	0.25980
10.040	1.8319	364.09	19892.	0.00067289	1477.0	0.26138
10.080	1.8403	364.97	19848.	0.00063898	1474.0	0.26285
10.120	1.8486	365.88	19807.	0.00059926	1471.3	0.26422
10.160	1.8568	366.79	19768.	0.00055371	1468.8	0.26548
10.200	1.8650	367.71	19730.	0.00050233	1466.5	0.26665
10.240	1.8732	368.63	19694.	0.00044513	1464.3	0.26772
10.280	1.8813	369.54	19659.	0.00038552	1462.3	0.26872
10.320	1.8895	370.41	19621.	0.00033018	1460.3	0.26973
10.360	1.8977	371.24	19581.	0.00027913	1458.3	0.27073
10.400	1.9059	372.03	19539.	0.00023235	1456.3	0.27174
10.440	1.9142	372.78	19496.	0.00018986	1454.3	0.27274
10.480	1.9225	373.49	19450.	0.00015164	1452.3	0.27375
10.520	1.9308	374.17	19402.	0.00011771	1450.2	0.27476
10.560	1.9392	374.81	19352.	8.8051e-05	1448.2	0.27577
10.600	1.9476	375.41	19300.	6.2676e-05	1446.2	0.27678
10.640	1.9561	375.99	19247.	4.1580e-05	1444.2	0.27778
10.680	1.9647	376.55	19192.	2.4765e-05	1442.2	0.27876
10.720	1.9734	377.11	19137.	1.2230e-05	1440.3	0.27972
10.760	1.9821	377.64	19080.	3.9751e-06	1438.4	0.28067
10.800	1.9910	378.17	19022.	0.00000	1436.5	0.28161
10.840	2.0000	378.68	18963.	0.00000	1434.7	0.28253
10.880	2.0090	379.18	18904.	0.00000	1432.9	0.28345
10.920	2.0181	379.68	18844.	0.00000	1431.0	0.28437
10.960	2.0272	380.17	18784.	0.00000	1429.2	0.28528
11.000	2.0364	380.66	18723.	0.00000	1427.4	0.28620
11.040	2.0456	381.14	18662.	0.00000	1425.5	0.28711
11.080	2.0548	381.60	18601.	0.00000	1423.7	0.28803
11.120	2.0639	382.04	18540.	0.00000	1421.8	0.28896
11.160	2.0730	382.45	18479.	0.00000	1420.0	0.28990
11.200	2.0820	382.84	18417.	0.00000	1418.1	0.29085
11.240	2.0910	383.21	18356.	0.00000	1416.2	0.29180
11.280	2.0999	383.55	18294.	0.00000	1414.2	0.29277
11.320	2.1087	383.88	18233.	0.00000	1412.3	0.29374
11.360	2.1175	384.19	18172.	0.00000	1410.3	0.29472
11.400	2.1262	384.51	18112.	0.00000	1408.4	0.29569
11.440	2.1348	384.83	18053.	0.00000	1406.5	0.29666
11.480	2.1434	385.17	17995.	0.00000	1404.5	0.29762
11.520	2.1520	385.51	17939.	0.00000	1402.6	0.29857
11.560	2.1604	385.85	17884.	0.00000	1400.7	0.29953
11.600	2.1688	386.21	17830.	0.00000	1398.8	0.30047
11.640	2.1772	386.57	17777.	0.00000	1396.9	0.30141
11.680	2.1855	386.93	17725.	0.00000	1395.1	0.30235
11.720	2.1937	387.31	17675.	0.00000	1393.2	0.30327
11.760	2.2017	387.70	17628.	0.00000	1391.4	0.30418
11.800	2.2097	388.10	17582.	0.00000	1389.6	0.30507
11.840	2.2175	388.52	17538.	0.00000	1387.9	0.30595
11.880	2.2252	388.92	17495.	0.00000	1386.1	0.30682
11.920	2.2327	389.32	17453.	0.00000	1384.4	0.30769
11.960	2.2400	389.70	17412.	0.00000	1382.7	0.30856

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
12.000	2.2472	390.07	17373.	0.00000	1380.9	0.30943
12.040	2.2542	390.43	17334.	0.00000	1379.2	0.31029
12.080	2.2610	390.77	17297.	0.00000	1377.4	0.31116
12.120	2.2676	391.11	17261.	0.00000	1375.7	0.31203
12.160	2.2741	391.43	17225.	0.00000	1374.0	0.31289
12.200	2.2804	391.75	17191.	0.00000	1372.2	0.31376
12.240	2.2865	392.05	17158.	0.00000	1370.5	0.31462
12.280	2.2925	392.34	17126.	0.00000	1368.8	0.31548
12.320	2.2984	392.64	17095.	0.00000	1367.1	0.31633
12.360	2.3042	392.95	17064.	0.00000	1365.4	0.31717
12.400	2.3101	393.26	17034.	0.00000	1363.8	0.31800
12.440	2.3158	393.58	17005.	0.00000	1362.2	0.31881
12.480	2.3215	393.90	16977.	0.00000	1360.6	0.31961
12.520	2.3272	394.23	16949.	0.00000	1359.0	0.32040
12.560	2.3330	394.55	16921.	0.00000	1357.4	0.32117
12.600	2.3389	394.88	16892.	0.00000	1355.9	0.32193
12.640	2.3448	395.21	16863.	0.00000	1354.4	0.32267
12.680	2.3509	395.54	16833.	0.00000	1353.0	0.32340
12.720	2.3571	395.86	16803.	0.00000	1351.5	0.32412
12.760	2.3635	396.19	16772.	0.00000	1350.1	0.32481
12.800	2.3699	396.52	16741.	0.00000	1348.8	0.32550
12.840	2.3764	396.85	16709.	0.00000	1347.4	0.32616
12.880	2.3830	397.17	16677.	0.00000	1346.1	0.32682
12.920	2.3898	397.50	16644.	0.00000	1344.9	0.32745
12.960	2.3966	397.83	16611.	0.00000	1343.6	0.32808
13.000	2.4037	398.15	16576.	0.00000	1342.4	0.32871
13.040	2.4109	398.47	16540.	0.00000	1341.1	0.32934
13.080	2.4183	398.78	16504.	0.00000	1339.9	0.32996
13.120	2.4259	399.10	16466.	0.00000	1338.6	0.33058
13.160	2.4336	399.41	16427.	0.00000	1337.4	0.33120
13.200	2.4415	399.72	16388.	0.00000	1336.1	0.33182
13.240	2.4496	400.03	16347.	0.00000	1334.9	0.33243
13.280	2.4578	400.34	16305.	0.00000	1333.7	0.33305
13.320	2.4663	400.65	16263.	0.00000	1332.5	0.33366
13.360	2.4748	400.95	16219.	0.00000	1331.2	0.33427
13.400	2.4836	401.26	16175.	0.00000	1330.0	0.33488
13.440	2.4927	401.58	16129.	0.00000	1328.8	0.33548
13.480	2.5019	401.90	16083.	0.00000	1327.6	0.33608
13.520	2.5113	402.23	16037.	0.00000	1326.4	0.33668
13.560	2.5210	402.57	15989.	0.00000	1325.2	0.33727
13.600	2.5309	402.92	15941.	0.00000	1324.1	0.33786
13.640	2.5410	403.27	15891.	0.00000	1322.9	0.33844
13.680	2.5513	403.63	15842.	0.00000	1321.7	0.33903
13.720	2.5618	404.00	15791.	0.00000	1320.6	0.33961
13.760	2.5725	404.37	15740.	0.00000	1319.4	0.34018
13.800	2.5830	404.74	15690.	0.00000	1318.2	0.34077
13.840	2.5934	405.12	15641.	0.00000	1317.1	0.34135
13.880	2.6036	405.49	15594.	0.00000	1315.9	0.34194
13.920	2.6138	405.87	15547.	0.00000	1314.7	0.34253
13.960	2.6238	406.25	15502.	0.00000	1313.5	0.34313

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
14.000	2.6337	406.63	15457.	0.00000	1312.3	0.34373
14.040	2.6434	407.02	15414.	0.00000	1311.1	0.34433
14.080	2.6531	407.40	15372.	0.00000	1309.9	0.34493
14.120	2.6626	407.79	15331.	0.00000	1308.7	0.34554
14.160	2.6720	408.17	15291.	0.00000	1307.5	0.34615
14.200	2.6813	408.56	15252.	0.00000	1306.2	0.34677
14.240	2.6905	408.95	15214.	0.00000	1305.0	0.34739
14.280	2.6995	409.33	15177.	0.00000	1303.8	0.34801
14.320	2.7084	409.72	15141.	0.00000	1302.5	0.34863
14.360	2.7171	410.10	15105.	0.00000	1301.3	0.34925
14.400	2.7257	410.47	15071.	0.00000	1300.0	0.34988
14.440	2.7342	410.85	15037.	0.00000	1298.8	0.35051
14.480	2.7426	411.22	15004.	0.00000	1297.5	0.35114
14.520	2.7509	411.58	14971.	0.00000	1296.2	0.35178
14.560	2.7592	411.93	14939.	0.00000	1294.9	0.35243
14.600	2.7674	412.28	14907.	0.00000	1293.6	0.35309
14.640	2.7755	412.61	14875.	0.00000	1292.3	0.35376
14.680	2.7835	412.92	14843.	0.00000	1290.9	0.35444
14.720	2.7914	413.22	14812.	0.00000	1289.5	0.35513
14.760	2.7992	413.50	14781.	0.00000	1288.1	0.35582
14.800	2.8069	413.76	14749.	0.00000	1286.7	0.35653
14.840	2.8145	414.01	14718.	0.00000	1285.3	0.35724
14.880	2.8220	414.24	14687.	0.00000	1283.8	0.35797
14.920	2.8294	414.45	14657.	0.00000	1282.4	0.35870
14.960	2.8367	414.64	14626.	0.00000	1280.9	0.35945
15.000	2.8440	414.83	14596.	0.00000	1279.4	0.36019
15.040	2.8514	415.02	14565.	0.00000	1277.9	0.36092
15.080	2.8588	415.21	14534.	0.00000	1276.5	0.36165
15.120	2.8664	415.41	14502.	0.00000	1275.0	0.36237
15.160	2.8741	415.60	14471.	0.00000	1273.6	0.36309
15.200	2.8818	415.79	14439.	0.00000	1272.2	0.36380
15.240	2.8897	415.99	14406.	0.00000	1270.8	0.36451
15.280	2.8976	416.19	14374.	0.00000	1269.4	0.36521
15.320	2.9057	416.39	14341.	0.00000	1268.0	0.36590
15.360	2.9138	416.59	14308.	0.00000	1266.6	0.36658
15.400	2.9220	416.79	14275.	0.00000	1265.3	0.36727
15.440	2.9303	416.99	14241.	0.00000	1263.9	0.36794
15.480	2.9387	417.20	14208.	0.00000	1262.6	0.36861
15.520	2.9470	417.41	14175.	0.00000	1261.2	0.36929
15.560	2.9554	417.63	14142.	0.00000	1259.9	0.36995
15.600	2.9638	417.86	14109.	0.00000	1258.5	0.37062
15.640	2.9722	418.09	14077.	0.00000	1257.2	0.37129
15.680	2.9807	418.32	14045.	0.00000	1255.9	0.37195
15.720	2.9891	418.57	14013.	0.00000	1254.6	0.37261
15.760	2.9975	418.82	13982.	0.00000	1253.3	0.37325
15.800	3.0058	419.09	13952.	0.00000	1252.0	0.37389
15.840	3.0141	419.36	13923.	0.00000	1250.7	0.37453
15.880	3.0223	419.65	13894.	0.00000	1249.5	0.37515
15.920	3.0304	419.95	13866.	0.00000	1248.3	0.37577
15.960	3.0386	420.26	13839.	0.00000	1247.0	0.37637

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
16.000	3.0466	420.58	13812.	0.00000	1245.8	0.37697
16.040	3.0546	420.91	13787.	0.00000	1244.7	0.37756
16.080	3.0626	421.25	13762.	0.00000	1243.5	0.37815
16.120	3.0705	421.60	13737.	0.00000	1242.4	0.37871
16.160	3.0783	421.94	13713.	0.00000	1241.3	0.37927
16.200	3.0860	422.28	13690.	0.00000	1240.2	0.37981
16.240	3.0937	422.62	13667.	0.00000	1239.1	0.38035
16.280	3.1013	422.96	13644.	0.00000	1238.0	0.38089
16.320	3.1088	423.29	13622.	0.00000	1236.9	0.38143
16.360	3.1162	423.62	13600.	0.00000	1235.9	0.38197
16.400	3.1235	423.94	13578.	0.00000	1234.8	0.38250
16.440	3.1307	424.25	13557.	0.00000	1233.7	0.38303
16.480	3.1379	424.56	13536.	0.00000	1232.7	0.38357
16.520	3.1449	424.87	13515.	0.00000	1231.6	0.38410
16.560	3.1519	425.17	13495.	0.00000	1230.5	0.38463
16.600	3.1588	425.47	13475.	0.00000	1229.5	0.38516
16.640	3.1656	425.76	13455.	0.00000	1228.4	0.38568
16.680	3.1723	426.04	13435.	0.00000	1227.4	0.38621
16.720	3.1790	426.32	13416.	0.00000	1226.3	0.38673
16.760	3.1857	426.58	13396.	0.00000	1225.3	0.38725
16.800	3.1924	426.84	13376.	0.00000	1224.3	0.38776
16.840	3.1991	427.08	13355.	0.00000	1223.3	0.38827
16.880	3.2058	427.31	13335.	0.00000	1222.2	0.38878
16.920	3.2125	427.53	13314.	0.00000	1221.2	0.38928
16.960	3.2192	427.74	13293.	0.00000	1220.2	0.38978
17.000	3.2259	427.94	13271.	0.00000	1219.2	0.39028
17.040	3.2326	428.12	13250.	0.00000	1218.2	0.39078
17.080	3.2393	428.30	13228.	0.00000	1217.2	0.39127
17.120	3.2460	428.46	13206.	0.00000	1216.3	0.39176
17.160	3.2527	428.61	13183.	0.00000	1215.3	0.39225
17.200	3.2594	428.75	13160.	0.00000	1214.3	0.39274
17.240	3.2661	428.88	13137.	0.00000	1213.4	0.39322
17.280	3.2728	429.00	13114.	0.00000	1212.4	0.39370
17.320	3.2795	429.11	13091.	0.00000	1211.4	0.39417
17.360	3.2862	429.21	13067.	0.00000	1210.5	0.39465
17.400	3.2930	429.32	13043.	0.00000	1209.5	0.39514
17.440	3.2999	429.44	13020.	0.00000	1208.5	0.39562
17.480	3.3070	429.56	12996.	0.00000	1207.6	0.39611
17.520	3.3141	429.69	12971.	0.00000	1206.6	0.39661
17.560	3.3214	429.82	12947.	0.00000	1205.6	0.39711
17.600	3.3287	429.96	12923.	0.00000	1204.6	0.39761
17.640	3.3362	430.10	12898.	0.00000	1203.6	0.39812
17.680	3.3438	430.25	12874.	0.00000	1202.5	0.39863
17.720	3.3515	430.41	12849.	0.00000	1201.5	0.39915
17.760	3.3593	430.57	12824.	0.00000	1200.5	0.39967
17.800	3.3672	430.73	12799.	0.00000	1199.4	0.40019
17.840	3.3752	430.91	12773.	0.00000	1198.4	0.40072
17.880	3.3833	431.08	12748.	0.00000	1197.3	0.40125
17.920	3.3916	431.27	12723.	0.00000	1196.2	0.40178
17.960	3.4000	431.46	12697.	0.00000	1195.2	0.40231

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
18.000	3.4085	431.65	12671.	0.00000	1194.1	0.40285
18.040	3.4171	431.86	12645.	0.00000	1193.0	0.40338
18.080	3.4258	432.07	12620.	0.00000	1192.0	0.40392
18.120	3.4346	432.29	12594.	0.00000	1190.9	0.40445
18.160	3.4435	432.51	12568.	0.00000	1189.8	0.40499
18.200	3.4525	432.75	12542.	0.00000	1188.7	0.40552
18.240	3.4616	432.99	12516.	0.00000	1187.7	0.40606
18.280	3.4708	433.23	12489.	0.00000	1186.6	0.40660
18.320	3.4802	433.48	12463.	0.00000	1185.5	0.40715
18.360	3.4898	433.72	12436.	0.00000	1184.4	0.40771
18.400	3.4994	433.97	12409.	0.00000	1183.3	0.40827
18.440	3.5093	434.22	12381.	0.00000	1182.1	0.40884
18.480	3.5192	434.47	12353.	0.00000	1181.0	0.40941
18.520	3.5294	434.73	12325.	0.00000	1179.8	0.41000
18.560	3.5396	434.98	12297.	0.00000	1178.6	0.41059
18.600	3.5500	435.24	12268.	0.00000	1177.4	0.41118
18.640	3.5605	435.49	12239.	0.00000	1176.2	0.41178
18.680	3.5709	435.74	12211.	0.00000	1175.1	0.41237
18.720	3.5814	436.00	12182.	0.00000	1173.9	0.41297
18.760	3.5918	436.25	12154.	0.00000	1172.7	0.41355
18.800	3.6023	436.50	12126.	0.00000	1171.5	0.41414
18.840	3.6127	436.76	12098.	0.00000	1170.4	0.41472
18.880	3.6232	437.01	12070.	0.00000	1169.2	0.41530
18.920	3.6336	437.26	12042.	0.00000	1168.1	0.41587
18.960	3.6440	437.52	12015.	0.00000	1166.9	0.41644
19.000	3.6545	437.77	11987.	0.00000	1165.8	0.41701
19.040	3.6649	438.02	11960.	0.00000	1164.7	0.41757
19.080	3.6753	438.28	11933.	0.00000	1163.5	0.41813
19.120	3.6856	438.53	11906.	0.00000	1162.5	0.41868
19.160	3.6957	438.78	11880.	0.00000	1161.4	0.41921
19.200	3.7057	439.02	11855.	0.00000	1160.3	0.41973
19.240	3.7155	439.27	11830.	0.00000	1159.3	0.42024
19.280	3.7252	439.51	11805.	0.00000	1158.3	0.42074
19.320	3.7348	439.75	11781.	0.00000	1157.3	0.42123
19.360	3.7443	439.99	11757.	0.00000	1156.4	0.42171
19.400	3.7536	440.22	11734.	0.00000	1155.5	0.42217
19.440	3.7628	440.46	11711.	0.00000	1154.6	0.42262
19.480	3.7719	440.69	11689.	0.00000	1153.7	0.42306
19.520	3.7808	440.93	11668.	0.00000	1152.8	0.42348
19.560	3.7895	441.16	11647.	0.00000	1152.0	0.42389
19.600	3.7980	441.41	11627.	0.00000	1151.3	0.42427
19.640	3.8064	441.66	11607.	0.00000	1150.5	0.42464
19.680	3.8146	441.91	11589.	0.00000	1149.8	0.42499
19.720	3.8226	442.16	11571.	0.00000	1149.2	0.42532
19.760	3.8304	442.42	11554.	0.00000	1148.5	0.42563
19.800	3.8381	442.69	11537.	0.00000	1148.0	0.42593
19.840	3.8458	442.96	11521.	0.00000	1147.4	0.42621
19.880	3.8534	443.25	11506.	0.00000	1146.9	0.42647
19.920	3.8612	443.53	11490.	0.00000	1146.3	0.42673
19.960	3.8689	443.82	11475.	0.00000	1145.8	0.42698

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
20.000	3.8767	444.12	11459.	0.00000	1145.4	0.42722
20.040	3.8845	444.42	11444.	0.00000	1144.9	0.42745
20.080	3.8924	444.73	11429.	0.00000	1144.4	0.42768
20.120	3.9003	445.04	11413.	0.00000	1144.0	0.42790
20.160	3.9082	445.35	11398.	0.00000	1143.6	0.42811
20.200	3.9162	445.67	11383.	0.00000	1143.2	0.42831
20.240	3.9243	445.98	11368.	0.00000	1142.8	0.42851
20.280	3.9324	446.28	11352.	0.00000	1142.4	0.42869
20.320	3.9406	446.57	11336.	0.00000	1142.1	0.42887
20.360	3.9490	446.85	11319.	0.00000	1141.7	0.42906
20.400	3.9577	447.13	11302.	0.00000	1141.3	0.42924
20.440	3.9665	447.40	11284.	0.00000	1141.0	0.42943
20.480	3.9755	447.65	11265.	0.00000	1140.6	0.42961
20.520	3.9847	447.91	11246.	0.00000	1140.2	0.42980
20.560	3.9940	448.15	11226.	-5.3293e-07	1139.8	0.42999
20.600	4.0034	448.39	11205.	-4.5415e-06	1139.4	0.43019
20.640	4.0127	448.62	11185.	-1.2026e-05	1139.0	0.43038
20.680	4.0221	448.84	11165.	-2.2986e-05	1138.6	0.43058
20.720	4.0315	449.06	11144.	-3.7421e-05	1138.2	0.43079
20.760	4.0409	449.28	11124.	-5.5332e-05	1137.8	0.43099
20.800	4.0503	449.49	11103.	-7.6719e-05	1137.4	0.43120
20.840	4.0597	449.69	11083.	-0.00010158	1137.0	0.43142
20.880	4.0692	449.88	11062.	-0.00012992	1136.5	0.43163
20.920	4.0786	450.07	11041.	-0.00016173	1136.1	0.43185
20.960	4.0881	450.26	11020.	-0.00019702	1135.7	0.43208
21.000	4.0975	450.44	10999.	-0.00023579	1135.2	0.43230
21.040	4.1070	450.61	10977.	-0.00027803	1134.7	0.43254
21.080	4.1163	450.77	10956.	-0.00032374	1134.3	0.43277
21.120	4.1255	450.92	10935.	-0.00037294	1133.8	0.43300
21.160	4.1345	451.05	10915.	-0.00042560	1133.3	0.43323
21.200	4.1433	451.18	10894.	-0.00048175	1132.9	0.43347
21.240	4.1520	451.29	10874.	-0.00054136	1132.4	0.43370
21.280	4.1607	451.39	10853.	-0.00059935	1131.9	0.43395
21.320	4.1692	451.48	10833.	-0.00065211	1131.4	0.43420
21.360	4.1778	451.56	10813.	-0.00069963	1130.9	0.43445
21.400	4.1863	451.64	10792.	-0.00074191	1130.4	0.43472
21.440	4.1947	451.71	10772.	-0.00077896	1129.8	0.43500
21.480	4.2031	451.78	10752.	-0.00081077	1129.2	0.43528
21.520	4.2114	451.86	10733.	-0.00083735	1128.7	0.43558
21.560	4.2196	451.94	10714.	-0.00085869	1128.0	0.43588
21.600	4.2277	452.03	10696.	-0.00087479	1127.4	0.43619
21.640	4.2358	452.13	10677.	-0.00088566	1126.8	0.43652
21.680	4.2438	452.23	10660.	-0.00089129	1126.1	0.43685
21.720	4.2517	452.34	10643.	-0.00089169	1125.4	0.43719
21.760	4.2596	452.45	10625.	-0.00089169	1124.7	0.43754
21.800	4.2677	452.56	10608.	-0.00089116	1124.0	0.43789
21.840	4.2760	452.67	10590.	-0.00088715	1123.3	0.43825
21.880	4.2845	452.78	10572.	-0.00087967	1122.6	0.43861
21.920	4.2933	452.88	10553.	-0.00086871	1121.9	0.43898
21.960	4.3023	452.98	10533.	-0.00085427	1121.1	0.43934

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
22.000	4.3115	453.08	10513.	-0.00083636	1120.4	0.43972
22.040	4.3211	453.19	10492.	-0.00081497	1119.6	0.44010
22.080	4.3311	453.30	10471.	-0.00079011	1118.8	0.44051
22.120	4.3415	453.42	10449.	-0.00076177	1117.9	0.44093
22.160	4.3523	453.55	10426.	-0.00072996	1117.1	0.44138
22.200	4.3636	453.69	10403.	-0.00069467	1116.1	0.44185
22.240	4.3752	453.84	10379.	-0.00065590	1115.1	0.44234
22.280	4.3872	454.00	10355.	-0.00061366	1114.1	0.44285
22.320	4.3991	454.17	10331.	-0.00056795	1113.1	0.44335
22.360	4.4110	454.33	10307.	-0.00051876	1112.1	0.44386
22.400	4.4228	454.49	10283.	-0.00046609	1111.1	0.44437
22.440	4.4346	454.66	10260.	-0.00040995	1110.1	0.44487
22.480	4.4464	454.83	10236.	-0.00035033	1109.1	0.44538
22.520	4.4580	454.99	10213.	-0.00029234	1108.0	0.44588
22.560	4.4695	455.16	10191.	-0.00023958	1107.1	0.44638
22.600	4.4809	455.32	10168.	-0.00019206	1106.1	0.44686
22.640	4.4921	455.47	10146.	-0.00014978	1105.1	0.44734
22.680	4.5031	455.63	10125.	-0.00011273	1104.2	0.44781
22.720	4.5140	455.78	10103.	-8.0919e-05	1103.3	0.44828
22.760	4.5248	455.93	10082.	-5.4343e-05	1102.3	0.44873
22.800	4.5354	456.08	10062.	-3.3003e-05	1101.5	0.44918
22.840	4.5458	456.23	10041.	-1.6899e-05	1100.6	0.44962
22.880	4.5561	456.37	10022.	-6.0299e-06	1099.7	0.45006
22.920	4.5663	456.51	10002.	-3.9705e-07	1098.9	0.45048
22.960	4.5763	456.64	9982.7	0.00000	1098.0	0.45090
23.000	4.5860	456.78	9964.2	0.00000	1097.2	0.45131
23.040	4.5955	456.93	9946.5	0.00000	1096.4	0.45172
23.080	4.6046	457.08	9929.6	0.00000	1095.6	0.45213
23.120	4.6137	457.23	9913.2	0.00000	1094.7	0.45253
23.160	4.6225	457.40	9897.5	0.00000	1093.9	0.45293
23.200	4.6313	457.58	9882.4	0.00000	1093.1	0.45333
23.240	4.6399	457.76	9867.9	0.00000	1092.4	0.45373
23.280	4.6483	457.96	9854.0	0.00000	1091.6	0.45412
23.320	4.6564	458.15	9840.9	0.00000	1090.8	0.45448
23.360	4.6642	458.33	9828.4	0.00000	1090.2	0.45483
23.400	4.6716	458.52	9816.6	0.00000	1089.5	0.45516
23.440	4.6788	458.70	9805.5	0.00000	1088.9	0.45546
23.480	4.6856	458.88	9795.1	0.00000	1088.3	0.45575
23.520	4.6922	459.06	9785.2	0.00000	1087.8	0.45602
23.560	4.6991	459.24	9774.8	0.00000	1087.2	0.45629
23.600	4.7061	459.42	9764.0	0.00000	1086.7	0.45656
23.640	4.7134	459.59	9752.7	0.00000	1086.2	0.45682
23.680	4.7209	459.76	9740.9	0.00000	1085.7	0.45707
23.720	4.7286	459.93	9728.7	0.00000	1085.2	0.45732
23.760	4.7366	460.09	9715.9	0.00000	1084.7	0.45757
23.800	4.7447	460.25	9702.7	0.00000	1084.2	0.45781
23.840	4.7531	460.40	9688.9	0.00000	1083.7	0.45805
23.880	4.7618	460.55	9674.7	0.00000	1083.2	0.45829
23.920	4.7706	460.70	9660.0	0.00000	1082.8	0.45851
23.960	4.7798	460.88	9645.4	0.00000	1082.3	0.45874

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
24.000	4.7893	461.09	9630.8	0.00000	1081.9	0.45896
24.040	4.7991	461.33	9616.2	0.00000	1081.5	0.45917
24.080	4.8093	461.61	9601.7	0.00000	1081.1	0.45937
24.120	4.8198	461.91	9587.2	0.00000	1080.7	0.45958
24.160	4.8306	462.25	9572.8	0.00000	1080.3	0.45977
24.200	4.8417	462.61	9558.4	0.00000	1079.9	0.45996
24.240	4.8530	462.99	9543.9	0.00000	1079.5	0.46014
24.280	4.8644	463.36	9529.1	0.00000	1079.2	0.46032
24.320	4.8759	463.72	9514.1	0.00000	1078.8	0.46049
24.360	4.8873	464.06	9499.0	0.00000	1078.5	0.46065
24.400	4.8987	464.40	9483.8	0.00000	1078.2	0.46080
24.440	4.9100	464.72	9468.5	0.00000	1077.9	0.46095
24.480	4.9213	465.03	9453.1	0.00000	1077.7	0.46108
24.520	4.9325	465.33	9437.7	0.00000	1077.4	0.46121
24.560	4.9436	465.62	9422.1	0.00000	1077.2	0.46133
24.600	4.9547	465.89	9406.5	0.00000	1076.9	0.46144
24.640	4.9657	466.15	9390.8	0.00000	1076.7	0.46154
24.680	4.9767	466.39	9374.9	0.00000	1076.5	0.46163
24.720	4.9876	466.63	9359.0	0.00000	1076.4	0.46172
24.760	4.9984	466.85	9343.1	0.00000	1076.2	0.46180
24.800	5.0091	467.06	9327.4	0.00000	1076.1	0.46188
24.840	5.0195	467.27	9312.0	0.00000	1075.9	0.46197
24.880	5.0298	467.47	9296.9	0.00000	1075.7	0.46205
24.920	5.0399	467.68	9282.1	0.00000	1075.5	0.46215
24.960	5.0499	467.87	9267.7	0.00000	1075.3	0.46224
25.000	5.0597	468.06	9253.5	0.00000	1075.2	0.46233
25.040	5.0692	468.25	9239.6	0.00000	1075.0	0.46243
25.080	5.0787	468.43	9226.1	0.00000	1074.8	0.46253
25.120	5.0879	468.61	9212.8	0.00000	1074.5	0.46264
25.160	5.0969	468.78	9199.8	0.00000	1074.3	0.46275
25.200	5.1057	468.92	9186.6	0.00000	1074.1	0.46286
25.240	5.1142	469.01	9173.2	0.00000	1073.9	0.46297
25.280	5.1224	469.07	9159.5	0.00000	1073.6	0.46309
25.320	5.1303	469.08	9145.7	0.00000	1073.4	0.46321
25.360	5.1380	469.06	9131.6	0.00000	1073.1	0.46334
25.400	5.1453	468.99	9117.2	0.00000	1072.9	0.46347
25.440	5.1526	468.91	9102.8	0.00000	1072.6	0.46360
25.480	5.1598	468.83	9088.4	0.00000	1072.4	0.46373
25.520	5.1671	468.76	9074.3	0.00000	1072.1	0.46386
25.560	5.1746	468.72	9060.3	0.00000	1071.9	0.46398
25.600	5.1821	468.69	9046.5	0.00000	1071.6	0.46410
25.640	5.1898	468.67	9032.9	0.00000	1071.4	0.46423
25.680	5.1975	468.68	9019.5	0.00000	1071.1	0.46435
25.720	5.2054	468.70	9006.3	0.00000	1070.9	0.46447
25.760	5.2134	468.74	8993.3	0.00000	1070.7	0.46458
25.800	5.2214	468.80	8980.5	0.00000	1070.4	0.46470
25.840	5.2295	468.87	8968.0	0.00000	1070.2	0.46482
25.880	5.2375	468.95	8955.8	0.00000	1069.9	0.46494
25.920	5.2454	469.04	8944.0	0.00000	1069.7	0.46506
25.960	5.2533	469.14	8932.5	0.00000	1069.4	0.46519

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
26.000	5.2611	469.26	8921.3	0.00000	1069.2	0.46531
26.040	5.2690	469.38	8910.4	0.00000	1069.0	0.46543
26.080	5.2768	469.52	8899.8	0.00000	1068.7	0.46555
26.120	5.2846	469.67	8889.5	0.00000	1068.5	0.46567
26.160	5.2923	469.83	8879.5	0.00000	1068.3	0.46578
26.200	5.3001	470.01	8869.7	0.00000	1068.0	0.46589
26.240	5.3078	470.19	8860.2	0.00000	1067.8	0.46600
26.280	5.3155	470.39	8851.0	0.00000	1067.6	0.46610
26.320	5.3232	470.60	8842.1	0.00000	1067.4	0.46620
26.360	5.3309	470.82	8833.4	0.00000	1067.2	0.46630
26.400	5.3386	471.06	8825.1	0.00000	1067.0	0.46640
26.440	5.3462	471.30	8817.0	0.00000	1066.8	0.46650
26.480	5.3538	471.56	8809.2	0.00000	1066.6	0.46659
26.520	5.3614	471.83	8801.6	0.00000	1066.5	0.46668
26.560	5.3690	472.11	8794.4	0.00000	1066.3	0.46676
26.600	5.3768	472.40	8787.1	0.00000	1066.1	0.46684
26.640	5.3847	472.70	8779.5	0.00000	1066.0	0.46692
26.680	5.3929	472.98	8771.6	0.00000	1065.8	0.46699
26.720	5.4011	473.25	8763.2	0.00000	1065.7	0.46707
26.760	5.4094	473.50	8754.5	0.00000	1065.5	0.46714
26.800	5.4178	473.74	8745.4	0.00000	1065.4	0.46721
26.840	5.4263	473.96	8735.9	0.00000	1065.2	0.46729
26.880	5.4349	474.17	8726.0	0.00000	1065.1	0.46736
26.920	5.4435	474.36	8715.8	0.00000	1065.0	0.46743
26.960	5.4520	474.53	8705.4	0.00000	1064.8	0.46751
27.000	5.4604	474.68	8694.7	0.00000	1064.6	0.46759
27.040	5.4689	474.81	8683.9	0.00000	1064.5	0.46767
27.080	5.4773	474.92	8672.6	0.00000	1064.3	0.46775
27.120	5.4859	475.02	8661.0	0.00000	1064.2	0.46782
27.160	5.4946	475.10	8648.9	0.00000	1064.0	0.46790
27.200	5.5034	475.17	8636.5	0.00000	1063.9	0.46797
27.240	5.5123	475.22	8623.7	0.00000	1063.7	0.46804
27.280	5.5213	475.26	8610.5	0.00000	1063.6	0.46811
27.320	5.5304	475.29	8596.9	0.00000	1063.5	0.46817
27.360	5.5396	475.30	8582.9	0.00000	1063.4	0.46823
27.400	5.5489	475.31	8568.8	0.00000	1063.2	0.46829
27.440	5.5583	475.32	8554.5	0.00000	1063.2	0.46833
27.480	5.5678	475.32	8540.0	0.00000	1063.1	0.46837
27.520	5.5773	475.32	8525.3	0.00000	1063.0	0.46841
27.560	5.5870	475.31	8510.4	0.00000	1062.9	0.46844
27.600	5.5967	475.29	8495.4	0.00000	1062.9	0.46846
27.640	5.6066	475.27	8480.2	0.00000	1062.9	0.46847
27.680	5.6165	475.25	8464.7	0.00000	1062.9	0.46848
27.720	5.6265	475.22	8449.1	0.00000	1062.9	0.46848
27.760	5.6366	475.19	8433.4	0.00000	1062.9	0.46847
27.800	5.6467	475.15	8417.4	0.00000	1062.9	0.46846
27.840	5.6568	475.11	8401.6	0.00000	1062.9	0.46844
27.880	5.6667	475.08	8386.2	0.00000	1063.0	0.46843
27.920	5.6764	475.06	8371.4	0.00000	1063.0	0.46841
27.960	5.6859	475.04	8357.0	0.00000	1063.0	0.46841

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
28.000	5.6952	475.04	8343.2	0.00000	1063.0	0.46840
28.040	5.7043	475.04	8329.8	0.00000	1063.0	0.46840
28.080	5.7131	475.04	8316.9	0.00000	1063.0	0.46841
28.120	5.7218	475.06	8304.6	0.00000	1063.0	0.46841
28.160	5.7304	475.09	8292.6	0.00000	1063.0	0.46842
28.200	5.7389	475.13	8281.0	0.00000	1062.9	0.46844
28.240	5.7474	475.19	8269.7	0.00000	1062.9	0.46845
28.280	5.7558	475.26	8258.7	0.00000	1062.9	0.46847
28.320	5.7642	475.35	8248.2	0.00000	1062.8	0.46849
28.360	5.7725	475.45	8237.9	0.00000	1062.8	0.46851
28.400	5.7808	475.56	8228.0	0.00000	1062.7	0.46854
28.440	5.7891	475.68	8218.3	0.00000	1062.7	0.46856
28.480	5.7974	475.81	8208.7	0.00000	1062.6	0.46859
28.520	5.8057	475.95	8199.3	0.00000	1062.6	0.46861
28.560	5.8141	476.09	8189.9	0.00000	1062.6	0.46863
28.600	5.8225	476.24	8180.7	0.00000	1062.5	0.46865
28.640	5.8309	476.38	8171.3	0.00000	1062.5	0.46867
28.680	5.8394	476.52	8161.8	0.00000	1062.4	0.46869
28.720	5.8480	476.66	8152.3	0.00000	1062.4	0.46872
28.760	5.8566	476.80	8142.6	0.00000	1062.3	0.46875
28.800	5.8652	476.93	8132.9	0.00000	1062.2	0.46879
28.840	5.8739	477.06	8123.0	0.00000	1062.2	0.46882
28.880	5.8827	477.18	8113.2	0.00000	1062.1	0.46886
28.920	5.8913	477.31	8103.5	0.00000	1062.0	0.46891
28.960	5.8998	477.45	8094.1	0.00000	1061.9	0.46895
29.000	5.9082	477.58	8084.9	0.00000	1061.8	0.46900
29.040	5.9165	477.72	8075.9	0.00000	1061.7	0.46905
29.080	5.9247	477.86	8067.1	0.00000	1061.6	0.46910
29.120	5.9329	478.00	8058.4	0.00000	1061.5	0.46916
29.160	5.9409	478.14	8049.8	0.00000	1061.4	0.46921
29.200	5.9489	478.28	8041.3	0.00000	1061.3	0.46925
29.240	5.9568	478.41	8032.8	0.00000	1061.2	0.46929
29.280	5.9646	478.54	8024.5	0.00000	1061.2	0.46933
29.320	5.9724	478.68	8016.2	0.00000	1061.1	0.46936
29.360	5.9801	478.80	8008.0	0.00000	1061.0	0.46939
29.400	5.9877	478.93	7999.9	0.00000	1061.0	0.46941
29.440	5.9953	479.05	7991.8	0.00000	1061.0	0.46944
29.480	6.0027	479.17	7983.8	0.00000	1060.9	0.46945
29.520	6.0101	479.29	7975.9	0.00000	1060.9	0.46947
29.560	6.0175	479.41	7968.1	0.00000	1060.9	0.46947
29.600	6.0247	479.53	7960.4	0.00000	1060.9	0.46948
29.640	6.0319	479.64	7952.7	0.00000	1060.9	0.46948
29.680	6.0391	479.75	7945.1	0.00000	1060.9	0.46948
29.720	6.0463	479.87	7937.5	0.00000	1060.8	0.46949
29.760	6.0534	479.99	7930.1	0.00000	1060.8	0.46949
29.800	6.0606	480.11	7922.8	0.00000	1060.8	0.46950
29.840	6.0677	480.24	7915.5	0.00000	1060.8	0.46951
29.880	6.0748	480.37	7908.4	0.00000	1060.8	0.46952
29.920	6.0819	480.50	7901.3	0.00000	1060.8	0.46953
29.960	6.0890	480.64	7894.4	0.00000	1060.7	0.46954

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
30.000	6.0961	480.78	7887.5	0.00000	1060.7	0.46955
30.040	6.1031	480.92	7880.8	0.00000	1060.7	0.46957
30.080	6.1101	481.07	7874.1	0.00000	1060.6	0.46959
30.120	6.1171	481.22	7867.6	0.00000	1060.6	0.46961
30.160	6.1241	481.36	7860.9	0.00000	1060.5	0.46964
30.200	6.1312	481.49	7854.1	0.00000	1060.5	0.46968
30.240	6.1383	481.62	7847.2	0.00000	1060.4	0.46972
30.280	6.1454	481.74	7840.1	0.00000	1060.3	0.46977
30.320	6.1526	481.86	7833.0	0.00000	1060.2	0.46983
30.360	6.1598	481.97	7825.7	0.00000	1060.0	0.46989
30.400	6.1670	482.08	7818.2	0.00000	1059.9	0.46996
30.440	6.1743	482.18	7810.7	0.00000	1059.8	0.47003
30.480	6.1816	482.27	7803.0	0.00000	1059.6	0.47011
30.520	6.1889	482.36	7795.2	0.00000	1059.4	0.47020
30.560	6.1963	482.45	7787.2	0.00000	1059.2	0.47030
30.600	6.2038	482.52	7779.2	0.00000	1059.0	0.47040
30.640	6.2112	482.59	7771.0	0.00000	1058.8	0.47051
30.680	6.2187	482.66	7762.7	0.00000	1058.6	0.47062
30.720	6.2262	482.72	7754.3	0.00000	1058.3	0.47074
30.760	6.2338	482.77	7745.7	0.00000	1058.1	0.47087
30.800	6.2415	482.82	7736.9	0.00000	1057.8	0.47100
30.840	6.2494	482.86	7727.9	0.00000	1057.6	0.47113
30.880	6.2574	482.90	7718.5	0.00000	1057.3	0.47127
30.920	6.2654	482.93	7709.2	0.00000	1057.0	0.47141
30.960	6.2735	482.97	7699.8	0.00000	1056.7	0.47156
31.000	6.2816	482.99	7690.3	0.00000	1056.4	0.47170
31.040	6.2897	483.02	7680.7	0.00000	1056.1	0.47185
31.080	6.2978	483.04	7671.1	0.00000	1055.8	0.47199
31.120	6.3060	483.05	7661.5	0.00000	1055.5	0.47214
31.160	6.3142	483.07	7651.8	0.00000	1055.2	0.47230
31.200	6.3224	483.08	7642.1	0.00000	1054.9	0.47245
31.240	6.3305	483.11	7632.7	0.00000	1054.6	0.47259
31.280	6.3385	483.14	7623.6	0.00000	1054.4	0.47273
31.320	6.3465	483.18	7614.7	0.00000	1054.1	0.47287
31.360	6.3544	483.23	7606.0	0.00000	1053.8	0.47299
31.400	6.3624	483.30	7597.5	0.00000	1053.6	0.47311
31.440	6.3704	483.38	7589.2	0.00000	1053.4	0.47322
31.480	6.3784	483.47	7581.1	0.00000	1053.2	0.47331
31.520	6.3865	483.57	7573.1	0.00000	1053.0	0.47340
31.560	6.3945	483.69	7565.3	0.00000	1052.9	0.47347
31.600	6.4026	483.81	7557.7	0.00000	1052.7	0.47354
31.640	6.4107	483.95	7550.3	0.00000	1052.6	0.47359
31.680	6.4188	484.11	7543.1	0.00000	1052.5	0.47364
31.720	6.4269	484.27	7536.1	0.00000	1052.5	0.47367
31.760	6.4351	484.45	7529.2	0.00000	1052.4	0.47370
31.800	6.4433	484.63	7522.4	0.00000	1052.4	0.47372
31.840	6.4516	484.81	7515.4	0.00000	1052.4	0.47373
31.880	6.4600	484.99	7508.4	0.00000	1052.3	0.47375
31.920	6.4686	485.16	7501.1	0.00000	1052.3	0.47376
31.960	6.4772	485.33	7493.7	0.00000	1052.3	0.47377

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
32.000	6.4859	485.50	7486.2	0.00000	1052.3	0.47378
32.040	6.4947	485.66	7478.7	0.00000	1052.2	0.47379
32.080	6.5034	485.82	7471.1	0.00000	1052.2	0.47380
32.120	6.5121	485.98	7463.5	0.00000	1052.2	0.47381
32.160	6.5208	486.13	7455.9	0.00000	1052.2	0.47383
32.200	6.5295	486.28	7448.3	0.00000	1052.1	0.47384
32.240	6.5381	486.43	7440.7	0.00000	1052.1	0.47386
32.280	6.5469	486.58	7433.1	0.00000	1052.1	0.47387
32.320	6.5557	486.74	7425.6	0.00000	1052.0	0.47389
32.360	6.5645	486.89	7418.1	0.00000	1052.0	0.47391
32.400	6.5735	487.06	7410.5	0.00000	1052.0	0.47393
32.440	6.5825	487.22	7402.9	0.00000	1051.9	0.47395
32.480	6.5917	487.38	7395.0	0.00000	1051.9	0.47398
32.520	6.6011	487.53	7386.8	0.00000	1051.8	0.47402
32.560	6.6107	487.66	7378.3	0.00000	1051.7	0.47406
32.600	6.6204	487.80	7369.5	0.00000	1051.6	0.47412
32.640	6.6301	487.91	7360.6	0.00000	1051.5	0.47417
32.680	6.6398	488.02	7351.4	0.00000	1051.3	0.47424
32.720	6.6496	488.11	7342.1	0.00000	1051.2	0.47431
32.760	6.6593	488.20	7332.6	0.00000	1051.1	0.47438
32.800	6.6691	488.26	7323.0	0.00000	1050.9	0.47446
32.840	6.6789	488.32	7313.1	0.00000	1050.7	0.47454
32.880	6.6887	488.37	7303.1	0.00000	1050.6	0.47463
32.920	6.6985	488.40	7292.9	0.00000	1050.4	0.47472
32.960	6.7083	488.42	7282.5	0.00000	1050.2	0.47482
33.000	6.7182	488.43	7271.9	0.00000	1050.0	0.47492
33.040	6.7280	488.43	7261.3	0.00000	1049.8	0.47502
33.080	6.7377	488.43	7250.9	0.00000	1049.6	0.47513
33.120	6.7474	488.44	7240.5	0.00000	1049.4	0.47522
33.160	6.7570	488.45	7230.4	0.00000	1049.2	0.47532
33.200	6.7665	488.47	7220.5	0.00000	1049.0	0.47540
33.240	6.7758	488.50	7210.8	0.00000	1048.9	0.47547
33.280	6.7851	488.54	7201.5	0.00000	1048.8	0.47553
33.320	6.7942	488.59	7192.5	0.00000	1048.7	0.47558
33.360	6.8032	488.64	7183.8	0.00000	1048.6	0.47562
33.400	6.8120	488.71	7175.4	0.00000	1048.5	0.47565
33.440	6.8208	488.79	7167.3	0.00000	1048.5	0.47567
33.480	6.8294	488.88	7159.4	0.00000	1048.5	0.47567
33.520	6.8378	488.97	7151.9	0.00000	1048.5	0.47567
33.560	6.8460	489.06	7144.6	0.00000	1048.5	0.47565
33.600	6.8540	489.15	7137.6	0.00000	1048.6	0.47562
33.640	6.8618	489.25	7130.8	0.00000	1048.6	0.47559
33.680	6.8694	489.35	7124.3	0.00000	1048.7	0.47554
33.720	6.8768	489.45	7118.1	0.00000	1048.9	0.47548
33.760	6.8840	489.55	7112.2	0.00000	1049.0	0.47541
33.800	6.8909	489.66	7106.5	0.00000	1049.2	0.47533
33.840	6.8977	489.76	7101.0	0.00000	1049.3	0.47524
33.880	6.9045	489.88	7095.7	0.00000	1049.5	0.47515
33.920	6.9115	490.00	7090.3	0.00000	1049.7	0.47506
33.960	6.9185	490.13	7084.9	0.00000	1049.9	0.47496

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
34.000	6.9258	490.27	7079.5	0.00000	1050.1	0.47486
34.040	6.9331	490.42	7074.1	0.00000	1050.3	0.47476
34.080	6.9406	490.57	7068.7	0.00000	1050.5	0.47466
34.120	6.9482	490.73	7063.3	0.00000	1050.7	0.47456
34.160	6.9560	490.90	7057.9	0.00000	1050.9	0.47446
34.200	6.9638	491.08	7052.4	0.00000	1051.1	0.47436
34.240	6.9718	491.26	7047.0	0.00000	1051.3	0.47425
34.280	6.9800	491.44	7041.4	0.00000	1051.5	0.47414
34.320	6.9882	491.62	7035.6	0.00000	1051.7	0.47404
34.360	6.9965	491.79	7029.8	0.00000	1052.0	0.47393
34.400	7.0050	491.96	7023.8	0.00000	1052.2	0.47382
34.440	7.0136	492.12	7017.5	0.00000	1052.4	0.47371
34.480	7.0224	492.27	7010.9	0.00000	1052.6	0.47361
34.520	7.0313	492.41	7004.1	0.00000	1052.8	0.47352
34.560	7.0404	492.54	6997.0	0.00000	1052.9	0.47344
34.600	7.0496	492.66	6989.5	0.00000	1053.1	0.47336
34.640	7.0590	492.77	6981.9	0.00000	1053.3	0.47328
34.680	7.0684	492.88	6974.2	0.00000	1053.4	0.47322
34.720	7.0778	492.99	6966.6	0.00000	1053.5	0.47317
34.760	7.0872	493.10	6958.9	0.00000	1053.6	0.47313
34.800	7.0966	493.21	6951.2	0.00000	1053.6	0.47310
34.840	7.1061	493.33	6943.6	0.00000	1053.7	0.47308
34.880	7.1155	493.44	6935.9	0.00000	1053.7	0.47307
34.920	7.1250	493.55	6928.2	0.00000	1053.7	0.47308
34.960	7.1345	493.66	6920.5	0.00000	1053.6	0.47309
35.000	7.1441	493.77	6912.8	0.00000	1053.6	0.47311
35.040	7.1536	493.88	6905.1	0.00000	1053.5	0.47315
35.080	7.1632	493.99	6897.4	0.00000	1053.4	0.47319
35.120	7.1726	494.10	6889.8	0.00000	1053.3	0.47324
35.160	7.1819	494.20	6882.3	0.00000	1053.2	0.47330
35.200	7.1911	494.31	6875.0	0.00000	1053.1	0.47336
35.240	7.2000	494.41	6867.8	0.00000	1053.0	0.47342
35.280	7.2088	494.52	6860.8	0.00000	1052.8	0.47349
35.320	7.2175	494.62	6854.0	0.00000	1052.7	0.47356
35.360	7.2260	494.72	6847.2	0.00000	1052.6	0.47363
35.400	7.2343	494.81	6840.6	0.00000	1052.4	0.47370
35.440	7.2425	494.90	6834.0	0.00000	1052.3	0.47377
35.480	7.2505	494.98	6827.5	0.00000	1052.2	0.47383
35.520	7.2584	495.07	6821.3	0.00000	1052.0	0.47390
35.560	7.2662	495.17	6815.2	0.00000	1051.9	0.47396
35.600	7.2739	495.27	6809.4	0.00000	1051.8	0.47401
35.640	7.2814	495.38	6803.8	0.00000	1051.7	0.47407
35.680	7.2888	495.49	6798.5	0.00000	1051.6	0.47412
35.720	7.2961	495.61	6793.3	0.00000	1051.5	0.47417
35.760	7.3033	495.74	6788.4	0.00000	1051.4	0.47422
35.800	7.3103	495.87	6783.6	0.00000	1051.3	0.47426
35.840	7.3172	496.01	6779.1	0.00000	1051.2	0.47430
35.880	7.3241	496.15	6774.8	0.00000	1051.1	0.47434
35.920	7.3309	496.29	6770.4	0.00000	1051.1	0.47437
35.960	7.3378	496.43	6765.9	0.00000	1051.0	0.47440

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
36.000	7.3449	496.57	6761.3	0.00000	1051.0	0.47443
36.040	7.3521	496.72	6756.7	0.00000	1050.9	0.47445
36.080	7.3594	496.86	6751.9	0.00000	1050.9	0.47447
36.120	7.3668	497.00	6747.1	0.00000	1050.8	0.47449
36.160	7.3743	497.14	6742.2	0.00000	1050.8	0.47451
36.200	7.3820	497.29	6737.1	0.00000	1050.8	0.47452
36.240	7.3897	497.43	6732.0	0.00000	1050.7	0.47454
36.280	7.3976	497.58	6726.8	0.00000	1050.7	0.47455
36.320	7.4056	497.73	6721.6	0.00000	1050.7	0.47455
36.360	7.4137	497.87	6716.2	0.00000	1050.7	0.47456
36.400	7.4218	498.00	6710.7	0.00000	1050.7	0.47456
36.440	7.4298	498.13	6705.1	0.00000	1050.7	0.47456
36.480	7.4379	498.25	6699.5	0.00000	1050.7	0.47456
36.520	7.4459	498.36	6693.7	0.00000	1050.7	0.47456
36.560	7.4540	498.46	6687.9	0.00000	1050.7	0.47455
36.600	7.4620	498.55	6681.9	0.00000	1050.7	0.47455
36.640	7.4701	498.64	6676.0	0.00000	1050.7	0.47455
36.680	7.4781	498.73	6670.0	0.00000	1050.7	0.47456
36.720	7.4861	498.81	6664.0	0.00000	1050.7	0.47457
36.760	7.4940	498.89	6657.9	0.00000	1050.7	0.47458
36.800	7.5020	498.96	6651.8	0.00000	1050.6	0.47460
36.840	7.5099	499.03	6645.7	0.00000	1050.6	0.47463
36.880	7.5178	499.09	6639.6	0.00000	1050.5	0.47466
36.920	7.5257	499.15	6633.4	0.00000	1050.4	0.47469
36.960	7.5335	499.20	6627.1	0.00000	1050.4	0.47473
37.000	7.5414	499.25	6620.9	0.00000	1050.3	0.47477
37.040	7.5493	499.30	6614.6	0.00000	1050.2	0.47482
37.080	7.5574	499.37	6608.5	0.00000	1050.1	0.47486
37.120	7.5657	499.47	6602.6	0.00000	1050.0	0.47489
37.160	7.5742	499.60	6596.8	0.00000	1050.0	0.47492
37.200	7.5828	499.74	6591.1	0.00000	1050.0	0.47493
37.240	7.5916	499.91	6585.7	0.00000	1049.9	0.47494
37.280	7.6005	500.09	6580.4	0.00000	1050.0	0.47493
37.320	7.6095	500.30	6575.3	0.00000	1050.0	0.47491
37.360	7.6186	500.52	6570.3	0.00000	1050.1	0.47489
37.400	7.6281	500.73	6564.9	0.00000	1050.1	0.47485
37.440	7.6379	500.92	6559.0	0.00000	1050.2	0.47481
37.480	7.6481	501.10	6552.7	0.00000	1050.3	0.47477
37.520	7.6585	501.27	6546.0	0.00000	1050.4	0.47472
37.560	7.6693	501.42	6538.8	0.00000	1050.5	0.47467
37.600	7.6801	501.57	6531.7	0.00000	1050.6	0.47461
37.640	7.6910	501.74	6524.6	0.00000	1050.7	0.47455
37.680	7.7020	501.91	6517.6	0.00000	1050.8	0.47449
37.720	7.7130	502.09	6510.6	0.00000	1051.0	0.47443
37.760	7.7241	502.27	6503.7	0.00000	1051.1	0.47437
37.800	7.7353	502.47	6496.9	0.00000	1051.2	0.47430
37.840	7.7465	502.67	6490.1	0.00000	1051.4	0.47423
37.880	7.7578	502.88	6483.4	0.00000	1051.5	0.47416
37.920	7.7692	503.10	6476.7	0.00000	1051.6	0.47409
37.960	7.7807	503.33	6470.1	0.00000	1051.8	0.47401

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
38.000	7.7923	503.57	6463.5	0.00000	1052.0	0.47393
38.040	7.8039	503.81	6457.0	0.00000	1052.1	0.47385
38.080	7.8155	504.06	6450.6	0.00000	1052.3	0.47378
38.120	7.8271	504.31	6444.3	0.00000	1052.4	0.47370
38.160	7.8387	504.57	6438.0	0.00000	1052.6	0.47363
38.200	7.8502	504.83	6431.8	0.00000	1052.7	0.47357
38.240	7.8617	505.10	6425.8	0.00000	1052.8	0.47350
38.280	7.8732	505.36	6419.7	0.00000	1052.9	0.47345
38.320	7.8844	505.60	6413.6	0.00000	1053.0	0.47340
38.360	7.8953	505.81	6407.4	0.00000	1053.1	0.47338
38.400	7.9060	506.00	6401.1	0.00000	1053.1	0.47336
38.440	7.9164	506.16	6394.7	0.00000	1053.1	0.47336
38.480	7.9266	506.30	6388.2	0.00000	1053.1	0.47338
38.520	7.9365	506.41	6381.5	0.00000	1053.0	0.47341
38.560	7.9461	506.49	6374.8	0.00000	1052.9	0.47346
38.600	7.9554	506.56	6368.1	0.00000	1052.8	0.47352
38.640	7.9643	506.63	6361.8	0.00000	1052.6	0.47359
38.680	7.9727	506.71	6356.1	0.00000	1052.5	0.47367
38.720	7.9806	506.80	6350.9	0.00000	1052.3	0.47375
38.760	7.9880	506.90	6346.3	0.00000	1052.1	0.47385
38.800	7.9950	507.01	6342.1	0.00000	1051.9	0.47396
38.840	8.0019	507.12	6337.9	0.00000	1051.7	0.47407
38.880	8.0089	507.23	6333.8	0.00000	1051.5	0.47417
38.920	8.0159	507.34	6329.5	0.00000	1051.3	0.47427
38.960	8.0230	507.45	6325.3	0.00000	1051.1	0.47437
39.000	8.0302	507.56	6321.1	0.00000	1050.9	0.47447
39.040	8.0375	507.67	6316.8	0.00000	1050.7	0.47456
39.080	8.0448	507.79	6312.5	0.00000	1050.5	0.47464
39.120	8.0522	507.91	6308.1	0.00000	1050.4	0.47473
39.160	8.0596	508.02	6303.8	0.00000	1050.2	0.47481
39.200	8.0672	508.14	6299.4	0.00000	1050.1	0.47488
39.240	8.0747	508.26	6294.9	0.00000	1049.9	0.47495
39.280	8.0824	508.37	6290.3	0.00000	1049.8	0.47502
39.320	8.0902	508.47	6285.5	0.00000	1049.7	0.47508
39.360	8.0981	508.56	6280.5	0.00000	1049.6	0.47512
39.400	8.1062	508.65	6275.4	0.00000	1049.5	0.47516
39.440	8.1145	508.74	6270.1	0.00000	1049.5	0.47518
39.480	8.1230	508.82	6264.6	0.00000	1049.4	0.47519
39.520	8.1316	508.89	6258.9	0.00000	1049.4	0.47519
39.560	8.1403	508.96	6253.0	0.00000	1049.5	0.47519
39.600	8.1492	509.02	6247.0	0.00000	1049.5	0.47516
39.640	8.1583	509.08	6240.7	0.00000	1049.6	0.47513
39.680	8.1676	509.13	6234.4	0.00000	1049.6	0.47510
39.720	8.1770	509.18	6227.9	0.00000	1049.7	0.47506
39.760	8.1865	509.24	6221.3	0.00000	1049.8	0.47503
39.800	8.1962	509.29	6214.5	0.00000	1049.9	0.47499
39.840	8.2061	509.33	6207.7	0.00000	1049.9	0.47494
39.880	8.2161	509.38	6200.7	0.00000	1050.0	0.47490
39.920	8.2263	509.42	6193.6	0.00000	1050.1	0.47485
39.960	8.2366	509.46	6186.4	0.00000	1050.2	0.47480

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
40.000	8.2471	509.50	6179.0	0.00000	1050.3	0.47475
40.040	8.2577	509.54	6171.5	0.00000	1050.4	0.47470
40.080	8.2684	509.58	6164.0	0.00000	1050.5	0.47465
40.120	8.2791	509.62	6156.5	0.00000	1050.6	0.47460
40.160	8.2897	509.65	6149.0	0.00000	1050.7	0.47455
40.200	8.3002	509.68	6141.6	0.00000	1050.8	0.47452
40.240	8.3107	509.71	6134.2	0.00000	1050.9	0.47448
40.280	8.3211	509.74	6126.9	0.00000	1050.9	0.47446
40.320	8.3315	509.77	6119.6	0.00000	1051.0	0.47443
40.360	8.3418	509.80	6112.3	0.00000	1051.0	0.47442
40.400	8.3520	509.82	6105.1	0.00000	1051.0	0.47441
40.440	8.3622	509.85	6097.9	0.00000	1051.0	0.47440
40.480	8.3724	509.87	6090.8	0.00000	1051.0	0.47440
40.520	8.3824	509.91	6083.9	0.00000	1051.0	0.47440
40.560	8.3924	509.96	6077.2	0.00000	1051.0	0.47442
40.600	8.4023	510.02	6070.7	0.00000	1051.0	0.47443
40.640	8.4121	510.09	6064.5	0.00000	1050.9	0.47444
40.680	8.4217	510.18	6058.6	0.00000	1050.9	0.47445
40.720	8.4312	510.28	6052.9	0.00000	1050.9	0.47446
40.760	8.4406	510.39	6047.5	0.00000	1050.9	0.47446
40.800	8.4498	510.52	6042.3	0.00000	1050.9	0.47447
40.840	8.4589	510.66	6037.5	0.00000	1050.9	0.47448
40.880	8.4679	510.81	6032.8	0.00000	1050.9	0.47448
40.920	8.4768	510.98	6028.4	0.00000	1050.9	0.47448
40.960	8.4855	511.15	6024.2	0.00000	1050.9	0.47446
41.000	8.4941	511.33	6020.3	0.00000	1050.9	0.47444
41.040	8.5026	511.53	6016.5	0.00000	1051.0	0.47440
41.080	8.5110	511.73	6012.9	0.00000	1051.1	0.47436
41.120	8.5193	511.95	6009.6	0.00000	1051.2	0.47431
41.160	8.5274	512.17	6006.4	0.00000	1051.3	0.47425
41.200	8.5355	512.39	6003.3	0.00000	1051.5	0.47418
41.240	8.5436	512.62	6000.3	0.00000	1051.6	0.47411
41.280	8.5516	512.85	5997.4	0.00000	1051.7	0.47404
41.320	8.5596	513.08	5994.5	0.00000	1051.9	0.47397
41.360	8.5676	513.31	5991.6	0.00000	1052.0	0.47389
41.400	8.5756	513.54	5988.6	0.00000	1052.2	0.47382
41.440	8.5836	513.76	5985.7	0.00000	1052.3	0.47374
41.480	8.5916	513.98	5982.7	0.00000	1052.5	0.47366
41.520	8.5996	514.20	5979.6	0.00000	1052.7	0.47357
41.560	8.6076	514.42	5976.5	0.00000	1052.8	0.47349
41.600	8.6156	514.63	5973.4	0.00000	1053.0	0.47341
41.640	8.6237	514.84	5970.3	0.00000	1053.2	0.47332
41.680	8.6319	515.04	5967.1	0.00000	1053.4	0.47323
41.720	8.6401	515.25	5963.7	0.00000	1053.6	0.47314
41.760	8.6485	515.45	5960.4	0.00000	1053.7	0.47304
41.800	8.6569	515.65	5956.9	0.00000	1053.9	0.47294
41.840	8.6656	515.84	5953.2	0.00000	1054.1	0.47284
41.880	8.6743	516.03	5949.4	0.00000	1054.3	0.47275
41.920	8.6833	516.21	5945.4	0.00000	1054.5	0.47267
41.960	8.6924	516.39	5941.2	0.00000	1054.7	0.47258

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
42.000	8.7017	516.56	5936.8	0.00000	1054.8	0.47250
42.040	8.7111	516.72	5932.3	0.00000	1055.0	0.47243
42.080	8.7206	516.89	5927.9	0.00000	1055.1	0.47236
42.120	8.7301	517.07	5923.4	0.00000	1055.3	0.47228
42.160	8.7397	517.25	5918.9	0.00000	1055.4	0.47221
42.200	8.7494	517.42	5914.4	0.00000	1055.5	0.47214
42.240	8.7591	517.61	5909.9	0.00000	1055.7	0.47207
42.280	8.7690	517.79	5905.5	0.00000	1055.8	0.47201
42.320	8.7788	517.98	5901.0	0.00000	1055.9	0.47194
42.360	8.7888	518.17	5896.5	0.00000	1056.1	0.47188
42.400	8.7988	518.37	5892.0	0.00000	1056.2	0.47181
42.440	8.8087	518.58	5887.6	0.00000	1056.3	0.47174
42.480	8.8187	518.79	5883.4	0.00000	1056.5	0.47167
42.520	8.8286	519.01	5879.2	0.00000	1056.6	0.47159
42.560	8.8385	519.22	5875.0	0.00000	1056.8	0.47152
42.600	8.8484	519.43	5870.8	0.00000	1056.9	0.47144
42.640	8.8582	519.65	5866.7	0.00000	1057.1	0.47136
42.680	8.8680	519.86	5862.6	0.00000	1057.3	0.47128
42.720	8.8778	520.07	5858.5	0.00000	1057.4	0.47120
42.760	8.8876	520.28	5854.5	0.00000	1057.6	0.47111
42.800	8.8973	520.50	5850.5	0.00000	1057.8	0.47103
42.840	8.9069	520.71	5846.5	0.00000	1057.9	0.47094
42.880	8.9165	520.92	5842.5	0.00000	1058.1	0.47085
42.920	8.9260	521.13	5838.7	0.00000	1058.3	0.47077
42.960	8.9353	521.34	5834.9	0.00000	1058.5	0.47068
43.000	8.9446	521.54	5831.2	0.00000	1058.6	0.47060
43.040	8.9536	521.75	5827.6	0.00000	1058.8	0.47051
43.080	8.9625	521.96	5824.1	0.00000	1058.9	0.47044
43.120	8.9713	522.16	5820.7	0.00000	1059.1	0.47036
43.160	8.9798	522.36	5817.4	0.00000	1059.2	0.47029
43.200	8.9882	522.56	5814.2	0.00000	1059.4	0.47023
43.240	8.9965	522.76	5811.1	0.00000	1059.5	0.47017
43.280	9.0046	522.96	5808.0	0.00000	1059.6	0.47011
43.320	9.0127	523.14	5804.8	0.00000	1059.7	0.47006
43.360	9.0206	523.31	5801.6	0.00000	1059.8	0.47002
43.400	9.0286	523.47	5798.3	0.00000	1059.8	0.46999
43.440	9.0364	523.62	5794.9	0.00000	1059.9	0.46996
43.480	9.0442	523.76	5791.5	0.00000	1059.9	0.46994
43.520	9.0520	523.89	5787.9	0.00000	1060.0	0.46993
43.560	9.0596	524.01	5784.3	0.00000	1060.0	0.46993
43.600	9.0672	524.11	5780.7	0.00000	1060.0	0.46993
43.640	9.0747	524.21	5776.9	0.00000	1059.9	0.46994
43.680	9.0822	524.30	5773.1	0.00000	1059.9	0.46995
43.720	9.0897	524.38	5769.3	0.00000	1059.9	0.46997
43.760	9.0971	524.46	5765.5	0.00000	1059.9	0.46998
43.800	9.1045	524.55	5761.8	0.00000	1059.8	0.47000
43.840	9.1118	524.64	5758.1	0.00000	1059.8	0.47002
43.880	9.1192	524.73	5754.4	0.00000	1059.8	0.47003
43.920	9.1265	524.82	5750.8	0.00000	1059.7	0.47005
43.960	9.1338	524.91	5747.3	0.00000	1059.7	0.47007

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
44.000	9.1411	525.01	5743.7	0.00000	1059.6	0.47009
44.040	9.1484	525.11	5740.3	0.00000	1059.6	0.47010
44.080	9.1556	525.21	5736.9	0.00000	1059.6	0.47012
44.120	9.1628	525.32	5733.5	0.00000	1059.5	0.47014
44.160	9.1700	525.43	5730.1	0.00000	1059.5	0.47016
44.200	9.1772	525.53	5726.8	0.00000	1059.5	0.47017
44.240	9.1843	525.65	5723.6	0.00000	1059.4	0.47019
44.280	9.1915	525.75	5720.3	0.00000	1059.4	0.47021
44.320	9.1987	525.86	5717.0	0.00000	1059.4	0.47022
44.360	9.2059	525.96	5713.6	0.00000	1059.4	0.47023
44.400	9.2131	526.07	5710.3	0.00000	1059.4	0.47023
44.440	9.2204	526.16	5706.9	0.00000	1059.4	0.47023
44.480	9.2277	526.26	5703.4	0.00000	1059.4	0.47023
44.520	9.2350	526.36	5699.9	0.00000	1059.4	0.47022
44.560	9.2423	526.45	5696.4	0.00000	1059.4	0.47021
44.600	9.2496	526.54	5692.9	0.00000	1059.4	0.47020
44.640	9.2570	526.63	5689.3	0.00000	1059.5	0.47018
44.680	9.2644	526.71	5685.7	0.00000	1059.5	0.47016
44.720	9.2718	526.80	5682.0	0.00000	1059.5	0.47014
44.760	9.2792	526.88	5678.4	0.00000	1059.6	0.47011
44.800	9.2867	526.96	5674.7	0.00000	1059.7	0.47008
44.840	9.2943	527.04	5670.9	0.00000	1059.7	0.47004
44.880	9.3022	527.12	5667.0	0.00000	1059.8	0.47001
44.920	9.3103	527.20	5662.9	0.00000	1059.9	0.46997
44.960	9.3187	527.29	5658.8	0.00000	1059.9	0.46994
45.000	9.3273	527.37	5654.5	0.00000	1060.0	0.46990
45.040	9.3360	527.45	5650.0	0.00000	1060.1	0.46987
45.080	9.3451	527.53	5645.5	0.00000	1060.1	0.46984
45.120	9.3543	527.61	5640.8	0.00000	1060.2	0.46981
45.160	9.3637	527.70	5636.0	0.00000	1060.3	0.46977
45.200	9.3734	527.78	5631.2	0.00000	1060.4	0.46973
45.240	9.3833	527.88	5626.3	0.00000	1060.5	0.46968
45.280	9.3934	527.98	5621.3	0.00000	1060.6	0.46962
45.320	9.4037	528.08	5616.2	0.00000	1060.7	0.46955
45.360	9.4142	528.18	5611.1	0.00000	1060.9	0.46947
45.400	9.4250	528.30	5605.9	0.00000	1061.1	0.46939
45.440	9.4359	528.41	5600.6	0.00000	1061.2	0.46929
45.480	9.4468	528.53	5595.4	0.00000	1061.4	0.46920
45.520	9.4578	528.65	5590.2	0.00000	1061.6	0.46911
45.560	9.4687	528.78	5585.1	0.00000	1061.8	0.46903
45.600	9.4797	528.91	5580.1	0.00000	1061.9	0.46895
45.640	9.4906	529.05	5575.1	0.00000	1062.1	0.46887
45.680	9.5016	529.19	5570.2	0.00000	1062.2	0.46879
45.720	9.5125	529.34	5565.3	0.00000	1062.4	0.46872
45.760	9.5235	529.49	5560.5	0.00000	1062.5	0.46864
45.800	9.5345	529.65	5555.8	0.00000	1062.7	0.46857
45.840	9.5454	529.82	5551.1	0.00000	1062.8	0.46851
45.880	9.5564	529.99	5546.5	0.00000	1062.9	0.46844
45.920	9.5674	530.17	5541.9	0.00000	1063.1	0.46838
45.960	9.5784	530.35	5537.4	0.00000	1063.2	0.46832

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
46.000	9.5893	530.53	5533.0	0.00000	1063.3	0.46827
46.040	9.6002	530.72	5528.7	0.00000	1063.4	0.46821
46.080	9.6108	530.91	5524.5	0.00000	1063.5	0.46815
46.120	9.6212	531.10	5520.5	0.00000	1063.6	0.46809
46.160	9.6313	531.29	5516.6	0.00000	1063.8	0.46802
46.200	9.6411	531.47	5512.9	0.00000	1063.9	0.46796
46.240	9.6506	531.66	5509.4	0.00000	1064.0	0.46789
46.280	9.6599	531.85	5506.0	0.00000	1064.2	0.46782
46.320	9.6688	532.03	5502.8	0.00000	1064.3	0.46775
46.360	9.6775	532.21	5499.7	0.00000	1064.5	0.46768
46.400	9.6859	532.39	5496.8	0.00000	1064.6	0.46761
46.440	9.6941	532.56	5494.0	0.00000	1064.7	0.46755
46.480	9.7019	532.73	5491.2	0.00000	1064.8	0.46750
46.520	9.7095	532.89	5488.6	0.00000	1064.9	0.46746
46.560	9.7168	533.05	5486.0	0.00000	1065.0	0.46742
46.600	9.7238	533.20	5483.6	0.00000	1065.0	0.46739
46.640	9.7306	533.34	5481.3	0.00000	1065.1	0.46737
46.680	9.7371	533.48	5479.0	0.00000	1065.1	0.46736
46.720	9.7435	533.61	5476.8	0.00000	1065.1	0.46734
46.760	9.7499	533.75	5474.6	0.00000	1065.2	0.46732
46.800	9.7562	533.88	5472.4	0.00000	1065.2	0.46729
46.840	9.7625	534.03	5470.3	0.00000	1065.3	0.46726
46.880	9.7687	534.17	5468.4	0.00000	1065.4	0.46723
46.920	9.7749	534.33	5466.4	0.00000	1065.4	0.46719
46.960	9.7811	534.48	5464.6	0.00000	1065.5	0.46714
47.000	9.7872	534.65	5462.9	0.00000	1065.6	0.46709
47.040	9.7932	534.81	5461.2	0.00000	1065.8	0.46703
47.080	9.7993	534.99	5459.6	0.00000	1065.9	0.46696
47.120	9.8052	535.17	5458.1	0.00000	1066.0	0.46689
47.160	9.8112	535.35	5456.7	0.00000	1066.2	0.46682
47.200	9.8171	535.54	5455.3	0.00000	1066.3	0.46674
47.240	9.8229	535.74	5454.1	0.00000	1066.5	0.46665
47.280	9.8288	535.94	5452.8	0.00000	1066.7	0.46656
47.320	9.8347	536.15	5451.7	0.00000	1066.9	0.46647
47.360	9.8407	536.37	5450.6	0.00000	1067.1	0.46638
47.400	9.8466	536.59	5449.6	0.00000	1067.3	0.46628
47.440	9.8526	536.82	5448.6	0.00000	1067.4	0.46619
47.480	9.8587	537.05	5447.6	0.00000	1067.6	0.46609
47.520	9.8649	537.28	5446.5	0.00000	1067.8	0.46599
47.560	9.8712	537.50	5445.2	0.00000	1068.1	0.46588
47.600	9.8777	537.71	5443.7	0.00000	1068.3	0.46578
47.640	9.8844	537.91	5442.1	0.00000	1068.5	0.46567
47.680	9.8912	538.11	5440.4	0.00000	1068.7	0.46556
47.720	9.8982	538.30	5438.5	0.00000	1068.9	0.46546
47.760	9.9054	538.48	5436.4	0.00000	1069.1	0.46534
47.800	9.9127	538.66	5434.2	0.00000	1069.4	0.46523
47.840	9.9202	538.83	5431.8	0.00000	1069.6	0.46512
47.880	9.9278	538.99	5429.3	0.00000	1069.8	0.46500
47.920	9.9355	539.15	5426.7	0.00000	1070.0	0.46488
47.960	9.9433	539.32	5424.1	0.00000	1070.3	0.46477

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
48.000	9.9513	539.49	5421.6	0.00000	1070.5	0.46465
48.040	9.9592	539.67	5419.0	0.00000	1070.8	0.46453
48.080	9.9673	539.84	5416.4	0.00000	1071.0	0.46441
48.120	9.9754	540.01	5413.7	0.00000	1071.2	0.46429
48.160	9.9836	540.18	5410.9	0.00000	1071.5	0.46418
48.200	9.9919	540.35	5408.2	0.00000	1071.7	0.46407
48.240	10.000	540.51	5405.3	0.00000	1071.9	0.46395
48.280	10.009	540.68	5402.4	0.00000	1072.1	0.46384
48.320	10.017	540.84	5399.5	0.00000	1072.4	0.46373
48.360	10.026	541.00	5396.5	0.00000	1072.6	0.46362
48.400	10.034	541.15	5393.4	0.00000	1072.8	0.46352
48.440	10.043	541.29	5390.0	0.00000	1073.0	0.46342
48.480	10.052	541.41	5386.5	0.00000	1073.2	0.46333
48.520	10.061	541.51	5382.7	0.00000	1073.3	0.46325
48.560	10.070	541.60	5378.7	0.00000	1073.5	0.46317
48.600	10.079	541.67	5374.5	0.00000	1073.6	0.46310
48.640	10.088	541.72	5370.1	0.00000	1073.7	0.46304
48.680	10.098	541.75	5365.4	0.00000	1073.8	0.46299
48.720	10.107	541.77	5360.7	0.00000	1073.9	0.46294
48.760	10.117	541.79	5355.9	0.00000	1074.0	0.46290
48.800	10.126	541.81	5351.1	0.00000	1074.1	0.46287
48.840	10.135	541.82	5346.2	0.00000	1074.1	0.46284
48.880	10.145	541.85	5341.6	0.00000	1074.2	0.46282
48.920	10.154	541.89	5337.1	0.00000	1074.2	0.46279
48.960	10.164	541.96	5332.7	0.00000	1074.3	0.46276
49.000	10.173	542.04	5328.6	0.00000	1074.4	0.46273
49.040	10.182	542.14	5324.6	0.00000	1074.4	0.46269
49.080	10.192	542.26	5320.9	0.00000	1074.5	0.46266
49.120	10.201	542.40	5317.3	0.00000	1074.6	0.46262
49.160	10.211	542.54	5313.7	0.00000	1074.7	0.46257
49.200	10.221	542.70	5310.2	0.00000	1074.8	0.46253
49.240	10.230	542.86	5306.8	0.00000	1074.9	0.46248
49.280	10.240	543.02	5303.3	0.00000	1074.9	0.46244
49.320	10.250	543.19	5300.0	0.00000	1075.0	0.46239
49.360	10.259	543.36	5296.6	0.00000	1075.1	0.46235
49.400	10.269	543.53	5293.4	0.00000	1075.2	0.46231
49.440	10.278	543.71	5290.2	0.00000	1075.3	0.46227
49.480	10.288	543.89	5287.0	0.00000	1075.3	0.46224
49.520	10.297	544.07	5283.9	0.00000	1075.4	0.46220
49.560	10.307	544.26	5280.9	0.00000	1075.5	0.46217
49.600	10.316	544.45	5277.9	0.00000	1075.5	0.46214
49.640	10.325	544.65	5275.1	0.00000	1075.6	0.46210
49.680	10.335	544.86	5272.4	0.00000	1075.7	0.46207
49.720	10.344	545.10	5270.0	0.00000	1075.8	0.46203
49.760	10.353	545.35	5267.8	0.00000	1075.9	0.46198
49.800	10.362	545.62	5265.8	0.00000	1075.9	0.46193
49.840	10.371	545.91	5264.1	0.00000	1076.1	0.46188
49.880	10.380	546.20	5262.4	0.00000	1076.2	0.46183
49.920	10.388	546.49	5260.7	0.00000	1076.3	0.46178
49.960	10.397	546.78	5259.0	0.00000	1076.4	0.46172

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
50.000	10.406	547.06	5257.3	0.00000	1076.5	0.46167
50.040	10.415	547.35	5255.6	0.00000	1076.6	0.46162
50.080	10.423	547.63	5253.9	0.00000	1076.7	0.46158
50.120	10.432	547.89	5252.2	0.00000	1076.7	0.46153
50.160	10.441	548.13	5250.2	0.00000	1076.8	0.46150
50.200	10.449	548.35	5248.0	0.00000	1076.9	0.46148
50.240	10.457	548.54	5245.7	0.00000	1076.9	0.46147
50.280	10.466	548.71	5243.2	0.00000	1076.9	0.46147
50.320	10.474	548.86	5240.5	0.00000	1076.9	0.46147
50.360	10.482	548.98	5237.6	0.00000	1076.8	0.46149
50.400	10.490	549.09	5234.7	0.00000	1076.8	0.46152
50.440	10.498	549.20	5231.7	0.00000	1076.7	0.46154
50.480	10.506	549.31	5228.8	0.00000	1076.7	0.46157
50.520	10.514	549.42	5225.8	0.00000	1076.6	0.46160
50.560	10.522	549.53	5222.8	0.00000	1076.6	0.46162
50.600	10.531	549.65	5219.8	0.00000	1076.5	0.46164
50.640	10.539	549.77	5216.7	0.00000	1076.5	0.46166
50.680	10.548	549.89	5213.7	0.00000	1076.5	0.46168
50.720	10.556	550.01	5210.6	0.00000	1076.4	0.46169
50.760	10.565	550.13	5207.5	0.00000	1076.4	0.46170
50.800	10.574	550.26	5204.3	0.00000	1076.4	0.46171
50.840	10.583	550.38	5201.1	0.00000	1076.4	0.46172
50.880	10.591	550.50	5197.9	0.00000	1076.4	0.46172
50.920	10.600	550.61	5194.6	0.00000	1076.4	0.46172
50.960	10.609	550.72	5191.3	0.00000	1076.4	0.46172
51.000	10.618	550.82	5187.9	0.00000	1076.4	0.46171
51.040	10.627	550.92	5184.5	0.00000	1076.4	0.46171
51.080	10.636	551.01	5181.0	0.00000	1076.4	0.46170
51.120	10.645	551.12	5177.7	0.00000	1076.5	0.46168
51.160	10.654	551.25	5174.5	0.00000	1076.5	0.46165
51.200	10.662	551.39	5171.6	0.00000	1076.6	0.46162
51.240	10.671	551.54	5168.7	0.00000	1076.7	0.46158
51.280	10.680	551.72	5166.1	0.00000	1076.8	0.46153
51.320	10.689	551.90	5163.6	0.00000	1076.9	0.46147
51.360	10.697	552.11	5161.3	0.00000	1077.0	0.46141
51.400	10.706	552.33	5159.2	0.00000	1077.2	0.46133
51.440	10.715	552.57	5157.2	0.00000	1077.3	0.46124
51.480	10.723	552.84	5155.5	0.00000	1077.5	0.46115
51.520	10.732	553.12	5153.9	0.00000	1077.7	0.46104
51.560	10.741	553.41	5152.6	0.00000	1078.0	0.46092
51.600	10.749	553.73	5151.4	0.00000	1078.2	0.46079
51.640	10.758	554.06	5150.3	0.00000	1078.5	0.46065
51.680	10.767	554.38	5149.2	0.00000	1078.8	0.46051
51.720	10.775	554.70	5148.1	0.00000	1079.1	0.46037
51.760	10.783	555.01	5147.0	0.00000	1079.4	0.46022
51.800	10.792	555.32	5145.9	0.00000	1079.7	0.46007
51.840	10.800	555.63	5144.8	0.00000	1080.0	0.45992
51.880	10.808	555.93	5143.7	0.00000	1080.3	0.45977
51.920	10.816	556.23	5142.6	0.00000	1080.6	0.45961
51.960	10.824	556.51	5141.3	0.00000	1080.9	0.45946

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
52.000	10.832	556.76	5139.9	0.00000	1081.2	0.45931
52.040	10.840	556.99	5138.4	0.00000	1081.5	0.45918
52.080	10.848	557.21	5136.7	0.00000	1081.7	0.45904
52.120	10.856	557.42	5134.9	0.00000	1082.0	0.45892
52.160	10.863	557.61	5133.0	0.00000	1082.2	0.45880
52.200	10.871	557.78	5131.0	0.00000	1082.5	0.45868
52.240	10.879	557.94	5128.9	0.00000	1082.7	0.45857
52.280	10.887	558.09	5126.6	0.00000	1082.9	0.45847
52.320	10.894	558.22	5124.2	0.00000	1083.1	0.45838
52.360	10.902	558.33	5121.7	0.00000	1083.2	0.45829
52.400	10.909	558.43	5119.1	0.00000	1083.4	0.45821
52.440	10.917	558.52	5116.4	0.00000	1083.6	0.45813
52.480	10.924	558.59	5113.5	0.00000	1083.7	0.45806
52.520	10.932	558.64	5110.5	0.00000	1083.8	0.45799
52.560	10.939	558.69	5107.5	0.00000	1083.9	0.45794
52.600	10.946	558.73	5104.5	0.00000	1084.1	0.45788
52.640	10.954	558.77	5101.4	0.00000	1084.1	0.45783
52.680	10.961	558.80	5098.3	0.00000	1084.2	0.45779
52.720	10.968	558.82	5095.2	0.00000	1084.3	0.45776
52.760	10.975	558.83	5092.1	0.00000	1084.4	0.45773
52.800	10.982	558.84	5089.0	0.00000	1084.4	0.45771
52.840	10.989	558.85	5085.8	0.00000	1084.4	0.45769
52.880	10.996	558.84	5082.6	0.00000	1084.5	0.45768
52.920	11.003	558.83	5079.4	0.00000	1084.5	0.45768
52.960	11.009	558.81	5076.2	0.00000	1084.4	0.45769
53.000	11.016	558.79	5072.9	0.00000	1084.4	0.45770
53.040	11.022	558.76	5069.6	0.00000	1084.4	0.45771
53.080	11.029	558.72	5066.4	0.00000	1084.3	0.45774
53.120	11.035	558.68	5063.0	0.00000	1084.3	0.45777
53.160	11.041	558.63	5059.7	0.00000	1084.2	0.45781
53.200	11.048	558.59	5056.5	0.00000	1084.1	0.45784
53.240	11.054	558.57	5053.4	0.00000	1084.1	0.45787
53.280	11.060	558.55	5050.5	0.00000	1084.0	0.45790
53.320	11.066	558.57	5047.6	0.00000	1084.0	0.45791
53.360	11.073	558.61	5044.8	0.00000	1084.0	0.45791
53.400	11.081	558.69	5042.2	0.00000	1084.0	0.45789
53.440	11.088	558.80	5039.6	0.00000	1084.1	0.45785
53.480	11.096	558.93	5037.2	0.00000	1084.2	0.45780
53.520	11.105	559.10	5034.9	0.00000	1084.4	0.45772
53.560	11.114	559.28	5032.5	0.00000	1084.5	0.45765
53.600	11.122	559.46	5030.2	0.00000	1084.6	0.45758
53.640	11.131	559.63	5027.8	0.00000	1084.8	0.45753
53.680	11.140	559.81	5025.3	0.00000	1084.9	0.45747
53.720	11.149	559.99	5022.8	0.00000	1085.0	0.45743
53.760	11.158	560.16	5020.3	0.00000	1085.0	0.45739
53.800	11.168	560.33	5017.6	0.00000	1085.1	0.45735
53.840	11.177	560.49	5014.8	0.00000	1085.2	0.45733
53.880	11.187	560.64	5011.9	0.00000	1085.2	0.45732
53.920	11.197	560.78	5008.8	0.00000	1085.2	0.45731
53.960	11.206	560.91	5005.6	0.00000	1085.2	0.45731

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
54.000	11.217	561.06	5002.3	0.00000	1085.2	0.45730
54.040	11.227	561.21	4999.1	0.00000	1085.2	0.45729
54.080	11.237	561.37	4995.9	0.00000	1085.3	0.45727
54.120	11.248	561.54	4992.6	0.00000	1085.3	0.45724
54.160	11.259	561.71	4989.4	0.00000	1085.4	0.45721
54.200	11.270	561.90	4986.1	0.00000	1085.5	0.45717
54.240	11.281	562.09	4982.8	0.00000	1085.6	0.45712
54.280	11.293	562.29	4979.6	0.00000	1085.7	0.45707
54.320	11.304	562.50	4976.3	0.00000	1085.8	0.45701
54.360	11.316	562.72	4973.1	0.00000	1085.9	0.45695
54.400	11.328	562.96	4969.9	0.00000	1086.1	0.45688
54.440	11.340	563.21	4966.8	0.00000	1086.2	0.45681
54.480	11.353	563.48	4963.7	0.00000	1086.4	0.45673
54.520	11.365	563.76	4960.8	0.00000	1086.5	0.45665
54.560	11.377	564.03	4957.8	0.00000	1086.7	0.45657
54.600	11.389	564.30	4954.9	0.00000	1086.8	0.45651
54.640	11.401	564.56	4952.1	0.00000	1086.9	0.45645
54.680	11.412	564.81	4949.4	0.00000	1087.0	0.45641
54.720	11.424	565.06	4946.7	0.00000	1087.1	0.45637
54.760	11.435	565.29	4943.9	0.00000	1087.1	0.45634
54.800	11.445	565.50	4941.0	0.00000	1087.2	0.45632
54.840	11.456	565.71	4938.1	0.00000	1087.3	0.45628
54.880	11.467	565.92	4935.3	0.00000	1087.4	0.45623
54.920	11.478	566.13	4932.4	0.00000	1087.5	0.45617
54.960	11.489	566.35	4929.6	0.00000	1087.6	0.45610
55.000	11.500	566.56	4926.7	0.00000	1087.8	0.45601
55.040	11.511	566.77	4923.8	0.00000	1088.0	0.45592
55.080	11.522	566.98	4921.0	0.00000	1088.2	0.45582
55.120	11.533	567.19	4918.1	0.00000	1088.4	0.45570
55.160	11.544	567.43	4915.5	0.00000	1088.7	0.45558
55.200	11.555	567.68	4913.1	0.00000	1088.9	0.45544
55.240	11.566	567.94	4910.8	0.00000	1089.2	0.45531
55.280	11.576	568.21	4908.7	0.00000	1089.5	0.45518
55.320	11.586	568.49	4906.7	0.00000	1089.7	0.45505
55.360	11.597	568.78	4904.9	0.00000	1090.0	0.45492
55.400	11.607	569.07	4903.2	0.00000	1090.2	0.45479
55.440	11.617	569.38	4901.6	0.00000	1090.5	0.45467
55.480	11.626	569.69	4900.2	0.00000	1090.7	0.45454
55.520	11.636	570.01	4898.9	0.00000	1091.0	0.45442
55.560	11.645	570.34	4897.8	0.00000	1091.2	0.45430
55.600	11.655	570.67	4896.7	0.00000	1091.5	0.45418
55.640	11.664	571.01	4895.7	0.00000	1091.7	0.45406
55.680	11.673	571.35	4894.8	0.00000	1091.9	0.45394
55.720	11.682	571.69	4894.0	0.00000	1092.2	0.45382
55.760	11.691	572.03	4893.2	0.00000	1092.4	0.45370
55.800	11.699	572.36	4892.3	0.00000	1092.7	0.45358
55.840	11.708	572.67	4891.3	0.00000	1092.9	0.45346
55.880	11.717	572.96	4890.2	0.00000	1093.1	0.45334
55.920	11.725	573.22	4888.9	0.00000	1093.4	0.45322
55.960	11.733	573.47	4887.5	0.00000	1093.6	0.45310

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
56.000	11.742	573.71	4886.1	0.00000	1093.9	0.45298
56.040	11.750	573.97	4884.9	0.00000	1094.1	0.45285
56.080	11.758	574.22	4883.7	0.00000	1094.4	0.45272
56.120	11.766	574.48	4882.5	0.00000	1094.6	0.45258
56.160	11.774	574.75	4881.5	0.00000	1094.9	0.45244
56.200	11.782	575.02	4880.5	0.00000	1095.2	0.45230
56.240	11.790	575.29	4879.6	0.00000	1095.5	0.45215
56.280	11.798	575.57	4878.8	0.00000	1095.8	0.45200
56.320	11.805	575.86	4878.1	0.00000	1096.1	0.45185
56.360	11.813	576.17	4877.5	0.00000	1096.4	0.45170
56.400	11.820	576.46	4876.9	0.00000	1096.7	0.45155
56.440	11.828	576.74	4876.2	0.00000	1097.0	0.45140
56.480	11.835	577.00	4875.3	0.00000	1097.3	0.45125
56.520	11.843	577.25	4874.3	0.00000	1097.6	0.45111
56.560	11.851	577.48	4873.1	0.00000	1097.9	0.45096
56.600	11.858	577.69	4871.8	0.00000	1098.2	0.45082
56.640	11.866	577.89	4870.3	0.00000	1098.4	0.45069
56.680	11.874	578.07	4868.7	0.00000	1098.7	0.45055
56.720	11.881	578.24	4867.0	0.00000	1099.0	0.45042
56.760	11.889	578.39	4865.1	0.00000	1099.2	0.45028
56.800	11.897	578.52	4863.1	0.00000	1099.5	0.45015
56.840	11.904	578.64	4861.0	0.00000	1099.8	0.45003
56.880	11.912	578.75	4858.7	0.00000	1100.0	0.44990
56.920	11.920	578.86	4856.3	0.00000	1100.3	0.44978
56.960	11.929	578.97	4853.7	0.00000	1100.5	0.44966
57.000	11.938	579.08	4851.1	0.00000	1100.7	0.44955
57.040	11.946	579.20	4848.5	0.00000	1100.9	0.44945
57.080	11.956	579.35	4846.0	0.00000	1101.1	0.44935
57.120	11.965	579.52	4843.6	0.00000	1101.3	0.44925
57.160	11.975	579.72	4841.3	0.00000	1101.5	0.44917
57.200	11.985	579.91	4839.0	0.00000	1101.6	0.44908
57.240	11.994	580.10	4836.6	0.00000	1101.8	0.44901
57.280	12.004	580.28	4834.2	0.00000	1101.9	0.44894
57.320	12.014	580.46	4831.7	0.00000	1102.1	0.44887
57.360	12.024	580.64	4829.1	0.00000	1102.2	0.44881
57.400	12.034	580.81	4826.6	0.00000	1102.3	0.44876
57.440	12.044	580.97	4823.9	0.00000	1102.4	0.44871
57.480	12.054	581.14	4821.3	0.00000	1102.5	0.44866
57.520	12.064	581.30	4818.6	0.00000	1102.6	0.44863
57.560	12.074	581.45	4815.7	0.00000	1102.6	0.44859
57.600	12.085	581.59	4812.8	0.00000	1102.7	0.44856
57.640	12.095	581.72	4809.9	0.00000	1102.8	0.44853
57.680	12.105	581.86	4807.0	0.00000	1102.8	0.44850
57.720	12.115	581.99	4804.1	0.00000	1102.9	0.44847
57.760	12.125	582.13	4801.2	0.00000	1102.9	0.44844
57.800	12.135	582.26	4798.3	0.00000	1103.0	0.44841
57.840	12.145	582.40	4795.5	0.00000	1103.1	0.44838
57.880	12.155	582.53	4792.6	0.00000	1103.1	0.44835
57.920	12.165	582.66	4789.8	0.00000	1103.2	0.44832
57.960	12.175	582.79	4787.0	0.00000	1103.2	0.44829

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
58.000	12.185	582.92	4784.2	0.00000	1103.3	0.44826
58.040	12.195	583.05	4781.4	0.00000	1103.3	0.44823
58.080	12.205	583.18	4778.6	0.00000	1103.4	0.44821
58.120	12.214	583.30	4775.8	0.00000	1103.5	0.44818
58.160	12.224	583.41	4773.0	0.00000	1103.5	0.44815
58.200	12.233	583.50	4770.2	0.00000	1103.6	0.44812
58.240	12.241	583.57	4767.4	0.00000	1103.6	0.44808
58.280	12.250	583.63	4764.6	0.00000	1103.7	0.44805
58.320	12.258	583.68	4761.8	0.00000	1103.8	0.44801
58.360	12.266	583.71	4758.9	0.00000	1103.9	0.44796
58.400	12.274	583.72	4756.0	0.00000	1104.0	0.44792
58.440	12.281	583.75	4753.3	0.00000	1104.1	0.44787
58.480	12.289	583.79	4750.6	0.00000	1104.2	0.44782
58.520	12.297	583.84	4748.1	0.00000	1104.3	0.44777
58.560	12.304	583.91	4745.7	0.00000	1104.4	0.44771
58.600	12.312	583.99	4743.5	0.00000	1104.5	0.44765
58.640	12.319	584.08	4741.3	0.00000	1104.6	0.44759
58.680	12.327	584.18	4739.3	0.00000	1104.8	0.44753
58.720	12.334	584.30	4737.4	0.00000	1104.9	0.44746
58.760	12.341	584.42	4735.6	0.00000	1105.0	0.44739
58.800	12.349	584.56	4733.9	0.00000	1105.2	0.44732
58.840	12.356	584.71	4732.2	0.00000	1105.3	0.44725
58.880	12.364	584.84	4730.4	0.00000	1105.5	0.44718
58.920	12.372	584.97	4728.4	0.00000	1105.6	0.44712
58.960	12.380	585.08	4726.2	0.00000	1105.7	0.44706
59.000	12.388	585.19	4723.9	0.00000	1105.8	0.44701
59.040	12.397	585.29	4721.5	0.00000	1105.9	0.44696
59.080	12.405	585.38	4718.9	0.00000	1106.0	0.44691
59.120	12.415	585.46	4716.1	0.00000	1106.1	0.44687
59.160	12.424	585.55	4713.3	0.00000	1106.2	0.44683
59.200	12.433	585.64	4710.5	0.00000	1106.3	0.44678
59.240	12.443	585.75	4707.7	0.00000	1106.4	0.44673
59.280	12.453	585.86	4704.9	0.00000	1106.5	0.44667
59.320	12.463	585.98	4702.1	0.00000	1106.6	0.44661
59.360	12.473	586.11	4699.3	0.00000	1106.7	0.44655
59.400	12.483	586.24	4696.4	0.00000	1106.9	0.44648
59.440	12.494	586.38	4693.5	0.00000	1107.0	0.44641
59.480	12.505	586.54	4690.7	0.00000	1107.1	0.44633
59.520	12.516	586.68	4687.7	0.00000	1107.3	0.44626
59.560	12.527	586.81	4684.6	0.00000	1107.4	0.44619
59.600	12.539	586.94	4681.3	0.00000	1107.5	0.44613
59.640	12.550	587.05	4677.9	0.00000	1107.7	0.44607
59.680	12.562	587.16	4674.5	0.00000	1107.8	0.44602
59.720	12.574	587.25	4670.8	0.00000	1107.9	0.44598
59.760	12.586	587.34	4667.1	0.00000	1107.9	0.44593
59.800	12.598	587.41	4663.2	0.00000	1108.0	0.44590
59.840	12.610	587.48	4659.3	-2.6604e-06	1108.1	0.44586
59.880	12.622	587.55	4655.5	-8.8698e-06	1108.2	0.44583
59.920	12.633	587.61	4651.6	-1.8628e-05	1108.2	0.44580
59.960	12.645	587.68	4647.8	-3.1936e-05	1108.3	0.44577

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
60.000	12.657	587.74	4643.9	-4.8793e-05	1108.3	0.44575
60.040	12.669	587.81	4640.1	-6.9199e-05	1108.4	0.44572
60.080	12.680	587.87	4636.5	-9.3154e-05	1108.4	0.44569
60.120	12.691	587.95	4633.0	-0.00012066	1108.5	0.44566
60.160	12.702	588.04	4629.6	-0.00015171	1108.6	0.44563
60.200	12.713	588.14	4626.5	-0.00018631	1108.6	0.44559
60.240	12.724	588.24	4623.4	-0.00022447	1108.7	0.44555
60.280	12.734	588.36	4620.6	-0.00026617	1108.8	0.44550
60.320	12.744	588.48	4617.9	-0.00031142	1108.9	0.44545
60.360	12.754	588.61	4615.3	-0.00036021	1109.0	0.44540
60.400	12.764	588.74	4612.8	-0.00041256	1109.1	0.44536
60.440	12.773	588.85	4610.3	-0.00046846	1109.2	0.44532
60.480	12.782	588.96	4607.8	-0.00052791	1109.3	0.44528
60.520	12.791	589.06	4605.4	-0.00058752	1109.3	0.44525
60.560	12.800	589.14	4602.9	-0.00064449	1109.4	0.44522
60.600	12.808	589.22	4600.4	-0.00069882	1109.4	0.44520
60.640	12.817	589.27	4597.8	-0.00075050	1109.5	0.44518
60.680	12.825	589.32	4595.3	-0.00079954	1109.5	0.44516
60.720	12.832	589.35	4592.8	-0.00084593	1109.5	0.44515
60.760	12.840	589.38	4590.3	-0.00088968	1109.5	0.44514
60.800	12.847	589.41	4588.0	-0.00093079	1109.6	0.44513
60.840	12.854	589.45	4585.8	-0.00096925	1109.6	0.44511
60.880	12.861	589.49	4583.7	-0.0010051	1109.6	0.44508
60.920	12.867	589.53	4581.7	-0.0010382	1109.7	0.44505
60.960	12.874	589.57	4579.8	-0.0010688	1109.8	0.44502
61.000	12.880	589.62	4578.1	-0.0010967	1109.8	0.44499
61.040	12.885	589.67	4576.4	-0.0011219	1109.9	0.44495
61.080	12.891	589.72	4574.8	-0.0011418	1110.0	0.44491
61.120	12.897	589.76	4573.1	-0.0011556	1110.1	0.44487
61.160	12.902	589.80	4571.4	-0.0011631	1110.2	0.44482
61.200	12.908	589.82	4569.6	-0.0011645	1110.2	0.44478
61.240	12.913	589.85	4567.9	-0.0011596	1110.3	0.44474
61.280	12.919	589.87	4566.1	-0.0011486	1110.4	0.44470
61.320	12.924	589.88	4564.2	-0.0011314	1110.5	0.44465
61.360	12.930	589.88	4562.4	-0.0011080	1110.6	0.44461
61.400	12.935	589.88	4560.5	-0.0010784	1110.7	0.44456
61.440	12.940	589.89	4558.6	-0.0010437	1110.8	0.44451
61.480	12.946	589.91	4556.8	-0.0010056	1110.9	0.44446
61.520	12.951	589.94	4555.1	-0.00096390	1111.0	0.44440
61.560	12.957	589.98	4553.4	-0.00091865	1111.2	0.44433
61.600	12.963	590.04	4551.9	-0.00086985	1111.3	0.44426
61.640	12.969	590.11	4550.3	-0.00081750	1111.5	0.44418
61.680	12.975	590.20	4548.9	-0.00076160	1111.6	0.44409
61.720	12.981	590.30	4547.5	-0.00070216	1111.8	0.44400
61.760	12.987	590.41	4546.2	-0.00064254	1112.0	0.44390
61.800	12.993	590.55	4545.1	-0.00058557	1112.2	0.44379
61.840	13.000	590.70	4544.0	-0.00053124	1112.5	0.44368
61.880	13.007	590.88	4543.0	-0.00047956	1112.7	0.44356
61.920	13.013	591.07	4542.1	-0.00043052	1112.9	0.44344
61.960	13.020	591.28	4541.3	-0.00038413	1113.2	0.44332

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
62.000	13.027	591.49	4540.5	-0.00034038	1113.4	0.44319
62.040	13.034	591.71	4539.8	-0.00029928	1113.7	0.44306
62.080	13.041	591.94	4539.1	-0.00026081	1114.0	0.44293
62.120	13.048	592.18	4538.5	-0.00022500	1114.2	0.44280
62.160	13.055	592.43	4537.9	-0.00019182	1114.5	0.44266
62.200	13.062	592.69	4537.4	-0.00016130	1114.8	0.44252
62.240	13.070	592.95	4536.9	-0.00013341	1115.1	0.44238
62.280	13.077	593.23	4536.5	-0.00010817	1115.3	0.44224
62.320	13.084	593.52	4536.1	-8.5575e-05	1115.6	0.44209
62.360	13.092	593.81	4535.8	-6.5624e-05	1115.9	0.44194
62.400	13.099	594.12	4535.6	-4.8316e-05	1116.2	0.44179
62.440	13.107	594.43	4535.4	-3.3653e-05	1116.5	0.44164
62.480	13.114	594.76	4535.2	-2.1634e-05	1116.8	0.44149
62.520	13.122	595.08	4535.0	-1.2259e-05	1117.1	0.44133
62.560	13.130	595.41	4534.8	-5.5286e-06	1117.5	0.44117
62.600	13.138	595.74	4534.5	-1.4422e-06	1117.8	0.44101
62.640	13.146	596.07	4534.2	0.00000	1118.1	0.44084
62.680	13.154	596.39	4533.9	0.00000	1118.5	0.44067
62.720	13.163	596.70	4533.4	0.00000	1118.8	0.44051
62.760	13.171	596.99	4532.7	0.00000	1119.1	0.44035
62.800	13.179	597.26	4531.9	0.00000	1119.4	0.44019
62.840	13.187	597.51	4531.0	0.00000	1119.7	0.44003
62.880	13.196	597.74	4529.9	0.00000	1120.1	0.43988
62.920	13.204	597.96	4528.7	0.00000	1120.4	0.43973
62.960	13.212	598.16	4527.5	0.00000	1120.7	0.43958
63.000	13.221	598.40	4526.3	0.00000	1121.0	0.43943
63.040	13.229	598.65	4525.4	0.00000	1121.3	0.43927
63.080	13.238	598.93	4524.5	0.00000	1121.6	0.43911
63.120	13.246	599.23	4523.9	0.00000	1121.9	0.43895
63.160	13.255	599.56	4523.3	0.00000	1122.2	0.43879
63.200	13.264	599.92	4523.0	0.00000	1122.6	0.43862
63.240	13.273	600.31	4522.8	0.00000	1122.9	0.43844
63.280	13.282	600.74	4522.9	0.00000	1123.3	0.43826
63.320	13.292	601.18	4523.0	0.00000	1123.7	0.43807
63.360	13.301	601.58	4522.8	0.00000	1124.0	0.43789
63.400	13.311	601.96	4522.3	0.00000	1124.4	0.43772
63.440	13.321	602.32	4521.6	0.00000	1124.7	0.43755
63.480	13.331	602.64	4520.6	0.00000	1125.0	0.43739
63.520	13.341	602.93	4519.3	0.00000	1125.3	0.43723
63.560	13.352	603.19	4517.8	0.00000	1125.6	0.43708
63.600	13.362	603.42	4516.0	0.00000	1125.9	0.43693
63.640	13.373	603.62	4513.9	0.00000	1126.2	0.43679
63.680	13.384	603.80	4511.5	0.00000	1126.5	0.43666
63.720	13.395	603.95	4509.0	0.00000	1126.7	0.43653
63.760	13.406	604.10	4506.5	0.00000	1127.0	0.43641
63.800	13.416	604.26	4504.1	0.00000	1127.2	0.43628
63.840	13.427	604.43	4501.9	0.00000	1127.5	0.43617
63.880	13.437	604.60	4499.7	0.00000	1127.7	0.43605
63.920	13.447	604.78	4497.7	0.00000	1127.9	0.43594
63.960	13.457	604.96	4495.8	0.00000	1128.1	0.43584

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
64.000	13.467	605.16	4493.9	0.00000	1128.3	0.43574
64.040	13.476	605.35	4492.2	0.00000	1128.5	0.43564
64.080	13.485	605.56	4490.6	0.00000	1128.7	0.43555
64.120	13.495	605.77	4489.1	0.00000	1128.9	0.43546
64.160	13.504	605.98	4487.7	0.00000	1129.1	0.43537
64.200	13.512	606.19	4486.4	0.00000	1129.2	0.43529
64.240	13.521	606.37	4484.8	0.00000	1129.4	0.43522
64.280	13.529	606.51	4483.1	0.00000	1129.5	0.43516
64.320	13.537	606.61	4481.2	0.00000	1129.6	0.43511
64.360	13.545	606.68	4479.2	0.00000	1129.7	0.43507
64.400	13.553	606.71	4476.9	0.00000	1129.7	0.43504
64.440	13.560	606.71	4474.5	0.00000	1129.8	0.43501
64.480	13.567	606.68	4472.0	0.00000	1129.8	0.43500
64.520	13.573	606.60	4469.2	0.00000	1129.8	0.43500
64.560	13.580	606.52	4466.4	0.00000	1129.8	0.43500
64.600	13.586	606.46	4463.9	0.00000	1129.8	0.43500
64.640	13.592	606.43	4461.8	0.00000	1129.8	0.43499
64.680	13.598	606.43	4459.9	0.00000	1129.8	0.43499
64.720	13.603	606.46	4458.2	0.00000	1129.9	0.43498
64.760	13.609	606.52	4456.8	0.00000	1129.9	0.43497
64.800	13.615	606.62	4455.7	0.00000	1129.9	0.43496
64.840	13.620	606.74	4454.8	0.00000	1129.9	0.43494
64.880	13.626	606.90	4454.1	0.00000	1130.0	0.43493
64.920	13.631	607.09	4453.7	0.00000	1130.0	0.43491
64.960	13.637	607.31	4453.5	0.00000	1130.0	0.43489
65.000	13.642	607.53	4453.3	0.00000	1130.1	0.43488
65.040	13.648	607.75	4453.0	0.00000	1130.1	0.43486
65.080	13.654	607.98	4452.7	0.00000	1130.1	0.43484
65.120	13.661	608.21	4452.3	0.00000	1130.2	0.43483
65.160	13.667	608.42	4451.7	0.00000	1130.2	0.43482
65.200	13.674	608.60	4450.8	0.00000	1130.2	0.43482
65.240	13.681	608.75	4449.5	0.00000	1130.1	0.43483
65.280	13.689	608.88	4448.0	0.00000	1130.1	0.43485
65.320	13.697	608.98	4446.1	0.00000	1130.1	0.43488
65.360	13.705	609.05	4444.0	0.00000	1130.0	0.43491
65.400	13.714	609.10	4441.6	0.00000	1129.9	0.43496
65.440	13.723	609.14	4439.0	0.00000	1129.8	0.43500
65.480	13.732	609.19	4436.4	0.00000	1129.7	0.43504
65.520	13.741	609.23	4433.7	0.00000	1129.7	0.43507
65.560	13.751	609.28	4431.0	0.00000	1129.6	0.43510
65.600	13.761	609.32	4428.2	0.00000	1129.6	0.43512
65.640	13.771	609.37	4425.4	0.00000	1129.5	0.43514
65.680	13.781	609.42	4422.5	0.00000	1129.5	0.43515
65.720	13.791	609.47	4419.5	0.00000	1129.5	0.43516
65.760	13.802	609.52	4416.5	0.00000	1129.5	0.43516
65.800	13.813	609.58	4413.4	0.00000	1129.5	0.43516
65.840	13.824	609.63	4410.2	-2.9158e-06	1129.5	0.43516
65.880	13.835	609.67	4407.0	-1.0292e-05	1129.5	0.43516
65.920	13.846	609.71	4403.7	-2.2128e-05	1129.5	0.43515
65.960	13.858	609.73	4400.3	-3.8425e-05	1129.5	0.43515

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
66.000	13.869	609.75	4396.9	-5.9181e-05	1129.5	0.43514
66.040	13.880	609.76	4393.4	-8.4398e-05	1129.5	0.43514
66.080	13.891	609.76	4389.9	-0.00011407	1129.6	0.43513
66.120	13.902	609.74	4386.4	-0.00014821	1129.6	0.43512
66.160	13.913	609.72	4382.8	-0.00018681	1129.6	0.43511
66.200	13.923	609.69	4379.1	-0.00022987	1129.6	0.43509
66.240	13.934	609.64	4375.5	-0.00027738	1129.7	0.43508
66.280	13.945	609.59	4371.7	-0.00032936	1129.7	0.43506
66.320	13.955	609.53	4368.0	-0.00038580	1129.7	0.43505
66.360	13.966	609.45	4364.1	-0.00044670	1129.8	0.43503
66.400	13.976	609.41	4360.6	-0.00050231	1129.8	0.43500
66.440	13.986	609.39	4357.2	-0.00055227	1129.9	0.43496
66.480	13.996	609.39	4354.1	-0.00059658	1130.0	0.43492
66.520	14.006	609.43	4351.3	-0.00063525	1130.1	0.43486
66.560	14.016	609.49	4348.7	-0.00066826	1130.2	0.43480
66.600	14.026	609.58	4346.3	-0.00069563	1130.4	0.43472
66.640	14.035	609.69	4344.1	-0.00071734	1130.5	0.43464
66.680	14.045	609.82	4342.1	-0.00073341	1130.7	0.43456
66.720	14.054	609.94	4340.0	-0.00074382	1130.9	0.43448
66.760	14.064	610.06	4338.0	-0.00074859	1131.0	0.43440
66.800	14.073	610.18	4335.9	-0.00074859	1131.2	0.43433
66.840	14.083	610.31	4333.9	-0.00074859	1131.3	0.43426
66.880	14.092	610.43	4332.0	-0.00074859	1131.4	0.43419
66.920	14.101	610.57	4330.1	-0.00074859	1131.6	0.43412
66.960	14.110	610.70	4328.3	-0.00074859	1131.7	0.43406
67.000	14.119	610.84	4326.5	-0.00074859	1131.8	0.43399
67.040	14.128	610.98	4324.8	-0.00074859	1132.0	0.43393
67.080	14.137	611.12	4323.1	-0.00074567	1132.1	0.43386
67.120	14.145	611.28	4321.5	-0.00073830	1132.2	0.43380
67.160	14.154	611.45	4320.0	-0.00072646	1132.3	0.43373
67.200	14.163	611.63	4318.6	-0.00071016	1132.5	0.43366
67.240	14.172	611.82	4317.3	-0.00068941	1132.6	0.43358
67.280	14.180	612.02	4316.0	-0.00066419	1132.8	0.43351
67.320	14.189	612.23	4314.9	-0.00063451	1132.9	0.43343
67.360	14.198	612.45	4313.8	-0.00060038	1133.1	0.43335
67.400	14.206	612.67	4312.7	-0.00056178	1133.3	0.43327
67.440	14.215	612.90	4311.7	-0.00051872	1133.4	0.43319
67.480	14.224	613.13	4310.6	-0.00047120	1133.6	0.43311
67.520	14.232	613.36	4309.6	-0.00041923	1133.7	0.43303
67.560	14.241	613.59	4308.6	-0.00036279	1133.9	0.43296
67.600	14.250	613.83	4307.7	-0.00030189	1134.0	0.43289
67.640	14.259	614.07	4306.7	-0.00024628	1134.2	0.43281
67.680	14.267	614.30	4305.7	-0.00019632	1134.3	0.43274
67.720	14.276	614.52	4304.7	-0.00015200	1134.5	0.43268
67.760	14.284	614.74	4303.7	-0.00011334	1134.6	0.43261
67.800	14.293	614.96	4302.7	-8.0327e-05	1134.7	0.43254
67.840	14.301	615.17	4301.7	-5.2963e-05	1134.8	0.43248
67.880	14.309	615.38	4300.6	-3.1248e-05	1135.0	0.43242
67.920	14.318	615.58	4299.5	-1.5183e-05	1135.1	0.43236
67.960	14.326	615.77	4298.3	-4.7667e-06	1135.2	0.43229

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
68.000	14.334	615.93	4297.0	0.00000	1135.3	0.43223
68.040	14.343	616.09	4295.5	0.00000	1135.5	0.43217
68.080	14.351	616.22	4294.0	0.00000	1135.6	0.43211
68.120	14.360	616.34	4292.2	0.00000	1135.7	0.43205
68.160	14.369	616.44	4290.3	0.00000	1135.8	0.43200
68.200	14.377	616.52	4288.3	0.00000	1135.9	0.43194
68.240	14.386	616.59	4286.1	0.00000	1136.0	0.43189
68.280	14.395	616.63	4283.7	0.00000	1136.1	0.43184
68.320	14.404	616.67	4281.4	0.00000	1136.2	0.43179
68.360	14.413	616.71	4278.9	0.00000	1136.3	0.43174
68.400	14.422	616.74	4276.5	0.00000	1136.4	0.43169
68.440	14.431	616.77	4274.0	0.00000	1136.5	0.43164
68.480	14.440	616.79	4271.5	0.00000	1136.6	0.43159
68.520	14.449	616.80	4269.0	0.00000	1136.7	0.43155
68.560	14.458	616.81	4266.4	0.00000	1136.8	0.43150
68.600	14.467	616.81	4263.7	0.00000	1136.9	0.43145
68.640	14.476	616.82	4261.1	0.00000	1137.0	0.43140
68.680	14.485	616.82	4258.6	0.00000	1137.1	0.43134
68.720	14.494	616.83	4256.0	0.00000	1137.2	0.43128
68.760	14.503	616.84	4253.5	0.00000	1137.4	0.43122
68.800	14.512	616.85	4251.0	0.00000	1137.5	0.43116
68.840	14.520	616.87	4248.5	0.00000	1137.6	0.43109
68.880	14.529	616.88	4246.1	0.00000	1137.8	0.43102
68.920	14.538	616.91	4243.7	0.00000	1137.9	0.43094
68.960	14.546	616.94	4241.4	0.00000	1138.1	0.43087
69.000	14.555	616.97	4239.1	0.00000	1138.2	0.43079
69.040	14.563	617.01	4237.0	0.00000	1138.4	0.43071
69.080	14.571	617.07	4234.9	0.00000	1138.5	0.43063
69.120	14.580	617.12	4232.9	0.00000	1138.7	0.43055
69.160	14.588	617.20	4231.0	0.00000	1138.9	0.43048
69.200	14.596	617.29	4229.4	0.00000	1139.0	0.43040
69.240	14.603	617.39	4227.9	0.00000	1139.2	0.43032
69.280	14.611	617.52	4226.5	0.00000	1139.3	0.43025
69.320	14.618	617.66	4225.4	0.00000	1139.5	0.43017
69.360	14.625	617.82	4224.4	0.00000	1139.6	0.43010
69.400	14.632	618.00	4223.6	0.00000	1139.8	0.43002
69.440	14.639	618.20	4222.9	0.00000	1139.9	0.42995
69.480	14.646	618.41	4222.4	0.00000	1140.0	0.42988
69.520	14.652	618.64	4222.1	0.00000	1140.2	0.42981
69.560	14.659	618.87	4221.8	0.00000	1140.3	0.42974
69.600	14.665	619.11	4221.6	0.00000	1140.5	0.42968
69.640	14.672	619.35	4221.4	0.00000	1140.6	0.42961
69.680	14.678	619.57	4221.0	0.00000	1140.7	0.42956
69.720	14.685	619.76	4220.3	0.00000	1140.8	0.42951
69.760	14.692	619.93	4219.4	0.00000	1140.9	0.42946
69.800	14.699	620.07	4218.3	0.00000	1141.0	0.42943
69.840	14.707	620.19	4217.0	0.00000	1141.0	0.42939
69.880	14.715	620.29	4215.5	0.00000	1141.1	0.42937
69.920	14.723	620.36	4213.7	0.00000	1141.1	0.42935
69.960	14.731	620.44	4211.9	0.00000	1141.1	0.42933

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
70.000	14.739	620.55	4210.3	0.00000	1141.2	0.42932
70.040	14.748	620.69	4208.8	0.00000	1141.2	0.42930
70.080	14.757	620.88	4207.4	0.00000	1141.2	0.42929
70.120	14.766	621.10	4206.2	0.00000	1141.3	0.42927
70.160	14.776	621.35	4205.1	0.00000	1141.3	0.42926
70.200	14.786	621.62	4204.1	0.00000	1141.3	0.42924
70.240	14.797	621.90	4203.1	0.00000	1141.4	0.42922
70.280	14.807	622.16	4202.0	0.00000	1141.4	0.42921
70.320	14.817	622.43	4200.8	0.00000	1141.4	0.42919
70.360	14.828	622.68	4199.6	0.00000	1141.5	0.42917
70.400	14.838	622.94	4198.4	0.00000	1141.5	0.42915
70.440	14.848	623.18	4197.1	0.00000	1141.5	0.42914
70.480	14.859	623.42	4195.8	0.00000	1141.6	0.42912
70.520	14.869	623.66	4194.4	0.00000	1141.6	0.42910
70.560	14.880	623.89	4193.0	0.00000	1141.6	0.42908
70.600	14.891	624.12	4191.5	0.00000	1141.7	0.42906
70.640	14.901	624.34	4190.0	0.00000	1141.7	0.42904
70.680	14.912	624.56	4188.4	0.00000	1141.8	0.42902
70.720	14.923	624.77	4186.8	0.00000	1141.8	0.42900
70.760	14.933	624.97	4185.2	0.00000	1141.8	0.42898
70.800	14.944	625.17	4183.5	0.00000	1141.9	0.42896
70.840	14.955	625.36	4181.6	0.00000	1141.9	0.42895
70.880	14.966	625.52	4179.6	0.00000	1141.9	0.42893
70.920	14.977	625.70	4177.8	0.00000	1142.0	0.42891
70.960	14.988	625.88	4176.0	0.00000	1142.0	0.42890
71.000	14.998	626.06	4174.2	0.00000	1142.1	0.42888
71.040	15.009	626.25	4172.6	0.00000	1142.1	0.42886
71.080	15.019	626.45	4171.1	0.00000	1142.1	0.42884
71.120	15.029	626.65	4169.6	0.00000	1142.2	0.42882
71.160	15.039	626.86	4168.3	0.00000	1142.2	0.42880
71.200	15.049	627.05	4166.8	0.00000	1142.3	0.42878
71.240	15.059	627.18	4165.1	0.00000	1142.3	0.42876
71.280	15.068	627.27	4163.1	0.00000	1142.3	0.42875
71.320	15.077	627.33	4161.1	0.00000	1142.3	0.42874
71.360	15.086	627.37	4158.9	0.00000	1142.3	0.42873
71.400	15.094	627.37	4156.6	0.00000	1142.3	0.42873
71.440	15.102	627.35	4154.2	0.00000	1142.3	0.42873
71.480	15.111	627.34	4151.8	0.00000	1142.3	0.42873
71.520	15.119	627.34	4149.5	0.00000	1142.3	0.42874
71.560	15.128	627.35	4147.2	0.00000	1142.3	0.42874
71.600	15.136	627.36	4144.9	0.00000	1142.3	0.42874
71.640	15.145	627.38	4142.7	0.00000	1142.3	0.42875
71.680	15.154	627.41	4140.5	0.00000	1142.3	0.42876
71.720	15.162	627.45	4138.4	0.00000	1142.3	0.42877
71.760	15.171	627.47	4136.1	0.00000	1142.2	0.42878
71.800	15.180	627.48	4133.6	0.00000	1142.2	0.42881
71.840	15.190	627.47	4131.1	0.00000	1142.1	0.42884
71.880	15.199	627.43	4128.4	0.00000	1142.1	0.42888
71.920	15.208	627.38	4125.5	0.00000	1142.0	0.42892
71.960	15.217	627.32	4122.5	0.00000	1141.8	0.42898

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
72.000	15.227	627.23	4119.4	0.00000	1141.7	0.42904
72.040	15.237	627.13	4116.1	0.00000	1141.6	0.42911
72.080	15.246	627.01	4112.8	0.00000	1141.4	0.42919
72.120	15.256	626.90	4109.4	0.00000	1141.3	0.42927
72.160	15.265	626.79	4106.1	0.00000	1141.1	0.42936
72.200	15.275	626.70	4102.9	0.00000	1140.9	0.42944
72.240	15.285	626.63	4099.9	0.00000	1140.8	0.42950
72.280	15.294	626.58	4097.0	0.00000	1140.7	0.42956
72.320	15.304	626.55	4094.2	0.00000	1140.6	0.42961
72.360	15.313	626.55	4091.6	0.00000	1140.5	0.42964
72.400	15.323	626.57	4089.2	0.00000	1140.5	0.42967
72.440	15.333	626.61	4086.9	0.00000	1140.4	0.42968
72.480	15.342	626.67	4084.8	0.00000	1140.4	0.42969
72.520	15.352	626.74	4082.8	0.00000	1140.5	0.42968
72.560	15.361	626.82	4080.7	0.00000	1140.5	0.42966
72.600	15.371	626.89	4078.6	0.00000	1140.5	0.42964
72.640	15.380	626.95	4076.5	0.00000	1140.6	0.42961
72.680	15.389	627.00	4074.4	0.00000	1140.7	0.42957
72.720	15.399	627.04	4072.2	0.00000	1140.7	0.42954
72.760	15.408	627.06	4069.9	0.00000	1140.8	0.42951
72.800	15.417	627.06	4067.5	0.00000	1140.9	0.42948
72.840	15.426	627.04	4065.0	0.00000	1140.9	0.42945
72.880	15.435	627.01	4062.5	0.00000	1141.0	0.42942
72.920	15.444	626.96	4059.8	0.00000	1141.0	0.42940
72.960	15.452	626.89	4057.1	0.00000	1141.0	0.42938
73.000	15.461	626.83	4054.5	0.00000	1141.1	0.42936
73.040	15.469	626.78	4051.9	0.00000	1141.2	0.42933
73.080	15.477	626.74	4049.5	0.00000	1141.2	0.42929
73.120	15.486	626.71	4047.1	0.00000	1141.3	0.42925
73.160	15.494	626.68	4044.9	0.00000	1141.4	0.42921
73.200	15.502	626.67	4042.7	0.00000	1141.5	0.42916
73.240	15.509	626.66	4040.6	0.00000	1141.6	0.42911
73.280	15.517	626.67	4038.7	0.00000	1141.7	0.42905
73.320	15.525	626.68	4036.8	0.00000	1141.8	0.42899
73.360	15.532	626.70	4035.0	0.00000	1142.0	0.42892
73.400	15.539	626.75	4033.4	0.00000	1142.1	0.42885
73.440	15.547	626.81	4031.8	0.00000	1142.2	0.42878
73.480	15.554	626.86	4030.3	0.00000	1142.4	0.42872
73.520	15.562	626.92	4028.7	0.00000	1142.5	0.42867
73.560	15.569	626.99	4027.2	0.00000	1142.6	0.42862
73.600	15.577	627.06	4025.7	0.00000	1142.6	0.42858
73.640	15.584	627.13	4024.3	0.00000	1142.7	0.42855
73.680	15.591	627.20	4022.8	0.00000	1142.8	0.42853
73.720	15.599	627.28	4021.4	0.00000	1142.8	0.42851
73.760	15.606	627.37	4020.0	0.00000	1142.8	0.42850
73.800	15.614	627.45	4018.6	0.00000	1142.8	0.42850
73.840	15.621	627.54	4017.2	0.00000	1142.8	0.42850
73.880	15.629	627.61	4015.7	0.00000	1142.8	0.42852
73.920	15.637	627.68	4014.1	0.00000	1142.7	0.42854
73.960	15.645	627.74	4012.5	0.00000	1142.7	0.42855

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
74.000	15.653	627.81	4010.8	0.00000	1142.7	0.42856
74.040	15.662	627.87	4009.0	0.00000	1142.7	0.42857
74.080	15.671	627.94	4007.2	0.00000	1142.6	0.42858
74.120	15.680	628.00	4005.3	0.00000	1142.6	0.42859
74.160	15.689	628.07	4003.4	0.00000	1142.6	0.42859
74.200	15.698	628.14	4001.5	0.00000	1142.6	0.42860
74.240	15.707	628.21	3999.6	0.00000	1142.6	0.42860
74.280	15.716	628.28	3997.7	0.00000	1142.6	0.42860
74.320	15.726	628.35	3995.8	0.00000	1142.6	0.42860
74.360	15.735	628.43	3993.9	0.00000	1142.6	0.42860
74.400	15.744	628.50	3992.1	0.00000	1142.6	0.42860
74.440	15.753	628.58	3990.2	0.00000	1142.6	0.42860
74.480	15.763	628.66	3988.4	0.00000	1142.6	0.42859
74.520	15.772	628.75	3986.6	0.00000	1142.6	0.42859
74.560	15.781	628.83	3984.8	0.00000	1142.6	0.42858
74.600	15.790	628.92	3983.1	0.00000	1142.7	0.42857
74.640	15.800	628.99	3981.2	0.00000	1142.7	0.42857
74.680	15.809	629.05	3979.3	0.00000	1142.7	0.42857
74.720	15.818	629.09	3977.3	0.00000	1142.7	0.42857
74.760	15.826	629.12	3975.3	0.00000	1142.7	0.42857
74.800	15.835	629.14	3973.2	0.00000	1142.7	0.42858
74.840	15.844	629.14	3971.0	0.00000	1142.6	0.42859
74.880	15.852	629.12	3968.8	0.00000	1142.6	0.42860
74.920	15.861	629.11	3966.5	0.00000	1142.6	0.42861
74.960	15.870	629.09	3964.1	0.00000	1142.6	0.42862
75.000	15.879	629.06	3961.8	0.00000	1142.6	0.42863
75.040	15.888	629.04	3959.3	0.00000	1142.5	0.42863
75.080	15.897	629.01	3956.9	0.00000	1142.5	0.42864
75.120	15.906	629.00	3954.5	0.00000	1142.5	0.42864
75.160	15.916	629.00	3952.2	0.00000	1142.5	0.42865
75.200	15.925	629.01	3950.0	0.00000	1142.5	0.42865
75.240	15.934	629.04	3947.9	0.00000	1142.5	0.42864
75.280	15.943	629.09	3945.9	0.00000	1142.5	0.42863
75.320	15.953	629.15	3943.9	0.00000	1142.6	0.42862
75.360	15.962	629.22	3942.0	0.00000	1142.6	0.42859
75.400	15.972	629.31	3940.2	0.00000	1142.7	0.42857
75.440	15.982	629.42	3938.4	0.00000	1142.7	0.42853
75.480	15.992	629.53	3936.5	0.00000	1142.8	0.42850
75.520	16.003	629.62	3934.6	0.00000	1142.9	0.42847
75.560	16.013	629.71	3932.5	0.00000	1142.9	0.42844
75.600	16.024	629.78	3930.4	0.00000	1143.0	0.42842
75.640	16.034	629.84	3928.2	0.00000	1143.0	0.42841
75.680	16.045	629.89	3925.9	0.00000	1143.0	0.42841
75.720	16.056	629.93	3923.5	0.00000	1143.0	0.42841
75.760	16.067	629.95	3921.0	0.00000	1143.0	0.42841
75.800	16.078	629.96	3918.5	0.00000	1143.0	0.42842
75.840	16.089	629.96	3915.8	0.00000	1142.9	0.42844
75.880	16.100	629.95	3913.0	0.00000	1142.9	0.42847
75.920	16.111	629.93	3910.2	0.00000	1142.8	0.42850
75.960	16.122	629.89	3907.3	0.00000	1142.7	0.42853

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
76.000	16.133	629.85	3904.3	0.00000	1142.7	0.42858
76.040	16.144	629.81	3901.3	0.00000	1142.6	0.42862
76.080	16.156	629.77	3898.4	0.00000	1142.5	0.42866
76.120	16.167	629.73	3895.4	0.00000	1142.4	0.42871
76.160	16.178	629.68	3892.4	0.00000	1142.3	0.42876
76.200	16.189	629.62	3889.4	0.00000	1142.2	0.42881
76.240	16.200	629.56	3886.4	0.00000	1142.1	0.42887
76.280	16.210	629.48	3883.4	0.00000	1141.9	0.42894
76.320	16.221	629.40	3880.4	0.00000	1141.8	0.42901
76.360	16.231	629.31	3877.4	0.00000	1141.6	0.42908
76.400	16.241	629.21	3874.4	0.00000	1141.5	0.42916
76.440	16.251	629.10	3871.3	0.00000	1141.3	0.42924
76.480	16.261	628.98	3868.3	0.00000	1141.1	0.42933
76.520	16.270	628.85	3865.3	0.00000	1140.9	0.42943
76.560	16.279	628.70	3862.3	0.00000	1140.7	0.42954
76.600	16.288	628.56	3859.3	0.00000	1140.5	0.42965
76.640	16.296	628.44	3856.6	0.00000	1140.3	0.42976
76.680	16.304	628.35	3854.1	0.00000	1140.1	0.42987
76.720	16.312	628.28	3851.8	0.00000	1139.9	0.42997
76.760	16.320	628.26	3849.8	0.00000	1139.7	0.43006
76.800	16.328	628.28	3848.1	0.00000	1139.5	0.43014
76.840	16.335	628.35	3846.7	0.00000	1139.4	0.43020
76.880	16.343	628.47	3845.5	0.00000	1139.3	0.43024
76.920	16.351	628.64	3844.7	0.00000	1139.3	0.43028
76.960	16.359	628.85	3844.1	0.00000	1139.2	0.43030
77.000	16.367	629.11	3843.9	0.00000	1139.2	0.43030
77.040	16.374	629.41	3843.9	0.00000	1139.2	0.43030
77.080	16.382	629.76	3844.2	0.00000	1139.3	0.43028
77.120	16.390	630.16	3844.8	0.00000	1139.3	0.43024
77.160	16.398	630.57	3845.5	0.00000	1139.4	0.43019
77.200	16.406	630.99	3846.1	0.00000	1139.6	0.43012
77.240	16.414	631.41	3846.8	0.00000	1139.7	0.43003
77.280	16.422	631.82	3847.3	0.00000	1139.9	0.42993
77.320	16.430	632.22	3847.8	0.00000	1140.2	0.42982
77.360	16.439	632.62	3848.2	0.00000	1140.4	0.42970
77.400	16.448	633.00	3848.5	0.00000	1140.7	0.42956
77.440	16.457	633.38	3848.7	0.00000	1141.0	0.42941
77.480	16.466	633.74	3848.8	0.00000	1141.3	0.42925
77.520	16.475	634.08	3848.8	0.00000	1141.6	0.42909
77.560	16.484	634.40	3848.6	0.00000	1141.9	0.42893
77.600	16.493	634.70	3848.3	0.00000	1142.2	0.42878
77.640	16.502	634.98	3847.9	0.00000	1142.5	0.42864
77.680	16.511	635.23	3847.4	0.00000	1142.8	0.42850
77.720	16.520	635.46	3846.7	0.00000	1143.1	0.42836
77.760	16.528	635.67	3845.9	0.00000	1143.3	0.42823
77.800	16.537	635.85	3845.0	0.00000	1143.6	0.42810
77.840	16.546	636.00	3843.9	0.00000	1143.8	0.42798
77.880	16.555	636.09	3842.5	0.00000	1144.1	0.42788
77.920	16.564	636.13	3840.7	0.00000	1144.2	0.42779
77.960	16.572	636.12	3838.6	0.00000	1144.4	0.42771

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
78.000	16.581	636.04	3836.2	0.00000	1144.5	0.42764
78.040	16.590	635.92	3833.5	0.00000	1144.6	0.42759
78.080	16.598	635.74	3830.4	0.00000	1144.7	0.42755
78.120	16.607	635.50	3827.0	0.00000	1144.8	0.42753
78.160	16.615	635.26	3823.7	0.00000	1144.8	0.42750
78.200	16.624	635.04	3820.3	0.00000	1144.9	0.42747
78.240	16.632	634.82	3817.1	0.00000	1144.9	0.42743
78.280	16.641	634.62	3813.9	0.00000	1145.0	0.42739
78.320	16.649	634.43	3810.8	0.00000	1145.1	0.42735
78.360	16.658	634.26	3807.8	0.00000	1145.2	0.42729
78.400	16.666	634.12	3805.0	0.00000	1145.3	0.42724
78.440	16.674	634.04	3802.6	0.00000	1145.4	0.42719
78.480	16.682	634.01	3800.6	0.00000	1145.5	0.42713
78.520	16.690	634.03	3798.9	0.00000	1145.7	0.42708
78.560	16.698	634.11	3797.6	0.00000	1145.8	0.42702
78.600	16.706	634.24	3796.6	0.00000	1145.9	0.42696
78.640	16.713	634.42	3795.9	0.00000	1146.0	0.42690
78.680	16.721	634.66	3795.6	0.00000	1146.1	0.42684
78.720	16.728	634.90	3795.4	0.00000	1146.2	0.42679
78.760	16.735	635.12	3795.1	0.00000	1146.3	0.42675
78.800	16.742	635.33	3794.7	0.00000	1146.4	0.42671
78.840	16.749	635.52	3794.3	0.00000	1146.5	0.42667
78.880	16.757	635.70	3793.7	0.00000	1146.5	0.42664
78.920	16.764	635.87	3793.1	0.00000	1146.6	0.42661
78.960	16.771	636.02	3792.4	0.00000	1146.6	0.42659
79.000	16.778	636.16	3791.6	0.00000	1146.7	0.42657
79.040	16.785	636.28	3790.8	0.00000	1146.7	0.42656
79.080	16.792	636.39	3789.9	0.00000	1146.7	0.42655
79.120	16.799	636.49	3788.9	0.00000	1146.7	0.42655
79.160	16.806	636.57	3787.8	0.00000	1146.7	0.42655
79.200	16.813	636.63	3786.6	0.00000	1146.7	0.42655
79.240	16.820	636.69	3785.4	0.00000	1146.7	0.42656
79.280	16.827	636.73	3784.1	0.00000	1146.7	0.42658
79.320	16.833	636.75	3782.7	0.00000	1146.6	0.42659
79.360	16.840	636.76	3781.3	0.00000	1146.6	0.42662
79.400	16.847	636.71	3779.4	0.00000	1146.5	0.42666
79.440	16.854	636.62	3777.4	0.00000	1146.4	0.42670
79.480	16.861	636.55	3775.5	0.00000	1146.3	0.42675
79.520	16.868	636.48	3773.5	0.00000	1146.2	0.42679
79.560	16.875	636.43	3771.7	0.00000	1146.2	0.42682
79.600	16.882	636.39	3769.9	0.00000	1146.1	0.42685
79.640	16.889	636.36	3768.1	0.00000	1146.0	0.42688
79.680	16.896	636.34	3766.4	0.00000	1146.0	0.42690
79.720	16.903	636.33	3764.7	0.00000	1146.0	0.42692
79.760	16.911	636.33	3763.0	0.00000	1145.9	0.42693
79.800	16.918	636.34	3761.5	0.00000	1145.9	0.42694
79.840	16.926	636.36	3759.9	0.00000	1145.9	0.42695
79.880	16.933	636.38	3758.4	0.00000	1145.9	0.42695
79.920	16.941	636.35	3756.5	0.00000	1145.9	0.42696
79.960	16.948	636.32	3754.6	0.00000	1145.9	0.42696

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
80.000	16.956	636.31	3752.9	0.00000	1145.9	0.42695
80.040	16.963	636.34	3751.3	0.00000	1145.9	0.42693
80.080	16.971	636.39	3749.9	0.00000	1146.0	0.42689
80.120	16.979	636.47	3748.6	0.00000	1146.1	0.42684
80.160	16.987	636.58	3747.4	0.00000	1146.3	0.42678
80.200	16.995	636.71	3746.5	0.00000	1146.4	0.42670
80.240	17.003	636.88	3745.6	0.00000	1146.6	0.42660
80.280	17.011	637.07	3744.9	0.00000	1146.8	0.42649
80.320	17.019	637.29	3744.4	0.00000	1147.1	0.42637
80.360	17.028	637.53	3744.0	0.00000	1147.3	0.42623
80.400	17.036	637.81	3743.8	0.00000	1147.6	0.42609
80.440	17.045	638.12	3743.8	0.00000	1147.9	0.42594
80.480	17.053	638.47	3743.9	0.00000	1148.3	0.42578
80.520	17.062	638.85	3744.2	0.00000	1148.6	0.42561
80.560	17.071	639.26	3744.6	0.00000	1148.9	0.42544
80.600	17.080	639.70	3745.3	0.00000	1149.3	0.42526
80.640	17.089	640.18	3746.1	0.00000	1149.6	0.42508
80.680	17.099	640.64	3746.8	0.00000	1150.0	0.42491
80.720	17.108	641.04	3747.1	0.00000	1150.3	0.42475
80.760	17.117	641.38	3747.1	0.00000	1150.6	0.42462
80.800	17.126	641.67	3746.7	0.00000	1150.8	0.42451
80.840	17.136	641.89	3746.0	0.00000	1151.0	0.42442
80.880	17.145	642.04	3744.8	0.00000	1151.1	0.42435
80.920	17.155	642.11	3743.2	0.00000	1151.2	0.42429
80.960	17.164	642.12	3741.2	0.00000	1151.3	0.42426
81.000	17.174	642.05	3738.7	0.00000	1151.3	0.42424
81.040	17.183	641.91	3735.8	0.00000	1151.3	0.42424
81.080	17.193	641.70	3732.5	0.00000	1151.3	0.42426
81.120	17.203	641.43	3728.8	0.00000	1151.2	0.42429
81.160	17.213	641.16	3725.0	0.00000	1151.1	0.42433
81.200	17.223	640.88	3721.2	0.00000	1151.0	0.42438
81.240	17.233	640.60	3717.5	0.00000	1150.9	0.42443
81.280	17.243	640.32	3713.7	0.00000	1150.8	0.42448
81.320	17.253	640.04	3710.0	0.00000	1150.7	0.42455
81.360	17.263	639.77	3706.2	0.00000	1150.6	0.42461
81.400	17.273	639.49	3702.5	0.00000	1150.4	0.42468
81.440	17.283	639.22	3698.8	0.00000	1150.3	0.42476
81.480	17.293	638.95	3695.2	0.00000	1150.1	0.42484
81.520	17.302	638.68	3691.5	0.00000	1149.9	0.42493
81.560	17.312	638.41	3687.9	0.00000	1149.8	0.42503
81.600	17.322	638.14	3684.2	0.00000	1149.6	0.42513
81.640	17.332	637.87	3680.6	0.00000	1149.4	0.42523
81.680	17.341	637.59	3677.0	0.00000	1149.2	0.42532
81.720	17.351	637.31	3673.3	0.00000	1149.0	0.42542
81.760	17.360	637.03	3669.7	0.00000	1148.8	0.42551
81.800	17.370	636.78	3666.3	0.00000	1148.6	0.42559
81.840	17.379	636.56	3663.1	0.00000	1148.5	0.42567
81.880	17.388	636.36	3660.0	0.00000	1148.3	0.42574
81.920	17.397	636.20	3657.1	0.00000	1148.2	0.42580
81.960	17.406	636.06	3654.4	0.00000	1148.1	0.42585

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
82.000	17.415	635.95	3651.9	0.00000	1148.0	0.42589
82.040	17.424	635.88	3649.6	0.00000	1148.0	0.42592
82.080	17.432	635.83	3647.6	0.00000	1147.9	0.42595
82.120	17.441	635.83	3645.8	0.00000	1147.9	0.42597
82.160	17.449	635.87	3644.2	0.00000	1147.8	0.42598
82.200	17.457	635.95	3643.0	0.00000	1147.8	0.42599
82.240	17.465	636.08	3642.0	0.00000	1147.8	0.42600
82.280	17.473	636.24	3641.3	0.00000	1147.8	0.42599
82.320	17.480	636.45	3640.9	0.00000	1147.8	0.42599
82.360	17.488	636.70	3640.8	0.00000	1147.9	0.42597
82.400	17.495	636.98	3640.9	0.00000	1147.9	0.42596
82.440	17.503	637.23	3640.7	0.00000	1147.9	0.42594
82.480	17.510	637.44	3640.4	0.00000	1148.0	0.42592
82.520	17.518	637.62	3639.8	0.00000	1148.0	0.42590
82.560	17.526	637.76	3639.0	0.00000	1148.0	0.42588
82.600	17.534	637.87	3638.0	0.00000	1148.1	0.42586
82.640	17.542	637.94	3636.7	0.00000	1148.1	0.42584
82.680	17.550	637.97	3635.2	0.00000	1148.2	0.42582
82.720	17.558	637.97	3633.5	0.00000	1148.2	0.42580
82.760	17.567	637.93	3631.5	0.00000	1148.2	0.42578
82.800	17.575	637.89	3629.6	0.00000	1148.3	0.42576
82.840	17.583	637.86	3627.7	0.00000	1148.3	0.42573
82.880	17.592	637.84	3625.8	0.00000	1148.4	0.42570
82.920	17.600	637.83	3624.0	0.00000	1148.5	0.42568
82.960	17.609	637.82	3622.3	0.00000	1148.5	0.42565
83.000	17.617	637.82	3620.5	0.00000	1148.6	0.42562
83.040	17.626	637.79	3618.7	0.00000	1148.6	0.42559
83.080	17.634	637.74	3616.7	0.00000	1148.7	0.42557
83.120	17.642	637.66	3614.5	0.00000	1148.7	0.42556
83.160	17.651	637.55	3612.2	0.00000	1148.7	0.42555
83.200	17.659	637.42	3609.8	0.00000	1148.7	0.42554
83.240	17.668	637.27	3607.2	0.00000	1148.7	0.42554
83.280	17.676	637.09	3604.4	0.00000	1148.7	0.42554
83.320	17.685	636.88	3601.5	0.00000	1148.7	0.42555
83.360	17.693	636.65	3598.5	0.00000	1148.7	0.42556
83.400	17.701	636.39	3595.3	0.00000	1148.6	0.42558
83.440	17.710	636.10	3592.0	0.00000	1148.6	0.42561
83.480	17.718	635.79	3588.5	0.00000	1148.5	0.42564
83.520	17.727	635.44	3584.8	0.00000	1148.5	0.42567
83.560	17.736	635.07	3581.0	0.00000	1148.4	0.42572
83.600	17.744	634.67	3577.0	0.00000	1148.3	0.42577
83.640	17.753	634.26	3572.9	0.00000	1148.2	0.42582
83.680	17.761	633.88	3569.0	0.00000	1148.1	0.42588
83.720	17.770	633.55	3565.4	0.00000	1147.9	0.42593
83.760	17.778	633.26	3562.1	0.00000	1147.8	0.42599
83.800	17.786	633.00	3559.0	0.00000	1147.7	0.42605
83.840	17.795	632.79	3556.2	0.00000	1147.6	0.42610
83.880	17.803	632.62	3553.6	0.00000	1147.5	0.42616
83.920	17.810	632.49	3551.3	0.00000	1147.4	0.42622
83.960	17.818	632.42	3549.3	0.00000	1147.3	0.42628

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
84.000	17.826	632.40	3547.7	0.00000	1147.1	0.42633
84.040	17.834	632.41	3546.1	0.00000	1147.1	0.42638
84.080	17.842	632.44	3544.6	0.00000	1147.0	0.42642
84.120	17.851	632.48	3543.2	0.00000	1146.9	0.42646
84.160	17.859	632.53	3541.8	0.00000	1146.8	0.42650
84.200	17.868	632.60	3540.5	0.00000	1146.7	0.42654
84.240	17.877	632.69	3539.3	0.00000	1146.7	0.42657
84.280	17.886	632.79	3538.1	0.00000	1146.6	0.42660
84.320	17.895	632.90	3536.8	0.00000	1146.5	0.42663
84.360	17.904	632.99	3535.5	0.00000	1146.5	0.42666
84.400	17.913	633.07	3534.1	0.00000	1146.4	0.42668
84.440	17.923	633.14	3532.6	0.00000	1146.4	0.42670
84.480	17.933	633.19	3531.0	0.00000	1146.4	0.42673
84.520	17.942	633.24	3529.3	0.00000	1146.3	0.42675
84.560	17.952	633.27	3527.6	0.00000	1146.3	0.42677
84.600	17.962	633.28	3525.7	0.00000	1146.2	0.42679
84.640	17.973	633.29	3523.7	0.00000	1146.2	0.42680
84.680	17.983	633.30	3521.7	0.00000	1146.2	0.42682
84.720	17.993	633.30	3519.7	0.00000	1146.2	0.42683
84.760	18.004	633.31	3517.8	0.00000	1146.1	0.42683
84.800	18.014	633.33	3515.8	0.00000	1146.1	0.42683
84.840	18.025	633.34	3513.9	0.00000	1146.2	0.42683
84.880	18.035	633.36	3511.9	0.00000	1146.2	0.42682
84.920	18.046	633.38	3510.0	0.00000	1146.2	0.42681
84.960	18.056	633.40	3508.1	0.00000	1146.2	0.42679
85.000	18.067	633.43	3506.2	0.00000	1146.3	0.42677
85.040	18.077	633.46	3504.3	0.00000	1146.3	0.42675
85.080	18.088	633.49	3502.4	0.00000	1146.4	0.42672
85.120	18.099	633.52	3500.5	0.00000	1146.4	0.42669
85.160	18.109	633.56	3498.7	0.00000	1146.5	0.42665
85.200	18.120	633.59	3496.8	0.00000	1146.6	0.42661
85.240	18.130	633.60	3494.9	0.00000	1146.7	0.42657
85.280	18.140	633.61	3493.0	0.00000	1146.7	0.42654
85.320	18.150	633.60	3491.1	0.00000	1146.8	0.42650
85.360	18.159	633.58	3489.1	0.00000	1146.9	0.42646
85.400	18.169	633.54	3487.1	0.00000	1147.0	0.42643
85.440	18.178	633.50	3485.1	0.00000	1147.0	0.42639
85.480	18.187	633.45	3483.0	0.00000	1147.1	0.42635
85.520	18.196	633.38	3481.0	0.00000	1147.2	0.42631
85.560	18.205	633.31	3479.0	0.00000	1147.3	0.42628
85.600	18.213	633.26	3477.1	0.00000	1147.3	0.42624
85.640	18.221	633.23	3475.3	0.00000	1147.4	0.42620
85.680	18.229	633.21	3473.7	0.00000	1147.5	0.42615
85.720	18.237	633.21	3472.1	0.00000	1147.6	0.42611
85.760	18.245	633.22	3470.8	0.00000	1147.7	0.42606
85.800	18.252	633.25	3469.5	0.00000	1147.8	0.42601
85.840	18.259	633.30	3468.4	0.00000	1147.9	0.42596
85.880	18.266	633.36	3467.4	0.00000	1148.0	0.42591
85.920	18.273	633.43	3466.5	0.00000	1148.1	0.42585
85.960	18.280	633.51	3465.6	0.00000	1148.2	0.42580

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
86.000	18.287	633.58	3464.7	0.00000	1148.3	0.42576
86.040	18.293	633.64	3463.8	0.00000	1148.4	0.42571
86.080	18.300	633.71	3462.9	0.00000	1148.5	0.42567
86.120	18.306	633.77	3462.0	0.00000	1148.5	0.42564
86.160	18.313	633.83	3461.2	0.00000	1148.6	0.42560
86.200	18.319	633.89	3460.3	0.00000	1148.7	0.42557
86.240	18.325	633.95	3459.4	0.00000	1148.7	0.42555
86.280	18.332	634.00	3458.6	0.00000	1148.7	0.42553
86.320	18.338	634.05	3457.7	0.00000	1148.8	0.42551
86.360	18.344	634.10	3456.8	0.00000	1148.8	0.42550
86.400	18.350	634.15	3456.0	0.00000	1148.8	0.42549
86.440	18.356	634.19	3455.0	0.00000	1148.8	0.42548
86.480	18.362	634.22	3454.1	0.00000	1148.8	0.42548
86.520	18.368	634.25	3453.1	0.00000	1148.8	0.42548
86.560	18.374	634.27	3452.1	0.00000	1148.8	0.42549
86.600	18.380	634.29	3451.0	0.00000	1148.8	0.42550
86.640	18.386	634.33	3450.0	0.00000	1148.8	0.42551
86.680	18.393	634.36	3449.0	0.00000	1148.8	0.42552
86.720	18.399	634.41	3448.1	0.00000	1148.7	0.42553
86.760	18.406	634.46	3447.1	0.00000	1148.7	0.42554
86.800	18.412	634.52	3446.2	0.00000	1148.7	0.42555
86.840	18.419	634.59	3445.3	0.00000	1148.7	0.42556
86.880	18.426	634.67	3444.5	0.00000	1148.7	0.42558
86.920	18.433	634.75	3443.6	0.00000	1148.6	0.42559
86.960	18.440	634.84	3442.8	0.00000	1148.6	0.42560
87.000	18.447	634.94	3442.0	0.00000	1148.6	0.42562
87.040	18.454	635.04	3441.3	0.00000	1148.5	0.42563
87.080	18.461	635.15	3440.5	0.00000	1148.5	0.42565
87.120	18.469	635.28	3439.8	0.00000	1148.5	0.42566
87.160	18.476	635.41	3439.1	0.00000	1148.4	0.42568
87.200	18.484	635.55	3438.4	0.00000	1148.4	0.42571
87.240	18.492	635.71	3437.7	0.00000	1148.3	0.42573
87.280	18.501	635.88	3437.1	0.00000	1148.3	0.42575
87.320	18.509	636.08	3436.6	0.00000	1148.3	0.42577
87.360	18.518	636.28	3436.1	0.00000	1148.2	0.42580
87.400	18.527	636.51	3435.6	0.00000	1148.2	0.42582
87.440	18.536	636.74	3435.2	0.00000	1148.1	0.42584
87.480	18.545	636.96	3434.6	0.00000	1148.1	0.42587
87.520	18.555	637.18	3434.0	0.00000	1148.0	0.42590
87.560	18.565	637.39	3433.3	0.00000	1147.9	0.42593
87.600	18.575	637.58	3432.6	0.00000	1147.9	0.42597
87.640	18.585	637.77	3431.7	0.00000	1147.8	0.42601
87.680	18.595	637.94	3430.8	0.00000	1147.7	0.42605
87.720	18.605	638.11	3429.8	0.00000	1147.6	0.42610
87.760	18.616	638.27	3428.7	0.00000	1147.5	0.42615
87.800	18.627	638.42	3427.5	0.00000	1147.4	0.42621
87.840	18.637	638.56	3426.3	0.00000	1147.3	0.42626
87.880	18.648	638.69	3425.0	0.00000	1147.2	0.42632
87.920	18.658	638.80	3423.8	0.00000	1147.1	0.42637
87.960	18.669	638.91	3422.4	0.00000	1147.0	0.42642

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
88.000	18.679	639.01	3421.1	0.00000	1146.9	0.42648
88.040	18.689	639.09	3419.7	0.00000	1146.7	0.42653
88.080	18.699	639.17	3418.3	0.00000	1146.6	0.42658
88.120	18.709	639.23	3416.8	0.00000	1146.5	0.42664
88.160	18.719	639.28	3415.3	0.00000	1146.4	0.42669
88.200	18.729	639.32	3413.7	0.00000	1146.3	0.42674
88.240	18.738	639.35	3412.1	0.00000	1146.2	0.42679
88.280	18.748	639.37	3410.5	0.00000	1146.1	0.42684
88.320	18.757	639.38	3408.8	0.00000	1146.0	0.42689
88.360	18.766	639.37	3407.1	0.00000	1145.9	0.42694
88.400	18.775	639.35	3405.4	0.00000	1145.8	0.42699
88.440	18.784	639.32	3403.7	0.00000	1145.7	0.42703
88.480	18.792	639.28	3401.9	0.00000	1145.7	0.42707
88.520	18.800	639.22	3400.1	0.00000	1145.6	0.42710
88.560	18.808	639.14	3398.3	0.00000	1145.5	0.42713
88.600	18.816	639.06	3396.5	0.00000	1145.5	0.42716
88.640	18.823	638.96	3394.7	0.00000	1145.5	0.42718
88.680	18.830	638.85	3392.8	0.00000	1145.4	0.42719
88.720	18.837	638.75	3391.1	0.00000	1145.4	0.42720
88.760	18.843	638.66	3389.4	0.00000	1145.4	0.42720
88.800	18.850	638.58	3387.7	0.00000	1145.4	0.42719
88.840	18.857	638.50	3386.1	0.00000	1145.5	0.42717
88.880	18.863	638.44	3384.6	0.00000	1145.5	0.42714
88.920	18.870	638.38	3383.1	0.00000	1145.6	0.42711
88.960	18.876	638.34	3381.8	0.00000	1145.7	0.42706
89.000	18.882	638.30	3380.4	0.00000	1145.8	0.42701
89.040	18.889	638.27	3379.2	0.00000	1145.9	0.42694
89.080	18.895	638.24	3377.9	0.00000	1146.1	0.42688
89.120	18.902	638.20	3376.5	0.00000	1146.2	0.42681
89.160	18.908	638.17	3375.1	0.00000	1146.3	0.42674
89.200	18.915	638.16	3373.8	0.00000	1146.5	0.42667
89.240	18.923	638.19	3372.6	0.00000	1146.6	0.42660
89.280	18.931	638.23	3371.5	0.00000	1146.8	0.42652
89.320	18.939	638.31	3370.5	0.00000	1146.9	0.42645
89.360	18.947	638.42	3369.5	0.00000	1147.1	0.42638
89.400	18.956	638.55	3368.7	0.00000	1147.2	0.42630
89.440	18.965	638.70	3367.8	0.00000	1147.4	0.42622
89.480	18.975	638.85	3367.0	0.00000	1147.5	0.42614
89.520	18.984	639.01	3366.1	0.00000	1147.7	0.42605
89.560	18.994	639.18	3365.2	0.00000	1147.9	0.42596
89.600	19.004	639.34	3364.2	0.00000	1148.1	0.42586
89.640	19.015	639.52	3363.3	0.00000	1148.3	0.42575
89.680	19.026	639.69	3362.3	0.00000	1148.5	0.42564
89.720	19.037	639.87	3361.3	0.00000	1148.7	0.42553
89.760	19.048	640.07	3360.3	0.00000	1149.0	0.42541
89.800	19.060	640.31	3359.5	0.00000	1149.2	0.42529
89.840	19.071	640.57	3358.8	0.00000	1149.5	0.42518
89.880	19.083	640.87	3358.3	0.00000	1149.7	0.42506
89.920	19.095	641.21	3358.0	0.00000	1149.9	0.42494
89.960	19.107	641.58	3357.8	0.00000	1150.2	0.42482

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
90.000	19.119	641.98	3357.8	0.00000	1150.4	0.42471
90.040	19.131	642.43	3358.0	0.00000	1150.6	0.42460
90.080	19.143	642.91	3358.3	0.00000	1150.8	0.42448
90.120	19.156	643.43	3358.9	0.00000	1151.1	0.42437
90.160	19.168	643.98	3359.7	0.00000	1151.3	0.42426
90.200	19.180	644.55	3360.5	0.00000	1151.5	0.42416
90.240	19.192	645.12	3361.3	0.00000	1151.7	0.42406
90.280	19.204	645.67	3362.2	0.00000	1151.9	0.42397
90.320	19.216	646.22	3363.0	0.00000	1152.0	0.42388
90.360	19.227	646.77	3363.8	0.00000	1152.2	0.42380
90.400	19.239	647.31	3364.5	0.00000	1152.3	0.42373
90.440	19.250	647.80	3365.1	0.00000	1152.5	0.42366
90.480	19.261	648.27	3365.6	0.00000	1152.6	0.42360
90.520	19.272	648.69	3365.9	0.00000	1152.7	0.42355
90.560	19.282	649.08	3366.1	0.00000	1152.8	0.42350
90.600	19.293	649.43	3366.2	0.00000	1152.9	0.42346
90.640	19.302	649.74	3366.1	0.00000	1153.0	0.42342
90.680	19.312	650.03	3365.9	0.00000	1153.0	0.42340
90.720	19.321	650.31	3365.7	0.00000	1153.0	0.42338
90.760	19.331	650.57	3365.5	0.00000	1153.1	0.42337
90.800	19.340	650.81	3365.2	0.00000	1153.1	0.42338
90.840	19.348	651.05	3364.9	0.00000	1153.0	0.42339
90.880	19.357	651.29	3364.7	0.00000	1153.0	0.42342
90.920	19.365	651.52	3364.4	0.00000	1152.9	0.42346
90.960	19.373	651.75	3364.2	0.00000	1152.8	0.42352
91.000	19.381	651.97	3364.0	0.00000	1152.6	0.42359
91.040	19.389	652.16	3363.6	0.00000	1152.5	0.42366
91.080	19.397	652.31	3363.0	0.00000	1152.3	0.42375
91.120	19.404	652.43	3362.3	0.00000	1152.1	0.42384
91.160	19.412	652.52	3361.5	0.00000	1151.9	0.42394
91.200	19.419	652.58	3360.5	0.00000	1151.7	0.42405
91.240	19.427	652.61	3359.4	0.00000	1151.5	0.42417
91.280	19.434	652.61	3358.2	0.00000	1151.2	0.42430
91.320	19.441	652.57	3356.8	0.00000	1150.9	0.42443
91.360	19.448	652.50	3355.2	0.00000	1150.6	0.42458
91.400	19.455	652.41	3353.6	0.00000	1150.3	0.42473
91.440	19.461	652.30	3351.8	0.00000	1150.0	0.42489
91.480	19.468	652.20	3350.2	0.00000	1149.7	0.42505
91.520	19.475	652.13	3348.6	0.00000	1149.4	0.42521
91.560	19.482	652.08	3347.2	0.00000	1149.1	0.42536
91.600	19.489	652.05	3345.8	0.00000	1148.8	0.42552
91.640	19.496	652.04	3344.6	0.00000	1148.5	0.42567
91.680	19.503	652.06	3343.5	0.00000	1148.2	0.42582
91.720	19.510	652.10	3342.5	0.00000	1147.9	0.42597
91.760	19.517	652.16	3341.6	0.00000	1147.6	0.42611
91.800	19.524	652.24	3340.8	0.00000	1147.3	0.42626
91.840	19.531	652.34	3340.1	0.00000	1147.0	0.42640
91.880	19.538	652.47	3339.5	0.00000	1146.7	0.42654
91.920	19.545	652.61	3339.1	0.00000	1146.5	0.42667
91.960	19.552	652.78	3338.7	0.00000	1146.2	0.42681

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
92.000	19.559	652.97	3338.5	0.00000	1145.9	0.42694
92.040	19.566	653.19	3338.4	0.00000	1145.7	0.42707
92.080	19.573	653.43	3338.3	0.00000	1145.4	0.42719
92.120	19.581	653.69	3338.4	0.00000	1145.2	0.42730
92.160	19.589	653.98	3338.5	0.00000	1145.0	0.42739
92.200	19.597	654.29	3338.8	0.00000	1144.9	0.42747
92.240	19.605	654.63	3339.1	0.00000	1144.7	0.42754
92.280	19.613	654.99	3339.5	0.00000	1144.6	0.42759
92.320	19.622	655.38	3340.0	0.00000	1144.5	0.42763
92.360	19.631	655.79	3340.6	0.00000	1144.5	0.42766
92.400	19.640	656.23	3341.3	0.00000	1144.5	0.42767
92.440	19.649	656.72	3342.3	0.00000	1144.5	0.42767
92.480	19.658	657.27	3343.4	0.00000	1144.5	0.42766
92.520	19.668	657.86	3344.8	0.00000	1144.5	0.42764
92.560	19.677	658.51	3346.4	0.00000	1144.6	0.42760
92.600	19.687	659.20	3348.3	0.00000	1144.7	0.42754
92.640	19.697	659.94	3350.3	0.00000	1144.9	0.42748
92.680	19.708	660.74	3352.6	0.00000	1145.0	0.42740
92.720	19.718	661.58	3355.1	0.00000	1145.2	0.42731
92.760	19.728	662.42	3357.5	0.00000	1145.4	0.42722
92.800	19.739	663.25	3359.9	0.00000	1145.5	0.42713
92.840	19.750	664.08	3362.3	0.00000	1145.7	0.42705
92.880	19.760	664.90	3364.6	0.00000	1145.9	0.42697
92.920	19.771	665.71	3366.9	0.00000	1146.0	0.42690
92.960	19.782	666.52	3369.1	0.00000	1146.1	0.42683
93.000	19.793	667.32	3371.3	0.00000	1146.3	0.42676
93.040	19.804	668.11	3373.5	0.00000	1146.4	0.42670
93.080	19.815	668.90	3375.5	0.00000	1146.5	0.42664
93.120	19.826	669.68	3377.6	0.00000	1146.6	0.42658
93.160	19.838	670.46	3379.6	0.00000	1146.7	0.42653
93.200	19.849	671.22	3381.5	0.00000	1146.9	0.42647
93.240	19.860	671.95	3383.2	0.00000	1147.0	0.42642
93.280	19.872	672.65	3384.8	0.00000	1147.1	0.42635
93.320	19.883	673.32	3386.3	0.00000	1147.2	0.42629
93.360	19.894	673.95	3387.6	0.00000	1147.3	0.42623
93.400	19.906	674.54	3388.6	0.00000	1147.5	0.42618
93.440	19.916	675.09	3389.6	0.00000	1147.6	0.42613
93.480	19.927	675.61	3390.3	0.00000	1147.7	0.42608
93.520	19.938	676.08	3390.9	0.00000	1147.7	0.42603
93.560	19.949	676.52	3391.3	0.00000	1147.8	0.42599
93.600	19.959	676.91	3391.5	0.00000	1147.9	0.42595
93.640	19.969	677.26	3391.5	0.00000	1148.0	0.42592
93.680	19.980	677.54	3391.2	0.00000	1148.0	0.42590
93.720	19.990	677.76	3390.6	0.00000	1148.0	0.42588
93.760	19.999	677.91	3389.8	0.00000	1148.1	0.42588
93.800	20.009	678.01	3388.6	0.00000	1148.0	0.42588
93.840	20.018	678.03	3387.2	0.00000	1148.0	0.42590
93.880	20.028	678.00	3385.4	0.00000	1148.0	0.42593
93.920	20.037	677.90	3383.4	0.00000	1147.9	0.42596
93.960	20.046	677.74	3381.1	0.00000	1147.8	0.42601

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
94.000	20.054	677.55	3378.7	0.00000	1147.7	0.42605
94.040	20.063	677.35	3376.2	0.00000	1147.6	0.42610
94.080	20.072	677.13	3373.7	0.00000	1147.5	0.42614
94.120	20.080	676.89	3371.1	0.00000	1147.4	0.42618
94.160	20.088	676.64	3368.4	0.00000	1147.4	0.42622
94.200	20.097	676.36	3365.7	0.00000	1147.3	0.42625
94.240	20.105	676.07	3362.9	0.00000	1147.2	0.42629
94.280	20.113	675.76	3360.0	0.00000	1147.2	0.42633
94.320	20.121	675.44	3357.1	0.00000	1147.1	0.42636
94.360	20.128	675.11	3354.1	0.00000	1147.0	0.42638
94.400	20.136	674.77	3351.2	0.00000	1147.0	0.42640
94.440	20.143	674.43	3348.3	0.00000	1147.0	0.42642
94.480	20.151	674.11	3345.4	0.00000	1146.9	0.42644
94.520	20.158	673.79	3342.7	0.00000	1146.9	0.42647
94.560	20.165	673.48	3340.0	0.00000	1146.8	0.42650
94.600	20.172	673.18	3337.3	0.00000	1146.7	0.42654
94.640	20.179	672.89	3334.8	0.00000	1146.7	0.42657
94.680	20.185	672.61	3332.3	0.00000	1146.6	0.42661
94.720	20.192	672.33	3329.8	0.00000	1146.5	0.42665
94.760	20.198	672.07	3327.5	0.00000	1146.4	0.42670
94.800	20.204	671.82	3325.2	0.00000	1146.3	0.42675
94.840	20.210	671.57	3323.0	0.00000	1146.2	0.42680
94.880	20.216	671.34	3320.8	0.00000	1146.1	0.42686
94.920	20.222	671.11	3318.7	0.00000	1146.0	0.42691
94.960	20.228	670.89	3316.7	0.00000	1145.9	0.42696
95.000	20.234	670.68	3314.7	0.00000	1145.8	0.42700
95.040	20.240	670.47	3312.7	0.00000	1145.7	0.42704
95.080	20.246	670.27	3310.8	0.00000	1145.6	0.42708
95.120	20.251	670.09	3308.9	0.00000	1145.6	0.42711
95.160	20.257	669.91	3307.1	0.00000	1145.5	0.42715
95.200	20.263	669.73	3305.3	0.00000	1145.5	0.42718
95.240	20.269	669.57	3303.5	0.00000	1145.4	0.42721
95.280	20.275	669.41	3301.7	0.00000	1145.3	0.42724
95.320	20.282	669.26	3299.9	0.00000	1145.3	0.42726
95.360	20.288	669.12	3298.2	0.00000	1145.2	0.42729
95.400	20.295	668.99	3296.4	0.00000	1145.2	0.42731
95.440	20.301	668.86	3294.7	0.00000	1145.1	0.42733
95.480	20.308	668.75	3293.0	0.00000	1145.1	0.42735
95.520	20.315	668.64	3291.4	0.00000	1145.1	0.42737
95.560	20.322	668.53	3289.7	0.00000	1145.0	0.42738
95.600	20.330	668.43	3288.0	0.00000	1145.0	0.42740
95.640	20.338	668.33	3286.2	0.00000	1145.0	0.42741
95.680	20.346	668.23	3284.5	0.00000	1145.0	0.42742
95.720	20.354	668.14	3282.7	0.00000	1144.9	0.42743
95.760	20.363	668.05	3280.9	0.00000	1144.9	0.42743
95.800	20.371	667.96	3279.0	0.00000	1144.9	0.42744
95.840	20.380	667.88	3277.2	0.00000	1144.9	0.42744
95.880	20.390	667.79	3275.2	0.00000	1144.9	0.42744
95.920	20.399	667.70	3273.3	0.00000	1144.9	0.42744
95.960	20.409	667.59	3271.2	0.00000	1144.9	0.42745

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
96.000	20.418	667.47	3269.1	0.00000	1144.9	0.42745
96.040	20.428	667.35	3266.9	0.00000	1144.9	0.42746
96.080	20.438	667.21	3264.6	0.00000	1144.9	0.42747
96.120	20.449	667.06	3262.3	0.00000	1144.8	0.42748
96.160	20.459	666.90	3259.9	0.00000	1144.8	0.42749
96.200	20.469	666.74	3257.4	0.00000	1144.8	0.42751
96.240	20.480	666.56	3254.8	0.00000	1144.8	0.42752
96.280	20.491	666.37	3252.2	0.00000	1144.7	0.42754
96.320	20.502	666.19	3249.6	0.00000	1144.7	0.42756
96.360	20.513	666.02	3247.0	0.00000	1144.7	0.42758
96.400	20.524	665.86	3244.5	0.00000	1144.6	0.42759
96.440	20.534	665.71	3242.1	0.00000	1144.6	0.42760
96.480	20.545	665.58	3239.7	0.00000	1144.6	0.42761
96.520	20.556	665.45	3237.4	0.00000	1144.6	0.42761
96.560	20.566	665.34	3235.2	0.00000	1144.6	0.42761
96.600	20.577	665.23	3233.1	0.00000	1144.6	0.42761
96.640	20.587	665.14	3231.0	0.00000	1144.6	0.42760
96.680	20.597	665.06	3229.0	0.00000	1144.6	0.42759
96.720	20.607	664.99	3227.1	0.00000	1144.6	0.42758
96.760	20.617	664.93	3225.2	0.00000	1144.7	0.42757
96.800	20.627	664.88	3223.4	0.00000	1144.7	0.42755
96.840	20.637	664.84	3221.7	0.00000	1144.7	0.42754
96.880	20.646	664.80	3220.0	0.00000	1144.8	0.42753
96.920	20.656	664.76	3218.4	0.00000	1144.8	0.42752
96.960	20.665	664.71	3216.7	0.00000	1144.8	0.42751
97.000	20.673	664.66	3215.1	0.00000	1144.8	0.42750
97.040	20.682	664.61	3213.5	0.00000	1144.8	0.42749
97.080	20.690	664.55	3211.9	0.00000	1144.8	0.42748
97.120	20.698	664.50	3210.4	0.00000	1144.9	0.42747
97.160	20.706	664.45	3209.0	0.00000	1144.9	0.42746
97.200	20.714	664.41	3207.6	0.00000	1144.9	0.42745
97.240	20.722	664.39	3206.2	0.00000	1144.9	0.42744
97.280	20.730	664.37	3204.9	0.00000	1145.0	0.42742
97.320	20.737	664.36	3203.7	0.00000	1145.0	0.42740
97.360	20.745	664.36	3202.6	0.00000	1145.1	0.42737
97.400	20.752	664.37	3201.5	0.00000	1145.1	0.42735
97.440	20.759	664.39	3200.5	0.00000	1145.2	0.42732
97.480	20.766	664.42	3199.6	0.00000	1145.2	0.42728
97.520	20.773	664.46	3198.7	0.00000	1145.3	0.42725
97.560	20.780	664.50	3197.8	0.00000	1145.4	0.42721
97.600	20.787	664.52	3196.9	0.00000	1145.4	0.42718
97.640	20.793	664.52	3195.8	0.00000	1145.5	0.42716
97.680	20.800	664.50	3194.7	0.00000	1145.5	0.42714
97.720	20.807	664.47	3193.5	0.00000	1145.5	0.42713
97.760	20.814	664.42	3192.2	0.00000	1145.5	0.42713
97.800	20.821	664.36	3190.8	0.00000	1145.5	0.42714
97.840	20.829	664.28	3189.3	0.00000	1145.5	0.42715
97.880	20.836	664.18	3187.7	0.00000	1145.5	0.42717
97.920	20.843	664.06	3186.1	0.00000	1145.4	0.42720
97.960	20.850	663.93	3184.3	0.00000	1145.3	0.42723

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
98.000	20.858	663.78	3182.5	0.00000	1145.3	0.42728
98.040	20.865	663.61	3180.6	0.00000	1145.2	0.42733
98.080	20.872	663.43	3178.6	0.00000	1145.0	0.42738
98.120	20.880	663.27	3176.7	0.00000	1144.9	0.42744
98.160	20.887	663.11	3174.8	0.00000	1144.8	0.42750
98.200	20.895	662.97	3173.0	0.00000	1144.7	0.42756
98.240	20.902	662.84	3171.2	0.00000	1144.6	0.42762
98.280	20.910	662.72	3169.6	0.00000	1144.4	0.42769
98.320	20.917	662.62	3167.9	0.00000	1144.3	0.42776
98.360	20.925	662.53	3166.4	0.00000	1144.1	0.42783
98.400	20.932	662.46	3164.8	0.00000	1144.0	0.42790
98.440	20.940	662.39	3163.4	0.00000	1143.9	0.42798
98.480	20.947	662.34	3162.0	0.00000	1143.7	0.42805
98.520	20.955	662.31	3160.7	0.00000	1143.5	0.42813
98.560	20.963	662.29	3159.4	0.00000	1143.4	0.42821
98.600	20.971	662.28	3158.2	0.00000	1143.2	0.42830
98.640	20.978	662.28	3157.0	0.00000	1143.0	0.42838
98.680	20.986	662.30	3155.9	0.00000	1142.9	0.42847
98.720	20.994	662.32	3154.9	0.00000	1142.7	0.42856
98.760	21.002	662.33	3153.7	0.00000	1142.5	0.42866
98.800	21.010	662.34	3152.5	0.00000	1142.3	0.42877
98.840	21.018	662.34	3151.3	0.00000	1142.1	0.42888
98.880	21.027	662.34	3150.0	0.00000	1141.8	0.42898
98.920	21.035	662.34	3148.7	0.00000	1141.6	0.42909
98.960	21.044	662.33	3147.5	0.00000	1141.4	0.42920
99.000	21.052	662.32	3146.1	0.00000	1141.2	0.42931
99.040	21.061	662.31	3144.8	0.00000	1141.0	0.42942
99.080	21.069	662.30	3143.5	0.00000	1140.8	0.42952
99.120	21.078	662.27	3142.1	0.00000	1140.5	0.42963
99.160	21.087	662.24	3140.6	0.00000	1140.3	0.42974
99.200	21.095	662.20	3139.2	0.00000	1140.1	0.42984
99.240	21.104	662.15	3137.7	0.00000	1139.9	0.42995
99.280	21.112	662.09	3136.1	0.00000	1139.7	0.43006
99.320	21.121	662.01	3134.5	0.00000	1139.5	0.43017
99.360	21.130	661.91	3132.7	0.00000	1139.2	0.43028
99.400	21.138	661.78	3130.8	0.00000	1139.0	0.43040
99.440	21.147	661.62	3128.7	0.00000	1138.8	0.43052
99.480	21.156	661.43	3126.5	0.00000	1138.5	0.43065
99.520	21.165	661.22	3124.2	0.00000	1138.2	0.43079
99.560	21.174	660.97	3121.7	0.00000	1138.0	0.43093
99.600	21.183	660.73	3119.2	0.00000	1137.7	0.43106
99.640	21.193	660.48	3116.7	0.00000	1137.4	0.43120
99.680	21.202	660.23	3114.2	0.00000	1137.1	0.43133
99.720	21.211	659.98	3111.7	0.00000	1136.9	0.43146
99.760	21.220	659.72	3109.1	0.00000	1136.6	0.43159
99.800	21.229	659.47	3106.6	0.00000	1136.4	0.43172
99.840	21.238	659.21	3104.0	0.00000	1136.1	0.43184
99.880	21.247	658.95	3101.5	0.00000	1135.9	0.43196
99.920	21.257	658.69	3098.9	0.00000	1135.6	0.43208
99.960	21.266	658.44	3096.4	0.00000	1135.4	0.43219

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
100.00	21.275	658.20	3093.9	0.00000	1135.2	0.43230
100.04	21.284	657.99	3091.6	0.00000	1135.0	0.43240
100.08	21.292	657.79	3089.4	0.00000	1134.8	0.43249
100.12	21.301	657.61	3087.3	0.00000	1134.6	0.43258
100.16	21.309	657.45	3085.3	0.00000	1134.5	0.43266
100.20	21.318	657.31	3083.5	0.00000	1134.3	0.43273
100.24	21.326	657.19	3081.7	0.00000	1134.2	0.43280
100.28	21.335	657.09	3080.0	0.00000	1134.1	0.43286
100.32	21.343	657.00	3078.4	0.00000	1134.0	0.43291
100.36	21.351	656.94	3076.9	0.00000	1133.9	0.43296
100.40	21.360	656.91	3075.5	0.00000	1133.8	0.43301
100.44	21.368	656.90	3074.3	0.00000	1133.7	0.43304
100.48	21.376	656.91	3073.1	0.00000	1133.7	0.43307
100.52	21.385	656.95	3072.1	0.00000	1133.6	0.43310
100.56	21.393	657.01	3071.2	0.00000	1133.6	0.43312
100.60	21.401	657.10	3070.4	0.00000	1133.5	0.43313
100.64	21.410	657.21	3069.7	0.00000	1133.5	0.43314
100.68	21.418	657.32	3069.0	0.00000	1133.5	0.43315
100.72	21.427	657.45	3068.3	0.00000	1133.5	0.43315
100.76	21.436	657.58	3067.7	0.00000	1133.5	0.43315
100.80	21.444	657.73	3067.2	0.00000	1133.5	0.43315
100.84	21.453	657.87	3066.6	0.00000	1133.5	0.43316
100.88	21.462	657.99	3065.8	0.00000	1133.5	0.43317
100.92	21.471	658.09	3065.0	0.00000	1133.4	0.43318
100.96	21.480	658.18	3064.1	0.00000	1133.4	0.43320
101.00	21.490	658.26	3063.1	0.00000	1133.4	0.43322
101.04	21.499	658.32	3062.1	0.00000	1133.3	0.43326
101.08	21.509	658.36	3060.9	0.00000	1133.2	0.43330
101.12	21.519	658.38	3059.7	0.00000	1133.1	0.43336
101.16	21.528	658.39	3058.3	0.00000	1132.9	0.43343
101.20	21.538	658.39	3056.9	0.00000	1132.8	0.43352
101.24	21.548	658.36	3055.4	0.00000	1132.6	0.43361
101.28	21.558	658.32	3053.9	0.00000	1132.4	0.43372
101.32	21.568	658.27	3052.2	0.00000	1132.1	0.43384
101.36	21.578	658.19	3050.5	0.00000	1131.9	0.43397
101.40	21.588	658.11	3048.6	0.00000	1131.6	0.43411
101.44	21.598	658.00	3046.7	0.00000	1131.3	0.43426
101.48	21.608	657.88	3044.7	0.00000	1131.0	0.43442
101.52	21.618	657.76	3042.8	0.00000	1130.6	0.43458
101.56	21.628	657.65	3040.8	0.00000	1130.4	0.43473
101.60	21.638	657.54	3038.9	0.00000	1130.1	0.43486
101.64	21.649	657.44	3037.0	0.00000	1129.8	0.43499
101.68	21.659	657.34	3035.1	0.00000	1129.6	0.43511
101.72	21.670	657.25	3033.2	0.00000	1129.4	0.43521
101.76	21.680	657.17	3031.3	0.00000	1129.2	0.43531
101.80	21.691	657.09	3029.5	0.00000	1129.0	0.43539
101.84	21.701	657.02	3027.6	0.00000	1128.9	0.43547
101.88	21.712	656.94	3025.8	0.00000	1128.7	0.43554
101.92	21.722	656.86	3024.0	0.00000	1128.6	0.43561
101.96	21.733	656.77	3022.1	0.00000	1128.4	0.43568

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
102.00	21.743	656.68	3020.3	0.00000	1128.3	0.43575
102.04	21.753	656.59	3018.5	0.00000	1128.2	0.43582
102.08	21.762	656.49	3016.7	0.00000	1128.0	0.43588
102.12	21.772	656.39	3014.9	0.00000	1127.9	0.43595
102.16	21.781	656.28	3013.1	0.00000	1127.8	0.43601
102.20	21.791	656.18	3011.4	0.00000	1127.7	0.43607
102.24	21.800	656.07	3009.6	0.00000	1127.6	0.43613
102.28	21.809	655.95	3007.8	0.00000	1127.5	0.43618
102.32	21.818	655.84	3006.1	0.00000	1127.4	0.43622
102.36	21.826	655.72	3004.3	0.00000	1127.3	0.43626
102.40	21.835	655.61	3002.6	0.00000	1127.2	0.43628
102.44	21.844	655.49	3000.9	0.00000	1127.2	0.43630
102.48	21.852	655.36	2999.1	0.00000	1127.2	0.43631
102.52	21.861	655.24	2997.4	0.00000	1127.2	0.43631
102.56	21.869	655.10	2995.6	0.00000	1127.2	0.43631
102.60	21.878	654.96	2993.8	0.00000	1127.2	0.43631
102.64	21.886	654.80	2991.9	0.00000	1127.2	0.43630
102.68	21.895	654.64	2990.0	0.00000	1127.2	0.43629
102.72	21.903	654.46	2988.1	0.00000	1127.2	0.43628
102.76	21.912	654.26	2986.0	0.00000	1127.2	0.43628
102.80	21.920	654.03	2983.8	0.00000	1127.2	0.43630
102.84	21.928	653.77	2981.5	0.00000	1127.1	0.43634
102.88	21.936	653.47	2979.1	0.00000	1127.0	0.43640
102.92	21.944	653.15	2976.5	0.00000	1126.9	0.43647
102.96	21.952	652.79	2973.8	0.00000	1126.7	0.43656
103.00	21.960	652.42	2971.0	0.00000	1126.5	0.43667
103.04	21.968	652.04	2968.3	0.00000	1126.2	0.43679
103.08	21.976	651.67	2965.5	0.00000	1126.0	0.43691
103.12	21.984	651.32	2962.9	0.00000	1125.7	0.43703
103.16	21.992	650.99	2960.3	0.00000	1125.5	0.43715
103.20	22.000	650.68	2957.8	0.00000	1125.3	0.43726
103.24	22.008	650.40	2955.4	0.00000	1125.1	0.43737
103.28	22.016	650.14	2953.2	0.00000	1124.8	0.43748
103.32	22.024	649.91	2951.0	0.00000	1124.6	0.43758
103.36	22.032	649.69	2948.9	0.00000	1124.4	0.43768
103.40	22.041	649.51	2946.9	0.00000	1124.3	0.43778
103.44	22.050	649.34	2945.0	0.00000	1124.1	0.43787
103.48	22.058	649.20	2943.2	0.00000	1123.9	0.43795
103.52	22.067	649.07	2941.4	0.00000	1123.7	0.43803
103.56	22.076	648.96	2939.8	0.00000	1123.6	0.43810
103.60	22.085	648.86	2938.1	0.00000	1123.5	0.43816
103.64	22.094	648.79	2936.6	0.00000	1123.4	0.43821
103.68	22.103	648.73	2935.1	0.00000	1123.3	0.43825
103.72	22.112	648.69	2933.7	0.00000	1123.2	0.43829
103.76	22.121	648.67	2932.4	0.00000	1123.2	0.43831
103.80	22.131	648.67	2931.1	0.00000	1123.2	0.43832
103.84	22.140	648.70	2930.0	0.00000	1123.2	0.43832
103.88	22.149	648.76	2929.1	0.00000	1123.2	0.43830
103.92	22.159	648.84	2928.2	0.00000	1123.3	0.43826
103.96	22.168	648.93	2927.4	0.00000	1123.3	0.43824

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
104.00	22.177	649.02	2926.6	0.00000	1123.4	0.43822
104.04	22.186	649.13	2925.9	0.00000	1123.4	0.43820
104.08	22.195	649.25	2925.2	0.00000	1123.4	0.43819
104.12	22.204	649.37	2924.6	0.00000	1123.4	0.43819
104.16	22.213	649.51	2924.0	0.00000	1123.4	0.43820
104.20	22.222	649.65	2923.5	0.00000	1123.4	0.43821
104.24	22.231	649.79	2923.0	0.00000	1123.3	0.43823
104.28	22.239	649.91	2922.4	0.00000	1123.3	0.43827
104.32	22.248	650.00	2921.7	0.00000	1123.2	0.43833
104.36	22.256	650.08	2920.9	0.00000	1123.0	0.43840
104.40	22.265	650.13	2920.0	0.00000	1122.8	0.43849
104.44	22.273	650.16	2919.0	0.00000	1122.6	0.43859
104.48	22.282	650.16	2918.0	0.00000	1122.4	0.43871
104.52	22.290	650.15	2916.8	0.00000	1122.1	0.43885
104.56	22.298	650.12	2915.6	0.00000	1121.8	0.43898
104.60	22.306	650.07	2914.3	0.00000	1121.6	0.43912
104.64	22.314	650.01	2913.0	0.00000	1121.3	0.43925
104.68	22.322	649.93	2911.6	0.00000	1121.1	0.43937
104.72	22.330	649.84	2910.2	0.00000	1120.8	0.43949
104.76	22.338	649.75	2908.7	0.00000	1120.6	0.43961
104.80	22.346	649.64	2907.2	0.00000	1120.3	0.43974
104.84	22.354	649.52	2905.7	0.00000	1120.1	0.43986
104.88	22.362	649.40	2904.1	0.00000	1119.8	0.43998
104.92	22.370	649.27	2902.5	0.00000	1119.6	0.44010
104.96	22.377	649.13	2900.9	0.00000	1119.4	0.44023
105.00	22.385	648.98	2899.3	0.00000	1119.1	0.44035
105.04	22.392	648.82	2897.6	0.00000	1118.9	0.44047
105.08	22.400	648.65	2895.8	0.00000	1118.6	0.44060
105.12	22.407	648.47	2894.1	0.00000	1118.4	0.44072
105.16	22.415	648.29	2892.3	0.00000	1118.1	0.44086
105.20	22.422	648.11	2890.5	0.00000	1117.8	0.44098
105.24	22.430	647.93	2888.7	0.00000	1117.6	0.44110
105.28	22.438	647.76	2886.9	0.00000	1117.4	0.44121
105.32	22.446	647.59	2885.2	0.00000	1117.2	0.44131
105.36	22.454	647.43	2883.4	0.00000	1117.0	0.44140
105.40	22.463	647.28	2881.7	0.00000	1116.8	0.44148
105.44	22.471	647.13	2879.9	0.00000	1116.7	0.44156
105.48	22.480	646.99	2878.2	0.00000	1116.6	0.44162
105.52	22.488	646.85	2876.5	0.00000	1116.5	0.44168
105.56	22.497	646.71	2874.7	0.00000	1116.4	0.44173
105.60	22.506	646.58	2873.0	0.00000	1116.3	0.44177
105.64	22.515	646.44	2871.3	0.00000	1116.2	0.44180
105.68	22.524	646.30	2869.5	0.00000	1116.2	0.44183
105.72	22.532	646.17	2867.8	0.00000	1116.1	0.44184
105.76	22.541	646.03	2866.0	0.00000	1116.1	0.44185
105.80	22.551	645.89	2864.3	0.00000	1116.1	0.44186
105.84	22.560	645.75	2862.5	0.00000	1116.0	0.44188
105.88	22.569	645.60	2860.7	0.00000	1116.0	0.44192
105.92	22.578	645.44	2858.8	0.00000	1115.9	0.44197
105.96	22.587	645.27	2856.9	0.00000	1115.8	0.44203

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
106.00	22.596	645.10	2855.0	0.00000	1115.6	0.44210
106.04	22.605	644.94	2853.1	0.00000	1115.5	0.44217
106.08	22.615	644.79	2851.3	0.00000	1115.3	0.44226
106.12	22.624	644.64	2849.5	0.00000	1115.1	0.44234
106.16	22.633	644.50	2847.7	0.00000	1114.9	0.44243
106.20	22.642	644.37	2845.9	0.00000	1114.8	0.44253
106.24	22.652	644.24	2844.2	0.00000	1114.6	0.44263
106.28	22.661	644.13	2842.6	0.00000	1114.3	0.44273
106.32	22.670	644.02	2840.9	0.00000	1114.1	0.44284
106.36	22.679	643.92	2839.3	0.00000	1113.9	0.44296
106.40	22.688	643.83	2837.7	0.00000	1113.7	0.44307
106.44	22.698	643.74	2836.2	0.00000	1113.5	0.44317
106.48	22.706	643.67	2834.8	0.00000	1113.3	0.44327
106.52	22.715	643.60	2833.4	0.00000	1113.1	0.44336
106.56	22.724	643.55	2832.1	0.00000	1112.9	0.44344
106.60	22.733	643.51	2830.8	0.00000	1112.8	0.44352
106.64	22.741	643.49	2829.6	0.00000	1112.7	0.44358
106.68	22.750	643.49	2828.6	0.00000	1112.5	0.44363
106.72	22.759	643.52	2827.6	0.00000	1112.5	0.44368
106.76	22.768	643.56	2826.7	0.00000	1112.4	0.44371
106.80	22.777	643.63	2825.9	0.00000	1112.3	0.44373
106.84	22.786	643.72	2825.2	0.00000	1112.3	0.44375
106.88	22.795	643.84	2824.6	0.00000	1112.3	0.44375
106.92	22.804	643.99	2824.1	0.00000	1112.3	0.44374
106.96	22.813	644.14	2823.6	0.00000	1112.3	0.44373
107.00	22.823	644.30	2823.1	0.00000	1112.4	0.44373
107.04	22.832	644.47	2822.6	0.00000	1112.4	0.44373
107.08	22.842	644.64	2822.2	0.00000	1112.4	0.44373
107.12	22.852	644.81	2821.7	0.00000	1112.3	0.44373
107.16	22.862	644.99	2821.2	0.00000	1112.3	0.44374
107.20	22.872	645.17	2820.7	0.00000	1112.3	0.44376
107.24	22.883	645.36	2820.3	0.00000	1112.3	0.44377
107.28	22.893	645.53	2819.7	0.00000	1112.2	0.44379
107.32	22.904	645.69	2819.1	0.00000	1112.2	0.44381
107.36	22.914	645.83	2818.5	0.00000	1112.2	0.44383
107.40	22.925	645.96	2817.8	0.00000	1112.1	0.44384
107.44	22.935	646.08	2817.1	0.00000	1112.1	0.44386
107.48	22.945	646.18	2816.3	0.00000	1112.1	0.44387
107.52	22.955	646.27	2815.4	0.00000	1112.0	0.44388
107.56	22.965	646.35	2814.5	0.00000	1112.0	0.44390
107.60	22.975	646.42	2813.6	0.00000	1112.0	0.44391
107.64	22.985	646.47	2812.6	0.00000	1112.0	0.44392
107.68	22.995	646.51	2811.5	0.00000	1112.0	0.44393
107.72	23.005	646.53	2810.4	0.00000	1111.9	0.44394
107.76	23.015	646.54	2809.3	0.00000	1111.9	0.44395
107.80	23.025	646.54	2808.1	0.00000	1111.9	0.44396
107.84	23.035	646.51	2806.8	0.00000	1111.9	0.44397
107.88	23.044	646.46	2805.4	0.00000	1111.9	0.44398
107.92	23.053	646.39	2804.0	0.00000	1111.8	0.44399
107.96	23.063	646.29	2802.4	0.00000	1111.8	0.44401

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
108.00	23.072	646.18	2800.8	-4.9926e-06	1111.8	0.44403
108.04	23.081	646.06	2799.2	-1.5250e-05	1111.7	0.44405
108.08	23.089	645.92	2797.5	-3.0771e-05	1111.6	0.44409
108.12	23.098	645.77	2795.8	-5.1558e-05	1111.6	0.44412
108.16	23.107	645.61	2794.1	-7.7609e-05	1111.5	0.44417
108.20	23.116	645.45	2792.3	-0.00010892	1111.4	0.44421
108.24	23.124	645.29	2790.6	-0.00014550	1111.3	0.44424
108.28	23.132	645.15	2789.0	-0.00018735	1111.3	0.44427
108.32	23.141	645.01	2787.4	-0.00023446	1111.2	0.44428
108.36	23.149	644.88	2785.9	-0.00028683	1111.2	0.44429
108.40	23.157	644.75	2784.4	-0.00034447	1111.2	0.44429
108.44	23.164	644.64	2783.0	-0.00040399	1111.2	0.44428
108.48	23.172	644.53	2781.6	-0.00045911	1111.3	0.44426
108.52	23.179	644.43	2780.3	-0.00050984	1111.3	0.44423
108.56	23.187	644.35	2779.0	-0.00055618	1111.4	0.44421
108.60	23.194	644.27	2777.8	-0.00059813	1111.5	0.44418
108.64	23.202	644.21	2776.6	-0.00063568	1111.5	0.44415
108.68	23.210	644.15	2775.4	-0.00066883	1111.6	0.44411
108.72	23.218	644.11	2774.3	-0.00069760	1111.7	0.44408
108.76	23.225	644.08	2773.2	-0.00072197	1111.7	0.44404
108.80	23.233	644.06	2772.2	-0.00074194	1111.8	0.44400
108.84	23.241	644.05	2771.2	-0.00075753	1111.9	0.44396
108.88	23.249	644.05	2770.2	-0.00076872	1112.0	0.44391
108.92	23.257	644.06	2769.3	-0.00077551	1112.1	0.44387
108.96	23.265	644.08	2768.5	-0.00077791	1112.2	0.44382
109.00	23.273	644.12	2767.7	-0.00077791	1112.3	0.44378
109.04	23.281	644.16	2766.9	-0.00077791	1112.3	0.44373
109.08	23.289	644.22	2766.2	-0.00077791	1112.4	0.44369
109.12	23.297	644.29	2765.5	-0.00077791	1112.5	0.44365
109.16	23.305	644.37	2764.9	-0.00077791	1112.6	0.44362
109.20	23.314	644.47	2764.4	-0.00077791	1112.6	0.44359
109.24	23.321	644.56	2763.8	-0.00077292	1112.7	0.44356
109.28	23.329	644.66	2763.3	-0.00076266	1112.8	0.44352
109.32	23.337	644.76	2762.8	-0.00074714	1112.8	0.44349
109.36	23.345	644.86	2762.4	-0.00072635	1112.9	0.44346
109.40	23.352	644.96	2761.9	-0.00070030	1113.0	0.44342
109.44	23.360	645.06	2761.4	-0.00066899	1113.0	0.44339
109.48	23.367	645.16	2761.0	-0.00063241	1113.1	0.44335
109.52	23.374	645.26	2760.6	-0.00059056	1113.2	0.44332
109.56	23.381	645.36	2760.2	-0.00054345	1113.3	0.44328
109.60	23.388	645.46	2759.8	-0.00049108	1113.3	0.44324
109.64	23.395	645.57	2759.4	-0.00043344	1113.4	0.44320
109.68	23.402	645.67	2759.1	-0.00037392	1113.5	0.44317
109.72	23.408	645.78	2758.8	-0.00031880	1113.5	0.44314
109.76	23.415	645.88	2758.4	-0.00026807	1113.6	0.44310
109.80	23.422	645.96	2757.9	-0.00022173	1113.7	0.44307
109.84	23.429	646.04	2757.4	-0.00017979	1113.7	0.44304
109.88	23.437	646.10	2756.8	-0.00014224	1113.8	0.44301
109.92	23.444	646.15	2756.1	-0.00010908	1113.9	0.44298
109.96	23.452	646.19	2755.4	-8.0315e-05	1113.9	0.44294

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
110.00	23.460	646.22	2754.6	-5.5945e-05	1114.0	0.44291
110.04	23.468	646.23	2753.7	-3.5969e-05	1114.1	0.44287
110.08	23.476	646.25	2752.8	-2.0386e-05	1114.1	0.44284
110.12	23.485	646.28	2752.0	-9.1973e-06	1114.2	0.44280
110.16	23.493	646.32	2751.1	-2.4018e-06	1114.3	0.44275
110.20	23.502	646.38	2750.3	0.00000	1114.4	0.44271
110.24	23.511	646.44	2749.5	0.00000	1114.5	0.44266
110.28	23.521	646.52	2748.8	0.00000	1114.6	0.44260
110.32	23.530	646.60	2748.0	0.00000	1114.8	0.44253
110.36	23.540	646.70	2747.3	0.00000	1114.9	0.44245
110.40	23.550	646.80	2746.5	0.00000	1115.1	0.44237
110.44	23.560	646.89	2745.7	0.00000	1115.3	0.44228
110.48	23.570	646.98	2744.9	0.00000	1115.4	0.44219
110.52	23.581	647.08	2744.2	0.00000	1115.6	0.44209
110.56	23.591	647.17	2743.4	0.00000	1115.8	0.44199
110.60	23.601	647.26	2742.5	0.00000	1116.0	0.44188
110.64	23.611	647.34	2741.7	0.00000	1116.3	0.44177
110.68	23.622	647.43	2740.9	0.00000	1116.5	0.44166
110.72	23.632	647.51	2740.0	0.00000	1116.7	0.44153
110.76	23.642	647.60	2739.2	0.00000	1117.0	0.44141
110.80	23.653	647.68	2738.3	0.00000	1117.3	0.44128
110.84	23.663	647.76	2737.4	0.00000	1117.5	0.44114
110.88	23.674	647.84	2736.5	0.00000	1117.8	0.44100
110.92	23.685	647.92	2735.6	0.00000	1118.1	0.44086
110.96	23.695	648.01	2734.8	0.00000	1118.4	0.44071
111.00	23.706	648.12	2734.0	0.00000	1118.7	0.44056
111.04	23.716	648.27	2733.5	0.00000	1119.0	0.44042
111.08	23.726	648.44	2733.0	0.00000	1119.3	0.44027
111.12	23.736	648.65	2732.7	0.00000	1119.5	0.44013
111.16	23.746	648.88	2732.6	0.00000	1119.8	0.43999
111.20	23.756	649.15	2732.6	0.00000	1120.1	0.43986
111.24	23.765	649.44	2732.8	0.00000	1120.4	0.43972
111.28	23.774	649.77	2733.1	0.00000	1120.6	0.43959
111.32	23.783	650.11	2733.5	0.00000	1120.9	0.43946
111.36	23.792	650.45	2733.9	0.00000	1121.1	0.43934
111.40	23.800	650.80	2734.4	0.00000	1121.4	0.43922
111.44	23.808	651.16	2735.0	0.00000	1121.6	0.43910
111.48	23.816	651.53	2735.6	0.00000	1121.8	0.43899
111.52	23.824	651.89	2736.3	0.00000	1122.0	0.43889
111.56	23.831	652.27	2737.0	0.00000	1122.2	0.43879
111.60	23.839	652.61	2737.6	0.00000	1122.4	0.43871
111.64	23.846	652.92	2738.0	0.00000	1122.6	0.43863
111.68	23.854	653.19	2738.3	0.00000	1122.7	0.43856
111.72	23.861	653.43	2738.4	0.00000	1122.8	0.43850
111.76	23.869	653.62	2738.3	0.00000	1122.9	0.43845
111.80	23.877	653.78	2738.1	0.00000	1123.0	0.43841
111.84	23.885	653.90	2737.7	0.00000	1123.0	0.43838
111.88	23.893	653.98	2737.1	0.00000	1123.1	0.43836
111.92	23.902	654.03	2736.3	0.00000	1123.1	0.43835
111.96	23.910	654.04	2735.5	0.00000	1123.1	0.43835

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
112.00	23.918	654.06	2734.6	0.00000	1123.1	0.43835
112.04	23.927	654.07	2733.7	0.00000	1123.1	0.43836
112.08	23.935	654.08	2732.8	0.00000	1123.1	0.43838
112.12	23.943	654.09	2731.9	0.00000	1123.0	0.43840
112.16	23.951	654.11	2731.0	0.00000	1122.9	0.43843
112.20	23.960	654.10	2730.1	0.00000	1122.9	0.43846
112.24	23.968	654.08	2729.1	0.00000	1122.8	0.43850
112.28	23.976	654.04	2728.0	0.00000	1122.7	0.43854
112.32	23.984	653.99	2726.8	0.00000	1122.6	0.43859
112.36	23.992	653.91	2725.6	0.00000	1122.5	0.43864
112.40	24.000	653.82	2724.3	0.00000	1122.4	0.43870
112.44	24.008	653.70	2722.9	0.00000	1122.3	0.43876
112.48	24.016	653.57	2721.5	0.00000	1122.2	0.43882
112.52	24.024	653.42	2719.9	0.00000	1122.0	0.43889
112.56	24.032	653.25	2718.3	0.00000	1121.9	0.43896
112.60	24.040	653.07	2716.7	0.00000	1121.7	0.43904
112.64	24.048	652.86	2714.9	0.00000	1121.6	0.43912
112.68	24.056	652.63	2713.1	0.00000	1121.4	0.43920
112.72	24.064	652.38	2711.1	0.00000	1121.2	0.43929
112.76	24.072	652.11	2709.1	0.00000	1121.0	0.43939
112.80	24.080	651.81	2707.0	0.00000	1120.8	0.43948
112.84	24.088	651.53	2704.9	0.00000	1120.7	0.43958
112.88	24.095	651.28	2703.0	0.00000	1120.5	0.43967
112.92	24.103	651.06	2701.2	0.00000	1120.3	0.43975
112.96	24.110	650.87	2699.6	0.00000	1120.1	0.43983
113.00	24.118	650.72	2698.1	0.00000	1120.0	0.43991
113.04	24.125	650.59	2696.8	0.00000	1119.9	0.43998
113.08	24.132	650.51	2695.6	0.00000	1119.7	0.44004
113.12	24.139	650.45	2694.6	0.00000	1119.6	0.44011
113.16	24.146	650.43	2693.7	0.00000	1119.5	0.44016
113.20	24.153	650.43	2693.0	0.00000	1119.4	0.44022
113.24	24.159	650.43	2692.2	0.00000	1119.3	0.44027
113.28	24.166	650.43	2691.5	0.00000	1119.2	0.44031
113.32	24.173	650.46	2690.9	0.00000	1119.1	0.44035
113.36	24.180	650.50	2690.3	0.00000	1119.0	0.44038
113.40	24.187	650.56	2689.7	0.00000	1119.0	0.44040
113.44	24.194	650.63	2689.2	0.00000	1119.0	0.44041
113.48	24.201	650.73	2688.8	0.00000	1119.0	0.44041
113.52	24.208	650.83	2688.5	0.00000	1119.0	0.44041
113.56	24.216	650.96	2688.2	0.00000	1119.0	0.44039
113.60	24.223	651.10	2688.0	0.00000	1119.1	0.44037
113.64	24.230	651.26	2687.8	0.00000	1119.1	0.44033
113.68	24.238	651.44	2687.7	0.00000	1119.2	0.44029
113.72	24.245	651.63	2687.7	0.00000	1119.3	0.44024
113.76	24.253	651.84	2687.7	0.00000	1119.5	0.44018
113.80	24.260	652.06	2687.8	0.00000	1119.6	0.44011
113.84	24.268	652.27	2687.8	0.00000	1119.7	0.44004
113.88	24.276	652.47	2687.8	0.00000	1119.9	0.43998
113.92	24.283	652.65	2687.7	0.00000	1120.0	0.43991
113.96	24.291	652.83	2687.5	0.00000	1120.1	0.43985

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
114.00	24.299	652.99	2687.3	0.00000	1120.2	0.43979
114.04	24.307	653.14	2687.0	0.00000	1120.4	0.43973
114.08	24.315	653.28	2686.7	0.00000	1120.5	0.43967
114.12	24.323	653.42	2686.4	0.00000	1120.6	0.43962
114.16	24.332	653.54	2686.0	0.00000	1120.7	0.43956
114.20	24.340	653.65	2685.5	0.00000	1120.8	0.43951
114.24	24.348	653.75	2685.0	0.00000	1120.9	0.43946
114.28	24.357	653.85	2684.5	0.00000	1121.0	0.43941
114.32	24.365	653.96	2684.0	0.00000	1121.1	0.43934
114.36	24.374	654.08	2683.5	0.00000	1121.3	0.43927
114.40	24.383	654.20	2683.1	0.00000	1121.4	0.43918
114.44	24.391	654.34	2682.7	0.00000	1121.6	0.43909
114.48	24.400	654.48	2682.3	0.00000	1121.8	0.43898
114.52	24.409	654.62	2681.9	0.00000	1122.1	0.43887
114.56	24.418	654.75	2681.5	0.00000	1122.3	0.43876
114.60	24.427	654.86	2680.9	0.00000	1122.5	0.43864
114.64	24.436	654.96	2680.4	0.00000	1122.8	0.43852
114.68	24.445	655.05	2679.7	0.00000	1123.0	0.43840
114.72	24.454	655.12	2679.0	0.00000	1123.3	0.43828
114.76	24.463	655.19	2678.3	0.00000	1123.5	0.43816
114.80	24.473	655.24	2677.5	0.00000	1123.7	0.43805
114.84	24.482	655.28	2676.6	0.00000	1123.9	0.43796
114.88	24.492	655.32	2675.7	0.00000	1124.1	0.43787
114.92	24.502	655.34	2674.7	0.00000	1124.2	0.43780
114.96	24.512	655.35	2673.7	0.00000	1124.3	0.43773
115.00	24.522	655.36	2672.6	0.00000	1124.4	0.43768
115.04	24.532	655.35	2671.4	0.00000	1124.5	0.43764
115.08	24.542	655.36	2670.4	0.00000	1124.6	0.43760
115.12	24.553	655.39	2669.4	0.00000	1124.7	0.43756
115.16	24.563	655.44	2668.5	0.00000	1124.8	0.43751
115.20	24.573	655.51	2667.7	0.00000	1124.9	0.43746
115.24	24.583	655.59	2666.9	0.00000	1125.0	0.43740
115.28	24.592	655.69	2666.2	0.00000	1125.1	0.43734
115.32	24.602	655.80	2665.7	0.00000	1125.3	0.43727
115.36	24.612	655.94	2665.2	0.00000	1125.4	0.43720
115.40	24.621	656.09	2664.7	0.00000	1125.6	0.43713
115.44	24.631	656.26	2664.4	0.00000	1125.7	0.43705
115.48	24.640	656.44	2664.1	0.00000	1125.9	0.43696
115.52	24.649	656.63	2663.9	0.00000	1126.0	0.43688
115.56	24.658	656.82	2663.7	0.00000	1126.2	0.43681
115.60	24.667	657.01	2663.5	0.00000	1126.3	0.43675
115.64	24.676	657.20	2663.3	0.00000	1126.4	0.43669
115.68	24.685	657.38	2663.1	0.00000	1126.5	0.43665
115.72	24.694	657.56	2662.9	0.00000	1126.6	0.43661
115.76	24.702	657.74	2662.7	0.00000	1126.7	0.43658
115.80	24.711	657.92	2662.5	0.00000	1126.7	0.43655
115.84	24.720	658.09	2662.2	0.00000	1126.7	0.43653
115.88	24.728	658.26	2662.0	0.00000	1126.8	0.43652
115.92	24.737	658.43	2661.7	0.00000	1126.8	0.43651
115.96	24.746	658.60	2661.5	0.00000	1126.8	0.43651

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
116.00	24.754	658.76	2661.2	0.00000	1126.8	0.43650
116.04	24.763	658.92	2660.9	0.00000	1126.8	0.43649
116.08	24.772	659.07	2660.6	0.00000	1126.9	0.43647
116.12	24.780	659.22	2660.3	0.00000	1126.9	0.43644
116.16	24.789	659.36	2659.9	0.00000	1127.0	0.43640
116.20	24.797	659.50	2659.6	0.00000	1127.1	0.43636
116.24	24.805	659.62	2659.2	0.00000	1127.2	0.43631
116.28	24.813	659.73	2658.8	0.00000	1127.3	0.43625
116.32	24.821	659.83	2658.4	0.00000	1127.4	0.43619
116.36	24.829	659.93	2657.9	0.00000	1127.6	0.43612
116.40	24.837	660.02	2657.4	0.00000	1127.7	0.43605
116.44	24.845	660.10	2656.9	0.00000	1127.8	0.43599
116.48	24.853	660.17	2656.3	0.00000	1128.0	0.43592
116.52	24.861	660.24	2655.8	0.00000	1128.1	0.43585
116.56	24.869	660.30	2655.1	0.00000	1128.3	0.43578
116.60	24.877	660.35	2654.5	0.00000	1128.4	0.43570
116.64	24.885	660.40	2653.8	0.00000	1128.6	0.43563
116.68	24.893	660.44	2653.2	0.00000	1128.7	0.43555
116.72	24.901	660.48	2652.4	0.00000	1128.9	0.43547
116.76	24.909	660.51	2651.7	0.00000	1129.0	0.43540
116.80	24.918	660.53	2650.9	0.00000	1129.2	0.43532
116.84	24.926	660.54	2650.0	0.00000	1129.3	0.43525
116.88	24.935	660.54	2649.1	0.00000	1129.4	0.43518
116.92	24.944	660.54	2648.2	0.00000	1129.6	0.43512
116.96	24.953	660.52	2647.1	0.00000	1129.7	0.43506
117.00	24.962	660.50	2646.1	0.00000	1129.8	0.43501
117.04	24.971	660.47	2644.9	0.00000	1129.9	0.43497
117.08	24.981	660.43	2643.8	0.00000	1129.9	0.43494
117.12	24.991	660.38	2642.6	0.00000	1130.0	0.43491
117.16	25.000	660.34	2641.4	0.00000	1130.1	0.43487
117.20	25.010	660.31	2640.2	0.00000	1130.1	0.43484
117.24	25.020	660.28	2639.0	0.00000	1130.2	0.43479
117.28	25.030	660.26	2637.9	0.00000	1130.3	0.43474
117.32	25.040	660.24	2636.7	0.00000	1130.4	0.43469
117.36	25.051	660.23	2635.6	0.00000	1130.6	0.43462
117.40	25.061	660.22	2634.5	0.00000	1130.7	0.43456
117.44	25.072	660.22	2633.4	0.00000	1130.8	0.43449
117.48	25.082	660.21	2632.3	0.00000	1131.0	0.43442
117.52	25.093	660.20	2631.1	0.00000	1131.1	0.43435
117.56	25.103	660.19	2630.0	0.00000	1131.2	0.43429
117.60	25.113	660.16	2628.8	0.00000	1131.3	0.43423
117.64	25.124	660.14	2627.6	0.00000	1131.5	0.43418
117.68	25.134	660.10	2626.3	0.00000	1131.6	0.43413
117.72	25.145	660.06	2625.1	0.00000	1131.6	0.43408
117.76	25.155	660.01	2623.8	0.00000	1131.7	0.43404
117.80	25.165	659.96	2622.5	0.00000	1131.8	0.43400
117.84	25.175	659.89	2621.2	0.00000	1131.9	0.43396
117.88	25.186	659.83	2619.9	0.00000	1132.0	0.43392
117.92	25.196	659.75	2618.5	0.00000	1132.0	0.43389
117.96	25.206	659.67	2617.2	0.00000	1132.1	0.43387

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
118.00	25.216	659.59	2615.8	0.00000	1132.1	0.43384
118.04	25.226	659.50	2614.4	0.00000	1132.2	0.43382
118.08	25.236	659.40	2613.0	0.00000	1132.2	0.43380
118.12	25.246	659.30	2611.6	0.00000	1132.3	0.43377
118.16	25.255	659.21	2610.3	0.00000	1132.3	0.43373
118.20	25.264	659.13	2609.0	0.00000	1132.4	0.43369
118.24	25.273	659.07	2607.8	0.00000	1132.5	0.43363
118.28	25.282	659.01	2606.7	0.00000	1132.7	0.43357
118.32	25.290	658.96	2605.7	0.00000	1132.8	0.43351
118.36	25.298	658.92	2604.7	0.00000	1132.9	0.43343
118.40	25.306	658.88	2603.7	0.00000	1133.1	0.43337
118.44	25.314	658.84	2602.7	0.00000	1133.2	0.43331
118.48	25.321	658.79	2601.8	0.00000	1133.3	0.43326
118.52	25.328	658.74	2600.9	0.00000	1133.4	0.43321
118.56	25.335	658.69	2599.9	0.00000	1133.5	0.43316
118.60	25.342	658.64	2599.0	0.00000	1133.6	0.43313
118.64	25.348	658.58	2598.2	0.00000	1133.6	0.43309
118.68	25.354	658.52	2597.3	0.00000	1133.7	0.43307
118.72	25.360	658.47	2596.5	0.00000	1133.7	0.43304
118.76	25.367	658.44	2595.7	0.00000	1133.8	0.43301
118.80	25.373	658.42	2595.0	0.00000	1133.9	0.43297
118.84	25.379	658.42	2594.4	0.00000	1134.0	0.43293
118.88	25.385	658.43	2593.8	0.00000	1134.0	0.43289
118.92	25.391	658.44	2593.2	0.00000	1134.1	0.43285
118.96	25.398	658.47	2592.6	0.00000	1134.2	0.43281
119.00	25.404	658.50	2592.1	0.00000	1134.3	0.43277
119.04	25.411	658.54	2591.5	0.00000	1134.3	0.43273
119.08	25.418	658.59	2591.1	0.00000	1134.4	0.43270
119.12	25.425	658.65	2590.6	0.00000	1134.5	0.43266
119.16	25.432	658.71	2590.1	0.00000	1134.6	0.43262
119.20	25.439	658.79	2589.7	0.00000	1134.6	0.43259
119.24	25.446	658.87	2589.3	0.00000	1134.7	0.43255
119.28	25.453	658.97	2588.9	0.00000	1134.8	0.43252
119.32	25.461	659.08	2588.6	0.00000	1134.9	0.43247
119.36	25.468	659.20	2588.3	0.00000	1135.0	0.43243
119.40	25.476	659.32	2588.1	0.00000	1135.1	0.43238
119.44	25.483	659.45	2587.8	0.00000	1135.2	0.43232
119.48	25.491	659.57	2587.5	0.00000	1135.3	0.43227
119.52	25.498	659.70	2587.2	0.00000	1135.4	0.43221
119.56	25.506	659.83	2587.0	0.00000	1135.5	0.43215
119.60	25.513	659.95	2586.7	0.00000	1135.6	0.43209
119.64	25.521	660.08	2586.4	0.00000	1135.8	0.43202
119.68	25.529	660.21	2586.2	0.00000	1135.9	0.43195
119.72	25.537	660.34	2585.9	0.00000	1136.0	0.43188
119.76	25.544	660.47	2585.6	0.00000	1136.2	0.43181
119.80	25.552	660.60	2585.3	0.00000	1136.3	0.43173
119.84	25.560	660.73	2585.0	0.00000	1136.5	0.43165
119.88	25.568	660.87	2584.8	0.00000	1136.7	0.43157
119.92	25.576	661.00	2584.5	0.00000	1136.8	0.43148
119.96	25.584	661.13	2584.1	0.00000	1137.0	0.43140

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
120.00	25.592	661.24	2583.8	0.00000	1137.2	0.43132
120.04	25.601	661.35	2583.3	0.00000	1137.3	0.43124
120.08	25.609	661.44	2582.9	0.00000	1137.5	0.43117
120.12	25.618	661.53	2582.4	0.00000	1137.6	0.43110
120.16	25.626	661.62	2581.8	0.00000	1137.8	0.43102
120.20	25.635	661.71	2581.3	0.00000	1137.9	0.43094
120.24	25.643	661.79	2580.7	0.00000	1138.1	0.43086
120.28	25.652	661.87	2580.2	0.00000	1138.3	0.43078
120.32	25.661	661.94	2579.6	0.00000	1138.4	0.43069
120.36	25.670	662.00	2578.9	0.00000	1138.6	0.43061
120.40	25.679	662.06	2578.2	0.00000	1138.7	0.43054
120.44	25.688	662.10	2577.5	0.00000	1138.9	0.43046
120.48	25.697	662.13	2576.7	0.00000	1139.0	0.43039
120.52	25.707	662.16	2575.8	0.00000	1139.2	0.43033
120.56	25.716	662.16	2574.9	0.00000	1139.3	0.43027
120.60	25.726	662.15	2573.9	0.00000	1139.4	0.43022
120.64	25.736	662.14	2572.8	0.00000	1139.4	0.43018
120.68	25.746	662.11	2571.7	0.00000	1139.5	0.43015
120.72	25.756	662.08	2570.6	0.00000	1139.6	0.43012
120.76	25.766	662.05	2569.5	0.00000	1139.6	0.43009
120.80	25.776	662.01	2568.4	0.00000	1139.7	0.43007
120.84	25.786	661.97	2567.2	0.00000	1139.7	0.43006
120.88	25.796	661.92	2566.0	0.00000	1139.7	0.43005
120.92	25.806	661.87	2564.9	0.00000	1139.7	0.43004
120.96	25.815	661.81	2563.7	0.00000	1139.7	0.43004
121.00	25.825	661.75	2562.5	0.00000	1139.7	0.43004
121.04	25.835	661.68	2561.2	0.00000	1139.7	0.43005
121.08	25.845	661.61	2560.0	0.00000	1139.7	0.43006
121.12	25.854	661.53	2558.8	0.00000	1139.6	0.43008
121.16	25.864	661.45	2557.5	0.00000	1139.6	0.43011
121.20	25.873	661.37	2556.3	0.00000	1139.6	0.43013
121.24	25.882	661.30	2555.1	0.00000	1139.5	0.43015
121.28	25.892	661.23	2553.9	0.00000	1139.5	0.43017
121.32	25.901	661.17	2552.8	0.00000	1139.4	0.43019
121.36	25.909	661.12	2551.7	0.00000	1139.4	0.43021
121.40	25.918	661.06	2550.6	0.00000	1139.4	0.43022
121.44	25.927	661.02	2549.5	0.00000	1139.3	0.43024
121.48	25.936	660.97	2548.5	0.00000	1139.3	0.43026
121.52	25.945	660.93	2547.4	0.00000	1139.2	0.43028
121.56	25.954	660.90	2546.4	0.00000	1139.2	0.43030
121.60	25.963	660.87	2545.4	0.00000	1139.2	0.43031
121.64	25.972	660.85	2544.5	0.00000	1139.2	0.43032
121.68	25.980	660.85	2543.7	0.00000	1139.2	0.43032
121.72	25.989	660.85	2542.8	0.00000	1139.2	0.43032
121.76	25.997	660.89	2542.2	0.00000	1139.2	0.43031
121.80	26.006	660.99	2541.8	0.00000	1139.2	0.43028
121.84	26.014	661.16	2541.6	0.00000	1139.3	0.43025
121.88	26.022	661.39	2541.7	0.00000	1139.4	0.43020
121.92	26.030	661.67	2541.9	0.00000	1139.5	0.43014
121.96	26.039	662.01	2542.4	0.00000	1139.7	0.43007

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
122.00	26.048	662.40	2543.0	0.00000	1139.8	0.43000
122.04	26.057	662.84	2543.8	0.00000	1140.0	0.42991
122.08	26.066	663.34	2544.8	0.00000	1140.2	0.42982
122.12	26.075	663.89	2546.0	0.00000	1140.4	0.42972
122.16	26.085	664.44	2547.2	0.00000	1140.6	0.42962
122.20	26.094	664.96	2548.2	0.00000	1140.8	0.42952
122.24	26.104	665.44	2549.1	0.00000	1140.9	0.42943
122.28	26.114	665.87	2549.9	0.00000	1141.1	0.42934
122.32	26.123	666.27	2550.4	0.00000	1141.3	0.42925
122.36	26.133	666.63	2550.9	0.00000	1141.5	0.42917
122.40	26.143	666.95	2551.1	0.00000	1141.6	0.42909
122.44	26.153	667.23	2551.2	0.00000	1141.8	0.42902
122.48	26.163	667.47	2551.2	0.00000	1141.9	0.42895
122.52	26.173	667.68	2551.0	0.00000	1142.0	0.42888
122.56	26.183	667.84	2550.6	0.00000	1142.2	0.42882
122.60	26.193	667.97	2550.1	0.00000	1142.3	0.42876
122.64	26.203	668.05	2549.5	0.00000	1142.4	0.42871
122.68	26.213	668.13	2548.8	0.00000	1142.5	0.42865
122.72	26.223	668.20	2548.2	0.00000	1142.6	0.42860
122.76	26.233	668.26	2547.5	0.00000	1142.7	0.42855
122.80	26.242	668.33	2546.8	0.00000	1142.8	0.42851
122.84	26.252	668.39	2546.1	0.00000	1142.9	0.42847
122.88	26.261	668.44	2545.4	0.00000	1143.0	0.42843
122.92	26.271	668.50	2544.7	0.00000	1143.0	0.42839
122.96	26.280	668.55	2544.0	0.00000	1143.1	0.42836
123.00	26.289	668.57	2543.2	0.00000	1143.1	0.42833
123.04	26.298	668.54	2542.2	0.00000	1143.2	0.42832
123.08	26.307	668.45	2541.0	0.00000	1143.2	0.42831
123.12	26.316	668.29	2539.5	0.00000	1143.2	0.42832
123.16	26.325	668.08	2537.9	0.00000	1143.1	0.42834
123.20	26.334	667.82	2536.1	0.00000	1143.1	0.42837
123.24	26.343	667.52	2534.1	0.00000	1143.0	0.42841
123.28	26.351	667.17	2531.9	0.00000	1142.9	0.42845
123.32	26.360	666.77	2529.6	0.00000	1142.8	0.42850
123.36	26.369	666.33	2527.1	0.00000	1142.7	0.42855
123.40	26.377	665.90	2524.6	0.00000	1142.6	0.42860
123.44	26.386	665.51	2522.3	0.00000	1142.5	0.42865
123.48	26.395	665.17	2520.1	0.00000	1142.4	0.42869
123.52	26.404	664.88	2518.2	0.00000	1142.4	0.42872
123.56	26.413	664.63	2516.4	0.00000	1142.3	0.42875
123.60	26.422	664.43	2514.7	0.00000	1142.3	0.42877
123.64	26.431	664.27	2513.2	0.00000	1142.2	0.42879
123.68	26.441	664.14	2511.9	0.00000	1142.2	0.42881
123.72	26.450	664.05	2510.6	0.00000	1142.2	0.42882
123.76	26.459	664.00	2509.6	0.00000	1142.1	0.42884
123.80	26.468	663.99	2508.6	0.00000	1142.1	0.42886
123.84	26.478	664.01	2507.8	0.00000	1142.1	0.42887
123.88	26.487	664.07	2507.2	0.00000	1142.0	0.42888
123.92	26.496	664.14	2506.6	0.00000	1142.0	0.42889
123.96	26.506	664.22	2506.0	0.00000	1142.0	0.42890

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
124.00	26.515	664.30	2505.4	0.00000	1142.0	0.42891
124.04	26.524	664.39	2504.8	0.00000	1142.0	0.42892
124.08	26.534	664.47	2504.3	0.00000	1142.0	0.42892
124.12	26.543	664.56	2503.8	0.00000	1142.0	0.42892
124.16	26.552	664.66	2503.2	0.00000	1142.0	0.42891
124.20	26.561	664.76	2502.8	0.00000	1142.0	0.42890
124.24	26.570	664.87	2502.3	0.00000	1142.1	0.42887
124.28	26.579	664.98	2501.9	0.00000	1142.1	0.42884
124.32	26.588	665.10	2501.5	0.00000	1142.2	0.42881
124.36	26.597	665.22	2501.1	0.00000	1142.3	0.42876
124.40	26.606	665.34	2500.7	0.00000	1142.4	0.42871
124.44	26.615	665.47	2500.4	0.00000	1142.5	0.42866
124.48	26.623	665.58	2500.0	0.00000	1142.6	0.42860
124.52	26.632	665.69	2499.6	0.00000	1142.7	0.42855
124.56	26.640	665.78	2499.2	0.00000	1142.8	0.42849
124.60	26.648	665.87	2498.8	0.00000	1142.9	0.42843
124.64	26.656	665.95	2498.4	0.00000	1143.1	0.42838
124.68	26.664	666.02	2497.9	0.00000	1143.2	0.42832
124.72	26.671	666.08	2497.4	0.00000	1143.3	0.42826
124.76	26.679	666.14	2496.9	0.00000	1143.4	0.42820
124.80	26.686	666.19	2496.4	0.00000	1143.5	0.42814
124.84	26.693	666.25	2496.0	0.00000	1143.7	0.42807
124.88	26.701	666.33	2495.5	0.00000	1143.8	0.42799
124.92	26.709	666.43	2495.2	0.00000	1144.0	0.42790
124.96	26.717	666.55	2494.9	0.00000	1144.2	0.42780
125.00	26.725	666.69	2494.6	0.00000	1144.4	0.42769
125.04	26.733	666.84	2494.4	0.00000	1144.7	0.42757
125.08	26.741	667.01	2494.3	0.00000	1144.9	0.42743
125.12	26.750	667.19	2494.2	0.00000	1145.2	0.42730
125.16	26.758	667.37	2494.0	0.00000	1145.5	0.42716
125.20	26.767	667.53	2493.9	0.00000	1145.8	0.42702
125.24	26.776	667.68	2493.6	0.00000	1146.0	0.42688
125.28	26.784	667.82	2493.4	0.00000	1146.3	0.42674
125.32	26.793	667.95	2493.0	0.00000	1146.6	0.42660
125.36	26.802	668.07	2492.7	0.00000	1146.9	0.42647
125.40	26.810	668.18	2492.3	0.00000	1147.1	0.42634
125.44	26.819	668.28	2491.8	0.00000	1147.4	0.42622
125.48	26.829	668.37	2491.3	0.00000	1147.6	0.42611
125.52	26.838	668.44	2490.7	0.00000	1147.8	0.42600
125.56	26.847	668.50	2490.0	0.00000	1148.0	0.42589
125.60	26.857	668.59	2489.5	0.00000	1148.2	0.42578
125.64	26.866	668.71	2489.1	0.00000	1148.5	0.42567
125.68	26.876	668.86	2488.7	0.00000	1148.7	0.42554
125.72	26.886	669.04	2488.5	0.00000	1149.0	0.42541
125.76	26.896	669.25	2488.3	0.00000	1149.3	0.42527
125.80	26.906	669.48	2488.3	0.00000	1149.5	0.42513
125.84	26.916	669.75	2488.4	0.00000	1149.9	0.42498
125.88	26.926	670.05	2488.5	0.00000	1150.2	0.42482
125.92	26.936	670.38	2488.8	0.00000	1150.5	0.42465
125.96	26.947	670.74	2489.1	0.00000	1150.8	0.42448

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
126.00	26.957	671.13	2489.6	0.00000	1151.2	0.42430
126.04	26.968	671.52	2490.1	0.00000	1151.6	0.42412
126.08	26.978	671.86	2490.4	0.00000	1151.9	0.42396
126.12	26.988	672.16	2490.6	0.00000	1152.2	0.42380
126.16	26.998	672.42	2490.6	0.00000	1152.5	0.42366
126.20	27.008	672.63	2490.5	0.00000	1152.7	0.42354
126.24	27.017	672.81	2490.3	0.00000	1153.0	0.42342
126.28	27.027	672.94	2489.9	0.00000	1153.2	0.42332
126.32	27.036	673.03	2489.4	0.00000	1153.3	0.42323
126.36	27.045	673.08	2488.8	0.00000	1153.5	0.42315
126.40	27.054	673.12	2488.1	0.00000	1153.7	0.42307
126.44	27.063	673.15	2487.4	0.00000	1153.8	0.42300
126.48	27.071	673.16	2486.6	0.00000	1154.0	0.42292
126.52	27.080	673.16	2485.8	0.00000	1154.1	0.42285
126.56	27.089	673.14	2485.0	0.00000	1154.2	0.42278
126.60	27.097	673.11	2484.1	0.00000	1154.4	0.42271
126.64	27.106	673.07	2483.2	0.00000	1154.5	0.42264
126.68	27.114	673.07	2482.4	0.00000	1154.7	0.42257
126.72	27.122	673.08	2481.7	0.00000	1154.8	0.42249
126.76	27.131	673.13	2481.1	0.00000	1155.0	0.42241
126.80	27.139	673.20	2480.6	0.00000	1155.2	0.42232
126.84	27.147	673.26	2480.0	0.00000	1155.3	0.42224
126.88	27.156	673.30	2479.4	0.00000	1155.5	0.42217
126.92	27.164	673.32	2478.8	0.00000	1155.6	0.42210
126.96	27.172	673.33	2478.1	0.00000	1155.7	0.42205
127.00	27.180	673.33	2477.3	0.00000	1155.8	0.42200
127.04	27.189	673.31	2476.5	0.00000	1155.9	0.42196

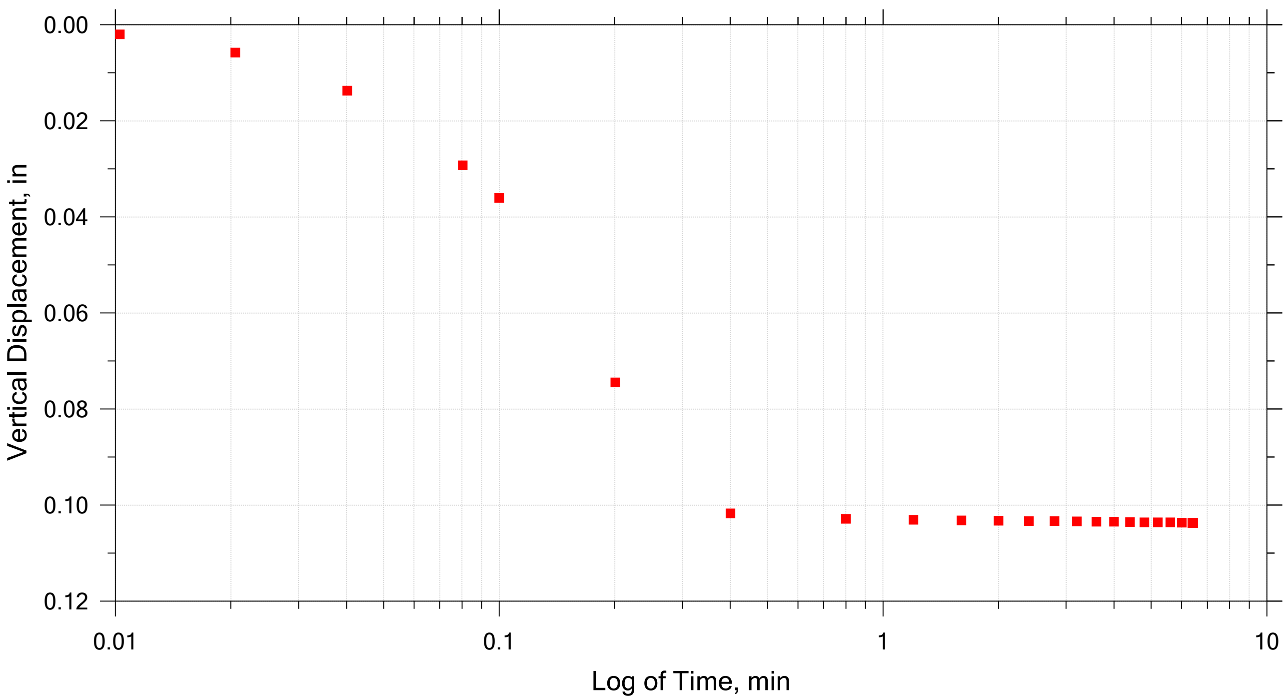
Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/12/20	Depth:
Test Number: 2	Preparation: reconstituted	Elevation:
Description:		
Remarks:		

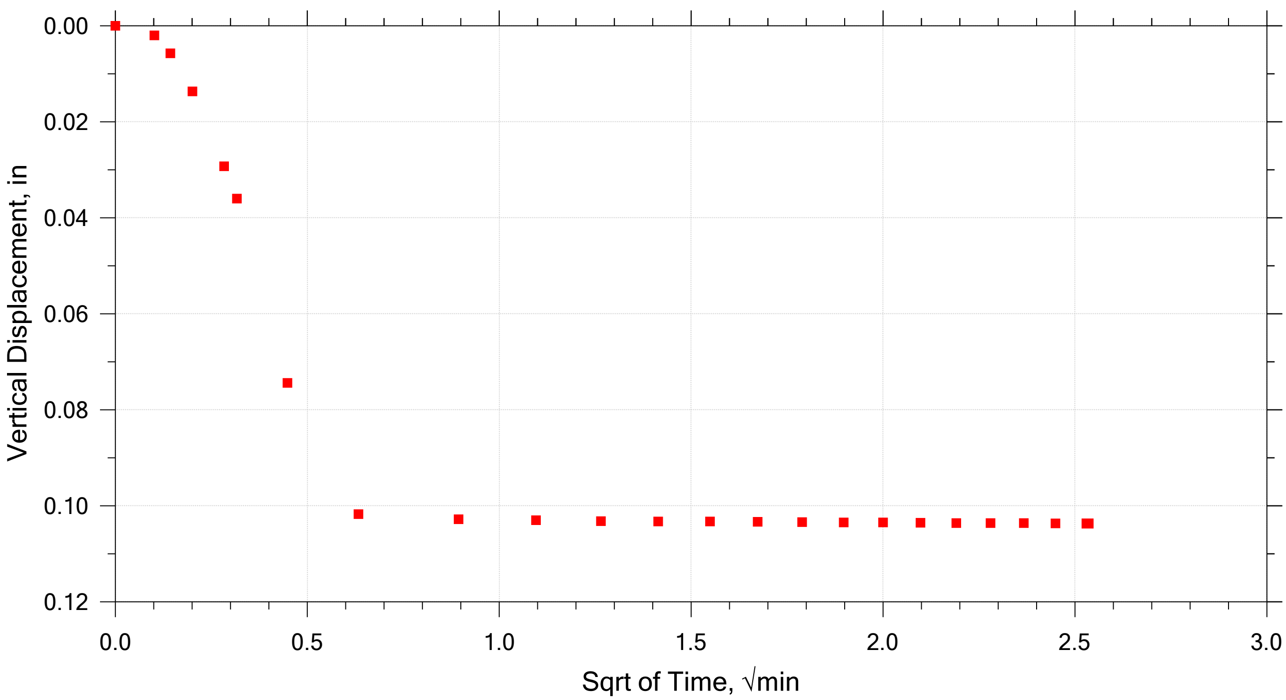
Direct Simple Shear Test

Consolidation Time Curve 1 of 4

Constant Load Step

Stress: 2.5e+03 psf





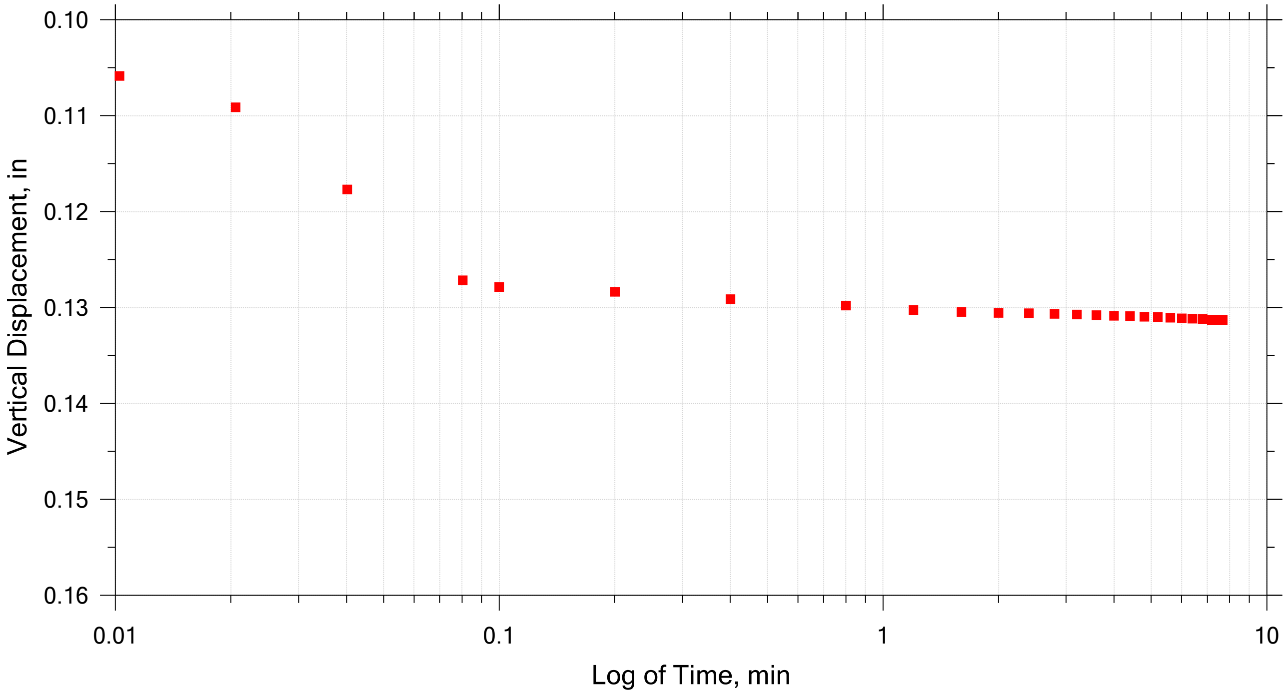
	Project Name: Hermosa	Location:	Project Number: TU201-00777/03
	Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
	Sample Number:	Test Date: 8/11/20	Depth:
	Test Number:	Preparation: Reconstituted	Elevation:
	Description:		
	Remarks:		

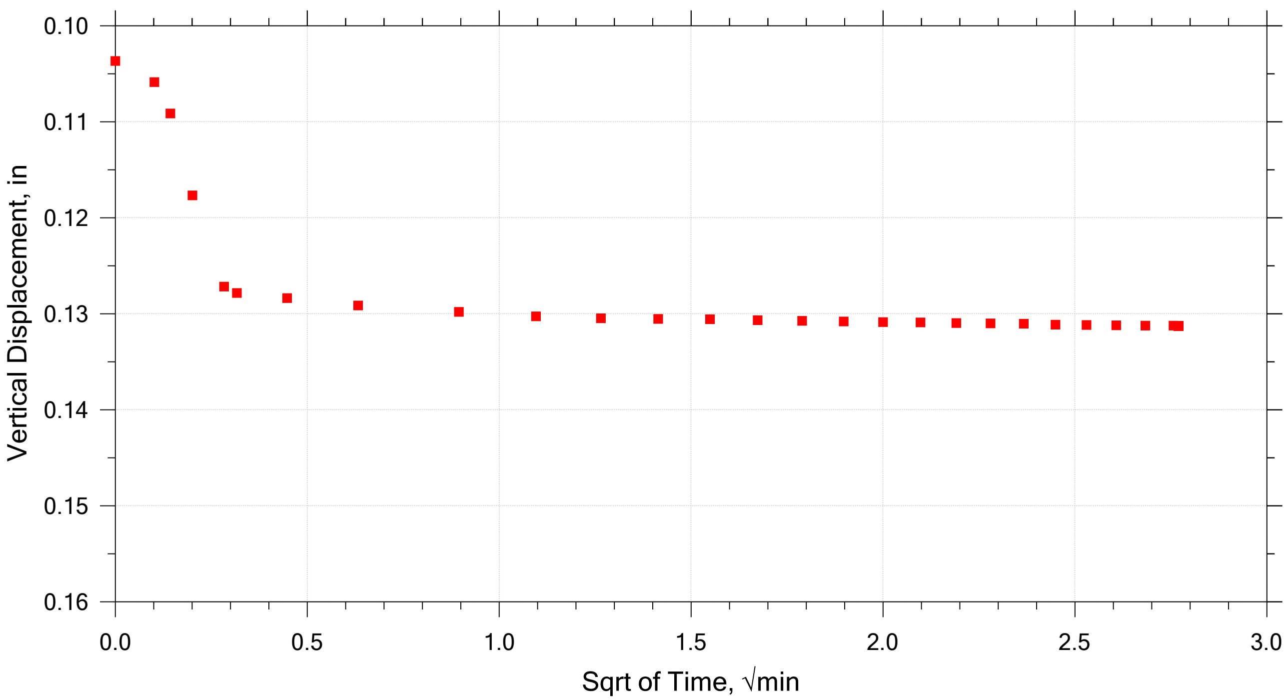
Direct Simple Shear Test

Consolidation Time Curve 2 of 4

Constant Load Step

Stress: 5e+03 psf





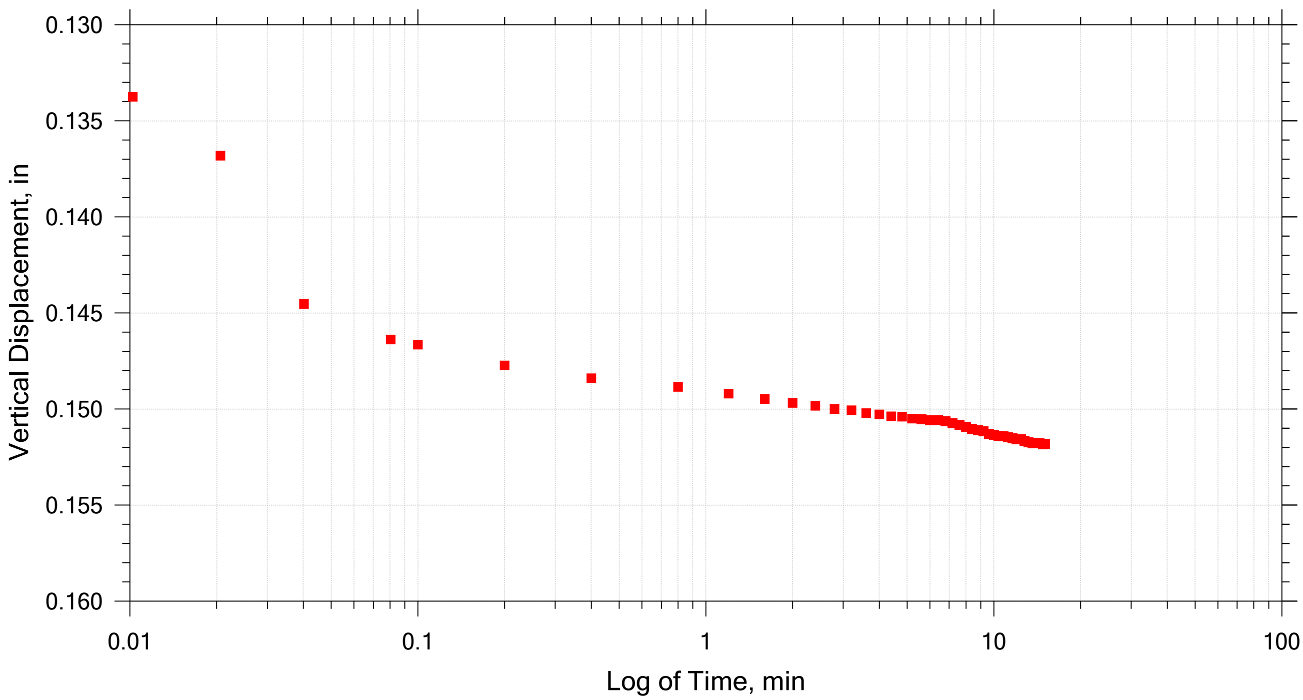
	Project Name: Hermosa	Location:	Project Number: TU201-00777/03
	Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
	Sample Number:	Test Date: 8/11/20	Depth:
	Test Number:	Preparation: Reconstituted	Elevation:
	Description:		
	Remarks:		

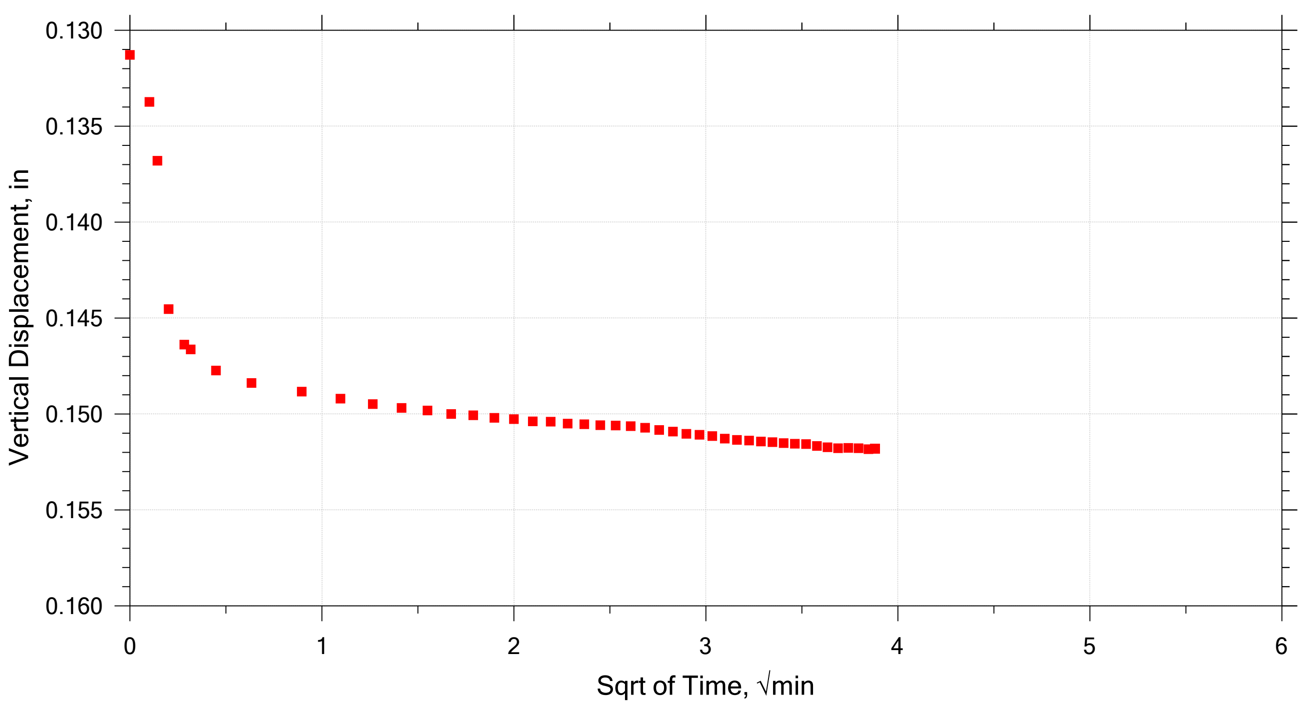
Direct Simple Shear Test

Consolidation Time Curve 3 of 4

Constant Load Step

Stress: 1e+04 psf





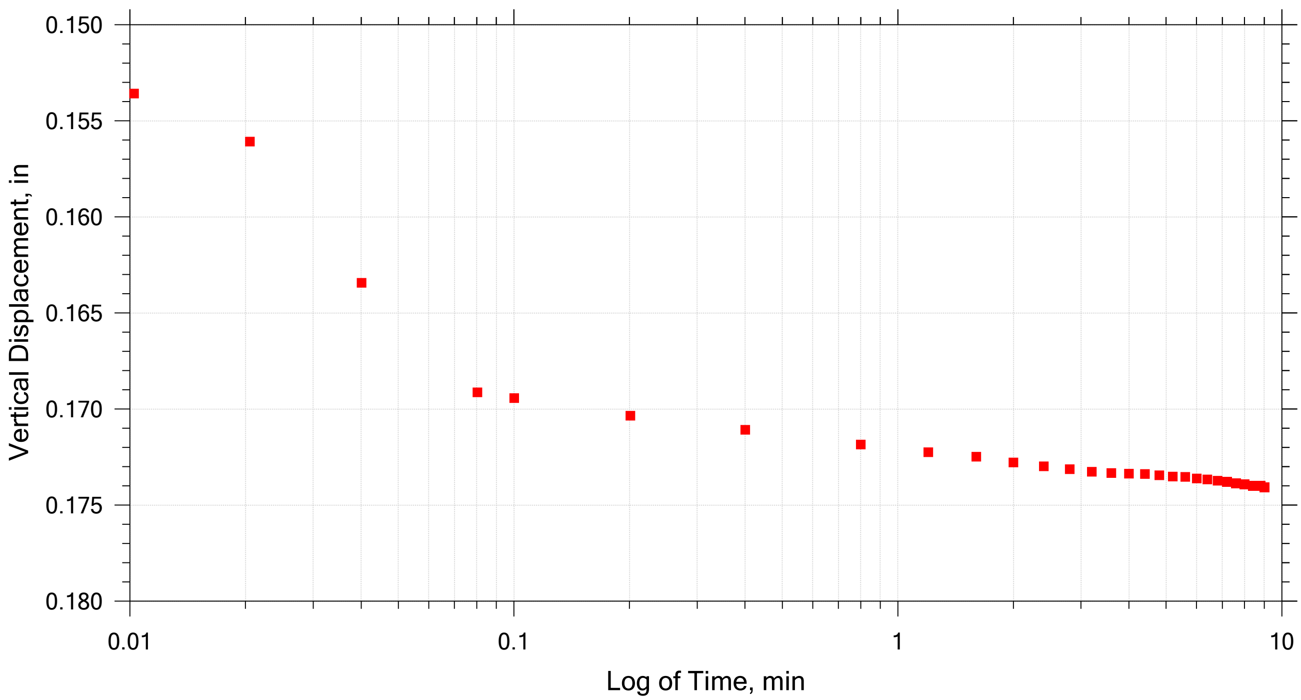
	Project Name: Hermosa	Location:	Project Number: TU201-00777/03
	Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
	Sample Number:	Test Date: 8/11/20	Depth:
	Test Number:	Preparation: Reconstituted	Elevation:
	Description:		
	Remarks:		

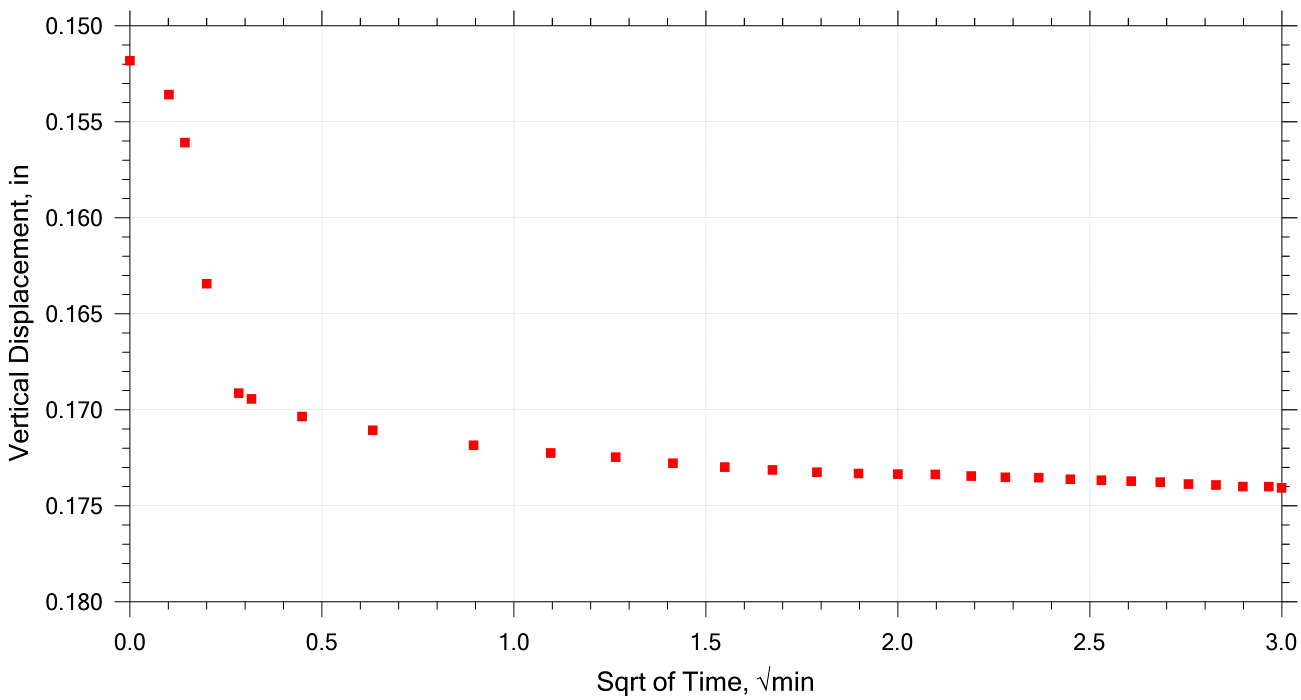
Direct Simple Shear Test

Consolidation Time Curve 4 of 4

Constant Load Step

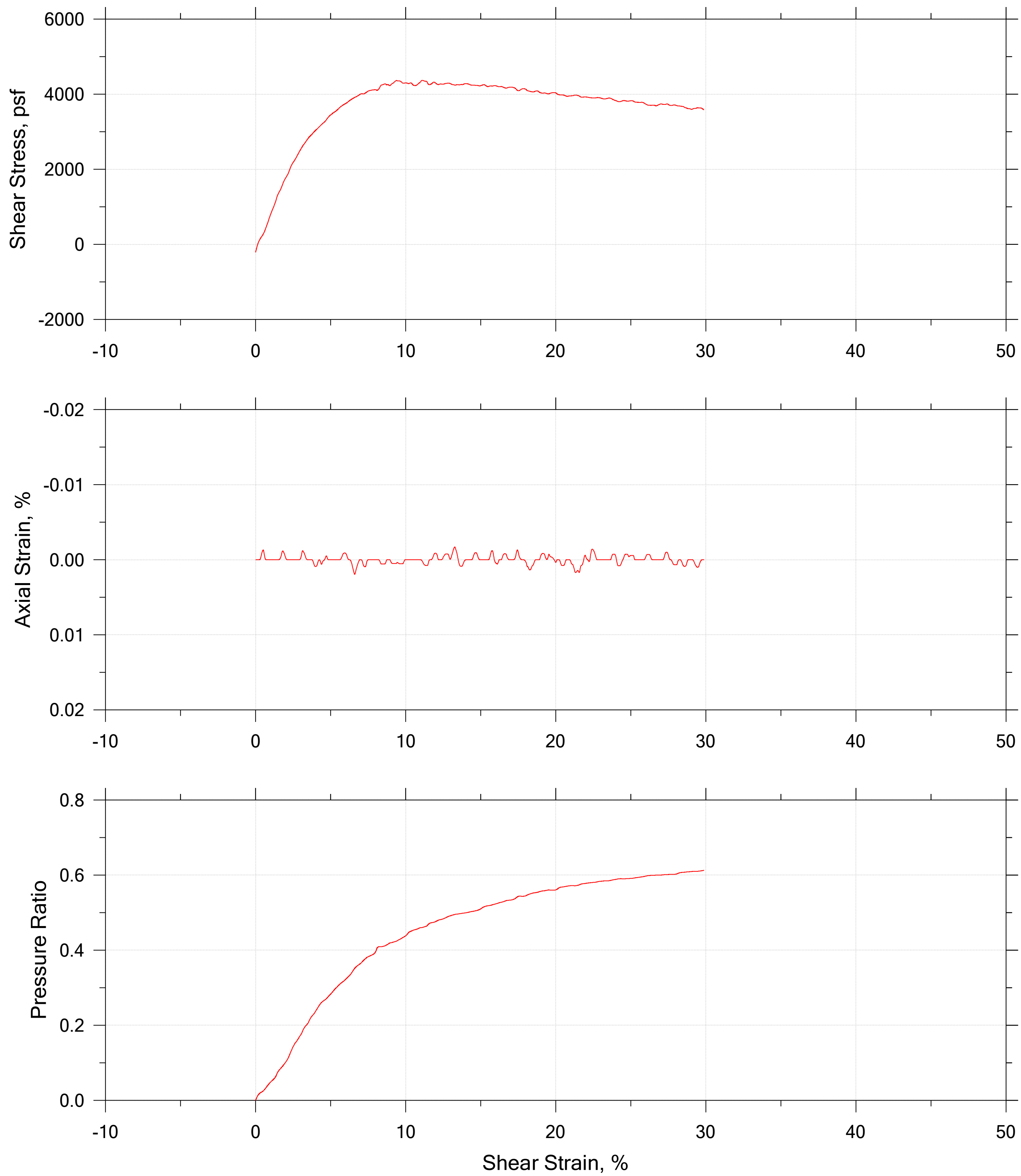
Stress: 2e+04 psf





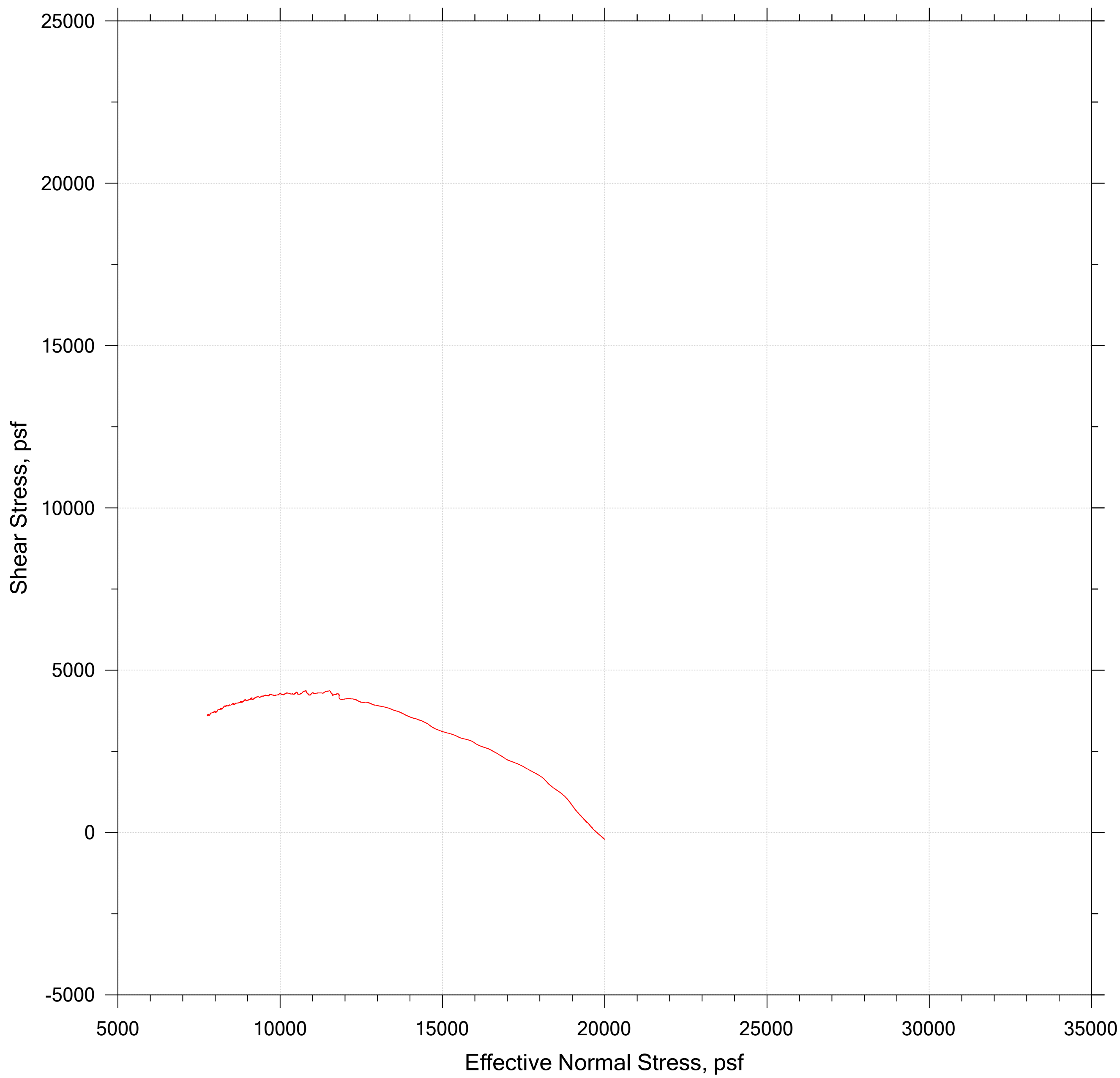
	Project Name: Hermosa	Location:	Project Number: TU201-00777/03
	Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
	Sample Number:	Test Date: 8/11/20	Depth:
	Test Number:	Preparation: Reconstituted	Elevation:
	Description:		
	Remarks:		

Direct Simple Shear Test



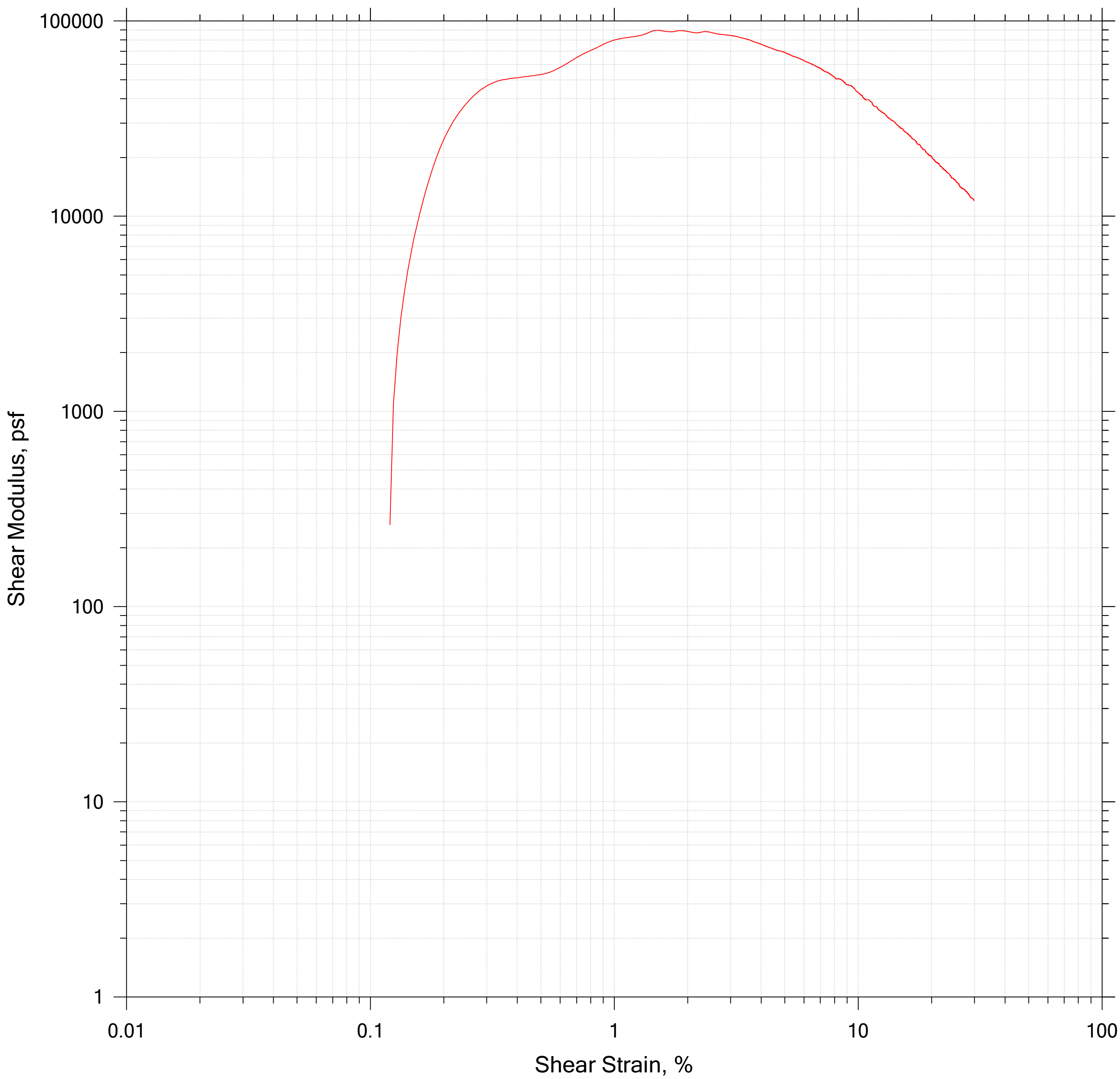
	Project Name: Hermosa	Location:	Project Number: TU201-00777/03
	Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
	Sample Number:	Test Date: 8/11/20	Depth:
	Test Number:	Preparation: Reconstituted	Elevation:
	Description:		
	Remarks:		

Direct Simple Shear Test



	Project Name: Hermosa	Location:	Project Number: TU201-00777/03
	Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
	Sample Number:	Test Date: 8/11/20	Depth:
	Test Number:	Preparation: Reconstituted	Elevation:
	Description:		
	Remarks:		

Direct Simple Shear Test



	Project Name: Hermosa	Location:	Project Number: TU201-00777/03
	Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
	Sample Number:	Test Date: 8/11/20	Depth:
	Test Number:	Preparation: Reconstituted	Elevation:
	Description:		
	Remarks:		

Direct Simple Shear Test

Specimen Dimension, in: 2.50	Specific Gravity: 2.87 (Measured)	Liquid Limit: Non-Plastic
Specimen Height, in: 1.00	Initial Void Ratio: 0.574	Plastic Limit: Non-Plastic
Final Height, in: 0.83	Final Void Ratio: 0.3	Plasticity Index: Non-Plastic

	Before Test Trimmings	Before Test Specimen	After Test Specimen	After Test Trimmings
Container ID		---		
Mass Container, kg	0	0	0	0
Mass Container + Wet Soil, kg	0.163	0.163	0.161	0.161
Mass Container + Dry Soil, kg	0.14645	0.14645	0.14645	0.14645
Mass Dry Soil, kg	0.14645	0.14645	0.14645	0.14645
Water Content, %	11.30	11.30	9.94	9.94
Void Ratio	---	0.57	0.30	---
Degree of Saturation, %	---	56.41	94.85	---
Dry Unit Weight, pcf	---	113.66	137.61	---

	Project Name: Hermosa	Location:	Project Number: TU201-00777/03
	Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
	Sample Number:	Test Date: 8/11/20	Depth:
	Test Number:	Preparation: Reconstituted	Elevation:
	Description:		
	Remarks:		

Direct Simple Shear Test

Consolidation Time Curve 1 of 4

Constant Load Step

Elapsed Time min	Sq.Rt. of Time min	Stress psf	Displacement Correction in	Corrected Displacement in	Strain %	Void Ratio
0.000	0.000	-3.42	0.0000	0.0000	0.000	0.574
0.010	0.101	42.2	0.0000	0.001974	0.197	0.571
0.021	0.143	81.0	0.0000	0.005749	0.575	0.565
0.040	0.200	186.	0.0000	0.01370	1.37	0.553
0.080	0.283	275.	0.0000	0.02925	2.92	0.528
0.100	0.316	323.	0.0000	0.03602	3.60	0.517
0.201	0.448	932.	0.0000	0.07443	7.44	0.457
0.401	0.633	2.48e+03	0.0000	0.1017	10.2	0.414
0.800	0.894	2.49e+03	0.0000	0.1028	10.3	0.412
1.200	1.096	2.50e+03	0.0000	0.1030	10.3	0.412
1.600	1.265	2.50e+03	0.0000	0.1032	10.3	0.412
2.000	1.414	2.50e+03	0.0000	0.1033	10.3	0.412
2.401	1.549	2.50e+03	0.0000	0.1033	10.3	0.412
2.800	1.673	2.50e+03	0.0000	0.1033	10.3	0.412
3.200	1.789	2.50e+03	0.0000	0.1034	10.3	0.411
3.600	1.897	2.50e+03	0.0000	0.1035	10.3	0.411
4.000	2.000	2.50e+03	0.0000	0.1035	10.3	0.411
4.400	2.098	2.50e+03	0.0000	0.1035	10.4	0.411
4.800	2.191	2.50e+03	0.0000	0.1036	10.4	0.411
5.201	2.280	2.50e+03	0.0000	0.1036	10.4	0.411
5.600	2.366	2.50e+03	0.0000	0.1036	10.4	0.411
6.001	2.450	2.50e+03	0.0000	0.1037	10.4	0.411
6.401	2.530	2.50e+03	0.0000	0.1037	10.4	0.411
6.426	2.535	2.50e+03	0.0000	0.1037	10.4	0.411

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Consolidation Time Curve 2 of 4

Constant Load Step

Elapsed Time min	Sq.Rt. of Time min	Stress psf	Displacement Correction in	Corrected Displacement in	Strain %	Void Ratio
0.000	0.000	2.50e+03	0.0000	0.1037	10.4	0.411
0.010	0.101	2.86e+03	0.0000	0.1059	10.6	0.408
0.021	0.143	3.02e+03	0.0000	0.1091	10.9	0.402
0.040	0.200	3.34e+03	0.0000	0.1177	11.8	0.389
0.080	0.284	4.80e+03	0.0000	0.1272	12.7	0.374
0.100	0.316	4.98e+03	0.0000	0.1279	12.8	0.373
0.200	0.447	4.99e+03	0.0000	0.1284	12.8	0.372
0.400	0.633	4.99e+03	0.0000	0.1291	12.9	0.371
0.801	0.895	5.00e+03	0.0000	0.1298	13.0	0.370
1.201	1.096	5.00e+03	0.0000	0.1303	13.0	0.369
1.601	1.265	5.00e+03	0.0000	0.1305	13.0	0.369
2.001	1.414	5.00e+03	0.0000	0.1306	13.1	0.369
2.400	1.549	5.00e+03	0.0000	0.1306	13.1	0.369
2.800	1.673	5.00e+03	0.0000	0.1307	13.1	0.368
3.200	1.789	5.00e+03	0.0000	0.1307	13.1	0.368
3.601	1.898	5.00e+03	0.0000	0.1308	13.1	0.368
4.001	2.000	5.00e+03	0.0000	0.1309	13.1	0.368
4.400	2.098	5.00e+03	0.0000	0.1309	13.1	0.368
4.801	2.191	5.00e+03	0.0000	0.1310	13.1	0.368
5.200	2.280	5.00e+03	0.0000	0.1310	13.1	0.368
5.601	2.367	5.00e+03	0.0000	0.1311	13.1	0.368
6.000	2.450	5.00e+03	0.0000	0.1311	13.1	0.368
6.400	2.530	5.00e+03	0.0000	0.1312	13.1	0.368
6.800	2.608	5.00e+03	0.0000	0.1312	13.1	0.368
7.201	2.683	5.00e+03	0.0000	0.1312	13.1	0.368
7.601	2.757	5.00e+03	0.0000	0.1312	13.1	0.368
7.672	2.770	5.00e+03	0.0000	0.1313	13.1	0.368

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Consolidation Time Curve 3 of 4

Constant Load Step

Elapsed Time min	Sq.Rt. of Time min	Stress psf	Displacement Correction in	Corrected Displacement in	Strain %	Void Ratio
0.000	0.000	5.00e+03	0.0000	0.1313	13.1	0.368
0.010	0.101	6.63e+03	0.0000	0.1337	13.4	0.364
0.021	0.144	7.60e+03	0.0000	0.1368	13.7	0.359
0.040	0.201	9.96e+03	0.0000	0.1445	14.5	0.347
0.080	0.284	9.86e+03	0.0000	0.1464	14.6	0.344
0.100	0.316	9.98e+03	0.0000	0.1466	14.7	0.343
0.200	0.447	9.97e+03	0.0000	0.1477	14.8	0.342
0.400	0.633	1.00e+04	0.0000	0.1484	14.8	0.341
0.801	0.895	9.99e+03	0.0000	0.1488	14.9	0.340
1.201	1.096	9.99e+03	0.0000	0.1492	14.9	0.339
1.600	1.265	1.00e+04	0.0000	0.1495	14.9	0.339
2.001	1.414	1.00e+04	0.0000	0.1497	15.0	0.339
2.401	1.549	1.00e+04	0.0000	0.1498	15.0	0.338
2.801	1.674	1.00e+04	0.0000	0.1500	15.0	0.338
3.200	1.789	1.00e+04	0.0000	0.1501	15.0	0.338
3.601	1.898	1.00e+04	0.0000	0.1502	15.0	0.338
4.001	2.000	1.00e+04	0.0000	0.1503	15.0	0.338
4.401	2.098	1.00e+04	0.0000	0.1504	15.0	0.337
4.800	2.191	1.00e+04	0.0000	0.1504	15.0	0.337
5.200	2.280	1.00e+04	0.0000	0.1505	15.1	0.337
5.601	2.367	1.00e+04	0.0000	0.1505	15.1	0.337
6.001	2.450	1.00e+04	0.0000	0.1506	15.1	0.337
6.401	2.530	1.00e+04	0.0000	0.1506	15.1	0.337
6.801	2.608	1.00e+04	0.0000	0.1506	15.1	0.337
7.200	2.683	1.00e+04	0.0000	0.1507	15.1	0.337
7.601	2.757	1.00e+04	0.0000	0.1508	15.1	0.337
8.000	2.828	1.00e+04	0.0000	0.1509	15.1	0.337
8.400	2.898	1.00e+04	0.0000	0.1510	15.1	0.336
8.801	2.967	1.00e+04	0.0000	0.1511	15.1	0.336
9.200	3.033	1.00e+04	0.0000	0.1512	15.1	0.336
9.601	3.098	1.00e+04	0.0000	0.1513	15.1	0.336
10.001	3.162	1.00e+04	0.0000	0.1514	15.1	0.336
10.401	3.225	1.00e+04	0.0000	0.1514	15.1	0.336
10.801	3.286	1.00e+04	0.0000	0.1514	15.1	0.336
11.200	3.347	1.00e+04	0.0000	0.1515	15.1	0.336
11.600	3.406	1.00e+04	0.0000	0.1515	15.2	0.336
12.001	3.464	1.00e+04	0.0000	0.1516	15.2	0.336
12.401	3.521	1.00e+04	0.0000	0.1516	15.2	0.336
12.801	3.578	1.00e+04	0.0000	0.1517	15.2	0.335
13.201	3.633	1.00e+04	0.0000	0.1517	15.2	0.335
13.600	3.688	1.00e+04	0.0000	0.1518	15.2	0.335
14.000	3.742	1.00e+04	0.0000	0.1518	15.2	0.335
14.401	3.795	1.00e+04	0.0000	0.1518	15.2	0.335
14.800	3.847	1.00e+04	0.0000	0.1518	15.2	0.335
15.075	3.883	1.00e+04	0.0000	0.1518	15.2	0.335

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Consolidation Time Curve 4 of 4

Constant Load Step

Elapsed Time min	Sq.Rt. of Time min	Stress psf	Displacement Correction in	Corrected Displacement in	Strain %	Void Ratio
0.000	0.000	1.00e+04	0.0000	0.1518	15.2	0.335
0.010	0.101	1.26e+04	0.0000	0.1536	15.4	0.332
0.021	0.143	1.43e+04	0.0000	0.1561	15.6	0.328
0.040	0.200	1.77e+04	0.0000	0.1634	16.3	0.317
0.080	0.284	2.00e+04	0.0000	0.1691	16.9	0.308
0.100	0.316	1.99e+04	0.0000	0.1694	16.9	0.307
0.201	0.448	2.00e+04	0.0000	0.1703	17.0	0.306
0.400	0.633	2.00e+04	0.0000	0.1711	17.1	0.305
0.800	0.895	2.00e+04	0.0000	0.1719	17.2	0.304
1.201	1.096	2.00e+04	0.0000	0.1723	17.2	0.303
1.601	1.265	2.00e+04	0.0000	0.1725	17.2	0.303
2.000	1.414	2.00e+04	0.0000	0.1728	17.3	0.302
2.400	1.549	2.00e+04	0.0000	0.1730	17.3	0.302
2.801	1.674	2.00e+04	0.0000	0.1731	17.3	0.302
3.201	1.789	2.00e+04	0.0000	0.1733	17.3	0.301
3.601	1.898	2.00e+04	0.0000	0.1733	17.3	0.301
4.000	2.000	2.00e+04	0.0000	0.1734	17.3	0.301
4.401	2.098	2.00e+04	0.0000	0.1734	17.3	0.301
4.801	2.191	2.00e+04	0.0000	0.1734	17.3	0.301
5.200	2.280	2.00e+04	0.0000	0.1735	17.4	0.301
5.600	2.366	2.00e+04	0.0000	0.1735	17.4	0.301
6.000	2.450	2.00e+04	0.0000	0.1736	17.4	0.301
6.400	2.530	2.00e+04	0.0000	0.1737	17.4	0.301
6.800	2.608	2.00e+04	0.0000	0.1737	17.4	0.301
7.200	2.683	2.00e+04	0.0000	0.1738	17.4	0.301
7.600	2.757	2.00e+04	0.0000	0.1739	17.4	0.300
8.001	2.829	2.00e+04	0.0000	0.1739	17.4	0.300
8.401	2.898	2.00e+04	0.0000	0.1740	17.4	0.300
8.800	2.966	2.00e+04	0.0000	0.1740	17.4	0.300
8.996	2.999	2.00e+04	0.0000	0.1741	17.4	0.300

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
0.00000	0.00000	-212.42	0.00000	0.00000	19997.	0.00000
0.040000	-2.1673e-06	-212.21	-7.5474	0.00000	19996.	8.1154e-06
0.080000	0.00012740	-211.80	-22.680	0.00000	19996.	2.8086e-05
0.12000	0.00038871	-211.17	-45.398	0.00000	19995.	5.9911e-05
0.16000	0.00078175	-210.34	-75.701	0.00000	19995.	0.00010359
0.20000	0.0013065	-209.29	-113.59	0.00000	19993.	0.00015913
0.24000	0.0019631	-208.04	-159.06	0.00000	19992.	0.00022652
0.28000	0.0027513	-206.57	-212.12	0.00000	19991.	0.00030576
0.32000	0.0036713	-204.90	-272.77	0.00000	19989.	0.00039686
0.36000	0.0047230	-203.02	-341.00	0.00000	19987.	0.00049982
0.40000	0.0059065	-200.93	-416.81	0.00000	19984.	0.00061463
0.44000	0.0072217	-198.63	-500.21	0.00000	19982.	0.00074129
0.48000	0.0086686	-196.12	-591.20	0.00000	19979.	0.00087981
0.52000	0.010247	-193.40	-689.77	0.00000	19976.	0.0010302
0.56000	0.011958	-190.48	-795.93	0.00000	19973.	0.0011924
0.60000	0.013800	-187.34	-909.67	0.00000	19969.	0.0013665
0.64000	0.015774	-184.00	-1031.0	0.00000	19966.	0.0015524
0.68000	0.017879	-180.44	-1159.9	0.00000	19962.	0.0017502
0.72000	0.020117	-176.68	-1296.4	0.00000	19957.	0.0019599
0.76000	0.022486	-172.71	-1440.5	0.00000	19953.	0.0021814
0.80000	0.024987	-168.52	-1592.2	0.00000	19948.	0.0024148
0.84000	0.027619	-164.13	-1751.4	0.00000	19943.	0.0026600
0.88000	0.030384	-159.53	-1918.2	0.00000	19938.	0.0029170
0.92000	0.033280	-154.72	-2092.7	0.00000	19933.	0.0031860
0.96000	0.036307	-149.71	-2274.7	0.00000	19927.	0.0034667
1.0000	0.039467	-144.48	-2464.3	0.00000	19921.	0.0037594
1.0400	0.042758	-139.04	-2661.5	0.00000	19915.	0.0040639
1.0800	0.046181	-133.40	-2866.2	0.00000	19909.	0.0043802
1.1200	0.049736	-127.54	-3078.6	0.00000	19902.	0.0047084
1.1600	0.053422	-121.48	-3298.5	0.00000	19896.	0.0050485
1.2000	0.057241	-115.20	-3526.0	0.00000	19889.	0.0054004
1.2400	0.061191	-108.72	-3761.1	0.00000	19881.	0.0057641
1.2800	0.065285	-102.28	-3949.4	0.00000	19874.	0.0061295
1.3200	0.069397	-95.892	-4064.6	0.00000	19867.	0.0064917
1.3600	0.073526	-89.567	-4106.5	0.00000	19860.	0.0068505
1.4000	0.077672	-83.303	-4075.3	0.00000	19853.	0.0072060
1.4400	0.081834	-77.099	-3970.8	0.00000	19845.	0.0075583
1.4800	0.086014	-70.956	-3793.2	0.00000	19839.	0.0079073
1.5200	0.090211	-64.872	-3542.5	0.00000	19832.	0.0082530
1.5600	0.094425	-58.849	-3218.5	0.00000	19825.	0.0085954
1.6000	0.098655	-52.886	-2821.3	0.00000	19818.	0.0089345
1.6400	0.10290	-46.984	-2351.0	0.00000	19811.	0.0092704
1.6800	0.10717	-41.141	-1807.5	0.00000	19805.	0.0096029
1.7200	0.11145	-35.359	-1190.8	0.00000	19798.	0.0099322
1.7600	0.11575	-29.637	-500.89	0.00000	19791.	0.010258
1.8000	0.12006	-23.976	262.18	0.00000	19785.	0.010581
1.8400	0.12440	-18.374	1098.4	0.00000	19779.	0.010900
1.8800	0.12875	-12.833	2007.9	0.00000	19772.	0.011216
1.9200	0.13311	-7.3522	2990.5	0.00000	19766.	0.011529
1.9600	0.13750	-1.9315	4046.3	0.00000	19760.	0.011839

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
2.0000	0.14190	3.4290	5175.3	0.00000	19754.	0.012145
2.0400	0.14632	8.7292	6377.4	0.00000	19748.	0.012448
2.0800	0.15075	13.969	7652.8	0.00000	19742.	0.012748
2.1200	0.15520	19.149	9001.3	0.00000	19736.	0.013044
2.1600	0.15967	24.268	10423.	0.00000	19730.	0.013337
2.2000	0.16416	29.328	11918.	0.00000	19724.	0.013627
2.2400	0.16866	34.327	13486.	0.00000	19718.	0.013914
2.2800	0.17318	39.265	15127.	0.00000	19713.	0.014197
2.3200	0.17777	44.144	16807.	0.00000	19707.	0.014475
2.3600	0.18245	48.963	18506.	0.00000	19702.	0.014747
2.4000	0.18724	53.722	20225.	0.00000	19696.	0.015013
2.4400	0.19211	58.420	21964.	0.00000	19691.	0.015273
2.4800	0.19709	63.059	23723.	0.00000	19686.	0.015527
2.5200	0.20215	67.676	25456.	0.00000	19681.	0.015777
2.5600	0.20729	72.294	27135.	0.00000	19676.	0.016024
2.6000	0.21250	76.912	28761.	0.00000	19671.	0.016268
2.6400	0.21780	81.530	30333.	0.00000	19666.	0.016510
2.6800	0.22318	86.149	31853.	0.00000	19662.	0.016748
2.7200	0.22863	90.767	33319.	0.00000	19657.	0.016984
2.7600	0.23417	95.386	34732.	0.00000	19652.	0.017217
2.8000	0.23978	100.01	36092.	0.00000	19648.	0.017448
2.8400	0.24547	104.62	37399.	0.00000	19643.	0.017675
2.8800	0.25125	109.24	38652.	0.00000	19639.	0.017900
2.9200	0.25710	113.86	39852.	0.00000	19634.	0.018122
2.9600	0.26303	118.49	40999.	0.00000	19630.	0.018341
3.0000	0.26904	123.10	42091.	-5.0896e-07	19626.	0.018557
3.0400	0.27514	127.69	43117.	-5.0761e-06	19621.	0.018769
3.0800	0.28134	132.25	44075.	-1.3701e-05	19617.	0.018976
3.1200	0.28762	136.78	44967.	-2.6385e-05	19613.	0.019179
3.1600	0.29400	141.27	45792.	-4.3126e-05	19609.	0.019378
3.2000	0.30046	145.74	46550.	-6.3926e-05	19605.	0.019573
3.2400	0.30702	150.18	47242.	-8.8784e-05	19601.	0.019764
3.2800	0.31367	154.59	47866.	-0.00011770	19598.	0.019950
3.3200	0.32041	158.97	48424.	-0.00015067	19594.	0.020132
3.3600	0.32724	163.32	48915.	-0.00018771	19591.	0.020309
3.4000	0.33417	167.65	49340.	-0.00022880	19587.	0.020483
3.4400	0.34118	171.94	49697.	-0.00027395	19584.	0.020652
3.4800	0.34828	176.20	49988.	-0.00032315	19580.	0.020817
3.5200	0.35548	180.43	50212.	-0.00037642	19577.	0.020978
3.5600	0.36272	184.64	50404.	-0.00043374	19574.	0.021136
3.6000	0.36996	188.81	50583.	-0.00049512	19571.	0.021293
3.6400	0.37722	192.95	50748.	-0.00056056	19568.	0.021448
3.6800	0.38446	197.08	50905.	-0.00062690	19565.	0.021603
3.7200	0.39163	201.20	51058.	-0.00069040	19561.	0.021761
3.7600	0.39875	205.31	51208.	-0.00075108	19558.	0.021920
3.8000	0.40580	209.42	51355.	-0.00080893	19555.	0.022082
3.8400	0.41280	213.52	51499.	-0.00086395	19552.	0.022245
3.8800	0.41973	217.61	51640.	-0.00091613	19548.	0.022410
3.9200	0.42660	221.70	51778.	-0.00096549	19545.	0.022578
3.9600	0.43342	225.79	51913.	-0.0010120	19542.	0.022747

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
4.0000	0.44017	229.87	52044.	-0.0010557	19538.	0.022919
4.0400	0.44686	233.94	52172.	-0.0010966	19535.	0.023092
4.0800	0.45349	238.01	52298.	-0.0011346	19531.	0.023268
4.1200	0.46006	242.07	52420.	-0.0011698	19528.	0.023445
4.1600	0.46656	246.12	52539.	-0.0012022	19524.	0.023625
4.2000	0.47301	250.17	52655.	-0.0012318	19521.	0.023806
4.2400	0.47940	254.22	52769.	-0.0012580	19517.	0.023990
4.2800	0.48571	258.29	52894.	-0.0012773	19513.	0.024177
4.3200	0.49195	262.38	53030.	-0.0012898	19509.	0.024367
4.3600	0.49812	266.50	53176.	-0.0012953	19505.	0.024561
4.4000	0.50421	270.64	53332.	-0.0012940	19502.	0.024759
4.4400	0.51023	274.81	53499.	-0.0012858	19498.	0.024960
4.4800	0.51618	279.00	53676.	-0.0012707	19493.	0.025164
4.5200	0.52206	283.22	53864.	-0.0012487	19489.	0.025372
4.5600	0.52786	287.45	54062.	-0.0012198	19485.	0.025584
4.6000	0.53359	291.72	54271.	-0.0011840	19481.	0.025799
4.6400	0.53925	296.03	54492.	-0.0011429	19476.	0.026017
4.6800	0.54482	300.40	54727.	-0.0010978	19472.	0.026240
4.7200	0.55032	304.85	54976.	-0.0010486	19467.	0.026468
4.7600	0.55573	309.36	55238.	-0.00099529	19463.	0.026699
4.8000	0.56106	313.93	55515.	-0.00093797	19458.	0.026935
4.8400	0.56631	318.57	55806.	-0.00087659	19453.	0.027175
4.8800	0.57148	323.28	56111.	-0.00081115	19448.	0.027419
4.9200	0.57661	328.05	56425.	-0.00074481	19443.	0.027666
4.9600	0.58172	332.86	56742.	-0.00068131	19438.	0.027914
5.0000	0.58683	337.71	57063.	-0.00062063	19433.	0.028162
5.0400	0.59193	342.60	57387.	-0.00056278	19428.	0.028411
5.0800	0.59702	347.53	57715.	-0.00050776	19423.	0.028661
5.1200	0.60211	352.51	58046.	-0.00045557	19418.	0.028912
5.1600	0.60718	357.53	58381.	-0.00040622	19413.	0.029164
5.2000	0.61225	362.59	58720.	-0.00035969	19408.	0.029416
5.2400	0.61731	367.70	59061.	-0.00031599	19403.	0.029669
5.2800	0.62236	372.85	59407.	-0.00027511	19398.	0.029923
5.3200	0.62741	378.04	59756.	-0.00023707	19393.	0.030178
5.3600	0.63244	383.27	60108.	-0.00020186	19388.	0.030433
5.4000	0.63747	388.55	60464.	-0.00016948	19383.	0.030689
5.4400	0.64249	393.87	60823.	-0.00013992	19378.	0.030946
5.4800	0.64750	399.23	61186.	-0.00011320	19373.	0.031204
5.5200	0.65251	404.63	61552.	-8.9304e-05	19367.	0.031463
5.5600	0.65752	410.07	61917.	-6.8238e-05	19362.	0.031723
5.6000	0.66254	415.56	62281.	-5.0002e-05	19357.	0.031984
5.6400	0.66756	421.08	62642.	-3.4595e-05	19352.	0.032246
5.6800	0.67260	426.65	63003.	-2.2017e-05	19347.	0.032510
5.7200	0.67764	432.26	63362.	-1.2269e-05	19341.	0.032774
5.7600	0.68269	437.91	63719.	-5.3498e-06	19336.	0.033041
5.8000	0.68775	443.60	64075.	-1.2602e-06	19331.	0.033308
5.8400	0.69282	449.32	64429.	0.00000	19325.	0.033576
5.8800	0.69790	455.07	64780.	0.00000	19320.	0.033846
5.9200	0.70300	460.82	65126.	0.00000	19314.	0.034116
5.9600	0.70811	466.56	65467.	0.00000	19309.	0.034386

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
6.0000	0.71324	472.30	65803.	0.00000	19304.	0.034657
6.0400	0.71838	478.04	66134.	0.00000	19298.	0.034928
6.0800	0.72354	483.78	66460.	0.00000	19293.	0.035200
6.1200	0.72871	489.51	66780.	0.00000	19287.	0.035473
6.1600	0.73391	495.25	67096.	0.00000	19282.	0.035745
6.2000	0.73911	500.98	67407.	0.00000	19276.	0.036019
6.2400	0.74434	506.71	67713.	0.00000	19271.	0.036293
6.2800	0.74958	512.44	68014.	0.00000	19265.	0.036567
6.3200	0.75483	518.16	68309.	0.00000	19260.	0.036842
6.3600	0.76010	523.89	68600.	0.00000	19254.	0.037117
6.4000	0.76539	529.61	68886.	0.00000	19249.	0.037392
6.4400	0.77069	535.34	69167.	0.00000	19243.	0.037669
6.4800	0.77601	541.11	69446.	0.00000	19238.	0.037945
6.5200	0.78134	546.92	69722.	0.00000	19232.	0.038222
6.5600	0.78668	552.77	69996.	0.00000	19227.	0.038498
6.6000	0.79204	558.67	70268.	0.00000	19221.	0.038776
6.6400	0.79741	564.60	70538.	0.00000	19216.	0.039053
6.6800	0.80279	570.58	70805.	0.00000	19210.	0.039331
6.7200	0.80819	576.60	71070.	0.00000	19205.	0.039609
6.7600	0.81360	582.66	71333.	0.00000	19199.	0.039887
6.8000	0.81901	588.76	71598.	0.00000	19193.	0.040165
6.8400	0.82442	594.90	71865.	0.00000	19188.	0.040443
6.8800	0.82983	601.09	72136.	0.00000	19182.	0.040720
6.9200	0.83523	607.33	72409.	0.00000	19177.	0.040997
6.9600	0.84063	613.60	72685.	0.00000	19171.	0.041274
7.0000	0.84603	619.92	72964.	0.00000	19166.	0.041551
7.0400	0.85143	626.29	73245.	0.00000	19160.	0.041828
7.0800	0.85682	632.69	73529.	0.00000	19155.	0.042104
7.1200	0.86221	639.14	73816.	0.00000	19149.	0.042381
7.1600	0.86760	645.64	74105.	0.00000	19144.	0.042656
7.2000	0.87299	652.17	74397.	0.00000	19138.	0.042932
7.2400	0.87837	658.75	74692.	0.00000	19133.	0.043208
7.2800	0.88375	665.38	74989.	0.00000	19127.	0.043483
7.3200	0.88913	672.05	75289.	0.00000	19122.	0.043758
7.3600	0.89458	678.77	75587.	0.00000	19116.	0.044033
7.4000	0.90010	685.55	75879.	0.00000	19111.	0.044306
7.4400	0.90571	692.39	76168.	0.00000	19105.	0.044579
7.4800	0.91140	699.29	76452.	0.00000	19100.	0.044852
7.5200	0.91718	706.25	76732.	0.00000	19094.	0.045123
7.5600	0.92304	713.27	77007.	0.00000	19089.	0.045394
7.6000	0.92897	720.34	77278.	0.00000	19083.	0.045665
7.6400	0.93500	727.48	77544.	0.00000	19078.	0.045934
7.6800	0.94110	734.67	77806.	0.00000	19073.	0.046203
7.7200	0.94729	741.87	78061.	0.00000	19067.	0.046472
7.7600	0.95356	749.09	78308.	0.00000	19062.	0.046740
7.8000	0.95992	756.33	78549.	0.00000	19057.	0.047007
7.8400	0.96636	763.58	78782.	0.00000	19051.	0.047275
7.8800	0.97289	770.85	79008.	0.00000	19046.	0.047541
7.9200	0.97950	778.13	79228.	0.00000	19041.	0.047807
7.9600	0.98617	785.41	79440.	0.00000	19035.	0.048073

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
8.0000	0.99288	792.67	79644.	0.00000	19030.	0.048339
8.0400	0.99963	799.92	79842.	0.00000	19025.	0.048605
8.0800	1.0064	807.16	80032.	0.00000	19019.	0.048870
8.1200	1.0133	814.39	80215.	0.00000	19014.	0.049135
8.1600	1.0201	821.60	80390.	0.00000	19009.	0.049400
8.2000	1.0271	828.80	80559.	0.00000	19003.	0.049665
8.2400	1.0340	835.99	80720.	0.00000	18998.	0.049930
8.2800	1.0410	843.16	80873.	0.00000	18993.	0.050195
8.3200	1.0481	850.33	81020.	0.00000	18988.	0.050459
8.3600	1.0552	857.48	81159.	0.00000	18982.	0.050723
8.4000	1.0623	864.61	81291.	0.00000	18977.	0.050988
8.4400	1.0695	871.74	81416.	0.00000	18972.	0.051252
8.4800	1.0767	878.85	81533.	0.00000	18966.	0.051515
8.5200	1.0840	885.95	81643.	0.00000	18961.	0.051779
8.5600	1.0913	893.03	81746.	0.00000	18956.	0.052042
8.6000	1.0986	900.10	81847.	0.00000	18951.	0.052306
8.6400	1.1058	907.13	81948.	0.00000	18945.	0.052570
8.6800	1.1130	914.14	82048.	0.00000	18940.	0.052834
8.7200	1.1202	921.13	82148.	0.00000	18935.	0.053100
8.7600	1.1273	928.10	82247.	0.00000	18929.	0.053367
8.8000	1.1345	935.06	82344.	0.00000	18924.	0.053634
8.8400	1.1416	942.01	82441.	0.00000	18919.	0.053903
8.8800	1.1487	948.93	82537.	0.00000	18913.	0.054173
8.9200	1.1557	955.84	82632.	0.00000	18908.	0.054444
8.9600	1.1627	962.74	82727.	0.00000	18902.	0.054716
9.0000	1.1697	969.62	82820.	0.00000	18897.	0.054989
9.0400	1.1767	976.48	82912.	0.00000	18892.	0.055263
9.0800	1.1837	983.33	83004.	0.00000	18886.	0.055538
9.1200	1.1906	990.16	83094.	0.00000	18881.	0.055814
9.1600	1.1975	996.97	83184.	0.00000	18875.	0.056092
9.2000	1.2044	1003.8	83273.	0.00000	18869.	0.056370
9.2400	1.2113	1010.6	83361.	0.00000	18864.	0.056649
9.2800	1.2183	1017.5	83449.	0.00000	18858.	0.056928
9.3200	1.2252	1024.3	83535.	0.00000	18853.	0.057209
9.3600	1.2322	1031.2	83622.	0.00000	18847.	0.057491
9.4000	1.2391	1038.1	83713.	0.00000	18841.	0.057780
9.4400	1.2459	1045.0	83808.	0.00000	18835.	0.058077
9.4800	1.2527	1051.9	83908.	0.00000	18829.	0.058382
9.5200	1.2594	1058.9	84012.	0.00000	18823.	0.058694
9.5600	1.2661	1065.9	84120.	0.00000	18817.	0.059014
9.6000	1.2726	1072.9	84233.	0.00000	18810.	0.059341
9.6400	1.2791	1079.9	84350.	0.00000	18803.	0.059677
9.6800	1.2856	1086.9	84472.	0.00000	18796.	0.060019
9.7200	1.2919	1094.0	84598.	0.00000	18789.	0.060370
9.7600	1.2982	1101.1	84729.	0.00000	18782.	0.060728
9.8000	1.3045	1108.2	84864.	0.00000	18775.	0.061094
9.8400	1.3106	1115.3	85003.	0.00000	18767.	0.061467
9.8800	1.3167	1122.5	85147.	0.00000	18760.	0.061848
9.9200	1.3227	1129.7	85295.	0.00000	18752.	0.062236
9.9600	1.3287	1136.8	85449.	0.00000	18744.	0.062632

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
10.000	1.3345	1144.0	85607.	0.00000	18736.	0.063034
10.040	1.3403	1151.2	85771.	0.00000	18728.	0.063443
10.080	1.3460	1158.4	85940.	0.00000	18720.	0.063859
10.120	1.3516	1165.6	86114.	0.00000	18711.	0.064281
10.160	1.3571	1172.9	86293.	0.00000	18703.	0.064711
10.200	1.3626	1180.1	86477.	0.00000	18694.	0.065148
10.240	1.3679	1187.3	86666.	0.00000	18685.	0.065591
10.280	1.3732	1194.6	86861.	0.00000	18676.	0.066041
10.320	1.3784	1201.9	87060.	0.00000	18667.	0.066498
10.360	1.3835	1209.1	87265.	0.00000	18658.	0.066962
10.400	1.3887	1216.4	87464.	0.00000	18648.	0.067434
10.440	1.3939	1223.6	87658.	0.00000	18639.	0.067913
10.480	1.3992	1230.9	87845.	0.00000	18629.	0.068400
10.520	1.4045	1238.1	88027.	0.00000	18619.	0.068895
10.560	1.4099	1245.3	88203.	0.00000	18609.	0.069398
10.600	1.4154	1252.5	88373.	0.00000	18599.	0.069908
10.640	1.4210	1259.6	88532.	0.00000	18588.	0.070420
10.680	1.4267	1266.7	88681.	0.00000	18578.	0.070931
10.720	1.4326	1273.9	88818.	0.00000	18568.	0.071444
10.760	1.4387	1281.0	88944.	0.00000	18558.	0.071958
10.800	1.4448	1288.0	89060.	0.00000	18547.	0.072473
10.840	1.4512	1295.1	89164.	0.00000	18537.	0.072989
10.880	1.4576	1302.1	89258.	0.00000	18527.	0.073505
10.920	1.4643	1309.1	89339.	0.00000	18516.	0.074021
10.960	1.4711	1316.0	89405.	0.00000	18506.	0.074532
11.000	1.4783	1323.0	89455.	0.00000	18496.	0.075039
11.040	1.4856	1329.9	89489.	0.00000	18486.	0.075541
11.080	1.4932	1336.8	89507.	0.00000	18476.	0.076039
11.120	1.5011	1343.6	89510.	0.00000	18466.	0.076531
11.160	1.5091	1350.4	89497.	0.00000	18456.	0.077019
11.200	1.5175	1357.2	89468.	0.00000	18447.	0.077503
11.240	1.5260	1364.0	89423.	0.00000	18437.	0.077982
11.280	1.5348	1370.7	89362.	0.00000	18428.	0.078456
11.320	1.5438	1377.4	89286.	0.00000	18418.	0.078925
11.360	1.5529	1384.1	89206.	-2.9695e-06	18409.	0.079388
11.400	1.5620	1390.8	89124.	-8.9172e-06	18400.	0.079845
11.440	1.5711	1397.5	89038.	-1.7843e-05	18391.	0.080296
11.480	1.5802	1404.2	88949.	-2.9747e-05	18382.	0.080740
11.520	1.5894	1410.8	88857.	-4.4629e-05	18373.	0.081178
11.560	1.5985	1417.5	88762.	-6.2490e-05	18365.	0.081610
11.600	1.6077	1424.2	88664.	-8.3328e-05	18356.	0.082035
11.640	1.6168	1430.8	88573.	-0.00010714	18348.	0.082453
11.680	1.6257	1437.5	88490.	-0.00013394	18340.	0.082864
11.720	1.6346	1444.2	88415.	-0.00016371	18332.	0.083267
11.760	1.6433	1450.9	88348.	-0.00019646	18324.	0.083664
11.800	1.6519	1457.7	88288.	-0.00023219	18316.	0.084053
11.840	1.6603	1464.4	88236.	-0.00027090	18308.	0.084435
11.880	1.6687	1471.2	88192.	-0.00031259	18301.	0.084810
11.920	1.6769	1478.0	88156.	-0.00035725	18293.	0.085177
11.960	1.6850	1484.8	88127.	-0.00040489	18286.	0.085537

	Project Name: Hermosa	Location:	Project Number: TU201-00777/03
	Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
	Sample Number:	Test Date: 8/11/20	Depth:
	Test Number:	Preparation: Reconstituted	Elevation:
	Description:		
	Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
12.000	1.6930	1491.6	88106.	-0.00045551	18279.	0.085890
12.040	1.7008	1498.4	88093.	-0.00050911	18272.	0.086236
12.080	1.7085	1505.3	88088.	-0.00056569	18265.	0.086575
12.120	1.7161	1512.1	88091.	-0.00062524	18259.	0.086906
12.160	1.7236	1519.0	88102.	-0.00068778	18252.	0.087231
12.200	1.7308	1525.9	88126.	-0.00075329	18246.	0.087555
12.240	1.7379	1532.8	88162.	-0.00081942	18239.	0.087878
12.280	1.7449	1539.8	88204.	-0.00088032	18233.	0.088202
12.320	1.7517	1546.8	88254.	-0.00093600	18226.	0.088525
12.360	1.7585	1553.8	88311.	-0.00098644	18220.	0.088850
12.400	1.7651	1560.9	88375.	-0.0010317	18213.	0.089174
12.440	1.7717	1567.9	88446.	-0.0010716	18207.	0.089500
12.480	1.7781	1575.1	88525.	-0.0011064	18200.	0.089825
12.520	1.7845	1582.2	88610.	-0.0011359	18194.	0.090152
12.560	1.7908	1589.4	88703.	-0.0011602	18187.	0.090478
12.600	1.7971	1596.6	88790.	-0.0011763	18181.	0.090807
12.640	1.8036	1603.8	88872.	-0.0011842	18174.	0.091138
12.680	1.8102	1611.0	88948.	-0.0011839	18168.	0.091471
12.720	1.8170	1618.2	89019.	-0.0011753	18161.	0.091806
12.760	1.8238	1625.4	89083.	-0.0011604	18154.	0.092147
12.800	1.8309	1632.7	89137.	-0.0011426	18147.	0.092502
12.840	1.8383	1639.9	89182.	-0.0011217	18140.	0.092870
12.880	1.8458	1647.2	89216.	-0.0010979	18132.	0.093251
12.920	1.8536	1654.5	89242.	-0.0010711	18124.	0.093646
12.960	1.8615	1661.7	89257.	-0.0010414	18116.	0.094054
13.000	1.8697	1669.0	89263.	-0.0010086	18107.	0.094476
13.040	1.8781	1676.3	89259.	-0.00097287	18099.	0.094911
13.080	1.8867	1683.7	89246.	-0.00093416	18090.	0.095360
13.120	1.8956	1691.0	89223.	-0.00089248	18081.	0.095822
13.160	1.9046	1698.3	89190.	-0.00084781	18071.	0.096297
13.200	1.9138	1705.6	89149.	-0.00080017	18061.	0.096779
13.240	1.9231	1712.8	89099.	-0.00074955	18052.	0.097270
13.280	1.9325	1720.0	89041.	-0.00069595	18042.	0.097768
13.320	1.9421	1727.1	88974.	-0.00063938	18031.	0.098274
13.360	1.9518	1734.1	88899.	-0.00057982	18021.	0.098787
13.400	1.9616	1741.1	88815.	-0.00051729	18011.	0.099309
13.440	1.9715	1748.1	88723.	-0.00045178	18000.	0.099838
13.480	1.9816	1755.0	88624.	-0.00038564	17989.	0.10037
13.520	1.9916	1761.8	88522.	-0.00032474	17979.	0.10092
13.560	2.0017	1768.5	88417.	-0.00026907	17968.	0.10146
13.600	2.0117	1775.2	88309.	-0.00021863	17957.	0.10202
13.640	2.0218	1781.8	88198.	-0.00017341	17945.	0.10257
13.680	2.0318	1788.4	88084.	-0.00013343	17934.	0.10314
13.720	2.0418	1794.9	87974.	-9.8680e-05	17923.	0.10371
13.760	2.0516	1801.4	87869.	-6.9158e-05	17911.	0.10429
13.800	2.0613	1807.9	87767.	-4.4866e-05	17900.	0.10487
13.840	2.0709	1814.4	87671.	-2.5804e-05	17888.	0.10546
13.880	2.0804	1820.8	87578.	-1.1973e-05	17876.	0.10606
13.920	2.0897	1827.2	87489.	-3.3713e-06	17864.	0.10667
13.960	2.0989	1833.6	87405.	0.00000	17851.	0.10728

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
14.000	2.1080	1840.0	87327.	0.00000	17839.	0.10790
14.040	2.1168	1846.4	87257.	0.00000	17827.	0.10851
14.080	2.1255	1852.7	87196.	0.00000	17815.	0.10912
14.120	2.1339	1859.0	87142.	0.00000	17803.	0.10972
14.160	2.1421	1865.3	87098.	0.00000	17791.	0.11032
14.200	2.1500	1871.6	87062.	0.00000	17779.	0.11092
14.240	2.1578	1877.9	87034.	0.00000	17767.	0.11151
14.280	2.1653	1884.1	87014.	0.00000	17755.	0.11210
14.320	2.1726	1890.3	87004.	0.00000	17743.	0.11268
14.360	2.1797	1896.5	87001.	0.00000	17732.	0.11326
14.400	2.1865	1902.7	87007.	0.00000	17720.	0.11384
14.440	2.1933	1908.9	87020.	0.00000	17709.	0.11441
14.480	2.1999	1915.2	87041.	0.00000	17697.	0.11499
14.520	2.2063	1921.5	87068.	0.00000	17686.	0.11557
14.560	2.2127	1927.8	87103.	0.00000	17674.	0.11615
14.600	2.2189	1934.2	87145.	0.00000	17662.	0.11673
14.640	2.2251	1940.7	87192.	0.00000	17651.	0.11732
14.680	2.2312	1947.2	87243.	0.00000	17639.	0.11791
14.720	2.2373	1953.8	87298.	0.00000	17627.	0.11850
14.760	2.2434	1960.5	87357.	0.00000	17615.	0.11910
14.800	2.2495	1967.2	87420.	0.00000	17603.	0.11969
14.840	2.2555	1974.0	87487.	0.00000	17591.	0.12030
14.880	2.2615	1980.9	87559.	0.00000	17579.	0.12090
14.920	2.2675	1987.8	87634.	0.00000	17567.	0.12151
14.960	2.2736	1994.8	87707.	0.00000	17555.	0.12212
15.000	2.2798	2001.8	87776.	0.00000	17542.	0.12273
15.040	2.2860	2008.8	87842.	0.00000	17530.	0.12335
15.080	2.2924	2015.8	87905.	0.00000	17518.	0.12396
15.120	2.2989	2022.8	87965.	0.00000	17505.	0.12458
15.160	2.3055	2029.9	88021.	0.00000	17493.	0.12520
15.200	2.3122	2037.0	88075.	0.00000	17481.	0.12582
15.240	2.3189	2044.0	88122.	0.00000	17468.	0.12645
15.280	2.3258	2050.9	88161.	0.00000	17455.	0.12709
15.320	2.3327	2057.7	88193.	0.00000	17442.	0.12773
15.360	2.3398	2064.4	88218.	0.00000	17429.	0.12838
15.400	2.3469	2071.0	88236.	0.00000	17416.	0.12904
15.440	2.3541	2077.5	88246.	0.00000	17403.	0.12970
15.480	2.3613	2083.9	88250.	0.00000	17390.	0.13038
15.520	2.3687	2090.2	88246.	0.00000	17376.	0.13106
15.560	2.3761	2096.4	88235.	0.00000	17362.	0.13174
15.600	2.3837	2102.6	88217.	0.00000	17348.	0.13244
15.640	2.3913	2108.6	88191.	0.00000	17334.	0.13314
15.680	2.3990	2114.5	88159.	0.00000	17320.	0.13385
15.720	2.4068	2120.4	88119.	0.00000	17306.	0.13456
15.760	2.4146	2126.1	88072.	0.00000	17291.	0.13529
15.800	2.4226	2131.8	88018.	0.00000	17277.	0.13602
15.840	2.4307	2137.4	87958.	0.00000	17262.	0.13675
15.880	2.4388	2143.0	87894.	0.00000	17247.	0.13748
15.920	2.4470	2148.5	87828.	0.00000	17233.	0.13821
15.960	2.4553	2154.0	87758.	0.00000	17218.	0.13894

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
16.000	2.4636	2159.5	87686.	0.00000	17204.	0.13966
16.040	2.4720	2164.9	87610.	0.00000	17189.	0.14038
16.080	2.4805	2170.3	87532.	0.00000	17175.	0.14110
16.120	2.4890	2175.7	87451.	0.00000	17161.	0.14182
16.160	2.4975	2181.1	87367.	0.00000	17146.	0.14253
16.200	2.5061	2186.4	87280.	0.00000	17132.	0.14325
16.240	2.5148	2191.7	87190.	0.00000	17118.	0.14396
16.280	2.5235	2196.9	87097.	0.00000	17104.	0.14466
16.320	2.5323	2202.2	87002.	0.00000	17090.	0.14536
16.360	2.5412	2207.4	86905.	0.00000	17076.	0.14605
16.400	2.5500	2212.6	86808.	0.00000	17063.	0.14673
16.440	2.5590	2217.8	86709.	0.00000	17049.	0.14739
16.480	2.5680	2223.2	86613.	0.00000	17036.	0.14803
16.520	2.5770	2228.6	86519.	0.00000	17024.	0.14866
16.560	2.5861	2234.2	86429.	0.00000	17012.	0.14927
16.600	2.5953	2239.9	86341.	0.00000	17000.	0.14986
16.640	2.6045	2245.7	86256.	0.00000	16989.	0.15043
16.680	2.6138	2251.6	86174.	0.00000	16978.	0.15098
16.720	2.6232	2257.6	86095.	0.00000	16967.	0.15151
16.760	2.6326	2263.8	86019.	0.00000	16957.	0.15203
16.800	2.6421	2270.0	85945.	0.00000	16947.	0.15253
16.840	2.6516	2276.4	85875.	0.00000	16937.	0.15301
16.880	2.6611	2282.8	85808.	0.00000	16927.	0.15350
16.920	2.6705	2289.2	85745.	0.00000	16917.	0.15399
16.960	2.6799	2295.7	85685.	0.00000	16908.	0.15447
17.000	2.6893	2302.3	85629.	0.00000	16898.	0.15495
17.040	2.6987	2308.9	85576.	0.00000	16889.	0.15543
17.080	2.7080	2315.5	85526.	0.00000	16879.	0.15591
17.120	2.7172	2322.1	85478.	0.00000	16869.	0.15640
17.160	2.7263	2328.7	85432.	0.00000	16859.	0.15689
17.200	2.7353	2335.2	85389.	0.00000	16849.	0.15739
17.240	2.7442	2341.8	85348.	0.00000	16839.	0.15790
17.280	2.7530	2348.2	85310.	0.00000	16829.	0.15841
17.320	2.7617	2354.7	85273.	0.00000	16819.	0.15893
17.360	2.7703	2361.1	85240.	0.00000	16808.	0.15945
17.400	2.7788	2367.5	85208.	0.00000	16798.	0.15998
17.440	2.7872	2373.9	85179.	0.00000	16787.	0.16051
17.480	2.7956	2380.3	85152.	0.00000	16776.	0.16105
17.520	2.8038	2386.5	85126.	0.00000	16766.	0.16157
17.560	2.8119	2392.8	85101.	0.00000	16755.	0.16209
17.600	2.8200	2398.9	85075.	0.00000	16745.	0.16260
17.640	2.8280	2405.0	85049.	0.00000	16735.	0.16311
17.680	2.8359	2411.0	85023.	0.00000	16725.	0.16362
17.720	2.8438	2416.9	84996.	0.00000	16715.	0.16413
17.760	2.8516	2422.7	84969.	0.00000	16704.	0.16464
17.800	2.8593	2428.5	84941.	0.00000	16694.	0.16514
17.840	2.8669	2434.1	84913.	0.00000	16684.	0.16565
17.880	2.8744	2439.7	84885.	0.00000	16674.	0.16615
17.920	2.8819	2445.2	84856.	0.00000	16664.	0.16665
17.960	2.8893	2450.7	84826.	0.00000	16654.	0.16715

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
18.000	2.8967	2456.0	84797.	0.00000	16644.	0.16765
18.040	2.9039	2461.3	84767.	0.00000	16634.	0.16814
18.080	2.9111	2466.5	84736.	0.00000	16625.	0.16862
18.120	2.9184	2471.7	84704.	0.00000	16615.	0.16909
18.160	2.9256	2476.8	84671.	-1.6187e-06	16606.	0.16954
18.200	2.9328	2481.9	84638.	-6.0815e-06	16597.	0.16999
18.240	2.9399	2487.0	84605.	-1.3388e-05	16589.	0.17043
18.280	2.9469	2491.9	84571.	-2.3539e-05	16580.	0.17086
18.320	2.9539	2496.8	84537.	-3.6534e-05	16571.	0.17129
18.360	2.9608	2501.7	84503.	-5.2373e-05	16563.	0.17171
18.400	2.9677	2506.4	84468.	-7.1056e-05	16555.	0.17213
18.440	2.9745	2511.1	84433.	-9.2582e-05	16547.	0.17253
18.480	2.9813	2515.8	84398.	-0.00011695	16538.	0.17294
18.520	2.9880	2520.4	84363.	-0.00014417	16531.	0.17333
18.560	2.9946	2524.9	84327.	-0.00017423	16523.	0.17372
18.600	3.0012	2529.3	84291.	-0.00020713	16515.	0.17410
18.640	3.0077	2533.7	84254.	-0.00024288	16508.	0.17448
18.680	3.0141	2538.1	84217.	-0.00028147	16500.	0.17485
18.720	3.0205	2542.3	84181.	-0.00032290	16493.	0.17521
18.760	3.0268	2546.6	84144.	-0.00036718	16485.	0.17559
18.800	3.0331	2550.8	84109.	-0.00041431	16478.	0.17598
18.840	3.0393	2554.9	84074.	-0.00046427	16470.	0.17638
18.880	3.0454	2559.0	84040.	-0.00051708	16461.	0.17680
18.920	3.0514	2563.1	84007.	-0.00057274	16453.	0.17722
18.960	3.0574	2567.1	83975.	-0.00063124	16444.	0.17766
19.000	3.0632	2571.1	83943.	-0.00069258	16435.	0.17810
19.040	3.0691	2575.1	83912.	-0.00075677	16426.	0.17856
19.080	3.0748	2579.0	83882.	-0.00082380	16417.	0.17903
19.120	3.0806	2582.9	83851.	-0.00088709	16407.	0.17952
19.160	3.0864	2586.8	83820.	-0.00094487	16397.	0.18003
19.200	3.0923	2590.7	83787.	-0.00099714	16386.	0.18056
19.240	3.0983	2594.7	83754.	-0.0010439	16375.	0.18111
19.280	3.1043	2598.7	83719.	-0.0010851	16364.	0.18168
19.320	3.1104	2602.7	83684.	-0.0011209	16352.	0.18227
19.360	3.1166	2606.7	83648.	-0.0011511	16340.	0.18288
19.400	3.1229	2610.7	83610.	-0.0011742	16327.	0.18350
19.440	3.1293	2614.9	83571.	-0.0011889	16315.	0.18413
19.480	3.1358	2619.0	83531.	-0.0011953	16302.	0.18477
19.520	3.1425	2623.2	83488.	-0.0011933	16289.	0.18542
19.560	3.1493	2627.5	83444.	-0.0011829	16276.	0.18607
19.600	3.1564	2631.9	83397.	-0.0011671	16263.	0.18673
19.640	3.1637	2636.3	83344.	-0.0011484	16250.	0.18739
19.680	3.1714	2640.8	83285.	-0.0011269	16236.	0.18804
19.720	3.1794	2645.4	83222.	-0.0011025	16223.	0.18869
19.760	3.1878	2650.1	83153.	-0.0010753	16211.	0.18934
19.800	3.1964	2654.9	83079.	-0.0010452	16198.	0.18998
19.840	3.2054	2659.7	82999.	-0.0010123	16185.	0.19062
19.880	3.2147	2664.6	82914.	-0.00097659	16172.	0.19126
19.920	3.2242	2669.6	82827.	-0.00093800	16159.	0.19189
19.960	3.2337	2674.7	82741.	-0.00089656	16147.	0.19251

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
20.000	3.2434	2679.9	82656.	-0.00085228	16135.	0.19312
20.040	3.2532	2685.2	82571.	-0.00080516	16123.	0.19372
20.080	3.2631	2690.6	82487.	-0.00075519	16111.	0.19431
20.120	3.2731	2696.1	82403.	-0.00070238	16100.	0.19488
20.160	3.2832	2701.6	82320.	-0.00064672	16088.	0.19545
20.200	3.2934	2707.3	82238.	-0.00058823	16077.	0.19600
20.240	3.3037	2713.1	82156.	-0.00052688	16066.	0.19654
20.280	3.3141	2719.0	82075.	-0.00046269	16056.	0.19707
20.320	3.3246	2724.9	81994.	-0.00039566	16045.	0.19760
20.360	3.3351	2731.0	81916.	-0.00033237	16035.	0.19810
20.400	3.3456	2737.0	81839.	-0.00027459	16026.	0.19858
20.440	3.3560	2743.1	81765.	-0.00022233	16016.	0.19904
20.480	3.3664	2749.2	81693.	-0.00017557	16008.	0.19949
20.520	3.3768	2755.4	81622.	-0.00013433	15999.	0.19992
20.560	3.3871	2761.4	81550.	-9.8606e-05	15990.	0.20036
20.600	3.3973	2767.3	81478.	-6.8390e-05	15981.	0.20080
20.640	3.4074	2773.1	81406.	-4.3687e-05	15972.	0.20125
20.680	3.4174	2778.8	81332.	-2.4496e-05	15963.	0.20169
20.720	3.4273	2784.4	81258.	-1.0818e-05	15954.	0.20215
20.760	3.4372	2789.8	81184.	-2.6529e-06	15945.	0.20260
20.800	3.4469	2795.2	81109.	0.00000	15936.	0.20306
20.840	3.4565	2800.5	81035.	0.00000	15927.	0.20353
20.880	3.4658	2805.6	80964.	0.00000	15917.	0.20402
20.920	3.4749	2810.6	80897.	0.00000	15907.	0.20452
20.960	3.4836	2815.4	80832.	0.00000	15897.	0.20503
21.000	3.4922	2820.2	80770.	0.00000	15886.	0.20556
21.040	3.5004	2824.8	80712.	0.00000	15875.	0.20611
21.080	3.5084	2829.3	80657.	0.00000	15864.	0.20666
21.120	3.5161	2833.6	80605.	0.00000	15853.	0.20724
21.160	3.5236	2837.8	80552.	0.00000	15841.	0.20783
21.200	3.5312	2841.9	80495.	0.00000	15828.	0.20844
21.240	3.5389	2845.9	80435.	0.00000	15816.	0.20906
21.280	3.5467	2849.9	80370.	0.00000	15804.	0.20968
21.320	3.5545	2853.7	80301.	0.00000	15791.	0.21031
21.360	3.5625	2857.4	80228.	0.00000	15778.	0.21095
21.400	3.5706	2861.1	80150.	0.00000	15766.	0.21159
21.440	3.5788	2864.7	80069.	0.00000	15753.	0.21223
21.480	3.5870	2868.2	79983.	0.00000	15740.	0.21288
21.520	3.5954	2871.6	79892.	0.00000	15727.	0.21354
21.560	3.6039	2874.9	79798.	0.00000	15713.	0.21420
21.600	3.6125	2878.2	79699.	0.00000	15700.	0.21487
21.640	3.6210	2881.3	79599.	0.00000	15686.	0.21554
21.680	3.6295	2884.4	79499.	0.00000	15673.	0.21622
21.720	3.6380	2887.4	79397.	0.00000	15659.	0.21690
21.760	3.6465	2890.5	79295.	0.00000	15646.	0.21758
21.800	3.6550	2893.5	79195.	0.00000	15633.	0.21823
21.840	3.6636	2896.7	79096.	0.00000	15620.	0.21887
21.880	3.6721	2899.9	79000.	0.00000	15608.	0.21949
21.920	3.6807	2903.2	78905.	0.00000	15596.	0.22008
21.960	3.6893	2906.6	78812.	0.00000	15584.	0.22066

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
22.000	3.6980	2910.1	78721.	0.00000	15573.	0.22122
22.040	3.7066	2913.6	78632.	0.00000	15562.	0.22176
22.080	3.7153	2917.2	78544.	0.00000	15552.	0.22228
22.120	3.7240	2920.9	78458.	0.00000	15542.	0.22278
22.160	3.7328	2924.7	78375.	0.00000	15532.	0.22326
22.200	3.7415	2928.5	78292.	0.00000	15523.	0.22372
22.240	3.7503	2932.4	78212.	0.00000	15514.	0.22416
22.280	3.7592	2936.4	78132.	3.4530e-06	15506.	0.22459
22.320	3.7681	2940.4	78052.	1.2095e-05	15497.	0.22500
22.360	3.7771	2944.4	77972.	2.5926e-05	15489.	0.22540
22.400	3.7862	2948.5	77892.	4.4947e-05	15482.	0.22579
22.440	3.7953	2952.5	77813.	6.9157e-05	15474.	0.22617
22.480	3.8043	2956.6	77735.	9.8555e-05	15466.	0.22656
22.520	3.8132	2960.6	77658.	0.00013314	15458.	0.22695
22.560	3.8221	2964.7	77582.	0.00017292	15450.	0.22735
22.600	3.8309	2968.6	77508.	0.00021789	15442.	0.22775
22.640	3.8396	2972.6	77435.	0.00026804	15434.	0.22815
22.680	3.8482	2976.6	77364.	0.00032339	15426.	0.22856
22.720	3.8568	2980.5	77294.	0.00038392	15418.	0.22898
22.760	3.8653	2984.4	77225.	0.00044964	15409.	0.22940
22.800	3.8737	2988.3	77158.	0.00051411	15401.	0.22982
22.840	3.8820	2992.1	77092.	0.00057356	15392.	0.23026
22.880	3.8904	2995.9	77024.	0.00062800	15383.	0.23070
22.920	3.8988	2999.7	76955.	0.00067742	15374.	0.23116
22.960	3.9073	3003.4	76884.	0.00072182	15365.	0.23163
23.000	3.9158	3007.0	76812.	0.00076122	15355.	0.23210
23.040	3.9243	3010.7	76738.	0.00079559	15346.	0.23259
23.080	3.9329	3014.3	76662.	0.00082495	15336.	0.23309
23.120	3.9415	3017.8	76585.	0.00084929	15325.	0.23361
23.160	3.9502	3021.3	76506.	0.00086862	15315.	0.23413
23.200	3.9589	3024.7	76425.	0.00088294	15304.	0.23466
23.240	3.9676	3028.1	76343.	0.00089224	15293.	0.23521
23.280	3.9764	3031.5	76259.	0.00089652	15282.	0.23576
23.320	3.9852	3034.8	76173.	0.00089652	15271.	0.23633
23.360	3.9941	3038.1	76087.	0.00089652	15259.	0.23690
23.400	4.0030	3041.4	75999.	0.00089652	15248.	0.23748
23.440	4.0120	3044.6	75910.	0.00089652	15236.	0.23806
23.480	4.0209	3047.8	75820.	0.00089652	15225.	0.23864
23.520	4.0299	3051.0	75730.	0.00089307	15213.	0.23923
23.560	4.0389	3054.1	75641.	0.00088443	15201.	0.23981
23.600	4.0478	3057.3	75552.	0.00087060	15189.	0.24040
23.640	4.0567	3060.5	75465.	0.00085157	15178.	0.24098
23.680	4.0656	3063.7	75378.	0.00082737	15166.	0.24156
23.720	4.0745	3066.9	75291.	0.00079797	15155.	0.24214
23.760	4.0834	3070.1	75206.	0.00076338	15143.	0.24272
23.800	4.0923	3073.3	75121.	0.00072360	15132.	0.24329
23.840	4.1011	3076.5	75037.	0.00067863	15120.	0.24387
23.880	4.1100	3079.7	74953.	0.00062848	15109.	0.24444
23.920	4.1187	3083.0	74871.	0.00057313	15097.	0.24501
23.960	4.1275	3086.2	74790.	0.00051260	15086.	0.24559

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
24.000	4.1362	3089.4	74711.	0.00044688	15074.	0.24615
24.040	4.1449	3092.7	74633.	0.00038241	15063.	0.24672
24.080	4.1536	3096.0	74556.	0.00032296	15052.	0.24728
24.120	4.1622	3099.3	74480.	0.00026852	15041.	0.24783
24.160	4.1708	3102.6	74405.	0.00021910	15030.	0.24838
24.200	4.1794	3105.9	74332.	0.00017470	15019.	0.24892
24.240	4.1879	3109.2	74259.	0.00013531	15008.	0.24946
24.280	4.1965	3112.6	74188.	0.00010093	14998.	0.24999
24.320	4.2049	3115.9	74118.	7.1571e-05	14987.	0.25051
24.360	4.2134	3119.3	74049.	4.7227e-05	14977.	0.25103
24.400	4.2218	3122.7	73981.	2.7897e-05	14967.	0.25154
24.440	4.2303	3126.2	73915.	1.3583e-05	14957.	0.25205
24.480	4.2386	3129.6	73849.	4.2838e-06	14946.	0.25255
24.520	4.2470	3133.0	73785.	2.1268e-06	14937.	0.25304
24.560	4.2553	3136.5	73721.	9.0736e-06	14927.	0.25352
24.600	4.2637	3139.9	73658.	2.0840e-05	14918.	0.25400
24.640	4.2720	3143.3	73594.	3.7427e-05	14908.	0.25447
24.680	4.2803	3146.8	73532.	5.8834e-05	14899.	0.25493
24.720	4.2885	3150.2	73469.	8.5061e-05	14890.	0.25539
24.760	4.2968	3153.6	73407.	0.00011611	14881.	0.25584
24.800	4.3050	3156.9	73345.	0.00015197	14872.	0.25628
24.840	4.3133	3160.3	73283.	0.00019266	14863.	0.25672
24.880	4.3215	3163.7	73222.	0.00023817	14854.	0.25716
24.920	4.3297	3167.1	73160.	0.00028849	14846.	0.25759
24.960	4.3379	3170.4	73099.	0.00034364	14837.	0.25801
25.000	4.3461	3173.8	73039.	0.00040361	14829.	0.25842
25.040	4.3542	3177.1	72979.	0.00046839	14821.	0.25883
25.080	4.3625	3180.5	72918.	0.00052939	14813.	0.25924
25.120	4.3709	3183.9	72855.	0.00057415	14805.	0.25963
25.160	4.3795	3187.3	72791.	0.00060268	14797.	0.26002
25.200	4.3883	3190.7	72724.	0.00061498	14790.	0.26039
25.240	4.3973	3194.2	72655.	0.00061105	14782.	0.26076
25.280	4.4066	3197.8	72584.	0.00059088	14775.	0.26112
25.320	4.4160	3201.4	72510.	0.00055449	14768.	0.26147
25.360	4.4256	3205.0	72435.	0.00050186	14761.	0.26181
25.400	4.4355	3208.6	72357.	0.00043469	14755.	0.26215
25.440	4.4454	3212.2	72277.	0.00037371	14748.	0.26248
25.480	4.4555	3215.8	72196.	0.00031892	14741.	0.26280
25.520	4.4656	3219.4	72113.	0.00027033	14735.	0.26313
25.560	4.4759	3223.0	72028.	0.00022792	14729.	0.26345
25.600	4.4863	3226.5	71942.	0.00019170	14722.	0.26376
25.640	4.4967	3230.1	71854.	0.00016167	14716.	0.26407
25.680	4.5073	3233.6	71764.	0.00013783	14710.	0.26438
25.720	4.5180	3237.1	71673.	0.00012018	14704.	0.26469
25.760	4.5288	3240.6	71580.	0.00010659	14698.	0.26499
25.800	4.5397	3244.1	71485.	9.4369e-05	14692.	0.26530
25.840	4.5507	3247.6	71391.	8.2602e-05	14685.	0.26561
25.880	4.5617	3251.3	71299.	6.6016e-05	14679.	0.26592
25.920	4.5726	3255.1	71212.	4.4609e-05	14673.	0.26623
25.960	4.5835	3259.0	71128.	1.8382e-05	14667.	0.26655

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
26.000	4.5944	3263.1	71048.	-1.2665e-05	14660.	0.26686
26.040	4.6053	3267.4	70971.	-4.8531e-05	14654.	0.26718
26.080	4.6161	3271.8	70898.	-8.9218e-05	14647.	0.26750
26.120	4.6270	3276.3	70829.	-0.00013472	14641.	0.26783
26.160	4.6378	3281.0	70763.	-0.00018505	14634.	0.26816
26.200	4.6486	3285.8	70701.	-0.00024020	14628.	0.26848
26.240	4.6593	3290.8	70643.	-0.00030016	14621.	0.26881
26.280	4.6701	3295.9	70588.	-0.00036495	14615.	0.26915
26.320	4.6807	3301.2	70538.	-0.00042594	14608.	0.26948
26.360	4.6911	3306.5	70493.	-0.00047071	14601.	0.26982
26.400	4.7013	3311.9	70454.	-0.00049924	14594.	0.27017
26.440	4.7113	3317.5	70420.	-0.00051154	14587.	0.27052
26.480	4.7211	3323.1	70392.	-0.00050760	14580.	0.27087
26.520	4.7306	3328.8	70370.	-0.00048744	14573.	0.27123
26.560	4.7400	3334.6	70351.	-0.00045104	14566.	0.27160
26.600	4.7492	3340.1	70330.	-0.00039842	14558.	0.27198
26.640	4.7582	3345.3	70307.	-0.00033125	14550.	0.27236
26.680	4.7672	3350.4	70280.	-0.00027027	14542.	0.27275
26.720	4.7761	3355.2	70251.	-0.00021548	14535.	0.27315
26.760	4.7849	3359.9	70218.	-0.00016688	14527.	0.27355
26.800	4.7937	3364.3	70182.	-0.00012447	14518.	0.27396
26.840	4.8025	3368.6	70144.	-8.8254e-05	14510.	0.27437
26.880	4.8111	3372.6	70102.	-5.8224e-05	14502.	0.27478
26.920	4.8198	3376.4	70057.	-3.4383e-05	14493.	0.27521
26.960	4.8283	3380.1	70009.	-1.6733e-05	14485.	0.27563
27.000	4.8369	3383.6	69960.	-5.2715e-06	14476.	0.27606
27.040	4.8456	3387.5	69915.	0.00000	14468.	0.27649
27.080	4.8545	3391.6	69874.	0.00000	14459.	0.27691
27.120	4.8636	3395.9	69831.	0.00000	14451.	0.27733
27.160	4.8731	3400.2	69787.	0.00000	14443.	0.27774
27.200	4.8828	3404.8	69742.	0.00000	14435.	0.27815
27.240	4.8927	3409.4	69696.	0.00000	14426.	0.27856
27.280	4.9030	3414.2	69648.	0.00000	14418.	0.27897
27.320	4.9134	3419.0	69599.	0.00000	14410.	0.27937
27.360	4.9237	3423.5	69547.	0.00000	14402.	0.27977
27.400	4.9340	3427.9	69491.	0.00000	14394.	0.28018
27.440	4.9442	3432.0	69431.	0.00000	14386.	0.28059
27.480	4.9544	3435.8	69368.	0.00000	14378.	0.28100
27.520	4.9644	3439.5	69301.	0.00000	14369.	0.28141
27.560	4.9745	3442.9	69230.	0.00000	14361.	0.28182
27.600	4.9844	3446.1	69156.	0.00000	14353.	0.28223
27.640	4.9943	3449.0	69078.	0.00000	14345.	0.28265
27.680	5.0041	3451.7	68997.	0.00000	14336.	0.28306
27.720	5.0138	3454.2	68912.	0.00000	14328.	0.28348
27.760	5.0235	3456.5	68824.	0.00000	14320.	0.28390
27.800	5.0331	3458.6	68734.	0.00000	14311.	0.28432
27.840	5.0425	3460.8	68647.	0.00000	14303.	0.28473
27.880	5.0519	3463.1	68566.	0.00000	14295.	0.28515
27.920	5.0611	3465.6	68488.	0.00000	14287.	0.28555
27.960	5.0701	3468.2	68416.	0.00000	14278.	0.28596

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
28.000	5.0791	3470.9	68347.	0.00000	14270.	0.28636
28.040	5.0879	3473.7	68283.	0.00000	14263.	0.28675
28.080	5.0966	3476.6	68224.	0.00000	14255.	0.28715
28.120	5.1051	3479.7	68169.	0.00000	14247.	0.28753
28.160	5.1136	3482.9	68119.	0.00000	14239.	0.28792
28.200	5.1221	3486.3	68073.	0.00000	14232.	0.28830
28.240	5.1307	3489.9	68029.	0.00000	14224.	0.28868
28.280	5.1390	3493.2	67983.	0.00000	14216.	0.28906
28.320	5.1472	3496.3	67935.	0.00000	14209.	0.28945
28.360	5.1553	3499.1	67884.	0.00000	14201.	0.28984
28.400	5.1632	3501.8	67831.	0.00000	14193.	0.29023
28.440	5.1710	3504.1	67776.	0.00000	14185.	0.29063
28.480	5.1786	3506.3	67718.	0.00000	14177.	0.29104
28.520	5.1860	3508.2	67658.	0.00000	14169.	0.29145
28.560	5.1934	3510.0	67596.	0.00000	14160.	0.29186
28.600	5.2010	3511.8	67534.	0.00000	14152.	0.29227
28.640	5.2086	3513.7	67471.	0.00000	14144.	0.29268
28.680	5.2163	3515.6	67408.	0.00000	14136.	0.29308
28.720	5.2242	3517.6	67345.	0.00000	14128.	0.29348
28.760	5.2321	3519.6	67281.	0.00000	14120.	0.29387
28.800	5.2402	3521.6	67216.	0.00000	14112.	0.29426
28.840	5.2484	3523.7	67152.	0.00000	14105.	0.29465
28.880	5.2566	3525.8	67086.	0.00000	14097.	0.29504
28.920	5.2650	3527.9	67021.	0.00000	14089.	0.29542
28.960	5.2734	3530.1	66954.	0.00000	14082.	0.29579
29.000	5.2820	3532.3	66888.	0.00000	14074.	0.29617
29.040	5.2907	3534.6	66821.	0.00000	14067.	0.29654
29.080	5.2995	3536.9	66753.	0.00000	14060.	0.29690
29.120	5.3083	3539.2	66685.	0.00000	14052.	0.29726
29.160	5.3173	3541.6	66618.	0.00000	14045.	0.29762
29.200	5.3263	3544.1	66552.	0.00000	14038.	0.29798
29.240	5.3354	3546.7	66488.	0.00000	14031.	0.29834
29.280	5.3446	3549.5	66425.	0.00000	14024.	0.29869
29.320	5.3538	3552.4	66365.	0.00000	14017.	0.29905
29.360	5.3630	3555.4	66306.	0.00000	14010.	0.29940
29.400	5.3723	3558.5	66249.	0.00000	14003.	0.29975
29.440	5.3814	3561.6	66194.	0.00000	13996.	0.30010
29.480	5.3904	3564.6	66140.	0.00000	13989.	0.30045
29.520	5.3993	3567.7	66088.	0.00000	13982.	0.30080
29.560	5.4081	3570.8	66037.	0.00000	13975.	0.30114
29.600	5.4167	3573.9	65988.	0.00000	13968.	0.30149
29.640	5.4252	3577.0	65941.	0.00000	13961.	0.30183
29.680	5.4336	3580.0	65896.	0.00000	13954.	0.30218
29.720	5.4418	3583.1	65852.	0.00000	13947.	0.30252
29.760	5.4499	3586.2	65809.	0.00000	13940.	0.30286
29.800	5.4579	3589.2	65769.	0.00000	13934.	0.30320
29.840	5.4659	3592.3	65729.	0.00000	13927.	0.30354
29.880	5.4739	3595.4	65689.	0.00000	13920.	0.30388
29.920	5.4820	3598.6	65649.	0.00000	13913.	0.30423
29.960	5.4902	3601.7	65608.	0.00000	13906.	0.30458

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
30.000	5.4985	3604.9	65567.	0.00000	13899.	0.30494
30.040	5.5068	3608.1	65526.	0.00000	13892.	0.30530
30.080	5.5152	3611.3	65484.	0.00000	13884.	0.30566
30.120	5.5237	3614.5	65442.	0.00000	13877.	0.30602
30.160	5.5322	3617.7	65399.	0.00000	13870.	0.30639
30.200	5.5408	3621.0	65356.	0.00000	13862.	0.30677
30.240	5.5495	3624.2	65313.	0.00000	13855.	0.30714
30.280	5.5585	3627.7	65269.	0.00000	13847.	0.30751
30.320	5.5679	3631.3	65226.	0.00000	13840.	0.30789
30.360	5.5775	3635.1	65181.	0.00000	13833.	0.30825
30.400	5.5876	3639.1	65136.	0.00000	13825.	0.30862
30.440	5.5980	3643.2	65089.	0.00000	13818.	0.30897
30.480	5.6088	3647.3	65039.	0.00000	13811.	0.30933
30.520	5.6199	3651.5	64986.	-2.2635e-06	13804.	0.30968
30.560	5.6310	3655.6	64931.	-9.9323e-06	13797.	0.31003
30.600	5.6422	3659.6	64875.	-2.3007e-05	13790.	0.31038
30.640	5.6535	3663.6	64815.	-4.1486e-05	13783.	0.31074
30.680	5.6649	3667.4	64754.	-6.5371e-05	13776.	0.31110
30.720	5.6763	3671.2	64691.	-9.4661e-05	13768.	0.31147
30.760	5.6878	3674.8	64625.	-0.00012936	13761.	0.31184
30.800	5.6994	3678.4	64557.	-0.00016946	13754.	0.31221
30.840	5.7110	3681.9	64487.	-0.00021496	13746.	0.31258
30.880	5.7227	3685.3	64415.	-0.00026588	13739.	0.31296
30.920	5.7345	3688.6	64340.	-0.00032219	13731.	0.31333
30.960	5.7464	3691.8	64263.	-0.00038392	13723.	0.31371
31.000	5.7583	3694.9	64184.	-0.00045104	13716.	0.31410
31.040	5.7703	3698.0	64104.	-0.00051427	13708.	0.31448
31.080	5.7823	3701.0	64023.	-0.00057262	13700.	0.31486
31.120	5.7942	3704.0	63943.	-0.00062611	13693.	0.31524
31.160	5.8061	3707.0	63863.	-0.00067474	13685.	0.31561
31.200	5.8178	3710.0	63785.	-0.00071850	13678.	0.31598
31.240	5.8295	3712.9	63708.	-0.00075739	13671.	0.31635
31.280	5.8411	3715.9	63632.	-0.00079141	13663.	0.31671
31.320	5.8526	3718.9	63557.	-0.00082057	13656.	0.31708
31.360	5.8641	3721.8	63483.	-0.00084486	13649.	0.31743
31.400	5.8754	3724.8	63410.	-0.00086428	13642.	0.31779
31.440	5.8867	3727.7	63338.	-0.00087884	13635.	0.31814
31.480	5.8980	3730.7	63267.	-0.00088853	13628.	0.31849
31.520	5.9089	3733.5	63196.	-0.00089336	13621.	0.31884
31.560	5.9194	3736.1	63127.	-0.00089336	13614.	0.31919
31.600	5.9299	3738.6	63058.	-0.00089336	13607.	0.31956
31.640	5.9402	3740.9	62988.	-0.00089336	13599.	0.31993
31.680	5.9503	3743.1	62918.	-0.00089336	13591.	0.32032
31.720	5.9603	3745.2	62847.	-0.00089336	13583.	0.32072
31.760	5.9703	3747.3	62776.	-0.00089109	13575.	0.32113
31.800	5.9804	3749.3	62705.	-0.00088342	13567.	0.32154
31.840	5.9908	3751.5	62633.	-0.00087035	13559.	0.32195
31.880	6.0013	3753.7	62561.	-0.00085187	13550.	0.32237
31.920	6.0117	3756.0	62490.	-0.00082798	13542.	0.32278
31.960	6.0222	3758.4	62421.	-0.00079869	13534.	0.32320

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
32.000	6.0326	3760.8	62353.	-0.00076400	13526.	0.32360
32.040	6.0431	3763.4	62288.	-0.00072390	13518.	0.32401
32.080	6.0535	3766.0	62224.	-0.00067839	13509.	0.32441
32.120	6.0638	3768.7	62162.	-0.00062748	13501.	0.32481
32.160	6.0742	3771.5	62102.	-0.00057116	13494.	0.32521
32.200	6.0845	3774.4	62043.	-0.00050944	13486.	0.32560
32.240	6.0948	3777.3	61987.	-0.00044231	13478.	0.32599
32.280	6.1052	3780.3	61931.	-0.00037909	13470.	0.32638
32.320	6.1155	3783.4	61877.	-0.00032073	13462.	0.32678
32.360	6.1258	3786.6	61824.	-0.00026724	13454.	0.32717
32.400	6.1362	3789.8	61772.	-0.00021862	13446.	0.32757
32.440	6.1465	3793.1	61721.	-0.00017486	13438.	0.32797
32.480	6.1569	3796.4	61670.	-0.00013597	13430.	0.32838
32.520	6.1674	3799.7	61619.	-0.00010194	13422.	0.32878
32.560	6.1779	3803.0	61567.	-7.2787e-05	13414.	0.32919
32.600	6.1885	3806.3	61515.	-4.8496e-05	13406.	0.32961
32.640	6.1991	3809.6	61463.	-2.9072e-05	13397.	0.33002
32.680	6.2097	3812.9	61410.	-1.4515e-05	13389.	0.33044
32.720	6.2205	3816.2	61358.	-4.8241e-06	13380.	0.33087
32.760	6.2312	3819.6	61305.	0.00000	13372.	0.33130
32.800	6.2420	3822.9	61251.	0.00000	13363.	0.33173
32.840	6.2527	3826.2	61199.	0.00000	13355.	0.33215
32.880	6.2632	3829.4	61148.	0.00000	13346.	0.33257
32.920	6.2736	3832.6	61097.	1.2852e-06	13338.	0.33299
32.960	6.2838	3835.7	61048.	7.6350e-06	13329.	0.33342
33.000	6.2938	3838.8	61000.	1.9049e-05	13321.	0.33386
33.040	6.3036	3841.8	60952.	3.5529e-05	13312.	0.33431
33.080	6.3133	3844.7	60906.	5.7073e-05	13303.	0.33476
33.120	6.3228	3847.6	60861.	8.3681e-05	13293.	0.33522
33.160	6.3323	3850.5	60815.	0.00011535	13284.	0.33570
33.200	6.3417	3853.2	60768.	0.00015209	13274.	0.33619
33.240	6.3512	3855.9	60719.	0.00019389	13264.	0.33670
33.280	6.3608	3858.5	60669.	0.00024076	13253.	0.33722
33.320	6.3703	3861.0	60618.	0.00029269	13243.	0.33775
33.360	6.3798	3863.4	60566.	0.00034969	13232.	0.33830
33.400	6.3894	3865.7	60512.	0.00041175	13220.	0.33887
33.440	6.3989	3868.0	60457.	0.00047888	13209.	0.33944
33.480	6.4084	3870.2	60402.	0.00054651	13197.	0.34002
33.520	6.4178	3872.4	60347.	0.00061415	13186.	0.34059
33.560	6.4271	3874.5	60292.	0.00068178	13175.	0.34115
33.600	6.4364	3876.5	60237.	0.00074942	13164.	0.34171
33.640	6.4455	3878.5	60183.	0.00081705	13152.	0.34227
33.680	6.4546	3880.4	60128.	0.00088468	13142.	0.34281
33.720	6.4635	3882.4	60075.	0.00095232	13131.	0.34335
33.760	6.4723	3884.3	60023.	0.0010200	13120.	0.34389
33.800	6.4810	3886.3	59973.	0.0010876	13110.	0.34441
33.840	6.4895	3888.3	59924.	0.0011552	13099.	0.34493
33.880	6.4979	3890.2	59876.	0.0012229	13089.	0.34545
33.920	6.5062	3892.2	59831.	0.0012905	13079.	0.34595
33.960	6.5144	3894.3	59786.	0.0013581	13069.	0.34645

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
34.000	6.5224	3896.3	59743.	0.0014258	13059.	0.34694
34.040	6.5303	3898.3	59702.	0.0014934	13049.	0.34743
34.080	6.5381	3900.4	59662.	0.0015610	13040.	0.34791
34.120	6.5457	3902.4	59623.	0.0016287	13030.	0.34838
34.160	6.5533	3904.5	59586.	0.0016950	13021.	0.34884
34.200	6.5607	3906.6	59550.	0.0017563	13012.	0.34928
34.240	6.5680	3908.7	59516.	0.0018125	13004.	0.34970
34.280	6.5753	3910.8	59481.	0.0018608	12996.	0.35010
34.320	6.5827	3912.7	59444.	0.0018971	12988.	0.35050
34.360	6.5902	3914.6	59404.	0.0019212	12980.	0.35090
34.400	6.5977	3916.3	59362.	0.0019333	12972.	0.35128
34.440	6.6053	3917.8	59318.	0.0019333	12965.	0.35166
34.480	6.6130	3919.3	59271.	0.0019212	12957.	0.35204
34.520	6.6207	3920.6	59222.	0.0018971	12950.	0.35240
34.560	6.6285	3921.8	59170.	0.0018609	12943.	0.35276
34.600	6.6364	3922.8	59116.	0.0018126	12936.	0.35311
34.640	6.6444	3923.7	59060.	0.0017522	12929.	0.35346
34.680	6.6524	3924.7	59004.	0.0016851	12922.	0.35379
34.720	6.6606	3925.9	58949.	0.0016174	12915.	0.35412
34.760	6.6690	3927.1	58895.	0.0015498	12909.	0.35445
34.800	6.6775	3928.5	58841.	0.0014822	12902.	0.35477
34.840	6.6862	3930.0	58787.	0.0014145	12896.	0.35510
34.880	6.6950	3931.7	58734.	0.0013469	12889.	0.35543
34.920	6.7041	3933.4	58682.	0.0012793	12883.	0.35576
34.960	6.7133	3935.3	58630.	0.0012116	12876.	0.35609
35.000	6.7226	3937.3	58578.	0.0011440	12869.	0.35642
35.040	6.7321	3939.5	58527.	0.0010764	12863.	0.35675
35.080	6.7418	3941.7	58477.	0.0010087	12856.	0.35708
35.120	6.7517	3944.1	58425.	0.00094108	12850.	0.35741
35.160	6.7619	3946.5	58374.	0.00087345	12843.	0.35774
35.200	6.7723	3949.0	58321.	0.00080581	12836.	0.35807
35.240	6.7829	3951.6	58269.	0.00073818	12830.	0.35839
35.280	6.7937	3954.3	58215.	0.00067054	12823.	0.35872
35.320	6.8048	3957.1	58161.	0.00060291	12817.	0.35904
35.360	6.8160	3960.0	58107.	0.00053528	12810.	0.35937
35.400	6.8276	3963.0	58052.	0.00046764	12804.	0.35969
35.440	6.8393	3966.0	57997.	0.00040001	12798.	0.36001
35.480	6.8511	3969.0	57940.	0.00033237	12791.	0.36034
35.520	6.8627	3971.8	57882.	0.00026758	12784.	0.36068
35.560	6.8742	3974.7	57826.	0.00020980	12778.	0.36100
35.600	6.8856	3977.5	57773.	0.00015903	12771.	0.36133
35.640	6.8967	3980.4	57721.	0.00011528	12765.	0.36164
35.680	6.9077	3983.3	57671.	7.8535e-05	12759.	0.36196
35.720	6.9185	3986.2	57622.	4.8804e-05	12753.	0.36226
35.760	6.9291	3989.0	57576.	2.6085e-05	12747.	0.36256
35.800	6.9395	3992.0	57531.	1.0378e-05	12741.	0.36286
35.840	6.9497	3994.9	57488.	1.6829e-06	12735.	0.36315
35.880	6.9598	3997.8	57448.	0.00000	12729.	0.36344
35.920	6.9697	4000.5	57405.	0.00000	12723.	0.36373
35.960	6.9795	4002.9	57361.	0.00000	12717.	0.36403

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
36.000	6.9890	4005.1	57314.	0.00000	12711.	0.36434
36.040	6.9984	4007.0	57264.	0.00000	12705.	0.36465
36.080	7.0076	4008.6	57212.	0.00000	12698.	0.36497
36.120	7.0167	4010.0	57158.	0.00000	12692.	0.36530
36.160	7.0255	4011.1	57102.	0.00000	12685.	0.36564
36.200	7.0342	4011.9	57043.	0.00000	12678.	0.36599
36.240	7.0428	4012.4	56981.	4.2829e-07	12671.	0.36634
36.280	7.0513	4012.8	56918.	6.9750e-06	12664.	0.36670
36.320	7.0598	4013.1	56853.	1.9640e-05	12657.	0.36706
36.360	7.0683	4013.3	56787.	3.8424e-05	12650.	0.36742
36.400	7.0767	4013.3	56720.	6.3326e-05	12642.	0.36778
36.440	7.0851	4013.3	56653.	9.4347e-05	12635.	0.36814
36.480	7.0934	4013.1	56584.	0.00013149	12628.	0.36851
36.520	7.1017	4012.8	56515.	0.00017474	12620.	0.36888
36.560	7.1099	4012.5	56445.	0.00022412	12613.	0.36925
36.600	7.1181	4012.0	56374.	0.00027961	12605.	0.36962
36.640	7.1262	4011.4	56302.	0.00034123	12598.	0.37000
36.680	7.1342	4010.8	56229.	0.00040880	12590.	0.37038
36.720	7.1422	4010.2	56158.	0.00047239	12583.	0.37075
36.760	7.1503	4009.8	56089.	0.00053200	12576.	0.37112
36.800	7.1584	4009.5	56022.	0.00058763	12568.	0.37148
36.840	7.1665	4009.4	55957.	0.00063928	12561.	0.37183
36.880	7.1746	4009.5	55894.	0.00068695	12554.	0.37218
36.920	7.1828	4009.7	55833.	0.00073064	12547.	0.37252
36.960	7.1910	4010.0	55774.	0.00077035	12541.	0.37286
37.000	7.1992	4010.6	55717.	0.00080607	12534.	0.37319
37.040	7.2075	4011.2	55662.	0.00083782	12528.	0.37351
37.080	7.2157	4012.0	55609.	0.00086559	12521.	0.37383
37.120	7.2240	4013.0	55558.	0.00088937	12515.	0.37414
37.160	7.2323	4014.1	55509.	0.00090918	12509.	0.37444
37.200	7.2407	4015.3	55462.	0.00092501	12503.	0.37474
37.240	7.2490	4016.7	55417.	0.00093685	12497.	0.37504
37.280	7.2574	4018.3	55374.	0.00094472	12491.	0.37532
37.320	7.2658	4020.0	55333.	0.00094860	12486.	0.37561
37.360	7.2743	4021.9	55294.	0.00094860	12480.	0.37588
37.400	7.2827	4023.9	55257.	0.00094860	12475.	0.37615
37.440	7.2911	4025.9	55221.	0.00094860	12470.	0.37641
37.480	7.2995	4028.1	55187.	0.00094817	12465.	0.37666
37.520	7.3078	4030.3	55154.	0.00094162	12460.	0.37690
37.560	7.3158	4032.4	55123.	0.00092896	12455.	0.37715
37.600	7.3237	4034.6	55093.	0.00091018	12450.	0.37740
37.640	7.3314	4036.7	55063.	0.00088527	12445.	0.37764
37.680	7.3389	4038.8	55036.	0.00085425	12440.	0.37788
37.720	7.3462	4040.9	55009.	0.00081711	12435.	0.37813
37.760	7.3533	4042.9	54983.	0.00077386	12431.	0.37837
37.800	7.3603	4045.0	54959.	0.00072448	12426.	0.37860
37.840	7.3671	4047.0	54936.	0.00066899	12421.	0.37884
37.880	7.3737	4049.0	54914.	0.00060737	12416.	0.37908
37.920	7.3801	4051.0	54893.	0.00053980	12412.	0.37931
37.960	7.3865	4052.9	54872.	0.00047621	12407.	0.37954

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
38.000	7.3928	4054.8	54851.	0.00041660	12403.	0.37977
38.040	7.3992	4056.7	54829.	0.00036097	12398.	0.38000
38.080	7.4055	4058.5	54807.	0.00030932	12393.	0.38022
38.120	7.4117	4060.3	54785.	0.00026165	12389.	0.38044
38.160	7.4180	4062.1	54762.	0.00021796	12385.	0.38066
38.200	7.4249	4064.0	54738.	0.00017825	12380.	0.38088
38.240	7.4324	4066.2	54712.	0.00014253	12376.	0.38109
38.280	7.4407	4068.7	54684.	0.00011078	12372.	0.38129
38.320	7.4498	4071.3	54654.	8.3012e-05	12368.	0.38148
38.360	7.4594	4074.1	54620.	5.9226e-05	12364.	0.38168
38.400	7.4697	4076.7	54581.	3.9420e-05	12360.	0.38188
38.440	7.4804	4079.1	54536.	2.3594e-05	12356.	0.38207
38.480	7.4917	4081.4	54485.	1.1749e-05	12352.	0.38228
38.520	7.5036	4083.5	54429.	3.8843e-06	12348.	0.38248
38.560	7.5156	4085.5	54369.	0.00000	12344.	0.38269
38.600	7.5278	4087.4	54307.	0.00000	12340.	0.38290
38.640	7.5402	4089.3	54244.	0.00000	12336.	0.38311
38.680	7.5527	4091.1	54179.	0.00000	12331.	0.38333
38.720	7.5654	4092.8	54111.	0.00000	12327.	0.38356
38.760	7.5782	4094.4	54042.	0.00000	12322.	0.38379
38.800	7.5912	4096.0	53971.	0.00000	12317.	0.38403
38.840	7.6044	4097.5	53899.	0.00000	12313.	0.38427
38.880	7.6177	4098.9	53824.	0.00000	12308.	0.38451
38.920	7.6312	4100.3	53747.	0.00000	12303.	0.38477
38.960	7.6448	4101.5	53669.	0.00000	12297.	0.38502
39.000	7.6585	4102.8	53590.	0.00000	12292.	0.38529
39.040	7.6723	4104.0	53510.	0.00000	12287.	0.38555
39.080	7.6860	4105.3	53431.	0.00000	12282.	0.38581
39.120	7.6996	4106.5	53352.	0.00000	12277.	0.38607
39.160	7.7133	4107.8	53273.	0.00000	12271.	0.38633
39.200	7.7270	4109.0	53194.	0.00000	12266.	0.38659
39.240	7.7406	4110.2	53116.	0.00000	12261.	0.38685
39.280	7.7543	4111.4	53037.	0.00000	12256.	0.38711
39.320	7.7679	4112.6	52959.	0.00000	12251.	0.38737
39.360	7.7815	4113.8	52881.	0.00000	12245.	0.38763
39.400	7.7951	4115.0	52803.	0.00000	12240.	0.38789
39.440	7.8080	4116.0	52726.	0.00000	12235.	0.38815
39.480	7.8202	4116.6	52652.	0.00000	12230.	0.38842
39.520	7.8316	4117.0	52579.	0.00000	12224.	0.38869
39.560	7.8422	4117.1	52507.	0.00000	12219.	0.38896
39.600	7.8522	4117.1	52440.	0.00000	12213.	0.38924
39.640	7.8615	4117.2	52377.	0.00000	12208.	0.38950
39.680	7.8703	4117.4	52321.	0.00000	12203.	0.38977
39.720	7.8785	4117.7	52269.	0.00000	12197.	0.39003
39.760	7.8861	4118.1	52224.	0.00000	12192.	0.39028
39.800	7.8935	4118.5	52181.	0.00000	12187.	0.39053
39.840	7.9006	4119.1	52140.	0.00000	12182.	0.39077
39.880	7.9076	4119.6	52101.	0.00000	12178.	0.39102
39.920	7.9143	4120.2	52063.	0.00000	12173.	0.39126
39.960	7.9208	4120.7	52027.	0.00000	12168.	0.39151

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
40.000	7.9270	4121.2	51992.	0.00000	12163.	0.39175
40.040	7.9330	4121.7	51959.	0.00000	12158.	0.39200
40.080	7.9387	4122.2	51927.	0.00000	12153.	0.39226
40.120	7.9442	4122.6	51897.	0.00000	12148.	0.39251
40.160	7.9495	4123.0	51868.	0.00000	12143.	0.39276
40.200	7.9545	4123.4	51840.	0.00000	12138.	0.39302
40.240	7.9594	4123.8	51813.	0.00000	12132.	0.39328
40.280	7.9641	4124.1	51786.	0.00000	12127.	0.39355
40.320	7.9688	4124.3	51758.	0.00000	12122.	0.39382
40.360	7.9735	4124.4	51730.	0.00000	12116.	0.39410
40.400	7.9780	4124.4	51701.	0.00000	12110.	0.39439
40.440	7.9825	4124.4	51671.	0.00000	12104.	0.39469
40.480	7.9870	4124.2	51641.	0.00000	12098.	0.39499
40.520	7.9913	4124.0	51610.	0.00000	12092.	0.39530
40.560	7.9956	4123.7	51579.	0.00000	12086.	0.39562
40.600	7.9998	4123.3	51547.	0.00000	12079.	0.39594
40.640	8.0040	4122.9	51514.	0.00000	12072.	0.39628
40.680	8.0080	4122.3	51481.	0.00000	12066.	0.39662
40.720	8.0121	4121.7	51448.	0.00000	12059.	0.39696
40.760	8.0160	4121.0	51414.	0.00000	12052.	0.39732
40.800	8.0199	4120.2	51379.	0.00000	12044.	0.39768
40.840	8.0237	4119.3	51344.	0.00000	12037.	0.39805
40.880	8.0274	4118.3	51308.	0.00000	12030.	0.39842
40.920	8.0311	4117.3	51272.	0.00000	12022.	0.39880
40.960	8.0347	4116.2	51235.	0.00000	12014.	0.39919
41.000	8.0382	4115.0	51197.	0.00000	12006.	0.39959
41.040	8.0417	4113.7	51159.	0.00000	11998.	0.40000
41.080	8.0451	4112.3	51121.	0.00000	11990.	0.40041
41.120	8.0484	4110.9	51082.	0.00000	11982.	0.40082
41.160	8.0518	4109.5	51043.	0.00000	11973.	0.40124
41.200	8.0552	4108.1	51004.	0.00000	11965.	0.40165
41.240	8.0585	4106.7	50965.	0.00000	11957.	0.40207
41.280	8.0619	4105.2	50927.	0.00000	11948.	0.40248
41.320	8.0654	4104.0	50890.	0.00000	11940.	0.40288
41.360	8.0690	4103.0	50854.	0.00000	11932.	0.40327
41.400	8.0727	4102.2	50820.	0.00000	11925.	0.40365
41.440	8.0765	4101.6	50789.	0.00000	11918.	0.40402
41.480	8.0805	4101.2	50759.	0.00000	11911.	0.40437
41.520	8.0845	4101.0	50730.	0.00000	11904.	0.40471
41.560	8.0887	4101.0	50704.	0.00000	11897.	0.40504
41.600	8.0930	4101.2	50679.	0.00000	11891.	0.40536
41.640	8.0975	4101.6	50656.	0.00000	11885.	0.40567
41.680	8.1020	4102.2	50635.	0.00000	11879.	0.40596
41.720	8.1067	4103.0	50615.	0.00000	11873.	0.40624
41.760	8.1115	4104.0	50598.	0.00000	11868.	0.40651
41.800	8.1164	4105.2	50582.	0.00000	11863.	0.40676
41.840	8.1214	4106.7	50568.	0.00000	11858.	0.40700
41.880	8.1266	4108.3	50555.	0.00000	11853.	0.40723
41.920	8.1319	4110.1	50545.	0.00000	11849.	0.40745
41.960	8.1372	4112.1	50536.	0.00000	11845.	0.40766

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
42.000	8.1428	4114.4	50528.	0.00000	11841.	0.40785
42.040	8.1488	4116.7	50520.	0.00000	11837.	0.40803
42.080	8.1550	4119.2	50512.	0.00000	11834.	0.40820
42.120	8.1615	4121.9	50504.	0.00000	11831.	0.40835
42.160	8.1684	4124.7	50496.	0.00000	11828.	0.40849
42.200	8.1756	4127.7	50488.	0.00000	11826.	0.40862
42.240	8.1831	4130.8	50480.	0.00000	11823.	0.40873
42.280	8.1910	4134.1	50471.	0.00000	11821.	0.40883
42.320	8.1991	4137.5	50463.	0.00000	11820.	0.40892
42.360	8.2077	4141.4	50457.	2.8730e-06	11818.	0.40899
42.400	8.2168	4146.0	50458.	1.2621e-05	11817.	0.40904
42.440	8.2264	4151.4	50464.	2.9243e-05	11817.	0.40907
42.480	8.2365	4157.6	50477.	5.2740e-05	11816.	0.40908
42.520	8.2471	4164.6	50496.	8.3111e-05	11817.	0.40908
42.560	8.2581	4172.2	50520.	0.00012036	11817.	0.40906
42.600	8.2695	4180.3	50548.	0.00016448	11817.	0.40904
42.640	8.2814	4189.0	50580.	0.00021547	11818.	0.40901
42.680	8.2936	4198.3	50617.	0.00027334	11818.	0.40898
42.720	8.3062	4208.2	50658.	0.00033809	11819.	0.40894
42.760	8.3189	4217.6	50693.	0.00040030	11820.	0.40890
42.800	8.3317	4225.7	50712.	0.00045317	11820.	0.40889
42.840	8.3445	4232.5	50716.	0.00049669	11820.	0.40890
42.880	8.3573	4238.0	50705.	0.00053087	11819.	0.40894
42.920	8.3702	4242.2	50679.	0.00055569	11818.	0.40899
42.960	8.3830	4245.1	50638.	0.00057117	11817.	0.40907
43.000	8.3958	4246.8	50581.	0.00057730	11815.	0.40916
43.040	8.4087	4247.6	50515.	0.00057730	11813.	0.40927
43.080	8.4218	4248.6	50450.	0.00057730	11810.	0.40938
43.120	8.4351	4249.8	50386.	0.00057730	11808.	0.40950
43.160	8.4485	4251.2	50323.	0.00057730	11806.	0.40961
43.200	8.4622	4252.7	50262.	0.00057730	11803.	0.40973
43.240	8.4759	4254.5	50202.	0.00057730	11801.	0.40985
43.280	8.4896	4256.5	50145.	0.00057730	11799.	0.40997
43.320	8.5032	4258.7	50091.	0.00057730	11796.	0.41009
43.360	8.5169	4261.1	50040.	0.00057730	11794.	0.41022
43.400	8.5305	4263.8	49991.	0.00057730	11791.	0.41035
43.440	8.5440	4266.6	49945.	0.00057730	11788.	0.41048
43.480	8.5573	4269.2	49898.	0.00057730	11786.	0.41062
43.520	8.5705	4271.7	49851.	0.00057730	11783.	0.41077
43.560	8.5835	4274.1	49804.	0.00057730	11780.	0.41092
43.600	8.5962	4276.1	49754.	0.00057443	11777.	0.41108
43.640	8.6086	4277.4	49698.	0.00056468	11773.	0.41124
43.680	8.6205	4277.9	49635.	0.00054806	11770.	0.41143
43.720	8.6321	4277.7	49566.	0.00052456	11766.	0.41162
43.760	8.6434	4276.8	49490.	0.00049419	11762.	0.41182
43.800	8.6542	4275.1	49409.	0.00045694	11757.	0.41204
43.840	8.6647	4272.7	49320.	0.00041282	11753.	0.41226
43.880	8.6748	4269.5	49225.	0.00036183	11748.	0.41250
43.920	8.6846	4265.6	49124.	0.00030396	11743.	0.41275
43.960	8.6940	4260.9	49017.	0.00023922	11738.	0.41301

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
44.000	8.7032	4256.6	48914.	0.00017700	11733.	0.41326
44.040	8.7124	4253.4	48824.	0.00012413	11728.	0.41350
44.080	8.7215	4251.2	48747.	8.0608e-05	11723.	0.41373
44.120	8.7306	4250.0	48682.	4.6435e-05	11719.	0.41393
44.160	8.7396	4249.9	48630.	2.1609e-05	11716.	0.41412
44.200	8.7485	4250.7	48590.	6.1305e-06	11712.	0.41430
44.240	8.7574	4252.7	48563.	0.00000	11709.	0.41446
44.280	8.7662	4255.1	48543.	0.00000	11706.	0.41461
44.320	8.7748	4257.1	48519.	0.00000	11703.	0.41477
44.360	8.7831	4258.7	48491.	0.00000	11700.	0.41492
44.400	8.7912	4259.8	48459.	0.00000	11696.	0.41509
44.440	8.7991	4260.5	48424.	0.00000	11693.	0.41525
44.480	8.8068	4260.7	48385.	0.00000	11690.	0.41542
44.520	8.8142	4260.5	48342.	0.00000	11686.	0.41560
44.560	8.8215	4259.9	48296.	0.00000	11683.	0.41577
44.600	8.8284	4258.8	48245.	0.00000	11679.	0.41596
44.640	8.8352	4257.3	48191.	0.00000	11675.	0.41614
44.680	8.8418	4255.5	48135.	0.00000	11671.	0.41633
44.720	8.8484	4253.6	48078.	0.00000	11668.	0.41652
44.760	8.8549	4251.6	48020.	0.00000	11664.	0.41671
44.800	8.8613	4249.5	47962.	0.00000	11660.	0.41690
44.840	8.8676	4247.3	47903.	0.00000	11656.	0.41709
44.880	8.8739	4245.0	47843.	0.00000	11652.	0.41729
44.920	8.8802	4242.8	47784.	0.00000	11648.	0.41748
44.960	8.8865	4240.7	47726.	0.00000	11645.	0.41766
45.000	8.8930	4238.7	47670.	0.00000	11641.	0.41785
45.040	8.8995	4237.0	47615.	0.00000	11637.	0.41803
45.080	8.9060	4235.3	47561.	0.00000	11634.	0.41820
45.120	8.9127	4233.8	47509.	0.00000	11631.	0.41838
45.160	8.9194	4232.5	47458.	0.00000	11627.	0.41854
45.200	8.9262	4231.2	47408.	0.00000	11624.	0.41871
45.240	8.9330	4230.2	47360.	0.00000	11621.	0.41887
45.280	8.9400	4229.3	47314.	0.00000	11618.	0.41902
45.320	8.9471	4228.7	47269.	0.00000	11615.	0.41917
45.360	8.9543	4228.4	47227.	0.00000	11612.	0.41932
45.400	8.9626	4229.8	47198.	1.6831e-05	11609.	0.41944
45.440	8.9730	4234.3	47193.	6.6055e-05	11608.	0.41950
45.480	8.9844	4240.4	47200.	0.00013147	11607.	0.41953
45.520	8.9960	4246.2	47203.	0.00019175	11607.	0.41957
45.560	9.0076	4251.7	47202.	0.00024688	11605.	0.41963
45.600	9.0193	4256.8	47197.	0.00029688	11604.	0.41969
45.640	9.0311	4261.7	47188.	0.00034173	11603.	0.41977
45.680	9.0429	4266.1	47176.	0.00038145	11601.	0.41985
45.720	9.0549	4270.3	47159.	0.00041602	11599.	0.41995
45.760	9.0668	4274.1	47139.	0.00044545	11597.	0.42006
45.800	9.0789	4277.6	47115.	0.00046975	11595.	0.42018
45.840	9.0910	4280.7	47087.	0.00048890	11592.	0.42030
45.880	9.1032	4283.5	47055.	0.00050292	11589.	0.42044
45.920	9.1155	4286.0	47020.	0.00051179	11586.	0.42059
45.960	9.1279	4288.1	46980.	0.00051552	11583.	0.42075

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
46.000	9.1404	4290.2	46939.	0.00051552	11580.	0.42092
46.040	9.1533	4292.9	46903.	0.00051552	11576.	0.42108
46.080	9.1666	4296.3	46872.	0.00051552	11573.	0.42124
46.120	9.1803	4300.3	46846.	0.00051552	11570.	0.42140
46.160	9.1943	4304.8	46824.	0.00051552	11567.	0.42156
46.200	9.2086	4309.7	46805.	0.00051552	11564.	0.42172
46.240	9.2231	4315.0	46789.	0.00051552	11560.	0.42188
46.280	9.2379	4320.7	46776.	0.00051552	11557.	0.42204
46.320	9.2529	4326.7	46766.	0.00051552	11554.	0.42221
46.360	9.2682	4333.2	46758.	0.00051552	11551.	0.42237
46.400	9.2838	4339.4	46747.	0.00051552	11547.	0.42255
46.440	9.2995	4345.3	46731.	0.00051552	11543.	0.42274
46.480	9.3156	4350.7	46710.	0.00051552	11539.	0.42293
46.520	9.3318	4355.8	46684.	0.00051552	11535.	0.42314
46.560	9.3483	4360.5	46652.	0.00051552	11531.	0.42335
46.600	9.3650	4364.8	46616.	0.00051552	11526.	0.42358
46.640	9.3810	4367.2	46563.	0.00049869	11521.	0.42384
46.680	9.3952	4366.5	46484.	0.00045585	11515.	0.42416
46.720	9.4086	4364.0	46391.	0.00040730	11508.	0.42451
46.760	9.4221	4361.7	46301.	0.00037436	11501.	0.42486
46.800	9.4357	4359.8	46213.	0.00035705	11494.	0.42519
46.840	9.4496	4358.1	46127.	0.00035536	11488.	0.42553
46.880	9.4636	4356.6	46044.	0.00036928	11481.	0.42585
46.920	9.4777	4355.4	45962.	0.00039607	11475.	0.42617
46.960	9.4920	4354.4	45883.	0.00042073	11468.	0.42648
47.000	9.5063	4353.6	45805.	0.00044326	11462.	0.42679
47.040	9.5208	4353.0	45729.	0.00046365	11456.	0.42709
47.080	9.5354	4352.5	45655.	0.00048192	11450.	0.42739
47.120	9.5502	4352.3	45583.	0.00049805	11444.	0.42769
47.160	9.5650	4352.3	45512.	0.00051204	11439.	0.42798
47.200	9.5800	4352.5	45444.	0.00052391	11433.	0.42826
47.240	9.5950	4352.5	45375.	0.00053223	11427.	0.42855
47.280	9.6098	4351.9	45298.	0.00053328	11421.	0.42884
47.320	9.6243	4350.6	45218.	0.00053328	11415.	0.42914
47.360	9.6385	4348.8	45133.	0.00053328	11409.	0.42944
47.400	9.6525	4346.5	45044.	0.00053328	11403.	0.42974
47.440	9.6661	4343.6	44951.	0.00053328	11397.	0.43004
47.480	9.6794	4340.2	44854.	0.00053328	11391.	0.43035
47.520	9.6924	4336.2	44752.	0.00053328	11385.	0.43065
47.560	9.7051	4331.7	44647.	0.00053328	11379.	0.43096
47.600	9.7176	4326.7	44538.	0.00053328	11373.	0.43128
47.640	9.7297	4321.8	44431.	0.00053328	11366.	0.43158
47.680	9.7416	4317.1	44328.	0.00053328	11360.	0.43189
47.720	9.7532	4312.6	44229.	0.00053328	11354.	0.43218
47.760	9.7645	4308.4	44134.	0.00053328	11349.	0.43247
47.800	9.7756	4304.5	44043.	0.00053328	11343.	0.43275
47.840	9.7864	4300.8	43955.	0.00053328	11337.	0.43303
47.880	9.7972	4297.6	43875.	0.00053328	11332.	0.43330
47.920	9.8083	4295.4	43801.	0.00052690	11327.	0.43356
47.960	9.8198	4293.9	43734.	0.00051004	11322.	0.43382

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
48.000	9.8317	4293.2	43673.	0.00048269	11317.	0.43407
48.040	9.8440	4293.3	43619.	0.00044487	11312.	0.43431
48.080	9.8566	4294.0	43571.	0.00039657	11307.	0.43455
48.120	9.8688	4294.7	43523.	0.00033779	11302.	0.43480
48.160	9.8809	4295.3	43475.	0.00027129	11297.	0.43505
48.200	9.8928	4296.0	43430.	0.00021205	11292.	0.43531
48.240	9.9044	4296.6	43385.	0.00016009	11287.	0.43558
48.280	9.9159	4297.3	43341.	0.00011540	11281.	0.43584
48.320	9.9271	4298.0	43299.	7.7986e-05	11276.	0.43612
48.360	9.9382	4298.7	43257.	4.7843e-05	11270.	0.43640
48.400	9.9490	4299.4	43217.	2.4973e-05	11265.	0.43668
48.440	9.9597	4300.1	43178.	9.3759e-06	11259.	0.43697
48.480	9.9702	4300.9	43141.	1.0515e-06	11253.	0.43726
48.520	9.9804	4301.6	43104.	0.00000	11247.	0.43756
48.560	9.9906	4302.2	43066.	0.00000	11241.	0.43787
48.600	10.001	4302.5	43026.	0.00000	11234.	0.43819
48.640	10.011	4302.6	42985.	0.00000	11228.	0.43852
48.680	10.020	4302.5	42942.	0.00000	11221.	0.43886
48.720	10.030	4302.1	42897.	0.00000	11214.	0.43922
48.760	10.040	4301.5	42850.	0.00000	11206.	0.43958
48.800	10.049	4300.7	42801.	0.00000	11199.	0.43996
48.840	10.059	4299.6	42751.	0.00000	11191.	0.44035
48.880	10.068	4298.5	42700.	0.00000	11183.	0.44075
48.920	10.077	4297.5	42651.	0.00000	11175.	0.44114
48.960	10.086	4296.7	42604.	0.00000	11167.	0.44153
49.000	10.096	4296.1	42560.	0.00000	11160.	0.44192
49.040	10.105	4295.8	42517.	0.00000	11152.	0.44231
49.080	10.114	4295.6	42476.	0.00000	11144.	0.44269
49.120	10.123	4295.2	42435.	0.00000	11137.	0.44307
49.160	10.131	4294.4	42392.	0.00000	11129.	0.44345
49.200	10.139	4293.2	42347.	0.00000	11122.	0.44383
49.240	10.146	4291.5	42301.	0.00000	11114.	0.44420
49.280	10.153	4289.4	42252.	0.00000	11107.	0.44458
49.320	10.159	4287.1	42202.	0.00000	11099.	0.44495
49.360	10.166	4285.2	42157.	0.00000	11092.	0.44531
49.400	10.172	4283.7	42115.	0.00000	11085.	0.44565
49.440	10.179	4282.7	42077.	0.00000	11079.	0.44598
49.480	10.186	4282.0	42043.	0.00000	11072.	0.44629
49.520	10.192	4281.8	42013.	0.00000	11066.	0.44659
49.560	10.199	4282.0	41986.	0.00000	11061.	0.44687
49.600	10.206	4282.7	41964.	0.00000	11055.	0.44714
49.640	10.213	4283.7	41945.	0.00000	11050.	0.44739
49.680	10.220	4285.0	41928.	0.00000	11045.	0.44763
49.720	10.227	4286.3	41912.	0.00000	11041.	0.44786
49.760	10.234	4287.7	41895.	0.00000	11037.	0.44808
49.800	10.241	4289.1	41880.	0.00000	11033.	0.44828
49.840	10.249	4290.5	41864.	0.00000	11029.	0.44847
49.880	10.256	4292.0	41850.	0.00000	11025.	0.44865
49.920	10.263	4293.6	41835.	0.00000	11022.	0.44882
49.960	10.270	4295.2	41821.	0.00000	11019.	0.44897

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
50.000	10.278	4296.8	41807.	0.00000	11016.	0.44911
50.040	10.285	4298.5	41794.	0.00000	11013.	0.44924
50.080	10.292	4300.2	41781.	0.00000	11011.	0.44936
50.120	10.300	4301.9	41767.	0.00000	11009.	0.44947
50.160	10.307	4303.2	41750.	0.00000	11007.	0.44958
50.200	10.314	4304.1	41729.	0.00000	11004.	0.44969
50.240	10.322	4304.6	41706.	0.00000	11002.	0.44980
50.280	10.329	4304.9	41679.	0.00000	11000.	0.44992
50.320	10.336	4304.8	41650.	0.00000	10997.	0.45004
50.360	10.344	4304.4	41617.	0.00000	10995.	0.45016
50.400	10.351	4303.8	41582.	0.00000	10992.	0.45028
50.440	10.358	4302.8	41544.	0.00000	10990.	0.45041
50.480	10.365	4301.5	41503.	0.00000	10987.	0.45054
50.520	10.372	4299.9	41459.	0.00000	10985.	0.45066
50.560	10.380	4298.0	41412.	0.00000	10982.	0.45080
50.600	10.387	4295.8	41362.	0.00000	10980.	0.45093
50.640	10.394	4293.3	41310.	0.00000	10977.	0.45106
50.680	10.401	4290.5	41254.	0.00000	10974.	0.45120
50.720	10.408	4287.3	41196.	0.00000	10971.	0.45134
50.760	10.416	4283.9	41135.	0.00000	10969.	0.45148
50.800	10.423	4280.2	41071.	0.00000	10966.	0.45162
50.840	10.430	4276.2	41004.	0.00000	10963.	0.45176
50.880	10.437	4272.1	40937.	0.00000	10960.	0.45190
50.920	10.444	4268.0	40870.	0.00000	10957.	0.45204
50.960	10.452	4264.2	40804.	0.00000	10955.	0.45218
51.000	10.459	4260.7	40741.	0.00000	10952.	0.45232
51.040	10.467	4257.3	40680.	0.00000	10949.	0.45245
51.080	10.474	4254.2	40621.	0.00000	10947.	0.45257
51.120	10.482	4251.4	40564.	0.00000	10944.	0.45270
51.160	10.490	4248.7	40509.	0.00000	10942.	0.45282
51.200	10.497	4246.3	40456.	0.00000	10939.	0.45294
51.240	10.505	4244.2	40405.	0.00000	10937.	0.45305
51.280	10.513	4242.3	40356.	0.00000	10935.	0.45317
51.320	10.521	4240.6	40309.	0.00000	10933.	0.45328
51.360	10.529	4239.1	40264.	0.00000	10931.	0.45338
51.400	10.538	4237.8	40220.	0.00000	10928.	0.45349
51.440	10.546	4236.7	40176.	0.00000	10926.	0.45359
51.480	10.555	4235.6	40133.	0.00000	10924.	0.45369
51.520	10.564	4234.6	40091.	0.00000	10922.	0.45380
51.560	10.572	4233.7	40049.	0.00000	10920.	0.45390
51.600	10.582	4232.9	40006.	0.00000	10918.	0.45400
51.640	10.591	4232.2	39964.	0.00000	10916.	0.45411
51.680	10.600	4231.5	39923.	0.00000	10914.	0.45421
51.720	10.610	4230.9	39881.	0.00000	10912.	0.45431
51.760	10.619	4230.4	39841.	0.00000	10910.	0.45441
51.800	10.629	4230.2	39803.	0.00000	10908.	0.45451
51.840	10.639	4230.3	39767.	0.00000	10906.	0.45462
51.880	10.648	4230.7	39735.	0.00000	10904.	0.45472
51.920	10.658	4231.4	39705.	0.00000	10902.	0.45483
51.960	10.668	4232.4	39678.	0.00000	10900.	0.45493

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
52.000	10.677	4233.7	39653.	0.00000	10897.	0.45504
52.040	10.687	4235.2	39632.	0.00000	10895.	0.45515
52.080	10.697	4237.0	39612.	0.00000	10893.	0.45526
52.120	10.707	4238.9	39593.	0.00000	10891.	0.45538
52.160	10.716	4240.9	39576.	0.00000	10888.	0.45549
52.200	10.726	4243.0	39560.	0.00000	10886.	0.45562
52.240	10.736	4245.3	39546.	0.00000	10883.	0.45574
52.280	10.745	4247.7	39532.	0.00000	10881.	0.45587
52.320	10.755	4250.2	39520.	0.00000	10878.	0.45601
52.360	10.764	4252.9	39509.	0.00000	10875.	0.45614
52.400	10.774	4255.7	39500.	0.00000	10872.	0.45629
52.440	10.784	4258.6	39491.	0.00000	10870.	0.45643
52.480	10.793	4261.6	39484.	0.00000	10867.	0.45658
52.520	10.803	4264.8	39478.	0.00000	10864.	0.45673
52.560	10.812	4268.0	39474.	0.00000	10860.	0.45689
52.600	10.821	4271.4	39471.	0.00000	10857.	0.45705
52.640	10.831	4275.1	39470.	0.00000	10854.	0.45721
52.680	10.840	4278.9	39472.	0.00000	10851.	0.45737
52.720	10.849	4283.0	39476.	0.00000	10847.	0.45754
52.760	10.858	4287.2	39482.	0.00000	10844.	0.45770
52.800	10.867	4291.3	39488.	0.00000	10841.	0.45788
52.840	10.875	4294.5	39486.	0.00000	10837.	0.45807
52.880	10.884	4296.7	39475.	0.00000	10833.	0.45828
52.920	10.892	4298.0	39457.	0.00000	10828.	0.45850
52.960	10.901	4299.0	39436.	0.00000	10823.	0.45874
53.000	10.910	4300.9	39421.	0.00000	10819.	0.45894
53.040	10.920	4303.7	39410.	0.00000	10816.	0.45913
53.080	10.930	4307.2	39404.	0.00000	10812.	0.45929
53.120	10.942	4311.5	39403.	0.00000	10810.	0.45942
53.160	10.954	4316.7	39406.	0.00000	10808.	0.45953
53.200	10.967	4322.6	39414.	0.00000	10806.	0.45961
53.240	10.980	4329.3	39426.	0.00000	10805.	0.45967
53.280	10.995	4336.9	39443.	0.00000	10804.	0.45970
53.320	11.010	4344.9	39461.	1.2284e-06	10804.	0.45972
53.360	11.025	4351.8	39470.	1.0016e-05	10803.	0.45975
53.400	11.040	4357.6	39469.	2.6363e-05	10802.	0.45981
53.440	11.055	4362.2	39458.	5.0270e-05	10801.	0.45988
53.480	11.070	4365.8	39438.	8.1736e-05	10799.	0.45997
53.520	11.085	4368.2	39407.	0.00012076	10796.	0.46009
53.560	11.100	4369.5	39366.	0.00016735	10794.	0.46022
53.600	11.115	4369.7	39316.	0.00022149	10791.	0.46037
53.640	11.130	4368.8	39256.	0.00028319	10787.	0.46055
53.680	11.145	4367.1	39187.	0.00034977	10783.	0.46073
53.720	11.160	4365.2	39118.	0.00041146	10780.	0.46093
53.760	11.175	4363.2	39048.	0.00046826	10776.	0.46112
53.800	11.191	4361.1	38977.	0.00052016	10772.	0.46132
53.840	11.206	4358.9	38905.	0.00056718	10768.	0.46151
53.880	11.221	4356.6	38832.	0.00060930	10764.	0.46172
53.920	11.236	4354.2	38758.	0.00064653	10760.	0.46192
53.960	11.252	4351.7	38683.	0.00067887	10756.	0.46213

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
54.000	11.267	4349.1	38607.	0.00070631	10751.	0.46234
54.040	11.282	4346.8	38533.	0.00072887	10747.	0.46254
54.080	11.298	4345.5	38469.	0.00074653	10743.	0.46274
54.120	11.313	4345.3	38415.	0.00075930	10740.	0.46291
54.160	11.329	4346.1	38370.	0.00076717	10737.	0.46308
54.200	11.344	4347.4	38330.	0.00077016	10733.	0.46324
54.240	11.358	4347.7	38284.	0.00077016	10730.	0.46343
54.280	11.372	4346.8	38231.	0.00077016	10725.	0.46365
54.320	11.385	4344.9	38170.	0.00077016	10720.	0.46390
54.360	11.397	4341.8	38103.	0.00077016	10715.	0.46417
54.400	11.408	4337.5	38028.	0.00077016	10709.	0.46447
54.440	11.418	4332.2	37947.	0.00077016	10702.	0.46480
54.480	11.428	4325.7	37858.	0.00077016	10695.	0.46516
54.520	11.437	4318.1	37762.	0.00077016	10687.	0.46555
54.560	11.445	4309.7	37661.	0.00076893	10679.	0.46596
54.600	11.453	4302.0	37568.	0.00076014	10671.	0.46635
54.640	11.461	4295.2	37482.	0.00074380	10664.	0.46672
54.680	11.468	4289.1	37403.	0.00071989	10657.	0.46708
54.720	11.476	4283.8	37332.	0.00068842	10650.	0.46741
54.760	11.484	4279.3	37268.	0.00064940	10643.	0.46774
54.800	11.491	4275.6	37211.	0.00060281	10637.	0.46804
54.840	11.499	4272.7	37162.	0.00054867	10632.	0.46833
54.880	11.506	4270.5	37119.	0.00048697	10626.	0.46860
54.920	11.513	4269.0	37083.	0.00042039	10621.	0.46886
54.960	11.520	4267.1	37044.	0.00035870	10616.	0.46912
55.000	11.527	4265.1	37004.	0.00030190	10611.	0.46938
55.040	11.534	4263.0	36964.	0.00025000	10606.	0.46963
55.080	11.541	4261.2	36925.	0.00020298	10601.	0.46988
55.120	11.548	4259.6	36889.	0.00016086	10596.	0.47011
55.160	11.555	4258.1	36853.	0.00012363	10591.	0.47034
55.200	11.562	4256.9	36820.	9.1295e-05	10587.	0.47055
55.240	11.570	4255.9	36788.	6.3849e-05	10583.	0.47076
55.280	11.577	4255.2	36758.	4.1296e-05	10579.	0.47096
55.320	11.584	4254.6	36730.	2.3634e-05	10575.	0.47114
55.360	11.592	4254.3	36703.	1.0864e-05	10572.	0.47132
55.400	11.599	4254.2	36678.	2.9861e-06	10568.	0.47149
55.440	11.607	4254.3	36654.	0.00000	10565.	0.47165
55.480	11.615	4254.7	36633.	0.00000	10562.	0.47180
55.520	11.623	4255.5	36616.	0.00000	10560.	0.47193
55.560	11.631	4256.8	36601.	0.00000	10557.	0.47206
55.600	11.639	4258.5	36590.	0.00000	10555.	0.47218
55.640	11.647	4260.5	36580.	0.00000	10552.	0.47230
55.680	11.656	4262.5	36570.	0.00000	10550.	0.47241
55.720	11.665	4264.6	36560.	0.00000	10548.	0.47251
55.760	11.674	4266.8	36550.	0.00000	10546.	0.47262
55.800	11.683	4269.1	36539.	0.00000	10544.	0.47272
55.840	11.693	4271.4	36529.	0.00000	10542.	0.47281
55.880	11.703	4273.9	36519.	-3.6845e-06	10540.	0.47291
55.920	11.713	4276.6	36510.	-1.1751e-05	10538.	0.47300
55.960	11.723	4279.4	36503.	-2.4200e-05	10537.	0.47308

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
56.000	11.733	4282.3	36496.	-4.1030e-05	10535.	0.47316
56.040	11.744	4285.4	36490.	-6.2243e-05	10533.	0.47324
56.080	11.754	4288.6	36486.	-8.7837e-05	10532.	0.47331
56.120	11.764	4292.0	36482.	-0.00011781	10531.	0.47338
56.160	11.775	4295.5	36480.	-0.00015217	10529.	0.47345
56.200	11.786	4299.2	36478.	-0.00019091	10528.	0.47351
56.240	11.796	4303.1	36478.	-0.00023404	10527.	0.47357
56.280	11.807	4306.9	36477.	-0.00028154	10526.	0.47362
56.320	11.818	4310.3	36473.	-0.00033343	10524.	0.47369
56.360	11.829	4313.5	36468.	-0.00038970	10523.	0.47376
56.400	11.839	4316.4	36460.	-0.00045035	10522.	0.47383
56.440	11.850	4319.0	36450.	-0.00051538	10520.	0.47391
56.480	11.860	4321.2	36436.	-0.00058023	10518.	0.47400
56.520	11.871	4322.7	36417.	-0.00063825	10516.	0.47410
56.560	11.881	4323.6	36393.	-0.00068941	10514.	0.47421
56.600	11.892	4323.8	36363.	-0.00073374	10512.	0.47433
56.640	11.902	4323.4	36328.	-0.00077122	10509.	0.47447
56.680	11.913	4322.4	36288.	-0.00080187	10506.	0.47461
56.720	11.923	4320.7	36242.	-0.00082566	10503.	0.47477
56.760	11.934	4318.4	36191.	-0.00084262	10499.	0.47494
56.800	11.944	4315.5	36135.	-0.00085273	10496.	0.47512
56.840	11.955	4311.9	36073.	-0.00085600	10492.	0.47531
56.880	11.965	4308.1	36011.	-0.00085600	10488.	0.47550
56.920	11.975	4304.5	35951.	-0.00085600	10484.	0.47569
56.960	11.985	4301.1	35893.	-0.00085600	10481.	0.47588
57.000	11.994	4297.8	35837.	-0.00085600	10477.	0.47606
57.040	12.003	4294.7	35784.	-0.00085600	10473.	0.47624
57.080	12.012	4291.8	35733.	-0.00085600	10470.	0.47642
57.120	12.021	4289.0	35684.	-0.00085232	10466.	0.47660
57.160	12.029	4286.2	35636.	-0.00084425	10463.	0.47678
57.200	12.038	4283.6	35589.	-0.00083180	10459.	0.47695
57.240	12.046	4281.1	35543.	-0.00081497	10456.	0.47712
57.280	12.055	4278.7	35499.	-0.00079376	10452.	0.47729
57.320	12.063	4276.4	35456.	-0.00076817	10449.	0.47746
57.360	12.071	4274.2	35414.	-0.00073819	10446.	0.47762
57.400	12.079	4272.1	35373.	-0.00070383	10442.	0.47779
57.440	12.086	4270.1	35333.	-0.00066509	10439.	0.47795
57.480	12.094	4268.2	35295.	-0.00062197	10436.	0.47811
57.520	12.102	4266.4	35258.	-0.00057446	10433.	0.47827
57.560	12.109	4264.7	35222.	-0.00052258	10430.	0.47842
57.600	12.116	4263.1	35187.	-0.00046631	10427.	0.47857
57.640	12.124	4261.6	35153.	-0.00040566	10424.	0.47873
57.680	12.131	4260.2	35121.	-0.00034062	10421.	0.47887
57.720	12.138	4259.1	35091.	-0.00027577	10418.	0.47902
57.760	12.144	4258.4	35066.	-0.00021776	10415.	0.47916
57.800	12.151	4258.0	35043.	-0.00016659	10412.	0.47929
57.840	12.158	4257.8	35022.	-0.00012226	10410.	0.47942
57.880	12.164	4257.9	35004.	-8.4778e-05	10407.	0.47954
57.920	12.171	4258.2	34987.	-5.4137e-05	10405.	0.47966
57.960	12.177	4258.6	34972.	-3.0339e-05	10403.	0.47977

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
58.000	12.184	4259.3	34960.	-1.3383e-05	10401.	0.47988
58.040	12.190	4260.3	34949.	-3.2702e-06	10399.	0.47998
58.080	12.196	4261.4	34940.	0.00000	10397.	0.48008
58.120	12.203	4262.5	34930.	0.00000	10395.	0.48017
58.160	12.210	4263.4	34919.	0.00000	10393.	0.48027
58.200	12.216	4264.0	34905.	0.00000	10391.	0.48038
58.240	12.223	4264.4	34889.	0.00000	10389.	0.48048
58.280	12.230	4264.7	34871.	0.00000	10386.	0.48059
58.320	12.238	4265.4	34854.	0.00000	10385.	0.48068
58.360	12.247	4266.3	34838.	0.00000	10383.	0.48077
58.400	12.256	4267.5	34822.	0.00000	10381.	0.48085
58.440	12.266	4269.0	34806.	0.00000	10380.	0.48092
58.480	12.276	4270.7	34790.	0.00000	10378.	0.48099
58.520	12.287	4272.0	34771.	0.00000	10377.	0.48106
58.560	12.298	4273.0	34749.	0.00000	10376.	0.48113
58.600	12.309	4273.7	34724.	0.00000	10374.	0.48122
58.640	12.320	4274.0	34695.	0.00000	10372.	0.48130
58.680	12.332	4274.1	34663.	0.00000	10370.	0.48139
58.720	12.343	4273.8	34628.	0.00000	10368.	0.48149
58.760	12.356	4273.2	34590.	0.00000	10366.	0.48159
58.800	12.368	4272.3	34548.	0.00000	10364.	0.48170
58.840	12.380	4271.1	34504.	0.00000	10362.	0.48181
58.880	12.393	4270.0	34459.	-6.5289e-06	10360.	0.48193
58.920	12.406	4269.0	34414.	-2.0407e-05	10357.	0.48207
58.960	12.420	4268.1	34370.	-4.1635e-05	10354.	0.48223
59.000	12.434	4267.4	34327.	-7.0213e-05	10350.	0.48240
59.040	12.447	4266.9	34284.	-0.00010614	10346.	0.48259
59.080	12.461	4266.8	34245.	-0.00014942	10342.	0.48279
59.120	12.476	4267.1	34208.	-0.00020004	10338.	0.48300
59.160	12.490	4267.7	34174.	-0.00025802	10334.	0.48323
59.200	12.504	4268.7	34142.	-0.00032334	10329.	0.48347
59.240	12.519	4269.9	34112.	-0.00038756	10324.	0.48371
59.280	12.533	4271.3	34083.	-0.00044680	10319.	0.48394
59.320	12.548	4272.8	34055.	-0.00050105	10315.	0.48418
59.360	12.563	4274.5	34028.	-0.00055032	10310.	0.48442
59.400	12.578	4276.3	34003.	-0.00059461	10305.	0.48465
59.440	12.592	4278.3	33978.	-0.00063391	10301.	0.48488
59.480	12.607	4280.5	33955.	-0.00066824	10296.	0.48511
59.520	12.622	4282.6	33932.	-0.00069758	10292.	0.48533
59.560	12.637	4284.4	33908.	-0.00072194	10287.	0.48557
59.600	12.651	4285.8	33881.	-0.00074132	10282.	0.48582
59.640	12.664	4286.9	33853.	-0.00075571	10277.	0.48608
59.680	12.677	4287.5	33823.	-0.00076512	10271.	0.48634
59.720	12.690	4288.0	33792.	-0.00076955	10266.	0.48661
59.760	12.703	4288.6	33764.	-0.00076955	10261.	0.48688
59.800	12.715	4289.4	33736.	-0.00076955	10255.	0.48714
59.840	12.727	4290.2	33710.	-0.00076955	10250.	0.48740
59.880	12.739	4291.1	33685.	-0.00076955	10245.	0.48766
59.920	12.751	4292.1	33662.	-0.00076955	10240.	0.48792
59.960	12.763	4293.1	33639.	-0.00076955	10235.	0.48817

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
60.000	12.774	4294.2	33618.	-0.00076955	10230.	0.48841
60.040	12.785	4295.4	33598.	-0.00076955	10225.	0.48866
60.080	12.796	4296.7	33580.	-0.00076955	10220.	0.48890
60.120	12.807	4297.6	33559.	-0.00076302	10216.	0.48913
60.160	12.817	4298.1	33536.	-0.00074915	10211.	0.48934
60.200	12.827	4298.3	33511.	-0.00072792	10207.	0.48954
60.240	12.837	4298.1	33484.	-0.00069934	10204.	0.48973
60.280	12.847	4297.8	33456.	-0.00066341	10200.	0.48990
60.320	12.857	4297.3	33427.	-0.00062014	10197.	0.49005
60.360	12.866	4296.7	33398.	-0.00056951	10194.	0.49019
60.400	12.876	4295.9	33367.	-0.00051153	10192.	0.49032
60.440	12.885	4295.0	33336.	-0.00044621	10190.	0.49042
60.480	12.894	4294.1	33305.	-0.00038199	10188.	0.49052
60.520	12.903	4293.2	33275.	-0.00032276	10186.	0.49062
60.560	12.912	4292.4	33246.	-0.00026850	10184.	0.49072
60.600	12.921	4291.6	33217.	-0.00021923	10182.	0.49082
60.640	12.930	4290.9	33189.	-0.00017494	10180.	0.49092
60.680	12.938	4290.3	33161.	-0.00013564	10178.	0.49101
60.720	12.947	4289.7	33134.	-0.00010131	10176.	0.49111
60.760	12.956	4289.0	33106.	-7.6494e-05	10174.	0.49121
60.800	12.964	4288.0	33077.	-6.3215e-05	10172.	0.49131
60.840	12.973	4286.7	33045.	-6.1479e-05	10170.	0.49142
60.880	12.982	4285.2	33011.	-7.1285e-05	10168.	0.49153
60.920	12.990	4283.4	32976.	-9.2632e-05	10165.	0.49164
60.960	12.999	4281.4	32939.	-0.00012552	10163.	0.49176
61.000	13.008	4279.1	32899.	-0.00016940	10161.	0.49189
61.040	13.016	4276.7	32859.	-0.00021984	10158.	0.49201
61.080	13.025	4274.2	32817.	-0.00027684	10155.	0.49214
61.120	13.034	4271.7	32775.	-0.00034040	10153.	0.49228
61.160	13.044	4269.2	32732.	-0.00040803	10150.	0.49241
61.200	13.053	4266.9	32691.	-0.00047567	10147.	0.49254
61.240	13.063	4264.8	32652.	-0.00054330	10145.	0.49267
61.280	13.072	4263.0	32614.	-0.00061094	10142.	0.49280
61.320	13.082	4261.5	32578.	-0.00067857	10140.	0.49292
61.360	13.092	4260.2	32544.	-0.00074621	10137.	0.49305
61.400	13.102	4259.1	32511.	-0.00081384	10135.	0.49317
61.440	13.112	4258.3	32480.	-0.00088148	10133.	0.49328
61.480	13.122	4257.6	32450.	-0.00094911	10130.	0.49340
61.520	13.132	4257.0	32420.	-0.0010167	10128.	0.49351
61.560	13.142	4256.4	32391.	-0.0010844	10126.	0.49363
61.600	13.152	4255.8	32361.	-0.0011520	10123.	0.49374
61.640	13.162	4255.2	32332.	-0.0012196	10121.	0.49386
61.680	13.172	4254.7	32303.	-0.0012873	10119.	0.49397
61.720	13.182	4254.0	32273.	-0.0013513	10117.	0.49409
61.760	13.192	4253.2	32243.	-0.0014108	10114.	0.49420
61.800	13.202	4252.3	32212.	-0.0014660	10112.	0.49431
61.840	13.212	4251.3	32180.	-0.0015166	10110.	0.49442
61.880	13.222	4250.2	32148.	-0.0015629	10108.	0.49453
61.920	13.232	4248.9	32114.	-0.0016047	10105.	0.49465
61.960	13.241	4247.5	32080.	-0.0016421	10103.	0.49476

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
62.000	13.251	4246.3	32047.	-0.0016705	10101.	0.49486
62.040	13.260	4245.2	32016.	-0.0016879	10099.	0.49496
62.080	13.270	4244.3	31987.	-0.0016943	10097.	0.49506
62.120	13.279	4243.6	31959.	-0.0016897	10095.	0.49515
62.160	13.288	4243.2	31934.	-0.0016742	10094.	0.49523
62.200	13.297	4242.9	31910.	-0.0016476	10092.	0.49531
62.240	13.306	4242.8	31888.	-0.0016100	10091.	0.49538
62.280	13.315	4242.9	31868.	-0.0015614	10089.	0.49545
62.320	13.323	4243.4	31850.	-0.0015044	10088.	0.49551
62.360	13.332	4244.3	31836.	-0.0014409	10087.	0.49556
62.400	13.341	4245.4	31823.	-0.0013732	10086.	0.49560
62.440	13.350	4246.7	31811.	-0.0013056	10085.	0.49565
62.480	13.360	4248.0	31799.	-0.0012380	10085.	0.49569
62.520	13.369	4249.4	31787.	-0.0011703	10084.	0.49573
62.560	13.379	4250.9	31775.	-0.0011027	10083.	0.49576
62.600	13.388	4252.5	31764.	-0.0010351	10082.	0.49580
62.640	13.398	4254.2	31752.	-0.00096731	10082.	0.49583
62.680	13.409	4255.5	31738.	-0.00089252	10081.	0.49586
62.720	13.419	4256.5	31722.	-0.00081070	10080.	0.49590
62.760	13.429	4257.1	31702.	-0.00072185	10079.	0.49595
62.800	13.439	4257.5	31680.	-0.00062598	10078.	0.49600
62.840	13.450	4257.5	31656.	-0.00052308	10077.	0.49605
62.880	13.461	4257.1	31629.	-0.00041315	10076.	0.49611
62.920	13.471	4256.5	31599.	-0.00029620	10075.	0.49618
62.960	13.482	4255.6	31567.	-0.00017586	10073.	0.49625
63.000	13.493	4254.5	31533.	-5.2927e-05	10072.	0.49632
63.040	13.504	4253.4	31499.	6.8155e-05	10070.	0.49640
63.080	13.515	4252.5	31466.	0.00018054	10069.	0.49647
63.120	13.527	4251.7	31435.	0.00028423	10067.	0.49655
63.160	13.538	4251.1	31405.	0.00037922	10066.	0.49662
63.200	13.549	4250.8	31376.	0.00046552	10064.	0.49669
63.240	13.560	4250.6	31349.	0.00054312	10063.	0.49677
63.280	13.572	4250.6	31323.	0.00061203	10062.	0.49684
63.320	13.583	4250.8	31298.	0.00067224	10060.	0.49690
63.360	13.594	4251.1	31275.	0.00072375	10059.	0.49697
63.400	13.605	4251.7	31253.	0.00076657	10058.	0.49704
63.440	13.617	4252.5	31232.	0.00080069	10056.	0.49710
63.480	13.628	4253.4	31213.	0.00082612	10055.	0.49717
63.520	13.640	4254.5	31195.	0.00084285	10054.	0.49723
63.560	13.651	4255.7	31177.	0.00085345	10052.	0.49730
63.600	13.662	4256.9	31160.	0.00085980	10051.	0.49736
63.640	13.673	4258.0	31143.	0.00086189	10050.	0.49743
63.680	13.684	4258.9	31126.	0.00086189	10048.	0.49750
63.720	13.694	4259.5	31105.	0.00086189	10047.	0.49757
63.760	13.705	4259.7	31083.	0.00086189	10045.	0.49765
63.800	13.716	4259.7	31058.	0.00086189	10044.	0.49773
63.840	13.726	4259.2	31031.	0.00086189	10042.	0.49782
63.880	13.737	4258.5	31001.	0.00086175	10040.	0.49791
63.920	13.747	4257.8	30973.	0.00085460	10038.	0.49799
63.960	13.758	4257.2	30944.	0.00084041	10037.	0.49808

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
64.000	13.768	4256.8	30918.	0.00081920	10035.	0.49816
64.040	13.779	4256.8	30894.	0.00079096	10034.	0.49824
64.080	13.790	4257.2	30873.	0.00075570	10032.	0.49831
64.120	13.801	4258.0	30855.	0.00071340	10031.	0.49838
64.160	13.811	4259.3	30840.	0.00066409	10030.	0.49844
64.200	13.822	4260.9	30828.	0.00060774	10028.	0.49849
64.240	13.833	4263.0	30818.	0.00054437	10028.	0.49854
64.280	13.844	4265.3	30811.	0.00047841	10027.	0.49859
64.320	13.855	4267.7	30803.	0.00041671	10026.	0.49863
64.360	13.867	4269.9	30794.	0.00035926	10025.	0.49868
64.400	13.878	4272.0	30784.	0.00030608	10024.	0.49873
64.440	13.889	4273.9	30772.	0.00025715	10023.	0.49879
64.480	13.901	4275.7	30759.	0.00021248	10021.	0.49884
64.520	13.913	4277.2	30745.	0.00017207	10020.	0.49890
64.560	13.924	4278.7	30730.	0.00013592	10019.	0.49896
64.600	13.936	4279.9	30713.	0.00010403	10018.	0.49902
64.640	13.948	4281.0	30695.	7.6392e-05	10017.	0.49909
64.680	13.959	4281.9	30676.	5.3015e-05	10015.	0.49916
64.720	13.971	4282.6	30655.	3.3895e-05	10014.	0.49923
64.760	13.983	4283.2	30633.	1.9034e-05	10012.	0.49930
64.800	13.995	4283.6	30609.	8.4312e-06	10011.	0.49937
64.840	14.007	4283.7	30583.	2.0865e-06	10009.	0.49945
64.880	14.019	4283.4	30555.	0.00000	10008.	0.49954
64.920	14.032	4283.0	30526.	0.00000	10006.	0.49962
64.960	14.044	4282.6	30497.	0.00000	10004.	0.49971
65.000	14.055	4282.1	30468.	0.00000	10002.	0.49980
65.040	14.067	4281.6	30439.	0.00000	10000.	0.49989
65.080	14.079	4281.1	30410.	0.00000	9998.6	0.49998
65.120	14.091	4280.6	30381.	0.00000	9996.8	0.50008
65.160	14.102	4280.0	30353.	0.00000	9994.9	0.50017
65.200	14.114	4279.5	30324.	0.00000	9993.0	0.50027
65.240	14.125	4278.8	30295.	0.00000	9991.1	0.50036
65.280	14.136	4277.8	30264.	0.00000	9989.1	0.50046
65.320	14.147	4276.6	30233.	0.00000	9987.1	0.50056
65.360	14.158	4275.4	30201.	0.00000	9985.1	0.50066
65.400	14.168	4274.0	30169.	0.00000	9983.1	0.50076
65.440	14.179	4272.5	30136.	0.00000	9981.2	0.50086
65.480	14.189	4270.9	30103.	0.00000	9979.2	0.50096
65.520	14.199	4269.2	30070.	0.00000	9977.3	0.50105
65.560	14.209	4267.3	30036.	0.00000	9975.3	0.50115
65.600	14.218	4265.5	30003.	0.00000	9973.4	0.50124
65.640	14.228	4263.7	29970.	0.00000	9971.6	0.50134
65.680	14.238	4262.1	29938.	0.00000	9969.8	0.50143
65.720	14.247	4260.5	29907.	0.00000	9968.0	0.50152
65.760	14.257	4258.9	29876.	0.00000	9966.3	0.50160
65.800	14.266	4257.5	29846.	0.00000	9964.6	0.50168
65.840	14.275	4256.1	29817.	0.00000	9963.0	0.50177
65.880	14.284	4254.8	29789.	0.00000	9961.4	0.50185
65.920	14.293	4253.5	29760.	0.00000	9959.8	0.50193
65.960	14.303	4252.2	29732.	0.00000	9958.2	0.50200

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
66.000	14.312	4250.8	29704.	0.00000	9956.6	0.50209
66.040	14.321	4249.4	29675.	0.00000	9955.0	0.50217
66.080	14.330	4248.2	29648.	0.00000	9953.4	0.50224
66.120	14.339	4247.1	29621.	0.00000	9951.9	0.50232
66.160	14.348	4246.1	29596.	0.00000	9950.4	0.50240
66.200	14.357	4245.3	29572.	0.00000	9948.9	0.50247
66.240	14.365	4244.6	29549.	0.00000	9947.5	0.50254
66.280	14.374	4244.1	29526.	0.00000	9946.1	0.50261
66.320	14.383	4243.7	29505.	0.00000	9944.7	0.50268
66.360	14.392	4243.4	29485.	0.00000	9943.4	0.50275
66.400	14.401	4243.3	29466.	-2.6174e-06	9942.1	0.50281
66.440	14.410	4243.4	29448.	-1.0697e-05	9940.9	0.50287
66.480	14.419	4243.6	29432.	-2.4240e-05	9939.7	0.50293
66.520	14.428	4244.0	29416.	-4.3245e-05	9938.6	0.50298
66.560	14.437	4244.3	29400.	-6.7712e-05	9937.5	0.50304
66.600	14.446	4244.6	29384.	-9.7642e-05	9936.4	0.50310
66.640	14.455	4244.8	29367.	-0.00013303	9935.2	0.50316
66.680	14.464	4245.0	29349.	-0.00017389	9934.0	0.50322
66.720	14.473	4245.1	29331.	-0.00022021	9932.8	0.50328
66.760	14.483	4245.1	29313.	-0.00027199	9931.6	0.50334
66.800	14.492	4245.1	29294.	-0.00032923	9930.3	0.50340
66.840	14.502	4245.1	29275.	-0.00039193	9929.0	0.50346
66.880	14.511	4245.0	29255.	-0.00045913	9927.8	0.50353
66.920	14.521	4244.8	29234.	-0.00052186	9926.4	0.50360
66.960	14.530	4244.6	29213.	-0.00058012	9925.0	0.50367
67.000	14.540	4244.2	29192.	-0.00063391	9923.5	0.50374
67.040	14.549	4243.8	29170.	-0.00068324	9922.0	0.50382
67.080	14.559	4243.2	29147.	-0.00072809	9920.4	0.50390
67.120	14.568	4242.6	29124.	-0.00076848	9918.8	0.50398
67.160	14.578	4242.0	29101.	-0.00080439	9917.1	0.50406
67.200	14.587	4241.3	29078.	-0.00083584	9915.4	0.50414
67.240	14.596	4240.7	29055.	-0.00086282	9913.8	0.50423
67.280	14.606	4240.1	29033.	-0.00088533	9912.1	0.50431
67.320	14.615	4239.5	29010.	-0.00090337	9910.4	0.50440
67.360	14.624	4239.0	28988.	-0.00091694	9908.7	0.50448
67.400	14.633	4238.4	28966.	-0.00092605	9907.0	0.50456
67.440	14.642	4237.8	28944.	-0.00093068	9905.3	0.50465
67.480	14.651	4237.3	28922.	-0.00093085	9903.6	0.50473
67.520	14.660	4236.8	28901.	-0.00093085	9901.9	0.50482
67.560	14.670	4236.4	28880.	-0.00093085	9900.2	0.50490
67.600	14.679	4236.2	28860.	-0.00093085	9898.5	0.50499
67.640	14.688	4236.0	28840.	-0.00092823	9896.8	0.50508
67.680	14.698	4235.8	28821.	-0.00092015	9895.1	0.50516
67.720	14.707	4235.7	28801.	-0.00090661	9893.3	0.50525
67.760	14.717	4235.6	28782.	-0.00088760	9891.5	0.50534
67.800	14.727	4235.6	28763.	-0.00086314	9889.6	0.50544
67.840	14.736	4235.6	28744.	-0.00083321	9887.7	0.50553
67.880	14.746	4235.6	28725.	-0.00079781	9885.8	0.50563
67.920	14.756	4235.4	28705.	-0.00075696	9883.7	0.50573
67.960	14.765	4235.2	28685.	-0.00071064	9881.5	0.50584

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
68.000	14.775	4234.8	28664.	-0.00065886	9879.2	0.50596
68.040	14.784	4234.3	28642.	-0.00060162	9876.8	0.50607
68.080	14.794	4233.7	28619.	-0.00053892	9874.3	0.50620
68.120	14.803	4233.0	28596.	-0.00047172	9871.7	0.50633
68.160	14.813	4232.2	28573.	-0.00040899	9869.1	0.50646
68.200	14.822	4231.3	28548.	-0.00035073	9866.3	0.50660
68.240	14.832	4230.4	28524.	-0.00029693	9863.5	0.50674
68.280	14.842	4229.3	28498.	-0.00024761	9860.6	0.50689
68.320	14.851	4228.2	28472.	-0.00020276	9857.7	0.50703
68.360	14.861	4227.0	28446.	-0.00016237	9854.6	0.50718
68.400	14.871	4225.8	28419.	-0.00012645	9851.5	0.50734
68.440	14.880	4224.8	28394.	-9.5006e-05	9848.3	0.50750
68.480	14.890	4224.1	28370.	-6.8027e-05	9844.9	0.50767
68.520	14.900	4223.5	28348.	-4.5517e-05	9841.3	0.50785
68.560	14.910	4223.2	28327.	-2.7476e-05	9837.7	0.50803
68.600	14.920	4223.1	28307.	-1.3904e-05	9833.8	0.50823
68.640	14.930	4223.3	28289.	-4.8003e-06	9829.8	0.50843
68.680	14.940	4223.7	28272.	-1.6572e-07	9825.7	0.50863
68.720	14.950	4224.3	28257.	0.00000	9821.4	0.50884
68.760	14.960	4225.0	28243.	0.00000	9817.0	0.50907
68.800	14.970	4225.9	28229.	0.00000	9812.5	0.50929
68.840	14.980	4226.9	28218.	0.00000	9807.7	0.50953
68.880	14.990	4228.1	28207.	0.00000	9802.9	0.50977
68.920	15.000	4229.3	28196.	0.00000	9798.0	0.51002
68.960	15.010	4230.3	28185.	0.00000	9793.0	0.51027
69.000	15.019	4231.4	28174.	0.00000	9788.0	0.51052
69.040	15.029	4232.4	28162.	0.00000	9783.0	0.51077
69.080	15.038	4233.3	28151.	0.00000	9778.0	0.51102
69.120	15.047	4234.2	28140.	0.00000	9773.0	0.51127
69.160	15.057	4235.3	28129.	0.00000	9768.0	0.51152
69.200	15.066	4236.4	28119.	0.00000	9763.1	0.51176
69.240	15.075	4237.7	28110.	0.00000	9758.2	0.51201
69.280	15.085	4239.1	28102.	0.00000	9753.3	0.51225
69.320	15.094	4240.6	28094.	0.00000	9748.5	0.51249
69.360	15.103	4242.1	28087.	0.00000	9743.7	0.51273
69.400	15.113	4243.8	28081.	0.00000	9739.0	0.51297
69.440	15.122	4245.6	28075.	0.00000	9734.3	0.51320
69.480	15.132	4247.4	28070.	0.00000	9729.7	0.51343
69.520	15.141	4249.2	28064.	0.00000	9725.2	0.51366
69.560	15.151	4250.9	28058.	0.00000	9720.7	0.51388
69.600	15.160	4252.5	28051.	0.00000	9716.3	0.51410
69.640	15.169	4254.0	28044.	0.00000	9712.0	0.51432
69.680	15.179	4255.2	28034.	0.00000	9707.8	0.51453
69.720	15.189	4256.0	28022.	0.00000	9703.8	0.51473
69.760	15.198	4256.4	28008.	0.00000	9699.9	0.51492
69.800	15.208	4256.5	27991.	0.00000	9696.2	0.51511
69.840	15.217	4256.2	27972.	0.00000	9692.6	0.51529
69.880	15.227	4255.6	27950.	0.00000	9689.2	0.51546
69.920	15.236	4254.6	27926.	0.00000	9685.9	0.51562
69.960	15.246	4253.3	27900.	0.00000	9682.8	0.51578

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
70.000	15.255	4251.8	27873.	0.00000	9679.8	0.51593
70.040	15.264	4250.0	27844.	0.00000	9677.0	0.51607
70.080	15.274	4247.9	27814.	0.00000	9674.3	0.51620
70.120	15.283	4245.6	27781.	0.00000	9671.8	0.51633
70.160	15.293	4243.2	27749.	0.00000	9669.4	0.51645
70.200	15.302	4240.7	27715.	0.00000	9667.0	0.51657
70.240	15.312	4238.2	27682.	0.00000	9664.6	0.51669
70.280	15.321	4235.6	27648.	0.00000	9662.2	0.51681
70.320	15.331	4233.0	27613.	0.00000	9659.9	0.51692
70.360	15.340	4230.3	27579.	0.00000	9657.6	0.51704
70.400	15.350	4227.5	27543.	0.00000	9655.4	0.51715
70.440	15.359	4224.8	27508.	0.00000	9653.2	0.51726
70.480	15.369	4222.2	27474.	0.00000	9651.1	0.51736
70.520	15.378	4219.7	27441.	0.00000	9649.2	0.51746
70.560	15.388	4217.3	27409.	0.00000	9647.3	0.51755
70.600	15.397	4215.0	27378.	0.00000	9645.5	0.51764
70.640	15.406	4212.9	27347.	0.00000	9643.8	0.51773
70.680	15.415	4210.9	27318.	0.00000	9642.2	0.51781
70.720	15.425	4209.1	27290.	0.00000	9640.7	0.51788
70.760	15.434	4207.6	27264.	0.00000	9639.3	0.51795
70.800	15.443	4206.3	27240.	0.00000	9638.0	0.51802
70.840	15.452	4205.4	27218.	0.00000	9636.7	0.51808
70.880	15.460	4204.7	27197.	0.00000	9635.5	0.51815
70.920	15.469	4204.3	27179.	0.00000	9634.3	0.51820
70.960	15.478	4204.2	27163.	0.00000	9633.2	0.51826
71.000	15.487	4204.3	27149.	0.00000	9632.2	0.51831
71.040	15.495	4204.8	27137.	0.00000	9631.3	0.51835
71.080	15.504	4205.5	27126.	0.00000	9630.4	0.51840
71.120	15.512	4206.6	27118.	0.00000	9629.6	0.51844
71.160	15.520	4207.7	27111.	-2.3665e-06	9628.9	0.51847
71.200	15.529	4208.9	27104.	-8.8695e-06	9628.1	0.51851
71.240	15.537	4210.0	27097.	-1.9509e-05	9627.3	0.51855
71.280	15.545	4211.1	27090.	-3.4285e-05	9626.5	0.51859
71.320	15.553	4212.1	27082.	-5.3198e-05	9625.7	0.51863
71.360	15.561	4213.1	27075.	-7.6247e-05	9624.9	0.51868
71.400	15.569	4214.1	27068.	-0.00010343	9624.0	0.51872
71.440	15.576	4215.1	27061.	-0.00013476	9623.2	0.51876
71.480	15.584	4216.0	27054.	-0.00017021	9622.3	0.51880
71.520	15.591	4216.9	27047.	-0.00020981	9621.5	0.51884
71.560	15.599	4217.8	27040.	-0.00025354	9620.6	0.51889
71.600	15.606	4218.6	27032.	-0.00030141	9619.7	0.51893
71.640	15.613	4219.4	27025.	-0.00035342	9618.8	0.51898
71.680	15.620	4220.1	27017.	-0.00040956	9617.9	0.51902
71.720	15.627	4220.6	27008.	-0.00046984	9616.9	0.51908
71.760	15.634	4220.9	26998.	-0.00053425	9615.8	0.51913
71.800	15.642	4221.0	26986.	-0.00060116	9614.6	0.51919
71.840	15.649	4221.0	26974.	-0.00066478	9613.4	0.51925
71.880	15.656	4221.0	26962.	-0.00072512	9612.1	0.51931
71.920	15.663	4221.0	26950.	-0.00078218	9610.8	0.51938
71.960	15.670	4220.9	26937.	-0.00083595	9609.4	0.51945

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
72.000	15.677	4220.8	26924.	-0.00088644	9607.9	0.51952
72.040	15.684	4220.7	26911.	-0.00093364	9606.4	0.51960
72.080	15.691	4220.5	26898.	-0.00097757	9604.8	0.51968
72.120	15.698	4220.2	26884.	-0.0010182	9603.2	0.51976
72.160	15.706	4220.0	26870.	-0.0010556	9601.5	0.51984
72.200	15.713	4219.7	26856.	-0.0010896	9599.7	0.51993
72.240	15.720	4219.3	26841.	-0.0011204	9597.9	0.52002
72.280	15.727	4218.9	26826.	-0.0011479	9596.1	0.52012
72.320	15.735	4218.5	26811.	-0.0011722	9594.1	0.52021
72.360	15.742	4218.0	26796.	-0.0011931	9592.1	0.52031
72.400	15.749	4217.6	26781.	-0.0012084	9590.1	0.52041
72.440	15.756	4217.4	26767.	-0.0012162	9588.1	0.52051
72.480	15.764	4217.4	26754.	-0.0012167	9586.2	0.52061
72.520	15.771	4217.5	26743.	-0.0012097	9584.2	0.52071
72.560	15.779	4217.8	26732.	-0.0011953	9582.3	0.52081
72.600	15.786	4218.3	26722.	-0.0011735	9580.3	0.52090
72.640	15.794	4218.9	26713.	-0.0011414	9578.4	0.52100
72.680	15.802	4219.5	26703.	-0.0010972	9576.5	0.52109
72.720	15.810	4220.2	26693.	-0.0010410	9574.6	0.52119
72.760	15.819	4221.0	26684.	-0.00097271	9572.8	0.52128
72.800	15.827	4221.8	26674.	-0.00089236	9570.9	0.52137
72.840	15.836	4222.6	26664.	-0.00079996	9569.1	0.52147
72.880	15.846	4223.6	26654.	-0.00069550	9567.2	0.52156
72.920	15.855	4224.5	26645.	-0.00057898	9565.4	0.52165
72.960	15.865	4225.6	26635.	-0.00045180	9563.6	0.52174
73.000	15.875	4226.6	26624.	-0.00032929	9561.8	0.52183
73.040	15.885	4227.5	26613.	-0.00021310	9559.9	0.52193
73.080	15.895	4228.2	26601.	-0.00010900	9557.9	0.52203
73.120	15.906	4228.6	26587.	-1.6991e-05	9555.8	0.52213
73.160	15.916	4228.9	26572.	6.2928e-05	9553.6	0.52224
73.200	15.926	4229.0	26555.	0.00013076	9551.4	0.52235
73.240	15.936	4228.8	26537.	0.00018649	9549.1	0.52246
73.280	15.947	4228.5	26518.	0.00023370	9546.7	0.52258
73.320	15.957	4228.1	26498.	0.00027762	9544.4	0.52270
73.360	15.968	4227.6	26477.	0.00031826	9542.0	0.52282
73.400	15.978	4227.0	26456.	0.00035562	9539.6	0.52294
73.440	15.989	4226.3	26435.	0.00038969	9537.2	0.52306
73.480	15.999	4225.5	26413.	0.00042048	9534.7	0.52318
73.520	16.010	4224.7	26390.	0.00044798	9532.3	0.52331
73.560	16.020	4223.8	26367.	0.00047221	9529.8	0.52343
73.600	16.031	4222.8	26343.	0.00049314	9527.3	0.52355
73.640	16.042	4221.7	26318.	0.00051080	9524.8	0.52368
73.680	16.053	4220.5	26293.	0.00052517	9522.3	0.52380
73.720	16.064	4219.2	26267.	0.00053626	9519.8	0.52393
73.760	16.074	4217.8	26241.	0.00054407	9517.3	0.52406
73.800	16.085	4216.4	26214.	0.00054859	9514.7	0.52418
73.840	16.096	4214.9	26187.	0.00054982	9512.2	0.52431
73.880	16.107	4213.4	26160.	0.00054489	9509.5	0.52444
73.920	16.118	4211.9	26134.	0.00053204	9506.9	0.52457
73.960	16.128	4210.5	26108.	0.00051126	9504.3	0.52471

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
74.000	16.138	4209.1	26083.	0.00048257	9501.6	0.52484
74.040	16.148	4207.8	26058.	0.00044596	9498.9	0.52498
74.080	16.158	4206.5	26035.	0.00040142	9496.1	0.52511
74.120	16.168	4205.2	26011.	0.00034897	9493.4	0.52525
74.160	16.177	4204.0	25989.	0.00028859	9490.6	0.52539
74.200	16.186	4202.9	25967.	0.00022169	9487.8	0.52553
74.240	16.195	4201.9	25946.	0.00016360	9485.1	0.52567
74.280	16.204	4201.0	25926.	0.00011431	9482.4	0.52580
74.320	16.213	4200.3	25907.	7.3836e-05	9479.7	0.52593
74.360	16.222	4199.7	25889.	4.2166e-05	9477.1	0.52606
74.400	16.231	4199.3	25872.	1.9303e-05	9474.6	0.52619
74.440	16.240	4199.1	25857.	5.2478e-06	9472.3	0.52631
74.480	16.250	4199.1	25842.	0.00000	9470.1	0.52642
74.520	16.259	4199.3	25829.	0.00000	9468.0	0.52652
74.560	16.268	4199.5	25816.	0.00000	9465.9	0.52662
74.600	16.277	4199.8	25804.	0.00000	9463.9	0.52672
74.640	16.286	4200.2	25791.	0.00000	9462.0	0.52682
74.680	16.295	4200.6	25780.	0.00000	9460.2	0.52691
74.720	16.304	4201.1	25769.	0.00000	9458.4	0.52700
74.760	16.313	4201.7	25758.	0.00000	9456.7	0.52708
74.800	16.322	4202.4	25748.	0.00000	9455.1	0.52716
74.840	16.331	4203.1	25738.	0.00000	9453.5	0.52724
74.880	16.340	4203.9	25729.	0.00000	9452.1	0.52732
74.920	16.349	4204.8	25720.	0.00000	9450.6	0.52739
74.960	16.358	4205.7	25711.	0.00000	9449.3	0.52746
75.000	16.367	4206.5	25702.	-4.5674e-06	9447.9	0.52753
75.040	16.376	4206.9	25690.	-1.7383e-05	9446.4	0.52760
75.080	16.386	4206.9	25675.	-3.8446e-05	9444.9	0.52768
75.120	16.395	4206.5	25658.	-6.7758e-05	9443.2	0.52776
75.160	16.404	4205.7	25639.	-0.00010532	9441.4	0.52785
75.200	16.414	4204.5	25617.	-0.00015113	9439.6	0.52794
75.240	16.423	4202.9	25592.	-0.00020518	9437.6	0.52804
75.280	16.433	4200.9	25566.	-0.00026749	9435.6	0.52814
75.320	16.442	4198.7	25537.	-0.00033354	9433.5	0.52825
75.360	16.452	4196.6	25510.	-0.00039512	9431.4	0.52835
75.400	16.462	4194.5	25482.	-0.00045223	9429.2	0.52846
75.440	16.471	4192.6	25456.	-0.00050488	9427.0	0.52857
75.480	16.481	4190.8	25430.	-0.00055305	9424.8	0.52868
75.520	16.491	4189.0	25404.	-0.00059675	9422.6	0.52879
75.560	16.500	4187.3	25379.	-0.00063598	9420.3	0.52890
75.600	16.510	4185.8	25354.	-0.00067074	9418.0	0.52902
75.640	16.520	4184.3	25330.	-0.00070103	9415.7	0.52914
75.680	16.530	4182.8	25306.	-0.00072685	9413.2	0.52926
75.720	16.540	4181.4	25282.	-0.00074819	9410.6	0.52939
75.760	16.550	4180.0	25259.	-0.00076507	9408.0	0.52952
75.800	16.559	4178.6	25236.	-0.00077748	9405.2	0.52966
75.840	16.569	4177.3	25213.	-0.00078542	9402.3	0.52981
75.880	16.579	4176.0	25190.	-0.00078888	9399.3	0.52996
75.920	16.589	4174.7	25167.	-0.00078888	9396.2	0.53011
75.960	16.599	4173.3	25144.	-0.00078888	9393.1	0.53026

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
76.000	16.608	4171.9	25121.	-0.00078888	9390.0	0.53042
76.040	16.618	4170.4	25097.	-0.00078888	9386.9	0.53057
76.080	16.628	4168.9	25073.	-0.00078888	9383.8	0.53073
76.120	16.637	4167.2	25049.	-0.00078888	9380.7	0.53089
76.160	16.647	4165.5	25024.	-0.00078888	9377.5	0.53105
76.200	16.656	4163.8	24999.	-0.00078888	9374.3	0.53120
76.240	16.666	4162.2	24975.	-0.00078431	9371.3	0.53136
76.280	16.675	4161.0	24954.	-0.00077150	9368.3	0.53150
76.320	16.684	4160.2	24935.	-0.00075044	9365.6	0.53164
76.360	16.693	4159.7	24919.	-0.00072112	9363.0	0.53177
76.400	16.702	4159.7	24905.	-0.00068356	9360.6	0.53189
76.440	16.711	4160.1	24894.	-0.00063776	9358.3	0.53201
76.480	16.721	4161.2	24886.	-0.00058370	9356.3	0.53211
76.520	16.731	4162.8	24882.	-0.00052140	9354.5	0.53220
76.560	16.741	4164.9	24879.	-0.00045534	9352.9	0.53228
76.600	16.751	4167.0	24877.	-0.00039376	9351.4	0.53235
76.640	16.761	4169.3	24875.	-0.00033665	9350.0	0.53242
76.680	16.772	4171.6	24873.	-0.00028401	9348.8	0.53248
76.720	16.783	4173.8	24870.	-0.00023584	9347.7	0.53254
76.760	16.794	4175.8	24865.	-0.00019214	9346.6	0.53259
76.800	16.806	4177.7	24859.	-0.00015290	9345.6	0.53264
76.840	16.817	4179.3	24852.	-0.00011815	9344.6	0.53269
76.880	16.829	4180.8	24843.	-8.7856e-05	9343.6	0.53274
76.920	16.841	4182.1	24833.	-6.2037e-05	9342.7	0.53279
76.960	16.854	4183.3	24822.	-4.0689e-05	9341.8	0.53283
77.000	16.866	4184.2	24809.	-2.3811e-05	9341.0	0.53287
77.040	16.879	4185.0	24795.	-1.1403e-05	9340.2	0.53291
77.080	16.892	4185.6	24780.	-3.4665e-06	9339.4	0.53295
77.120	16.906	4186.1	24763.	0.00000	9338.7	0.53299
77.160	16.919	4186.4	24745.	0.00000	9337.8	0.53303
77.200	16.933	4186.6	24727.	0.00000	9336.9	0.53308
77.240	16.946	4186.8	24707.	0.00000	9335.7	0.53313
77.280	16.960	4186.9	24688.	0.00000	9334.5	0.53320
77.320	16.975	4186.9	24667.	0.00000	9333.1	0.53327
77.360	16.989	4186.9	24647.	0.00000	9331.5	0.53334
77.400	17.003	4187.0	24626.	0.00000	9329.9	0.53343
77.440	17.018	4186.9	24606.	0.00000	9328.0	0.53352
77.480	17.032	4186.9	24585.	0.00000	9326.1	0.53362
77.520	17.046	4186.9	24564.	0.00000	9324.0	0.53372
77.560	17.061	4186.8	24543.	0.00000	9321.8	0.53383
77.600	17.075	4186.7	24522.	0.00000	9319.5	0.53395
77.640	17.089	4186.6	24501.	0.00000	9317.0	0.53407
77.680	17.104	4186.4	24479.	0.00000	9314.3	0.53421
77.720	17.118	4185.9	24456.	0.00000	9311.5	0.53435
77.760	17.131	4185.2	24433.	0.00000	9308.4	0.53450
77.800	17.144	4184.3	24408.	0.00000	9305.2	0.53466
77.840	17.157	4183.2	24383.	0.00000	9301.8	0.53483
77.880	17.170	4181.8	24357.	0.00000	9298.2	0.53501
77.920	17.183	4180.3	24330.	-9.0049e-07	9294.4	0.53520
77.960	17.195	4178.6	24304.	-5.1991e-06	9290.6	0.53539

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
78.000	17.206	4176.9	24277.	-1.2896e-05	9286.7	0.53559
78.040	17.217	4175.2	24251.	-2.3990e-05	9282.7	0.53579
78.080	17.228	4173.4	24226.	-3.8483e-05	9278.7	0.53599
78.120	17.239	4171.6	24200.	-5.6374e-05	9274.7	0.53619
78.160	17.249	4169.8	24176.	-7.7663e-05	9270.6	0.53639
78.200	17.259	4167.9	24151.	-0.00010235	9266.4	0.53660
78.240	17.268	4166.0	24127.	-0.00013044	9262.2	0.53681
78.280	17.277	4164.1	24103.	-0.00016192	9258.0	0.53702
78.320	17.285	4162.1	24080.	-0.00019680	9253.7	0.53724
78.360	17.294	4160.1	24057.	-0.00023508	9249.4	0.53745
78.400	17.302	4158.1	24034.	-0.00027676	9245.2	0.53766
78.440	17.309	4156.0	24011.	-0.00032183	9240.9	0.53787
78.480	17.317	4153.9	23989.	-0.00037031	9236.8	0.53808
78.520	17.324	4151.7	23967.	-0.00042218	9232.7	0.53829
78.560	17.330	4149.5	23945.	-0.00047745	9228.6	0.53849
78.600	17.337	4147.2	23922.	-0.00053611	9224.5	0.53870
78.640	17.343	4144.8	23899.	-0.00059818	9220.5	0.53890
78.680	17.350	4142.3	23876.	-0.00066364	9216.6	0.53909
78.720	17.356	4139.8	23853.	-0.00073013	9212.6	0.53929
78.760	17.362	4137.3	23830.	-0.00079344	9208.8	0.53948
78.800	17.368	4134.8	23808.	-0.00085357	9205.0	0.53967
78.840	17.374	4132.4	23785.	-0.00091052	9201.3	0.53986
78.880	17.380	4129.9	23763.	-0.00096430	9197.7	0.54004
78.920	17.386	4127.5	23741.	-0.0010149	9194.1	0.54021
78.960	17.392	4125.0	23719.	-0.0010623	9190.7	0.54039
79.000	17.398	4122.6	23697.	-0.0011066	9187.3	0.54056
79.040	17.403	4120.2	23676.	-0.0011476	9183.9	0.54073
79.080	17.409	4117.9	23655.	-0.0011855	9180.7	0.54089
79.120	17.414	4115.5	23634.	-0.0012202	9177.5	0.54105
79.160	17.420	4113.2	23613.	-0.0012508	9174.4	0.54120
79.200	17.425	4111.0	23593.	-0.0012749	9171.3	0.54136
79.240	17.430	4108.9	23574.	-0.0012924	9168.3	0.54151
79.280	17.436	4106.9	23555.	-0.0013033	9165.3	0.54166
79.320	17.441	4105.0	23537.	-0.0013076	9162.3	0.54181
79.360	17.447	4103.2	23519.	-0.0013053	9159.4	0.54195
79.400	17.452	4101.5	23502.	-0.0012965	9156.5	0.54210
79.440	17.458	4099.9	23485.	-0.0012811	9153.7	0.54224
79.480	17.464	4098.4	23469.	-0.0012591	9150.9	0.54238
79.520	17.469	4097.1	23454.	-0.0012306	9148.1	0.54252
79.560	17.475	4095.8	23439.	-0.0011957	9145.4	0.54265
79.600	17.481	4094.7	23425.	-0.0011574	9142.8	0.54278
79.640	17.487	4093.9	23412.	-0.0011157	9140.4	0.54290
79.680	17.493	4093.3	23400.	-0.0010707	9138.2	0.54301
79.720	17.500	4092.9	23389.	-0.0010222	9136.1	0.54312
79.760	17.506	4092.7	23379.	-0.00097032	9134.2	0.54321
79.800	17.513	4092.8	23371.	-0.00091505	9132.5	0.54330
79.840	17.520	4093.0	23363.	-0.00085638	9130.9	0.54338
79.880	17.527	4093.5	23356.	-0.00079431	9129.5	0.54345
79.920	17.534	4094.2	23350.	-0.00072885	9128.2	0.54351
79.960	17.541	4095.1	23345.	-0.00066236	9127.1	0.54357

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
80.000	17.549	4096.0	23341.	-0.00059905	9126.2	0.54361
80.040	17.557	4097.2	23337.	-0.00053892	9125.3	0.54366
80.080	17.565	4098.5	23334.	-0.00048197	9124.6	0.54369
80.120	17.573	4100.0	23331.	-0.00042820	9123.9	0.54373
80.160	17.582	4101.6	23329.	-0.00037760	9123.4	0.54375
80.200	17.591	4103.4	23327.	-0.00033018	9123.0	0.54377
80.240	17.600	4105.4	23326.	-0.00028594	9122.7	0.54379
80.280	17.609	4107.5	23326.	-0.00024488	9122.5	0.54380
80.320	17.619	4109.8	23326.	-0.00020699	9122.4	0.54380
80.360	17.629	4112.4	23327.	-0.00017228	9122.6	0.54379
80.400	17.640	4115.4	23329.	-0.00014075	9123.0	0.54377
80.440	17.652	4118.7	23332.	-0.00011240	9123.7	0.54374
80.480	17.665	4122.5	23337.	-8.7230e-05	9124.7	0.54369
80.520	17.678	4126.2	23340.	-6.5235e-05	9125.7	0.54364
80.560	17.691	4129.6	23342.	-4.6418e-05	9126.6	0.54359
80.600	17.705	4132.8	23343.	-3.0778e-05	9127.4	0.54355
80.640	17.718	4135.7	23341.	-1.8317e-05	9128.1	0.54352
80.680	17.732	4138.4	23339.	-9.0333e-06	9128.7	0.54349
80.720	17.746	4140.8	23334.	-2.9277e-06	9129.2	0.54346
80.760	17.759	4142.9	23328.	0.00000	9129.6	0.54344
80.800	17.773	4144.8	23320.	0.00000	9129.9	0.54343
80.840	17.787	4146.3	23311.	0.00000	9129.9	0.54343
80.880	17.801	4147.4	23299.	0.00000	9129.7	0.54344
80.920	17.815	4148.1	23285.	0.00000	9129.3	0.54346
80.960	17.829	4148.5	23269.	0.00000	9128.7	0.54349
81.000	17.843	4148.5	23251.	0.00000	9127.8	0.54353
81.040	17.856	4148.2	23232.	2.4899e-06	9126.8	0.54358
81.080	17.870	4147.9	23213.	8.3694e-06	9125.6	0.54364
81.120	17.883	4147.3	23193.	1.7638e-05	9124.3	0.54371
81.160	17.897	4146.7	23172.	3.0297e-05	9122.8	0.54378
81.200	17.910	4145.9	23150.	4.6345e-05	9121.2	0.54386
81.240	17.923	4144.9	23128.	6.5783e-05	9119.4	0.54395
81.280	17.936	4143.8	23106.	8.8610e-05	9117.5	0.54405
81.320	17.948	4142.4	23082.	0.00011483	9115.5	0.54415
81.360	17.960	4140.9	23058.	0.00014443	9113.3	0.54426
81.400	17.972	4139.1	23033.	0.00017743	9110.9	0.54438
81.440	17.984	4137.2	23007.	0.00021381	9108.5	0.54450
81.480	17.995	4135.0	22981.	0.00025359	9105.9	0.54463
81.520	18.006	4132.7	22954.	0.00029675	9103.2	0.54476
81.560	18.017	4130.1	22926.	0.00034331	9100.3	0.54491
81.600	18.027	4127.3	22897.	0.00039325	9097.2	0.54506
81.640	18.036	4124.0	22867.	0.00044659	9093.8	0.54523
81.680	18.045	4120.3	22835.	0.00050331	9090.1	0.54542
81.720	18.053	4116.1	22803.	0.00056342	9086.1	0.54562
81.760	18.060	4112.0	22770.	0.00062692	9082.0	0.54582
81.800	18.067	4108.1	22740.	0.00069381	9078.0	0.54602
81.840	18.074	4104.6	22711.	0.00075413	9074.2	0.54622
81.880	18.082	4101.6	22684.	0.00080508	9070.4	0.54640
81.920	18.090	4099.0	22660.	0.00084666	9066.7	0.54659
81.960	18.099	4096.9	22637.	0.00087887	9063.1	0.54677

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
82.000	18.107	4095.2	22617.	0.00090171	9059.7	0.54694
82.040	18.116	4093.9	22599.	0.00091518	9056.3	0.54711
82.080	18.125	4093.1	22583.	0.00091928	9053.1	0.54727
82.120	18.135	4092.5	22567.	0.00092607	9049.9	0.54743
82.160	18.145	4091.8	22551.	0.00094494	9046.6	0.54759
82.200	18.155	4091.1	22535.	0.00097589	9043.3	0.54776
82.240	18.166	4090.2	22517.	0.0010189	9040.0	0.54792
82.280	18.176	4089.2	22498.	0.0010715	9036.5	0.54810
82.320	18.188	4087.8	22477.	0.0011328	9033.0	0.54828
82.360	18.199	4086.5	22456.	0.0011872	9029.4	0.54845
82.400	18.210	4085.2	22434.	0.0012339	9025.9	0.54863
82.440	18.222	4083.8	22413.	0.0012731	9022.5	0.54880
82.480	18.233	4082.6	22392.	0.0013046	9019.1	0.54897
82.520	18.245	4081.3	22371.	0.0013286	9015.7	0.54914
82.560	18.256	4080.0	22350.	0.0013450	9012.4	0.54930
82.600	18.268	4078.8	22329.	0.0013538	9009.2	0.54947
82.640	18.280	4077.6	22308.	0.0013550	9006.0	0.54963
82.680	18.291	4076.3	22287.	0.0013487	9002.8	0.54978
82.720	18.303	4075.2	22266.	0.0013347	8999.6	0.54994
82.760	18.315	4074.0	22246.	0.0013132	8996.6	0.55010
82.800	18.327	4072.8	22225.	0.0012841	8993.5	0.55025
82.840	18.339	4071.7	22204.	0.0012474	8990.5	0.55040
82.880	18.351	4070.6	22184.	0.0012031	8987.6	0.55055
82.920	18.363	4069.5	22163.	0.0011512	8984.7	0.55069
82.960	18.375	4068.4	22142.	0.0010917	8981.8	0.55083
83.000	18.387	4067.5	22123.	0.0010282	8979.0	0.55097
83.040	18.400	4066.7	22104.	0.00096134	8976.3	0.55111
83.080	18.412	4066.0	22085.	0.00090102	8973.7	0.55124
83.120	18.424	4065.2	22066.	0.00085008	8971.2	0.55137
83.160	18.435	4064.3	22048.	0.00080850	8968.7	0.55149
83.200	18.446	4063.5	22030.	0.00077629	8966.2	0.55161
83.240	18.457	4062.6	22012.	0.00075345	8963.8	0.55173
83.280	18.468	4061.6	21994.	0.00073998	8961.5	0.55185
83.320	18.478	4060.6	21976.	0.00073588	8959.3	0.55196
83.360	18.488	4059.9	21960.	0.00072909	8957.2	0.55207
83.400	18.498	4059.6	21947.	0.00071021	8955.3	0.55216
83.440	18.507	4059.8	21936.	0.00067926	8953.6	0.55224
83.480	18.516	4060.4	21929.	0.00063623	8952.1	0.55232
83.520	18.525	4061.6	21925.	0.00058113	8950.9	0.55238
83.560	18.534	4063.2	21923.	0.00051394	8949.9	0.55243
83.600	18.542	4064.8	21922.	0.00045035	8948.8	0.55248
83.640	18.551	4066.4	21920.	0.00039095	8947.8	0.55253
83.680	18.560	4068.0	21918.	0.00033575	8946.8	0.55258
83.720	18.568	4069.5	21916.	0.00028474	8945.8	0.55263
83.760	18.577	4071.0	21914.	0.00023793	8944.8	0.55268
83.800	18.586	4072.4	21911.	0.00019532	8943.8	0.55274
83.840	18.595	4073.8	21909.	0.00015691	8942.8	0.55279
83.880	18.603	4075.2	21906.	0.00012269	8941.8	0.55284
83.920	18.612	4076.5	21902.	9.2664e-05	8940.8	0.55289
83.960	18.621	4077.8	21899.	6.6837e-05	8939.8	0.55294

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
84.000	18.630	4079.1	21895.	4.5207e-05	8938.8	0.55299
84.040	18.639	4080.3	21892.	2.7773e-05	8937.8	0.55304
84.080	18.648	4081.6	21888.	1.4535e-05	8936.8	0.55309
84.120	18.656	4082.8	21884.	5.4937e-06	8935.8	0.55314
84.160	18.665	4084.1	21881.	6.4868e-07	8934.8	0.55318
84.200	18.674	4085.3	21877.	0.00000	8933.8	0.55323
84.240	18.683	4086.5	21873.	0.00000	8932.8	0.55328
84.280	18.691	4087.5	21869.	0.00000	8931.8	0.55333
84.320	18.700	4088.3	21863.	0.00000	8930.7	0.55339
84.360	18.708	4089.0	21857.	0.00000	8929.6	0.55344
84.400	18.717	4089.6	21850.	0.00000	8928.5	0.55350
84.440	18.725	4090.0	21843.	0.00000	8927.3	0.55356
84.480	18.733	4090.2	21835.	0.00000	8926.1	0.55362
84.520	18.741	4090.3	21826.	0.00000	8924.8	0.55368
84.560	18.749	4090.3	21817.	0.00000	8923.5	0.55375
84.600	18.757	4090.1	21806.	0.00000	8922.2	0.55382
84.640	18.765	4089.7	21796.	0.00000	8920.8	0.55388
84.680	18.772	4089.2	21784.	0.00000	8919.4	0.55395
84.720	18.780	4088.6	21772.	0.00000	8918.0	0.55403
84.760	18.787	4087.7	21758.	0.00000	8916.4	0.55410
84.800	18.795	4086.5	21743.	0.00000	8914.8	0.55418
84.840	18.802	4085.2	21728.	0.00000	8913.2	0.55427
84.880	18.809	4083.7	21712.	0.00000	8911.4	0.55435
84.920	18.817	4082.2	21695.	0.00000	8909.7	0.55444
84.960	18.824	4080.6	21678.	0.00000	8907.8	0.55453
85.000	18.831	4078.9	21661.	0.00000	8906.0	0.55463
85.040	18.839	4077.1	21643.	0.00000	8904.0	0.55472
85.080	18.846	4075.2	21624.	0.00000	8902.1	0.55482
85.120	18.853	4073.2	21606.	0.00000	8900.0	0.55492
85.160	18.860	4071.1	21586.	0.00000	8898.0	0.55503
85.200	18.867	4068.9	21567.	0.00000	8895.8	0.55513
85.240	18.875	4066.6	21546.	0.00000	8893.6	0.55524
85.280	18.882	4064.2	21526.	0.00000	8891.4	0.55535
85.320	18.889	4061.7	21504.	0.00000	8889.1	0.55547
85.360	18.896	4059.0	21482.	0.00000	8886.8	0.55559
85.400	18.903	4056.3	21460.	-3.0983e-06	8884.4	0.55570
85.440	18.911	4053.8	21438.	-1.4773e-05	8882.2	0.55581
85.480	18.918	4051.6	21417.	-3.5025e-05	8880.1	0.55592
85.520	18.927	4049.6	21397.	-6.3854e-05	8878.0	0.55602
85.560	18.935	4047.7	21378.	-0.00010126	8876.1	0.55612
85.600	18.944	4046.1	21360.	-0.00014724	8874.2	0.55621
85.640	18.952	4044.8	21343.	-0.00020180	8872.4	0.55630
85.680	18.962	4043.6	21326.	-0.00026493	8870.8	0.55639
85.720	18.971	4042.6	21310.	-0.00033064	8869.2	0.55647
85.760	18.981	4041.5	21294.	-0.00039228	8867.5	0.55655
85.800	18.990	4040.3	21277.	-0.00044987	8865.9	0.55663
85.840	18.999	4039.2	21260.	-0.00050340	8864.2	0.55671
85.880	19.009	4038.0	21244.	-0.00055287	8862.6	0.55680
85.920	19.018	4036.7	21226.	-0.00059827	8860.9	0.55688
85.960	19.028	4035.5	21209.	-0.00063962	8859.1	0.55697

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
86.000	19.038	4034.3	21192.	-0.00067691	8857.4	0.55705
86.040	19.047	4033.2	21176.	-0.00071015	8855.8	0.55714
86.080	19.057	4032.2	21160.	-0.00073932	8854.2	0.55722
86.120	19.066	4031.4	21145.	-0.00076443	8852.6	0.55730
86.160	19.076	4030.6	21130.	-0.00078548	8851.1	0.55737
86.200	19.085	4030.0	21116.	-0.00080248	8849.6	0.55745
86.240	19.095	4029.4	21103.	-0.00081541	8848.1	0.55752
86.280	19.105	4029.0	21090.	-0.00082429	8846.7	0.55759
86.320	19.114	4028.7	21078.	-0.00082911	8845.3	0.55766
86.360	19.124	4028.5	21066.	-0.00082986	8844.0	0.55773
86.400	19.134	4028.6	21055.	-0.00082986	8842.7	0.55779
86.440	19.144	4028.8	21045.	-0.00082986	8841.7	0.55784
86.480	19.155	4029.3	21035.	-0.00082986	8840.7	0.55789
86.520	19.167	4030.0	21027.	-0.00082986	8839.9	0.55793
86.560	19.178	4031.0	21019.	-0.00082986	8839.2	0.55796
86.600	19.190	4032.1	21012.	-0.00082986	8838.7	0.55799
86.640	19.202	4033.2	21004.	-0.00082677	8838.1	0.55802
86.680	19.214	4034.0	20996.	-0.00081509	8837.4	0.55806
86.720	19.225	4034.6	20987.	-0.00079484	8836.6	0.55810
86.760	19.236	4034.9	20976.	-0.00076601	8835.6	0.55814
86.800	19.246	4034.9	20965.	-0.00072861	8834.6	0.55820
86.840	19.257	4034.6	20953.	-0.00068262	8833.4	0.55826
86.880	19.267	4034.1	20939.	-0.00062807	8832.1	0.55832
86.920	19.276	4033.4	20925.	-0.00056493	8830.7	0.55839
86.960	19.286	4032.4	20910.	-0.00049923	8829.3	0.55846
87.000	19.295	4031.5	20895.	-0.00043758	8827.8	0.55854
87.040	19.305	4030.6	20880.	-0.00037999	8826.3	0.55861
87.080	19.314	4029.6	20864.	-0.00032647	8824.9	0.55868
87.120	19.323	4028.6	20849.	-0.00027700	8823.4	0.55875
87.160	19.333	4027.6	20834.	-0.00023159	8822.0	0.55883
87.200	19.342	4026.6	20819.	-0.00019024	8820.5	0.55890
87.240	19.351	4025.6	20804.	-0.00015295	8819.0	0.55897
87.280	19.360	4024.6	20789.	-0.00011972	8817.6	0.55905
87.320	19.369	4023.5	20774.	-9.0547e-05	8816.1	0.55912
87.360	19.378	4022.5	20759.	-6.5434e-05	8814.7	0.55919
87.400	19.387	4021.4	20744.	-4.5794e-05	8813.2	0.55926
87.440	19.396	4020.4	20729.	-3.3844e-05	8811.8	0.55933
87.480	19.405	4019.5	20715.	-2.9582e-05	8810.5	0.55940
87.520	19.414	4018.6	20701.	-3.3010e-05	8809.3	0.55946
87.560	19.423	4017.8	20687.	-4.4126e-05	8808.1	0.55952
87.600	19.431	4017.1	20674.	-6.2931e-05	8806.9	0.55958
87.640	19.440	4016.3	20661.	-8.6124e-05	8805.8	0.55964
87.680	19.448	4015.5	20648.	-0.00011295	8804.6	0.55970
87.720	19.455	4014.6	20636.	-0.00014340	8803.3	0.55976
87.760	19.462	4013.6	20623.	-0.00017748	8802.1	0.55982
87.800	19.469	4012.6	20611.	-0.00021519	8800.8	0.55989
87.840	19.475	4011.5	20599.	-0.00025653	8799.5	0.55995
87.880	19.481	4010.6	20588.	-0.00030150	8798.2	0.56001
87.920	19.487	4009.7	20576.	-0.00035011	8797.0	0.56007
87.960	19.494	4008.9	20566.	-0.00040234	8795.9	0.56013

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
88.000	19.500	4008.2	20555.	-0.00045820	8794.8	0.56018
88.040	19.506	4007.5	20545.	-0.00051769	8793.8	0.56023
88.080	19.513	4006.9	20535.	-0.00058081	8792.9	0.56028
88.120	19.519	4006.4	20526.	-0.00064756	8792.0	0.56032
88.160	19.526	4006.7	20520.	-0.00069854	8791.6	0.56035
88.200	19.535	4008.1	20518.	-0.00072750	8791.6	0.56034
88.240	19.544	4010.6	20520.	-0.00073443	8792.2	0.56031
88.280	19.555	4013.3	20523.	-0.00072236	8793.0	0.56028
88.320	19.566	4015.9	20524.	-0.00069268	8793.7	0.56024
88.360	19.578	4018.4	20525.	-0.00064537	8794.5	0.56020
88.400	19.591	4020.8	20524.	-0.00058044	8795.3	0.56016
88.440	19.604	4023.1	20522.	-0.00052165	8796.0	0.56013
88.480	19.618	4025.3	20518.	-0.00047331	8796.6	0.56009
88.520	19.632	4027.4	20514.	-0.00043541	8797.2	0.56006
88.560	19.647	4029.4	20509.	-0.00040796	8797.8	0.56004
88.600	19.662	4031.2	20503.	-0.00039096	8798.3	0.56001
88.640	19.677	4032.9	20495.	-0.00038300	8798.8	0.55999
88.680	19.693	4034.5	20487.	-0.00037795	8799.1	0.55997
88.720	19.709	4036.0	20478.	-0.00036928	8799.4	0.55996
88.760	19.725	4037.3	20468.	-0.00035697	8799.6	0.55995
88.800	19.741	4038.5	20458.	-0.00034104	8799.7	0.55994
88.840	19.757	4039.7	20448.	-0.00032148	8799.8	0.55994
88.880	19.773	4040.7	20436.	-0.00029829	8799.8	0.55994
88.920	19.789	4041.5	20425.	-0.00027146	8799.7	0.55994
88.960	19.804	4042.3	20412.	-0.00024101	8799.6	0.55995
89.000	19.820	4043.0	20399.	-0.00020693	8799.3	0.55996
89.040	19.836	4043.5	20386.	-0.00016922	8799.1	0.55997
89.080	19.852	4044.0	20372.	-0.00012788	8798.7	0.55999
89.120	19.868	4044.3	20358.	-8.2905e-05	8798.3	0.56001
89.160	19.884	4044.5	20343.	-3.4304e-05	8797.8	0.56004
89.200	19.899	4044.7	20327.	1.7926e-05	8797.2	0.56007
89.240	19.915	4044.6	20311.	7.3787e-05	8796.6	0.56010
89.280	19.931	4044.5	20295.	0.00013328	8795.9	0.56013
89.320	19.947	4044.3	20277.	0.00019640	8795.1	0.56017
89.360	19.962	4044.0	20260.	0.00026315	8794.2	0.56022
89.400	19.977	4042.9	20239.	0.00031413	8792.8	0.56029
89.440	19.991	4040.8	20215.	0.00034309	8790.7	0.56039
89.480	20.003	4037.6	20187.	0.00035002	8788.1	0.56052
89.520	20.014	4034.2	20158.	0.00033795	8785.2	0.56067
89.560	20.025	4031.0	20131.	0.00030827	8782.1	0.56082
89.600	20.035	4027.9	20105.	0.00026096	8779.0	0.56097
89.640	20.044	4025.0	20081.	0.00019603	8775.8	0.56113
89.680	20.053	4022.1	20058.	0.00013724	8772.6	0.56130
89.720	20.062	4019.5	20037.	8.8896e-05	8769.3	0.56146
89.760	20.069	4017.0	20016.	5.1000e-05	8765.9	0.56163
89.800	20.077	4014.6	19997.	2.3552e-05	8762.5	0.56180
89.840	20.083	4012.4	19979.	6.5519e-06	8759.0	0.56197
89.880	20.090	4010.3	19963.	0.00000	8755.6	0.56215
89.920	20.096	4008.3	19947.	0.00000	8752.0	0.56233
89.960	20.102	4006.5	19932.	0.00000	8748.3	0.56251

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
90.000	20.108	4004.7	19917.	0.00000	8744.6	0.56270
90.040	20.114	4002.9	19902.	0.00000	8740.8	0.56289
90.080	20.120	4001.3	19888.	0.00000	8736.9	0.56308
90.120	20.126	3999.7	19874.	0.00000	8732.9	0.56328
90.160	20.132	3998.2	19861.	0.00000	8728.8	0.56349
90.200	20.138	3996.8	19848.	0.00000	8724.7	0.56369
90.240	20.144	3995.5	19835.	0.00000	8720.7	0.56389
90.280	20.150	3994.3	19823.	0.00000	8716.6	0.56409
90.320	20.156	3993.2	19812.	0.00000	8712.7	0.56429
90.360	20.162	3992.1	19800.	0.00000	8708.7	0.56449
90.400	20.169	3991.2	19790.	0.00000	8704.9	0.56468
90.440	20.175	3990.4	19779.	0.00000	8701.0	0.56488
90.480	20.182	3989.7	19769.	0.00000	8697.2	0.56507
90.520	20.188	3989.1	19760.	0.00000	8693.5	0.56525
90.560	20.195	3988.5	19751.	0.00000	8689.7	0.56544
90.600	20.201	3988.1	19742.	0.00000	8686.1	0.56562
90.640	20.208	3987.6	19733.	0.00000	8682.6	0.56579
90.680	20.215	3987.2	19724.	0.00000	8679.3	0.56596
90.720	20.222	3986.8	19716.	0.00000	8676.0	0.56612
90.760	20.229	3986.4	19707.	9.5605e-08	8672.9	0.56628
90.800	20.236	3986.1	19698.	6.0746e-06	8670.0	0.56643
90.840	20.244	3985.7	19689.	1.7937e-05	8667.1	0.56657
90.880	20.251	3985.3	19680.	3.5683e-05	8664.4	0.56670
90.920	20.259	3985.0	19671.	5.9312e-05	8661.9	0.56683
90.960	20.266	3984.6	19662.	8.8824e-05	8659.5	0.56695
91.000	20.274	3984.3	19653.	0.00012422	8657.2	0.56707
91.040	20.282	3984.0	19643.	0.00016550	8655.0	0.56718
91.080	20.290	3983.7	19634.	0.00021266	8653.0	0.56728
91.120	20.299	3983.3	19624.	0.00026571	8651.1	0.56737
91.160	20.307	3983.0	19614.	0.00032464	8649.4	0.56746
91.200	20.316	3982.7	19605.	0.00038945	8647.8	0.56754
91.240	20.325	3982.5	19595.	0.00045399	8646.3	0.56761
91.280	20.334	3982.2	19585.	0.00051258	8644.9	0.56768
91.320	20.343	3982.1	19576.	0.00056523	8643.7	0.56774
91.360	20.352	3982.0	19566.	0.00061193	8642.7	0.56779
91.400	20.361	3982.0	19557.	0.00065268	8641.7	0.56784
91.440	20.371	3982.0	19548.	0.00068749	8640.9	0.56788
91.480	20.381	3982.0	19539.	0.00071635	8640.0	0.56793
91.520	20.391	3982.1	19530.	0.00073927	8639.1	0.56797
91.560	20.400	3982.2	19521.	0.00075623	8638.3	0.56801
91.600	20.410	3982.4	19512.	0.00076725	8637.4	0.56806
91.640	20.421	3982.6	19503.	0.00077233	8636.6	0.56810
91.680	20.431	3982.8	19495.	0.00077233	8635.8	0.56814
91.720	20.441	3982.8	19485.	0.00077233	8634.9	0.56818
91.760	20.451	3982.7	19475.	0.00077233	8633.9	0.56823
91.800	20.461	3982.5	19464.	0.00077233	8632.9	0.56828
91.840	20.472	3982.1	19452.	0.00077233	8631.9	0.56833
91.880	20.482	3981.6	19440.	0.00077233	8630.8	0.56839
91.920	20.492	3980.9	19427.	0.00077233	8629.7	0.56844
91.960	20.502	3980.0	19413.	0.00077233	8628.5	0.56850

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
92.000	20.513	3979.0	19399.	0.00077223	8627.2	0.56857
92.040	20.523	3977.9	19383.	0.00076625	8625.9	0.56863
92.080	20.533	3976.7	19368.	0.00075439	8624.6	0.56870
92.120	20.544	3975.3	19351.	0.00073665	8623.2	0.56877
92.160	20.554	3973.8	19334.	0.00071302	8621.7	0.56884
92.200	20.564	3972.2	19317.	0.00068350	8620.3	0.56891
92.240	20.574	3970.6	19300.	0.00064811	8618.8	0.56899
92.280	20.584	3969.1	19284.	0.00060683	8617.3	0.56906
92.320	20.593	3967.7	19268.	0.00055967	8615.8	0.56914
92.360	20.603	3966.3	19252.	0.00050662	8614.4	0.56921
92.400	20.612	3965.0	19237.	0.00044769	8613.0	0.56928
92.440	20.622	3963.7	19222.	0.00038288	8611.5	0.56935
92.480	20.631	3962.4	19207.	0.00031834	8610.1	0.56942
92.520	20.640	3961.2	19193.	0.00025974	8608.7	0.56949
92.560	20.649	3959.9	19178.	0.00020710	8607.3	0.56956
92.600	20.657	3958.7	19164.	0.00016040	8606.0	0.56963
92.640	20.666	3957.4	19150.	0.00011964	8604.6	0.56970
92.680	20.674	3956.2	19136.	8.4837e-05	8603.2	0.56977
92.720	20.683	3954.9	19123.	5.5977e-05	8601.9	0.56983
92.760	20.691	3953.7	19109.	3.3063e-05	8600.6	0.56990
92.800	20.699	3952.5	19096.	1.6095e-05	8599.3	0.56996
92.840	20.707	3951.2	19083.	5.0744e-06	8598.0	0.57003
92.880	20.714	3950.0	19070.	0.00000	8596.7	0.57009
92.920	20.722	3948.8	19057.	0.00000	8595.4	0.57016
92.960	20.729	3947.8	19045.	0.00000	8594.2	0.57022
93.000	20.737	3946.9	19034.	0.00000	8593.0	0.57028
93.040	20.744	3946.2	19024.	0.00000	8591.8	0.57034
93.080	20.751	3945.6	19014.	0.00000	8590.7	0.57039
93.120	20.759	3945.2	19005.	0.00000	8589.6	0.57045
93.160	20.766	3945.0	18998.	0.00000	8588.6	0.57050
93.200	20.773	3944.9	18991.	0.00000	8587.5	0.57055
93.240	20.780	3945.0	18984.	0.00000	8586.6	0.57060
93.280	20.787	3945.2	18979.	0.00000	8585.6	0.57065
93.320	20.795	3945.6	18974.	0.00000	8584.7	0.57069
93.360	20.802	3946.2	18971.	0.00000	8583.9	0.57073
93.400	20.809	3946.9	18968.	0.00000	8583.1	0.57077
93.440	20.816	3947.8	18965.	0.00000	8582.3	0.57081
93.480	20.823	3948.6	18963.	0.00000	8581.4	0.57086
93.520	20.830	3949.4	18960.	0.00000	8580.6	0.57090
93.560	20.837	3950.1	18957.	0.00000	8579.7	0.57094
93.600	20.844	3950.8	18954.	0.00000	8578.8	0.57099
93.640	20.852	3951.5	18950.	0.00000	8577.9	0.57103
93.680	20.859	3952.0	18946.	0.00000	8577.1	0.57107
93.720	20.867	3952.6	18942.	0.00000	8576.2	0.57112
93.760	20.875	3953.0	18937.	0.00000	8575.3	0.57116
93.800	20.883	3953.4	18931.	0.00000	8574.4	0.57121
93.840	20.892	3953.8	18926.	0.00000	8573.6	0.57125
93.880	20.900	3954.1	18919.	0.00000	8572.7	0.57129
93.920	20.909	3954.3	18913.	0.00000	8571.8	0.57134
93.960	20.917	3954.5	18906.	0.00000	8570.9	0.57138

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
94.000	20.926	3954.6	18898.	3.3455e-06	8570.1	0.57142
94.040	20.935	3954.8	18891.	1.3256e-05	8569.3	0.57146
94.080	20.945	3955.0	18883.	2.9732e-05	8568.5	0.57150
94.120	20.954	3955.2	18876.	5.2773e-05	8567.7	0.57154
94.160	20.964	3955.4	18868.	8.2379e-05	8567.0	0.57158
94.200	20.974	3955.7	18861.	0.00011855	8566.4	0.57161
94.240	20.984	3956.0	18853.	0.00016129	8565.8	0.57164
94.280	20.994	3956.4	18846.	0.00021059	8565.3	0.57166
94.320	21.004	3956.8	18839.	0.00026645	8564.9	0.57168
94.360	21.014	3957.2	18832.	0.00032889	8564.5	0.57170
94.400	21.025	3957.7	18824.	0.00039472	8564.2	0.57172
94.440	21.036	3958.1	18817.	0.00045187	8563.9	0.57173
94.480	21.047	3958.5	18809.	0.00050035	8563.7	0.57174
94.520	21.058	3958.9	18801.	0.00054015	8563.5	0.57175
94.560	21.069	3959.2	18792.	0.00057126	8563.4	0.57176
94.600	21.081	3959.5	18783.	0.00059370	8563.3	0.57176
94.640	21.093	3959.7	18773.	0.00060746	8563.2	0.57177
94.680	21.105	3959.9	18763.	0.00061254	8563.1	0.57177
94.720	21.118	3960.2	18753.	0.00061955	8563.2	0.57177
94.760	21.131	3960.7	18744.	0.00064346	8563.4	0.57176
94.800	21.144	3961.5	18736.	0.00068427	8563.7	0.57174
94.840	21.158	3962.6	18729.	0.00074197	8564.1	0.57172
94.880	21.171	3964.0	18724.	0.00081658	8564.7	0.57169
94.920	21.186	3965.6	18719.	0.00090809	8565.3	0.57166
94.960	21.200	3967.6	18715.	0.0010165	8566.1	0.57162
95.000	21.214	3969.8	18713.	0.0011418	8567.0	0.57158
95.040	21.229	3972.1	18711.	0.0012707	8567.9	0.57153
95.080	21.244	3974.0	18707.	0.0013842	8568.4	0.57151
95.120	21.259	3975.6	18702.	0.0014823	8568.6	0.57150
95.160	21.273	3976.9	18695.	0.0015650	8568.6	0.57150
95.200	21.288	3977.9	18687.	0.0016322	8568.3	0.57152
95.240	21.302	3978.5	18677.	0.0016806	8567.6	0.57155
95.280	21.316	3978.7	18665.	0.0017071	8566.6	0.57160
95.320	21.331	3978.4	18652.	0.0017115	8565.3	0.57166
95.360	21.345	3977.8	18636.	0.0016940	8563.6	0.57175
95.400	21.359	3977.0	18620.	0.0016673	8561.7	0.57184
95.440	21.373	3976.1	18604.	0.0016386	8559.8	0.57194
95.480	21.387	3975.1	18587.	0.0016080	8557.8	0.57204
95.520	21.401	3974.0	18570.	0.0015754	8555.7	0.57214
95.560	21.414	3972.8	18553.	0.0015407	8553.5	0.57226
95.600	21.428	3971.5	18535.	0.0015041	8551.2	0.57237
95.640	21.441	3970.2	18518.	0.0014687	8548.8	0.57249
95.680	21.454	3968.9	18500.	0.0014465	8546.3	0.57261
95.720	21.467	3967.5	18483.	0.0014375	8543.8	0.57274
95.760	21.480	3966.2	18466.	0.0014418	8541.3	0.57286
95.800	21.492	3964.8	18449.	0.0014594	8538.7	0.57299
95.840	21.504	3963.5	18433.	0.0014902	8536.0	0.57313
95.880	21.516	3962.1	18416.	0.0015343	8533.2	0.57327
95.920	21.527	3960.8	18400.	0.0015916	8530.4	0.57341
95.960	21.539	3959.3	18384.	0.0016516	8527.5	0.57355

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
96.000	21.550	3957.6	18366.	0.0016879	8524.5	0.57370
96.040	21.561	3955.5	18347.	0.0016986	8521.2	0.57387
96.080	21.572	3953.2	18327.	0.0016837	8517.8	0.57404
96.120	21.582	3950.6	18306.	0.0016432	8514.2	0.57422
96.160	21.593	3947.8	18283.	0.0015771	8510.4	0.57441
96.200	21.604	3944.6	18260.	0.0014855	8506.4	0.57461
96.240	21.614	3941.2	18235.	0.0013682	8502.3	0.57481
96.280	21.625	3937.7	18210.	0.0012393	8498.1	0.57502
96.320	21.635	3934.6	18187.	0.0011258	8494.3	0.57521
96.360	21.645	3931.9	18166.	0.0010277	8490.8	0.57539
96.400	21.655	3929.6	18147.	0.00094507	8487.5	0.57555
96.440	21.665	3927.6	18129.	0.00087786	8484.6	0.57570
96.480	21.675	3926.0	18114.	0.00082607	8482.0	0.57583
96.520	21.685	3924.8	18100.	0.00078972	8479.7	0.57595
96.560	21.694	3924.0	18088.	0.00076879	8477.6	0.57605
96.600	21.704	3923.5	18078.	0.00076329	8475.9	0.57613
96.640	21.714	3923.2	18069.	0.00076035	8474.3	0.57621
96.680	21.723	3923.0	18060.	0.00075283	8472.8	0.57629
96.720	21.732	3922.9	18051.	0.00074074	8471.4	0.57636
96.760	21.742	3922.7	18043.	0.00072408	8469.9	0.57643
96.800	21.751	3922.7	18035.	0.00070284	8468.6	0.57650
96.840	21.761	3922.7	18027.	0.00067703	8467.3	0.57656
96.880	21.770	3922.8	18020.	0.00064664	8466.1	0.57662
96.920	21.779	3922.9	18013.	0.00061168	8464.9	0.57668
96.960	21.788	3923.1	18006.	0.00057215	8463.8	0.57674
97.000	21.797	3923.3	17999.	0.00052804	8462.7	0.57679
97.040	21.807	3923.6	17993.	0.00047680	8461.7	0.57684
97.080	21.816	3923.9	17987.	0.00041542	8460.7	0.57689
97.120	21.825	3924.3	17981.	0.00034391	8459.7	0.57694
97.160	21.835	3924.7	17975.	0.00026228	8458.7	0.57699
97.200	21.844	3925.1	17969.	0.00017051	8457.8	0.57704
97.240	21.853	3925.6	17964.	7.9949e-05	8456.9	0.57709
97.280	21.862	3926.1	17958.	-7.4745e-06	8456.0	0.57713
97.320	21.871	3926.6	17954.	-9.1766e-05	8455.1	0.57717
97.360	21.880	3927.1	17949.	-0.00017293	8454.3	0.57721
97.400	21.888	3927.7	17945.	-0.00025095	8453.5	0.57725
97.440	21.896	3928.3	17941.	-0.00032585	8452.7	0.57729
97.480	21.904	3928.9	17937.	-0.00039761	8452.0	0.57733
97.520	21.912	3929.5	17933.	-0.00046164	8451.3	0.57737
97.560	21.920	3930.0	17929.	-0.00051334	8450.5	0.57740
97.600	21.928	3930.3	17924.	-0.00055272	8449.6	0.57745
97.640	21.936	3930.6	17918.	-0.00057977	8448.8	0.57749
97.680	21.945	3930.7	17912.	-0.00059450	8447.8	0.57754
97.720	21.953	3930.7	17905.	-0.00059690	8446.8	0.57759
97.760	21.962	3930.6	17897.	-0.00058697	8445.7	0.57764
97.800	21.971	3930.3	17889.	-0.00056472	8444.6	0.57770
97.840	21.980	3930.0	17880.	-0.00053015	8443.4	0.57776
97.880	21.989	3929.5	17871.	-0.00048325	8442.1	0.57782
97.920	21.998	3928.9	17861.	-0.00042402	8440.8	0.57789
97.960	22.008	3928.3	17850.	-0.00035839	8439.5	0.57795

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
98.000	22.018	3927.6	17839.	-0.00029906	8438.1	0.57802
98.040	22.027	3927.0	17828.	-0.00024605	8436.8	0.57809
98.080	22.037	3926.3	17817.	-0.00019933	8435.5	0.57815
98.120	22.047	3925.6	17806.	-0.00015892	8434.2	0.57822
98.160	22.057	3925.0	17795.	-0.00012482	8432.9	0.57829
98.200	22.068	3924.4	17784.	-9.7020e-05	8431.6	0.57835
98.240	22.078	3923.7	17773.	-7.5527e-05	8430.3	0.57842
98.280	22.089	3923.1	17761.	-5.7774e-05	8429.0	0.57848
98.320	22.099	3922.5	17750.	-4.0767e-05	8427.8	0.57854
98.360	22.110	3921.9	17739.	-2.4508e-05	8426.6	0.57860
98.400	22.121	3921.3	17727.	-7.6247e-06	8425.5	0.57866
98.440	22.131	3920.6	17716.	1.0833e-05	8424.3	0.57871
98.480	22.142	3920.0	17705.	3.0864e-05	8423.2	0.57877
98.520	22.152	3919.3	17693.	5.2469e-05	8422.1	0.57883
98.560	22.163	3918.5	17681.	7.5647e-05	8421.0	0.57888
98.600	22.173	3917.8	17670.	0.00010040	8419.9	0.57894
98.640	22.183	3916.9	17658.	0.00012673	8418.8	0.57899
98.680	22.193	3916.1	17646.	0.00015463	8417.7	0.57904
98.720	22.204	3915.2	17634.	0.00018410	8416.6	0.57910
98.760	22.214	3914.3	17622.	0.00020991	8415.6	0.57915
98.800	22.223	3913.5	17610.	0.00021942	8414.6	0.57920
98.840	22.233	3912.8	17599.	0.00021262	8413.6	0.57925
98.880	22.243	3912.1	17588.	0.00018950	8412.6	0.57930
98.920	22.252	3911.4	17578.	0.00015008	8411.7	0.57934
98.960	22.262	3910.9	17568.	9.4348e-05	8410.8	0.57939
99.000	22.271	3910.4	17559.	2.2305e-05	8410.0	0.57943
99.040	22.280	3909.9	17549.	-6.6047e-05	8409.1	0.57947
99.080	22.289	3909.5	17540.	-0.00016826	8408.3	0.57951
99.120	22.298	3909.2	17532.	-0.00028279	8407.6	0.57955
99.160	22.307	3908.9	17523.	-0.00040966	8406.8	0.57959
99.200	22.317	3908.5	17514.	-0.00054292	8406.1	0.57963
99.240	22.326	3908.1	17505.	-0.00066988	8405.3	0.57966
99.280	22.335	3907.6	17496.	-0.00079053	8404.5	0.57971
99.320	22.344	3907.0	17486.	-0.00090488	8403.6	0.57975
99.360	22.354	3906.3	17475.	-0.0010129	8402.7	0.57980
99.400	22.363	3905.5	17464.	-0.0011147	8401.7	0.57984
99.440	22.373	3904.7	17453.	-0.0012069	8400.7	0.57989
99.480	22.383	3903.9	17442.	-0.0012824	8399.8	0.57994
99.520	22.393	3903.1	17431.	-0.0013410	8398.9	0.57999
99.560	22.403	3902.5	17420.	-0.0013829	8398.0	0.58003
99.600	22.414	3901.8	17409.	-0.0014081	8397.2	0.58007
99.640	22.425	3901.3	17398.	-0.0014178	8396.4	0.58011
99.680	22.436	3900.8	17387.	-0.0014131	8395.7	0.58014
99.720	22.447	3900.4	17376.	-0.0014027	8395.1	0.58018
99.760	22.459	3900.1	17366.	-0.0013884	8394.3	0.58021
99.800	22.470	3899.8	17356.	-0.0013701	8393.6	0.58025
99.840	22.481	3899.5	17346.	-0.0013479	8392.9	0.58028
99.880	22.493	3899.3	17337.	-0.0013216	8392.1	0.58032
99.920	22.504	3899.1	17327.	-0.0012913	8391.4	0.58036
99.960	22.515	3899.0	17318.	-0.0012571	8390.6	0.58040

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
100.00	22.526	3899.0	17309.	-0.0012189	8389.8	0.58044
100.04	22.537	3899.0	17301.	-0.0011767	8389.0	0.58048
100.08	22.548	3899.0	17292.	-0.0011305	8388.1	0.58052
100.12	22.559	3899.1	17284.	-0.0010804	8387.3	0.58057
100.16	22.570	3899.2	17276.	-0.0010262	8386.4	0.58061
100.20	22.581	3899.3	17269.	-0.00096808	8385.5	0.58065
100.24	22.592	3899.6	17261.	-0.00090596	8384.6	0.58070
100.28	22.602	3899.8	17254.	-0.00083986	8383.7	0.58074
100.32	22.613	3900.1	17248.	-0.00077222	8382.8	0.58079
100.36	22.624	3900.6	17241.	-0.00070459	8381.8	0.58084
100.40	22.634	3901.0	17236.	-0.00063695	8380.9	0.58088
100.44	22.644	3901.6	17231.	-0.00056932	8379.9	0.58093
100.48	22.654	3902.3	17226.	-0.00050168	8379.0	0.58098
100.52	22.663	3903.0	17222.	-0.00043405	8378.0	0.58103
100.56	22.673	3903.7	17218.	-0.00036641	8377.0	0.58108
100.60	22.682	3904.6	17214.	-0.00029878	8376.0	0.58113
100.64	22.692	3905.5	17211.	-0.00023115	8375.0	0.58118
100.68	22.701	3906.4	17208.	-0.00016671	8373.9	0.58123
100.72	22.710	3907.2	17205.	-0.00011274	8372.8	0.58129
100.76	22.718	3907.9	17202.	-6.9245e-05	8371.5	0.58135
100.80	22.726	3908.6	17199.	-3.6224e-05	8370.1	0.58142
100.84	22.734	3909.2	17196.	-1.3676e-05	8368.7	0.58150
100.88	22.741	3909.8	17192.	-1.6015e-06	8367.1	0.58157
100.92	22.748	3910.2	17189.	0.00000	8365.5	0.58166
100.96	22.755	3910.6	17186.	0.00000	8363.8	0.58174
101.00	22.762	3911.0	17182.	0.00000	8362.1	0.58183
101.04	22.770	3911.4	17178.	0.00000	8360.4	0.58191
101.08	22.777	3911.7	17174.	0.00000	8358.7	0.58199
101.12	22.784	3912.0	17170.	0.00000	8357.1	0.58207
101.16	22.792	3912.1	17165.	0.00000	8355.5	0.58215
101.20	22.799	3912.2	17160.	0.00000	8354.0	0.58223
101.24	22.807	3912.3	17154.	0.00000	8352.4	0.58231
101.28	22.815	3912.2	17148.	0.00000	8351.0	0.58238
101.32	22.822	3912.2	17142.	0.00000	8349.5	0.58245
101.36	22.830	3912.0	17135.	0.00000	8348.1	0.58253
101.40	22.838	3911.7	17128.	0.00000	8346.7	0.58259
101.44	22.846	3911.4	17121.	0.00000	8345.4	0.58266
101.48	22.855	3911.1	17113.	0.00000	8344.1	0.58273
101.52	22.863	3910.6	17105.	0.00000	8342.8	0.58279
101.56	22.871	3910.1	17097.	0.00000	8341.5	0.58285
101.60	22.879	3909.6	17088.	0.00000	8340.3	0.58291
101.64	22.888	3908.9	17079.	0.00000	8339.2	0.58297
101.68	22.896	3908.3	17070.	0.00000	8338.1	0.58303
101.72	22.905	3907.6	17061.	0.00000	8337.0	0.58308
101.76	22.913	3907.0	17052.	0.00000	8336.0	0.58313
101.80	22.921	3906.3	17043.	0.00000	8335.1	0.58318
101.84	22.929	3905.5	17033.	0.00000	8334.2	0.58322
101.88	22.937	3904.8	17024.	0.00000	8333.4	0.58326
101.92	22.945	3904.1	17015.	0.00000	8332.6	0.58330
101.96	22.953	3903.3	17006.	0.00000	8331.9	0.58333

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
102.00	22.961	3902.5	16997.	0.00000	8331.3	0.58337
102.04	22.969	3901.7	16988.	0.00000	8330.7	0.58340
102.08	22.976	3900.9	16978.	0.00000	8330.1	0.58342
102.12	22.984	3900.1	16969.	0.00000	8329.6	0.58345
102.16	22.991	3899.2	16960.	0.00000	8329.2	0.58347
102.20	22.999	3898.4	16951.	0.00000	8328.9	0.58349
102.24	23.006	3897.5	16942.	0.00000	8328.6	0.58350
102.28	23.013	3896.6	16932.	0.00000	8328.3	0.58351
102.32	23.020	3895.8	16924.	0.00000	8328.1	0.58353
102.36	23.027	3895.0	16915.	0.00000	8327.8	0.58354
102.40	23.034	3894.2	16906.	0.00000	8327.6	0.58355
102.44	23.041	3893.3	16897.	0.00000	8327.3	0.58357
102.48	23.048	3892.5	16889.	0.00000	8326.9	0.58359
102.52	23.055	3891.7	16880.	0.00000	8326.4	0.58361
102.56	23.062	3890.8	16871.	0.00000	8325.9	0.58363
102.60	23.069	3889.9	16862.	0.00000	8325.3	0.58366
102.64	23.076	3889.0	16853.	0.00000	8324.6	0.58370
102.68	23.083	3888.1	16844.	0.00000	8323.9	0.58373
102.72	23.090	3887.2	16835.	0.00000	8323.1	0.58377
102.76	23.096	3886.2	16826.	0.00000	8322.2	0.58382
102.80	23.103	3885.3	16817.	0.00000	8321.3	0.58386
102.84	23.110	3884.3	16808.	0.00000	8320.3	0.58392
102.88	23.117	3883.2	16799.	0.00000	8319.2	0.58397
102.92	23.124	3882.2	16789.	0.00000	8318.0	0.58403
102.96	23.131	3881.0	16779.	0.00000	8316.8	0.58409
103.00	23.138	3880.0	16769.	0.00000	8315.6	0.58415
103.04	23.148	3879.3	16759.	0.00000	8315.1	0.58417
103.08	23.159	3878.7	16749.	0.00000	8314.8	0.58419
103.12	23.170	3878.3	16739.	0.00000	8314.5	0.58420
103.16	23.181	3877.9	16729.	0.00000	8314.2	0.58422
103.20	23.192	3877.6	16720.	0.00000	8313.9	0.58424
103.24	23.203	3877.3	16711.	0.00000	8313.5	0.58426
103.28	23.214	3877.2	16702.	0.00000	8313.1	0.58428
103.32	23.225	3877.0	16694.	0.00000	8312.6	0.58430
103.36	23.236	3877.0	16685.	0.00000	8312.1	0.58432
103.40	23.248	3877.0	16677.	0.00000	8311.6	0.58435
103.44	23.259	3877.1	16670.	0.00000	8311.1	0.58437
103.48	23.270	3877.2	16662.	0.00000	8310.5	0.58440
103.52	23.281	3877.5	16655.	0.00000	8309.9	0.58443
103.56	23.293	3877.7	16648.	0.00000	8309.3	0.58446
103.60	23.304	3878.1	16642.	0.00000	8308.7	0.58450
103.64	23.316	3878.5	16635.	0.00000	8308.0	0.58453
103.68	23.327	3879.1	16630.	0.00000	8307.4	0.58456
103.72	23.338	3879.8	16624.	0.00000	8306.9	0.58459
103.76	23.350	3880.5	16619.	0.00000	8306.4	0.58461
103.80	23.361	3881.4	16615.	0.00000	8306.0	0.58463
103.84	23.373	3882.3	16611.	0.00000	8305.7	0.58465
103.88	23.384	3883.3	16607.	0.00000	8305.5	0.58466
103.92	23.396	3884.4	16603.	0.00000	8305.3	0.58466
103.96	23.408	3885.5	16599.	0.00000	8305.3	0.58467

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
104.00	23.419	3886.7	16596.	0.00000	8305.3	0.58466
104.04	23.431	3888.0	16593.	0.00000	8305.4	0.58466
104.08	23.443	3889.4	16591.	0.00000	8305.6	0.58465
104.12	23.455	3890.8	16588.	0.00000	8305.9	0.58463
104.16	23.468	3892.4	16586.	0.00000	8306.3	0.58462
104.20	23.480	3893.9	16584.	0.00000	8306.7	0.58460
104.24	23.491	3895.3	16582.	0.00000	8306.8	0.58459
104.28	23.501	3896.3	16580.	0.00000	8306.3	0.58461
104.32	23.509	3897.1	16577.	0.00000	8305.5	0.58466
104.36	23.517	3897.7	16574.	0.00000	8304.6	0.58470
104.40	23.526	3898.3	16570.	0.00000	8303.6	0.58475
104.44	23.534	3898.7	16566.	0.00000	8302.7	0.58480
104.48	23.543	3899.0	16562.	0.00000	8301.6	0.58485
104.52	23.551	3899.2	16557.	0.00000	8300.5	0.58490
104.56	23.560	3899.3	16551.	0.00000	8299.4	0.58496
104.60	23.568	3899.3	16545.	0.00000	8298.2	0.58502
104.64	23.577	3899.1	16538.	0.00000	8297.0	0.58508
104.68	23.585	3898.9	16531.	0.00000	8295.7	0.58514
104.72	23.594	3898.5	16524.	0.00000	8294.4	0.58521
104.76	23.603	3898.0	16516.	0.00000	8293.0	0.58528
104.80	23.611	3897.4	16507.	0.00000	8291.6	0.58535
104.84	23.620	3896.7	16498.	0.00000	8290.1	0.58542
104.88	23.629	3895.9	16488.	0.00000	8288.6	0.58550
104.92	23.638	3894.9	16478.	-3.2024e-06	8287.1	0.58558
104.96	23.646	3893.8	16467.	-1.2746e-05	8285.5	0.58565
105.00	23.655	3892.6	16456.	-2.8632e-05	8284.0	0.58573
105.04	23.664	3891.3	16444.	-5.0859e-05	8282.5	0.58581
105.08	23.673	3889.9	16432.	-7.9427e-05	8280.9	0.58588
105.12	23.682	3888.3	16420.	-0.00011434	8279.3	0.58596
105.16	23.691	3886.7	16407.	-0.00015559	8277.7	0.58604
105.20	23.699	3885.0	16393.	-0.00020318	8276.1	0.58613
105.24	23.708	3883.2	16380.	-0.00025712	8274.4	0.58621
105.28	23.717	3881.2	16366.	-0.00031739	8272.8	0.58629
105.32	23.725	3879.2	16351.	-0.00038401	8271.1	0.58638
105.36	23.734	3877.1	16336.	-0.00044668	8269.3	0.58646
105.40	23.743	3875.0	16322.	-0.00050343	8267.6	0.58655
105.44	23.751	3873.0	16307.	-0.00055427	8265.8	0.58664
105.48	23.760	3870.9	16292.	-0.00059920	8264.1	0.58673
105.52	23.769	3868.9	16278.	-0.00063821	8262.4	0.58681
105.56	23.778	3867.0	16264.	-0.00067130	8260.7	0.58689
105.60	23.787	3865.0	16249.	-0.00069849	8259.1	0.58698
105.64	23.796	3863.2	16235.	-0.00071975	8257.5	0.58706
105.68	23.805	3861.3	16221.	-0.00073511	8255.9	0.58713
105.72	23.814	3859.5	16208.	-0.00074454	8254.4	0.58721
105.76	23.823	3857.7	16194.	-0.00074807	8252.9	0.58729
105.80	23.832	3856.0	16180.	-0.00074807	8251.4	0.58736
105.84	23.842	3854.3	16167.	-0.00074807	8250.0	0.58743
105.88	23.851	3852.6	16153.	-0.00074807	8248.6	0.58750
105.92	23.860	3850.9	16140.	-0.00074807	8247.3	0.58756
105.96	23.870	3849.3	16127.	-0.00074807	8246.0	0.58763

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
106.00	23.879	3847.7	16114.	-0.00074807	8244.8	0.58769
106.04	23.889	3846.1	16100.	-0.00074807	8243.6	0.58775
106.08	23.898	3844.5	16088.	-0.00074807	8242.5	0.58781
106.12	23.908	3843.0	16075.	-0.00074807	8241.4	0.58786
106.16	23.918	3841.5	16062.	-0.00074487	8240.3	0.58792
106.20	23.927	3840.1	16049.	-0.00073532	8239.2	0.58797
106.24	23.937	3838.7	16037.	-0.00071944	8238.1	0.58803
106.28	23.947	3837.4	16025.	-0.00069721	8237.0	0.58808
106.32	23.956	3836.1	16013.	-0.00066864	8235.8	0.58814
106.36	23.966	3834.9	16002.	-0.00063232	8234.7	0.58820
106.40	23.975	3833.7	15990.	-0.00058563	8233.4	0.58826
106.44	23.985	3832.5	15979.	-0.00052858	8232.2	0.58832
106.48	23.994	3831.3	15968.	-0.00046117	8230.9	0.58839
106.52	24.004	3830.1	15957.	-0.00038339	8229.5	0.58845
106.56	24.013	3829.0	15946.	-0.00029526	8228.1	0.58852
106.60	24.022	3827.8	15935.	-0.00020705	8226.7	0.58859
106.64	24.031	3826.5	15924.	-0.00012073	8225.3	0.58867
106.68	24.040	3825.2	15912.	-3.6304e-05	8223.8	0.58874
106.72	24.049	3823.9	15901.	4.6227e-05	8222.3	0.58881
106.76	24.058	3822.5	15889.	0.00012686	8220.8	0.58889
106.80	24.067	3821.1	15878.	0.00020561	8219.3	0.58896
106.84	24.075	3819.6	15866.	0.00028246	8217.8	0.58904
106.88	24.084	3818.0	15854.	0.00035742	8216.2	0.58912
106.92	24.092	3816.4	15841.	0.00043048	8214.7	0.58920
106.96	24.100	3814.7	15829.	0.00050166	8213.1	0.58928
107.00	24.109	3813.0	15817.	0.00057093	8211.4	0.58936
107.04	24.117	3811.3	15804.	0.00063360	8209.9	0.58944
107.08	24.125	3809.8	15792.	0.00068694	8208.4	0.58951
107.12	24.134	3808.3	15780.	0.00073096	8207.1	0.58958
107.16	24.143	3806.9	15769.	0.00076565	8205.8	0.58964
107.20	24.152	3805.7	15758.	0.00079101	8204.7	0.58969
107.24	24.161	3804.5	15747.	0.00080705	8203.7	0.58975
107.28	24.171	3803.5	15736.	0.00081376	8202.8	0.58979
107.32	24.181	3802.5	15726.	0.00081376	8202.0	0.58983
107.36	24.190	3801.7	15716.	0.00081376	8201.2	0.58987
107.40	24.200	3801.1	15707.	0.00081376	8200.4	0.58991
107.44	24.210	3800.6	15699.	0.00081376	8199.7	0.58995
107.48	24.219	3800.2	15691.	0.00081376	8198.9	0.58998
107.52	24.229	3800.0	15684.	0.00081376	8198.2	0.59002
107.56	24.239	3799.9	15677.	0.00081376	8197.5	0.59006
107.60	24.248	3800.0	15671.	0.00081235	8196.9	0.59009
107.64	24.258	3800.2	15666.	0.00080691	8196.2	0.59012
107.68	24.268	3800.7	15662.	0.00079745	8195.7	0.59015
107.72	24.278	3801.3	15658.	0.00078398	8195.2	0.59017
107.76	24.287	3802.1	15655.	0.00076648	8194.8	0.59019
107.80	24.297	3803.0	15652.	0.00074496	8194.4	0.59021
107.84	24.307	3804.2	15650.	0.00071942	8194.0	0.59023
107.88	24.318	3805.5	15649.	0.00068985	8193.8	0.59024
107.92	24.328	3806.9	15648.	0.00065627	8193.6	0.59025
107.96	24.338	3808.3	15648.	0.00061866	8193.5	0.59025

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
108.00	24.348	3809.8	15647.	0.00057704	8193.5	0.59025
108.04	24.359	3811.4	15647.	0.00053139	8193.7	0.59025
108.08	24.370	3813.0	15646.	0.00048172	8193.9	0.59024
108.12	24.380	3814.7	15646.	0.00042803	8194.2	0.59022
108.16	24.391	3816.4	15646.	0.00037032	8194.6	0.59020
108.20	24.402	3818.2	15647.	0.00030858	8195.1	0.59018
108.24	24.413	3820.0	15647.	0.00024283	8195.7	0.59015
108.28	24.425	3821.8	15647.	0.00018016	8196.3	0.59012
108.32	24.435	3823.6	15648.	0.00012682	8196.9	0.59009
108.36	24.446	3825.2	15647.	7.9625e-05	8197.3	0.59006
108.40	24.457	3826.7	15647.	3.5601e-05	8197.7	0.59005
108.44	24.467	3828.0	15646.	-5.2549e-06	8197.9	0.59003
108.48	24.477	3829.2	15644.	-4.2942e-05	8198.1	0.59003
108.52	24.487	3830.3	15642.	-7.7461e-05	8198.0	0.59003
108.56	24.497	3831.1	15639.	-0.00011143	8197.9	0.59003
108.60	24.507	3831.9	15636.	-0.00015155	8197.8	0.59004
108.64	24.516	3832.4	15632.	-0.00019783	8197.6	0.59005
108.68	24.526	3832.7	15627.	-0.00025027	8197.4	0.59006
108.72	24.536	3832.9	15622.	-0.00030887	8197.2	0.59007
108.76	24.546	3832.9	15615.	-0.00037363	8196.9	0.59009
108.80	24.556	3832.7	15608.	-0.00043796	8196.6	0.59010
108.84	24.566	3832.4	15601.	-0.00049609	8196.3	0.59011
108.88	24.576	3832.0	15593.	-0.00054802	8196.1	0.59013
108.92	24.586	3831.4	15584.	-0.00059375	8195.8	0.59014
108.96	24.596	3830.7	15575.	-0.00063328	8195.5	0.59015
109.00	24.607	3829.9	15565.	-0.00066661	8195.3	0.59017
109.04	24.617	3829.0	15555.	-0.00069374	8195.1	0.59018
109.08	24.627	3827.9	15544.	-0.00071467	8194.9	0.59019
109.12	24.638	3826.7	15532.	-0.00072939	8194.6	0.59020
109.16	24.648	3825.5	15521.	-0.00073792	8194.4	0.59021
109.20	24.659	3824.3	15509.	-0.00074024	8194.1	0.59023
109.24	24.669	3823.1	15498.	-0.00074024	8193.8	0.59024
109.28	24.679	3822.0	15487.	-0.00074024	8193.4	0.59026
109.32	24.690	3821.0	15476.	-0.00074024	8193.0	0.59028
109.36	24.700	3820.0	15466.	-0.00074024	8192.5	0.59031
109.40	24.710	3819.1	15456.	-0.00074024	8191.9	0.59034
109.44	24.720	3818.3	15447.	-0.00074024	8191.3	0.59037
109.48	24.730	3817.6	15437.	-0.00074024	8190.6	0.59040
109.52	24.740	3816.9	15428.	-0.00074024	8189.9	0.59043
109.56	24.750	3816.3	15420.	-0.00074024	8189.2	0.59047
109.60	24.760	3815.8	15411.	-0.00073707	8188.4	0.59051
109.64	24.770	3815.4	15404.	-0.00072773	8187.6	0.59055
109.68	24.780	3815.2	15397.	-0.00071224	8186.8	0.59059
109.72	24.789	3815.0	15390.	-0.00069059	8186.1	0.59063
109.76	24.799	3815.0	15384.	-0.00066278	8185.4	0.59066
109.80	24.809	3815.2	15379.	-0.00062882	8184.7	0.59070
109.84	24.818	3815.5	15374.	-0.00058869	8184.0	0.59073
109.88	24.828	3815.8	15369.	-0.00054647	8183.4	0.59076
109.92	24.838	3816.3	15365.	-0.00050713	8182.9	0.59079
109.96	24.848	3816.8	15361.	-0.00047068	8182.4	0.59081

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
110.00	24.859	3817.5	15357.	-0.00043712	8182.1	0.59083
110.04	24.869	3818.2	15353.	-0.00041302	8181.8	0.59084
110.08	24.880	3818.9	15349.	-0.00040417	8181.6	0.59085
110.12	24.891	3819.7	15346.	-0.00041056	8181.4	0.59086
110.16	24.903	3820.5	15342.	-0.00043219	8181.3	0.59087
110.20	24.914	3821.4	15338.	-0.00045327	8181.1	0.59088
110.24	24.925	3822.1	15335.	-0.00047329	8180.8	0.59089
110.28	24.936	3822.9	15331.	-0.00049227	8180.5	0.59091
110.32	24.947	3823.7	15327.	-0.00051020	8180.1	0.59093
110.36	24.959	3824.5	15323.	-0.00052708	8179.6	0.59095
110.40	24.970	3825.2	15320.	-0.00054292	8179.1	0.59097
110.44	24.981	3826.0	15316.	-0.00055770	8178.5	0.59100
110.48	24.992	3826.6	15312.	-0.00056757	8177.9	0.59103
110.52	25.003	3827.2	15307.	-0.00057019	8177.3	0.59107
110.56	25.014	3827.7	15302.	-0.00057019	8176.6	0.59110
110.60	25.025	3828.0	15297.	-0.00057019	8175.9	0.59114
110.64	25.036	3828.2	15291.	-0.00057019	8175.2	0.59117
110.68	25.047	3828.2	15284.	-0.00057019	8174.5	0.59121
110.72	25.058	3828.1	15277.	-0.00057019	8173.8	0.59124
110.76	25.068	3827.8	15270.	-0.00057019	8173.0	0.59128
110.80	25.079	3827.4	15262.	-0.00057019	8172.3	0.59131
110.84	25.089	3826.9	15253.	-0.00057019	8171.6	0.59135
110.88	25.100	3826.2	15244.	-0.00057019	8170.9	0.59139
110.92	25.110	3825.3	15235.	-0.00057019	8170.1	0.59143
110.96	25.120	3824.4	15225.	-0.00057019	8169.4	0.59146
111.00	25.130	3823.2	15214.	-0.00057019	8168.6	0.59150
111.04	25.141	3822.0	15203.	-0.00057019	8167.9	0.59154
111.08	25.151	3820.5	15191.	-0.00057019	8167.1	0.59158
111.12	25.160	3819.0	15179.	-0.00056613	8166.3	0.59162
111.16	25.170	3817.3	15167.	-0.00055303	8165.4	0.59166
111.20	25.179	3815.6	15155.	-0.00053088	8164.4	0.59171
111.24	25.187	3813.7	15142.	-0.00049969	8163.4	0.59176
111.28	25.196	3811.8	15129.	-0.00045946	8162.3	0.59182
111.32	25.204	3809.7	15116.	-0.00041018	8161.1	0.59188
111.36	25.211	3807.5	15103.	-0.00035185	8159.8	0.59194
111.40	25.218	3805.4	15090.	-0.00028449	8158.5	0.59201
111.44	25.226	3803.4	15078.	-0.00022389	8157.2	0.59207
111.48	25.233	3801.6	15066.	-0.00017053	8155.9	0.59214
111.52	25.240	3799.9	15055.	-0.00012443	8154.6	0.59220
111.56	25.248	3798.3	15045.	-8.5570e-05	8153.4	0.59226
111.60	25.255	3796.9	15035.	-5.3960e-05	8152.2	0.59232
111.64	25.262	3795.6	15026.	-2.9598e-05	8151.1	0.59238
111.68	25.269	3794.5	15017.	-1.2484e-05	8149.9	0.59243
111.72	25.276	3793.6	15009.	-2.6183e-06	8148.8	0.59249
111.76	25.283	3792.7	15001.	0.00000	8147.8	0.59254
111.80	25.291	3792.1	14994.	0.00000	8146.7	0.59259
111.84	25.298	3791.6	14988.	0.00000	8145.7	0.59265
111.88	25.305	3791.4	14983.	0.00000	8144.6	0.59270
111.92	25.313	3791.1	14977.	0.00000	8143.6	0.59275
111.96	25.321	3790.8	14971.	0.00000	8142.6	0.59280

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
112.00	25.329	3790.5	14966.	0.00000	8141.6	0.59285
112.04	25.337	3790.2	14959.	0.00000	8140.6	0.59290
112.08	25.345	3789.8	14953.	0.00000	8139.6	0.59295
112.12	25.353	3789.4	14947.	0.00000	8138.6	0.59300
112.16	25.361	3789.0	14940.	0.00000	8137.6	0.59305
112.20	25.370	3788.5	14933.	0.00000	8136.7	0.59310
112.24	25.378	3788.0	14926.	0.00000	8135.7	0.59314
112.28	25.387	3787.5	14919.	0.00000	8134.8	0.59319
112.32	25.396	3787.0	14912.	0.00000	8133.9	0.59324
112.36	25.405	3786.4	14904.	0.00000	8133.0	0.59328
112.40	25.414	3785.9	14897.	0.00000	8132.1	0.59333
112.44	25.423	3785.6	14890.	0.00000	8131.2	0.59337
112.48	25.432	3785.3	14884.	0.00000	8130.2	0.59342
112.52	25.441	3785.2	14878.	0.00000	8129.3	0.59347
112.56	25.451	3785.2	14873.	0.00000	8128.3	0.59352
112.60	25.460	3785.4	14868.	0.00000	8127.3	0.59357
112.64	25.469	3785.5	14863.	0.00000	8126.3	0.59362
112.68	25.479	3785.6	14858.	0.00000	8125.3	0.59367
112.72	25.488	3785.5	14853.	0.00000	8124.3	0.59372
112.76	25.497	3785.5	14847.	0.00000	8123.3	0.59377
112.80	25.506	3785.3	14841.	0.00000	8122.2	0.59382
112.84	25.515	3785.0	14835.	0.00000	8121.2	0.59387
112.88	25.524	3784.7	14828.	0.00000	8120.1	0.59393
112.92	25.533	3784.4	14822.	0.00000	8119.0	0.59398
112.96	25.542	3783.9	14815.	0.00000	8117.9	0.59404
113.00	25.551	3783.4	14808.	0.00000	8116.8	0.59409
113.04	25.560	3782.8	14800.	0.00000	8115.7	0.59415
113.08	25.569	3782.2	14793.	0.00000	8114.6	0.59420
113.12	25.578	3781.6	14785.	0.00000	8113.5	0.59426
113.16	25.587	3781.3	14778.	0.00000	8112.3	0.59432
113.20	25.597	3781.1	14772.	0.00000	8111.2	0.59437
113.24	25.607	3781.2	14767.	0.00000	8110.0	0.59443
113.28	25.616	3781.6	14762.	0.00000	8108.9	0.59449
113.32	25.627	3782.1	14759.	0.00000	8107.7	0.59455
113.36	25.637	3782.6	14755.	0.00000	8106.5	0.59461
113.40	25.647	3783.1	14751.	0.00000	8105.3	0.59467
113.44	25.657	3783.7	14747.	0.00000	8104.2	0.59472
113.48	25.668	3784.2	14743.	0.00000	8103.0	0.59478
113.52	25.678	3784.7	14739.	0.00000	8101.9	0.59484
113.56	25.689	3785.2	14735.	0.00000	8100.8	0.59489
113.60	25.699	3785.7	14731.	0.00000	8099.6	0.59495
113.64	25.710	3786.1	14726.	0.00000	8098.6	0.59500
113.68	25.721	3786.3	14721.	0.00000	8097.5	0.59506
113.72	25.732	3786.4	14715.	0.00000	8096.4	0.59511
113.76	25.743	3786.2	14708.	0.00000	8095.3	0.59517
113.80	25.754	3785.8	14700.	0.00000	8094.1	0.59523
113.84	25.765	3785.2	14692.	0.00000	8092.8	0.59529
113.88	25.776	3784.4	14682.	0.00000	8091.4	0.59536
113.92	25.788	3783.3	14672.	0.00000	8089.9	0.59544
113.96	25.799	3782.0	14660.	0.00000	8088.4	0.59551

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
114.00	25.810	3780.6	14648.	0.00000	8086.8	0.59559
114.04	25.821	3778.8	14635.	0.00000	8085.1	0.59568
114.08	25.833	3776.9	14621.	0.00000	8083.3	0.59577
114.12	25.844	3774.8	14607.	0.00000	8081.4	0.59586
114.16	25.855	3772.4	14591.	0.00000	8079.5	0.59596
114.20	25.867	3769.8	14575.	0.00000	8077.4	0.59606
114.24	25.878	3767.0	14557.	0.00000	8075.3	0.59617
114.28	25.890	3764.1	14540.	-3.7850e-06	8073.2	0.59627
114.32	25.901	3761.2	14522.	-1.4319e-05	8071.2	0.59637
114.36	25.913	3758.4	14505.	-3.1601e-05	8069.2	0.59647
114.40	25.924	3755.5	14488.	-5.5633e-05	8067.2	0.59657
114.44	25.935	3752.6	14470.	-8.6413e-05	8065.4	0.59666
114.48	25.946	3749.8	14453.	-0.00012394	8063.5	0.59676
114.52	25.957	3746.9	14436.	-0.00016822	8061.8	0.59684
114.56	25.967	3744.1	14419.	-0.00021925	8060.1	0.59693
114.60	25.978	3741.5	14403.	-0.00027702	8058.4	0.59701
114.64	25.989	3739.2	14388.	-0.00034155	8056.7	0.59709
114.68	25.999	3737.0	14374.	-0.00040587	8055.1	0.59718
114.72	26.010	3734.7	14359.	-0.00046405	8053.4	0.59726
114.76	26.021	3732.5	14345.	-0.00051609	8051.6	0.59735
114.80	26.031	3730.3	14331.	-0.00056200	8049.7	0.59745
114.84	26.042	3728.1	14316.	-0.00060175	8047.8	0.59754
114.88	26.052	3725.8	14302.	-0.00063537	8045.8	0.59764
114.92	26.063	3723.6	14288.	-0.00066285	8043.7	0.59775
114.96	26.073	3721.4	14273.	-0.00068419	8041.7	0.59785
115.00	26.084	3719.3	14259.	-0.00069939	8039.6	0.59795
115.04	26.094	3717.2	14246.	-0.00070844	8037.7	0.59805
115.08	26.105	3715.2	14232.	-0.00071135	8035.7	0.59814
115.12	26.116	3713.3	14219.	-0.00071135	8033.9	0.59824
115.16	26.127	3711.7	14207.	-0.00071135	8032.3	0.59832
115.20	26.138	3710.3	14195.	-0.00071135	8030.7	0.59840
115.24	26.149	3709.0	14185.	-0.00071135	8029.3	0.59847
115.28	26.160	3708.0	14175.	-0.00071135	8028.1	0.59853
115.32	26.171	3707.2	14166.	-0.00071135	8027.0	0.59858
115.36	26.182	3706.7	14158.	-0.00071135	8026.0	0.59863
115.40	26.193	3706.3	14150.	-0.00071135	8025.2	0.59867
115.44	26.204	3706.1	14144.	-0.00071135	8024.6	0.59870
115.48	26.215	3706.2	14138.	-0.00071135	8024.0	0.59873
115.52	26.227	3706.3	14132.	-0.00070757	8023.6	0.59875
115.56	26.238	3706.4	14126.	-0.00069704	8023.1	0.59878
115.60	26.249	3706.4	14120.	-0.00067975	8022.6	0.59880
115.64	26.260	3706.3	14114.	-0.00065572	8022.1	0.59883
115.68	26.271	3706.2	14108.	-0.00062494	8021.5	0.59885
115.72	26.282	3706.1	14102.	-0.00058741	8021.0	0.59888
115.76	26.293	3705.9	14095.	-0.00054313	8020.4	0.59891
115.80	26.304	3705.7	14088.	-0.00049211	8019.8	0.59894
115.84	26.315	3705.4	14081.	-0.00043433	8019.2	0.59897
115.88	26.326	3705.1	14074.	-0.00036981	8018.5	0.59901
115.92	26.337	3704.8	14068.	-0.00030548	8017.9	0.59904
115.96	26.347	3704.8	14062.	-0.00024730	8017.3	0.59907

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
116.00	26.358	3705.0	14056.	-0.00019526	8016.9	0.59909
116.04	26.369	3705.2	14051.	-0.00014936	8016.5	0.59911
116.08	26.379	3705.4	14047.	-0.00010960	8016.1	0.59913
116.12	26.390	3705.7	14042.	-7.5981e-05	8015.8	0.59914
116.16	26.400	3706.1	14038.	-4.8503e-05	8015.6	0.59915
116.20	26.411	3706.5	14034.	-2.7166e-05	8015.4	0.59916
116.24	26.421	3707.0	14031.	-1.1970e-05	8015.3	0.59917
116.28	26.431	3707.5	14027.	-2.9144e-06	8015.3	0.59917
116.32	26.441	3708.0	14024.	0.00000	8015.3	0.59917
116.36	26.451	3708.5	14021.	0.00000	8015.3	0.59917
116.40	26.461	3709.0	14017.	0.00000	8015.3	0.59917
116.44	26.471	3709.3	14013.	0.00000	8015.2	0.59917
116.48	26.480	3709.5	14009.	0.00000	8015.1	0.59918
116.52	26.490	3709.6	14004.	0.00000	8015.0	0.59918
116.56	26.500	3709.6	13999.	0.00000	8014.8	0.59919
116.60	26.509	3709.5	13994.	0.00000	8014.6	0.59920
116.64	26.519	3709.4	13988.	0.00000	8014.4	0.59921
116.68	26.528	3709.2	13982.	0.00000	8014.1	0.59923
116.72	26.537	3708.9	13977.	0.00000	8013.7	0.59925
116.76	26.546	3708.5	13970.	0.00000	8013.3	0.59927
116.80	26.555	3708.1	13964.	0.00000	8012.8	0.59929
116.84	26.564	3707.5	13957.	0.00000	8012.4	0.59931
116.88	26.572	3706.9	13950.	0.00000	8011.9	0.59934
116.92	26.581	3706.1	13943.	0.00000	8011.3	0.59937
116.96	26.589	3705.2	13935.	0.00000	8010.7	0.59940
117.00	26.597	3704.2	13927.	0.00000	8010.1	0.59943
117.04	26.606	3703.1	13919.	0.00000	8009.5	0.59946
117.08	26.614	3701.9	13910.	0.00000	8008.8	0.59949
117.12	26.622	3700.6	13901.	0.00000	8008.1	0.59953
117.16	26.629	3699.2	13892.	0.00000	8007.3	0.59957
117.20	26.637	3697.6	13882.	0.00000	8006.5	0.59961
117.24	26.645	3696.0	13872.	0.00000	8005.7	0.59965
117.28	26.652	3694.3	13862.	0.00000	8004.9	0.59969
117.32	26.660	3693.0	13853.	0.00000	8004.1	0.59973
117.36	26.667	3692.1	13845.	0.00000	8003.4	0.59976
117.40	26.675	3691.4	13839.	0.00000	8002.7	0.59980
117.44	26.683	3691.0	13833.	0.00000	8002.1	0.59983
117.48	26.691	3691.0	13829.	0.00000	8001.6	0.59985
117.52	26.699	3691.3	13826.	0.00000	8001.1	0.59988
117.56	26.707	3691.9	13824.	0.00000	8000.6	0.59990
117.60	26.715	3692.8	13823.	0.00000	8000.2	0.59992
117.64	26.724	3694.1	13823.	0.00000	7999.9	0.59994
117.68	26.732	3695.6	13825.	0.00000	7999.6	0.59995
117.72	26.740	3697.5	13827.	0.00000	7999.4	0.59996
117.76	26.749	3699.4	13830.	0.00000	7999.2	0.59997
117.80	26.758	3701.4	13833.	0.00000	7999.0	0.59998
117.84	26.767	3703.4	13835.	0.00000	7998.8	0.59999
117.88	26.777	3705.4	13838.	0.00000	7998.7	0.60000
117.92	26.787	3707.4	13840.	0.00000	7998.7	0.60000
117.96	26.797	3709.4	13842.	0.00000	7998.6	0.60000

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
118.00	26.808	3711.4	13844.	0.00000	7998.6	0.60000
118.04	26.818	3713.4	13846.	0.00000	7998.6	0.60000
118.08	26.829	3715.4	13848.	0.00000	7998.7	0.60000
118.12	26.841	3717.4	13849.	0.00000	7998.8	0.59999
118.16	26.852	3719.4	13851.	0.00000	7998.9	0.59999
118.20	26.864	3721.4	13853.	0.00000	7998.9	0.59999
118.24	26.875	3723.4	13854.	0.00000	7999.0	0.59998
118.28	26.886	3725.3	13856.	0.00000	7999.0	0.59998
118.32	26.898	3727.3	13857.	0.00000	7999.0	0.59998
118.36	26.909	3729.3	13859.	0.00000	7999.0	0.59998
118.40	26.921	3731.3	13860.	0.00000	7999.0	0.59998
118.44	26.932	3733.2	13862.	0.00000	7998.9	0.59999
118.48	26.944	3735.2	13863.	0.00000	7998.9	0.59999
118.52	26.955	3737.2	13864.	0.00000	7998.8	0.59999
118.56	26.967	3738.8	13865.	0.00000	7998.6	0.60000
118.60	26.978	3740.2	13864.	0.00000	7998.4	0.60001
118.64	26.989	3741.3	13862.	0.00000	7998.0	0.60003
118.68	27.001	3742.1	13860.	0.00000	7997.6	0.60005
118.72	27.012	3742.6	13856.	0.00000	7997.2	0.60007
118.76	27.022	3742.9	13851.	0.00000	7996.7	0.60010
118.80	27.033	3742.8	13846.	0.00000	7996.2	0.60012
118.84	27.044	3742.5	13839.	0.00000	7995.6	0.60015
118.88	27.054	3741.9	13832.	0.00000	7994.9	0.60019
118.92	27.064	3741.0	13823.	0.00000	7994.3	0.60022
118.96	27.075	3739.9	13813.	0.00000	7993.5	0.60026
119.00	27.085	3738.7	13804.	0.00000	7992.8	0.60029
119.04	27.094	3737.5	13795.	0.00000	7992.0	0.60033
119.08	27.104	3736.3	13786.	0.00000	7991.2	0.60037
119.12	27.113	3735.1	13777.	0.00000	7990.4	0.60041
119.16	27.121	3733.9	13768.	0.00000	7989.5	0.60046
119.20	27.130	3732.7	13759.	0.00000	7988.7	0.60050
119.24	27.138	3731.6	13751.	0.00000	7987.8	0.60054
119.28	27.146	3730.4	13742.	-4.1652e-06	7986.9	0.60059
119.32	27.154	3729.5	13735.	-1.3356e-05	7986.1	0.60063
119.36	27.161	3728.6	13728.	-2.7574e-05	7985.2	0.60067
119.40	27.169	3727.8	13721.	-4.6817e-05	7984.4	0.60071
119.44	27.176	3727.1	13715.	-7.1086e-05	7983.6	0.60075
119.48	27.184	3726.6	13709.	-0.00010038	7982.9	0.60079
119.52	27.191	3726.1	13704.	-0.00013470	7982.3	0.60082
119.56	27.199	3725.8	13699.	-0.00017405	7981.7	0.60085
119.60	27.207	3725.6	13694.	-0.00021842	7981.2	0.60087
119.64	27.214	3725.5	13690.	-0.00026782	7980.7	0.60090
119.68	27.222	3725.5	13686.	-0.00032224	7980.2	0.60092
119.72	27.230	3725.7	13682.	-0.00038169	7979.9	0.60094
119.76	27.238	3725.9	13679.	-0.00044617	7979.5	0.60096
119.80	27.246	3726.2	13677.	-0.00051228	7979.3	0.60097
119.84	27.254	3726.6	13674.	-0.00057430	7979.0	0.60098
119.88	27.262	3727.1	13672.	-0.00063222	7978.9	0.60099
119.92	27.270	3727.6	13669.	-0.00068604	7978.7	0.60100
119.96	27.278	3728.2	13667.	-0.00073576	7978.5	0.60101

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
120.00	27.286	3728.8	13666.	-0.00078139	7978.4	0.60101
120.04	27.295	3729.5	13664.	-0.00082293	7978.2	0.60102
120.08	27.303	3730.3	13662.	-0.00086036	7978.1	0.60103
120.12	27.312	3731.0	13661.	-0.00089370	7978.0	0.60103
120.16	27.320	3731.9	13660.	-0.00092294	7977.9	0.60104
120.20	27.329	3732.8	13659.	-0.00094809	7977.8	0.60104
120.24	27.338	3733.8	13658.	-0.00096914	7977.7	0.60105
120.28	27.346	3734.8	13657.	-0.00098609	7977.7	0.60105
120.32	27.355	3735.9	13657.	-0.00099895	7977.6	0.60105
120.36	27.364	3737.0	13657.	-0.0010077	7977.6	0.60105
120.40	27.373	3738.2	13656.	-0.0010124	7977.5	0.60106
120.44	27.382	3739.4	13656.	-0.0010129	7977.5	0.60106
120.48	27.392	3740.5	13656.	-0.0010129	7977.5	0.60106
120.52	27.401	3741.3	13654.	-0.0010088	7977.3	0.60107
120.56	27.410	3741.8	13651.	-0.00099958	7977.1	0.60108
120.60	27.419	3741.9	13647.	-0.00098537	7976.7	0.60110
120.64	27.427	3741.8	13643.	-0.00096612	7976.3	0.60112
120.68	27.436	3741.3	13636.	-0.00094185	7975.8	0.60114
120.72	27.445	3740.5	13629.	-0.00091256	7975.3	0.60117
120.76	27.454	3739.4	13621.	-0.00087824	7974.6	0.60120
120.80	27.462	3738.0	13612.	-0.00083889	7973.9	0.60124
120.84	27.471	3736.3	13601.	-0.00079452	7973.1	0.60128
120.88	27.479	3734.3	13590.	-0.00074512	7972.1	0.60133
120.92	27.487	3731.9	13577.	-0.00069070	7971.1	0.60138
120.96	27.496	3729.3	13564.	-0.00063124	7970.1	0.60143
121.00	27.504	3726.6	13550.	-0.00056677	7969.0	0.60148
121.04	27.512	3724.0	13536.	-0.00050066	7968.0	0.60153
121.08	27.521	3721.6	13524.	-0.00043864	7967.0	0.60158
121.12	27.529	3719.4	13511.	-0.00038072	7966.0	0.60163
121.16	27.538	3717.3	13499.	-0.00032690	7965.1	0.60168
121.20	27.546	3715.3	13488.	-0.00027717	7964.2	0.60172
121.24	27.555	3713.5	13477.	-0.00023155	7963.4	0.60176
121.28	27.563	3711.9	13467.	-0.00019001	7962.6	0.60180
121.32	27.572	3710.4	13457.	-0.00015258	7961.8	0.60184
121.36	27.581	3709.0	13448.	-0.00011924	7961.1	0.60188
121.40	27.589	3707.8	13440.	-8.9995e-05	7960.4	0.60191
121.44	27.598	3706.7	13431.	-6.4849e-05	7959.8	0.60194
121.48	27.607	3705.8	13424.	-4.3799e-05	7959.2	0.60197
121.52	27.616	3705.0	13416.	-2.6846e-05	7958.7	0.60200
121.56	27.625	3704.2	13409.	-1.3990e-05	7958.1	0.60203
121.60	27.634	3703.3	13401.	-5.2300e-06	7957.6	0.60205
121.64	27.643	3702.4	13393.	-5.6669e-07	7957.1	0.60208
121.68	27.653	3701.4	13385.	0.00000	7956.6	0.60211
121.72	27.663	3700.6	13378.	0.00000	7956.1	0.60213
121.76	27.673	3700.1	13371.	0.00000	7955.8	0.60214
121.80	27.684	3699.8	13365.	7.0317e-06	7955.6	0.60215
121.84	27.694	3699.8	13359.	2.3434e-05	7955.4	0.60216
121.88	27.706	3700.0	13354.	4.9206e-05	7955.4	0.60216
121.92	27.717	3700.4	13351.	8.4349e-05	7955.4	0.60216
121.96	27.729	3701.1	13347.	0.00012886	7955.6	0.60215

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
122.00	27.742	3702.1	13345.	0.00018275	7955.8	0.60214
122.04	27.754	3703.3	13343.	0.00024600	7956.2	0.60212
122.08	27.767	3704.7	13342.	0.00031083	7956.6	0.60210
122.12	27.780	3706.2	13341.	0.00037040	7957.0	0.60208
122.16	27.793	3707.9	13341.	0.00042470	7957.4	0.60206
122.20	27.806	3709.7	13341.	0.00047373	7957.8	0.60204
122.24	27.820	3711.3	13341.	0.00051751	7958.1	0.60203
122.28	27.833	3712.6	13339.	0.00055601	7958.4	0.60201
122.32	27.846	3713.7	13337.	0.00058926	7958.5	0.60201
122.36	27.858	3714.5	13334.	0.00061723	7958.5	0.60201
122.40	27.871	3715.0	13329.	0.00063995	7958.3	0.60202
122.44	27.884	3715.2	13324.	0.00065740	7958.1	0.60203
122.48	27.896	3715.1	13318.	0.00066958	7957.8	0.60204
122.52	27.909	3714.8	13311.	0.00067650	7957.3	0.60207
122.56	27.921	3714.1	13303.	0.00067815	7956.8	0.60209
122.60	27.934	3713.3	13294.	0.00067815	7956.1	0.60213
122.64	27.946	3712.3	13285.	0.00067815	7955.2	0.60217
122.68	27.958	3711.2	13275.	0.00067815	7954.2	0.60222
122.72	27.970	3709.9	13265.	0.00067815	7953.1	0.60228
122.76	27.981	3708.5	13254.	0.00067815	7951.8	0.60234
122.80	27.993	3707.2	13244.	0.00067815	7950.4	0.60241
122.84	28.004	3705.8	13234.	0.00067815	7948.9	0.60249
122.88	28.015	3704.5	13224.	0.00067815	7947.3	0.60257
122.92	28.026	3703.3	13214.	0.00067815	7945.5	0.60266
122.96	28.036	3702.0	13205.	0.00067815	7943.7	0.60275
123.00	28.046	3700.8	13196.	0.00067815	7941.7	0.60285
123.04	28.056	3699.6	13187.	0.00067112	7939.6	0.60295
123.08	28.066	3698.5	13178.	0.00065472	7937.3	0.60307
123.12	28.075	3697.3	13170.	0.00062895	7935.0	0.60318
123.16	28.084	3696.1	13161.	0.00059380	7932.5	0.60331
123.20	28.092	3695.0	13153.	0.00054929	7929.9	0.60344
123.24	28.100	3693.8	13145.	0.00049541	7927.2	0.60357
123.28	28.108	3692.7	13138.	0.00043215	7924.4	0.60371
123.32	28.116	3691.6	13130.	0.00036732	7921.5	0.60386
123.36	28.123	3690.6	13123.	0.00030776	7918.6	0.60400
123.40	28.131	3689.7	13116.	0.00025345	7915.8	0.60414
123.44	28.139	3688.9	13110.	0.00020442	7913.0	0.60428
123.48	28.147	3688.3	13104.	0.00016064	7910.3	0.60442
123.52	28.154	3687.7	13098.	0.00012214	7907.6	0.60455
123.56	28.162	3687.2	13093.	8.8895e-05	7905.0	0.60468
123.60	28.170	3686.8	13088.	6.0918e-05	7902.4	0.60481
123.64	28.178	3686.6	13083.	3.8205e-05	7899.8	0.60494
123.68	28.186	3686.4	13079.	2.0756e-05	7897.3	0.60507
123.72	28.194	3686.3	13075.	8.5728e-06	7894.9	0.60519
123.76	28.202	3686.4	13071.	1.6540e-06	7892.5	0.60531
123.80	28.210	3686.5	13068.	0.00000	7890.1	0.60543
123.84	28.219	3686.7	13065.	0.00000	7887.8	0.60554
123.88	28.227	3686.8	13061.	0.00000	7885.6	0.60565
123.92	28.235	3686.9	13058.	0.00000	7883.4	0.60576
123.96	28.244	3686.8	13054.	0.00000	7881.3	0.60587

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
124.00	28.252	3686.7	13049.	0.00000	7879.3	0.60597
124.04	28.261	3686.3	13044.	0.00000	7877.3	0.60607
124.08	28.270	3685.9	13038.	0.00000	7875.4	0.60616
124.12	28.280	3685.3	13032.	0.00000	7873.6	0.60626
124.16	28.289	3684.6	13025.	0.00000	7871.8	0.60635
124.20	28.299	3683.8	13018.	1.3728e-06	7870.0	0.60643
124.24	28.308	3683.1	13011.	8.1647e-06	7868.5	0.60651
124.28	28.318	3682.3	13004.	2.0376e-05	7867.0	0.60658
124.32	28.328	3681.7	12997.	3.8006e-05	7865.7	0.60665
124.36	28.339	3681.0	12990.	6.1055e-05	7864.5	0.60671
124.40	28.349	3680.4	12983.	8.9523e-05	7863.5	0.60676
124.44	28.359	3679.9	12976.	0.00012341	7862.6	0.60680
124.48	28.370	3679.4	12970.	0.00016272	7861.8	0.60684
124.52	28.381	3679.0	12963.	0.00020744	7861.2	0.60687
124.56	28.392	3678.5	12957.	0.00025759	7860.7	0.60690
124.60	28.403	3678.2	12951.	0.00031315	7860.3	0.60692
124.64	28.414	3677.9	12945.	0.00037413	7859.9	0.60694
124.68	28.425	3677.7	12939.	0.00044053	7859.6	0.60696
124.72	28.436	3677.4	12932.	0.00050435	7859.2	0.60697
124.76	28.447	3676.8	12925.	0.00056324	7858.7	0.60700
124.80	28.458	3676.0	12918.	0.00061719	7858.2	0.60702
124.84	28.468	3675.0	12909.	0.00066620	7857.5	0.60706
124.88	28.479	3673.7	12900.	0.00071028	7856.8	0.60709
124.92	28.490	3672.2	12890.	0.00074941	7856.0	0.60713
124.96	28.500	3670.6	12879.	0.00078362	7855.1	0.60718
125.00	28.511	3668.6	12868.	0.00081288	7854.2	0.60723
125.04	28.521	3666.5	12856.	0.00083721	7853.1	0.60728
125.08	28.531	3664.2	12843.	0.00085661	7852.0	0.60734
125.12	28.542	3661.6	12829.	0.00087107	7850.7	0.60740
125.16	28.552	3658.8	12815.	0.00088059	7849.4	0.60746
125.20	28.562	3655.9	12800.	0.00088517	7848.0	0.60753
125.24	28.572	3653.0	12786.	0.00088517	7846.6	0.60760
125.28	28.581	3650.3	12772.	0.00088517	7845.3	0.60767
125.32	28.591	3648.1	12760.	0.00088517	7844.1	0.60773
125.36	28.601	3646.1	12749.	0.00088517	7843.1	0.60778
125.40	28.611	3644.6	12739.	0.00088517	7842.1	0.60783
125.44	28.621	3643.3	12730.	0.00088380	7841.3	0.60787
125.48	28.631	3642.2	12722.	0.00087701	7840.6	0.60791
125.52	28.640	3641.3	12714.	0.00086480	7839.9	0.60794
125.56	28.650	3640.5	12707.	0.00084717	7839.2	0.60797
125.60	28.660	3639.9	12701.	0.00082412	7838.6	0.60800
125.64	28.670	3639.3	12694.	0.00079565	7838.0	0.60804
125.68	28.680	3638.5	12687.	0.00076176	7837.3	0.60807
125.72	28.689	3637.6	12680.	0.00072245	7836.5	0.60811
125.76	28.699	3636.5	12671.	0.00067773	7835.7	0.60815
125.80	28.708	3635.2	12663.	0.00062759	7834.7	0.60820
125.84	28.717	3633.7	12654.	0.00057202	7833.7	0.60825
125.88	28.725	3632.0	12644.	0.00051104	7832.7	0.60830
125.92	28.734	3630.1	12634.	0.00044464	7831.5	0.60836
125.96	28.743	3628.3	12624.	0.00038082	7830.4	0.60841

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
126.00	28.751	3626.7	12614.	0.00032193	7829.4	0.60846
126.04	28.759	3625.1	12605.	0.00026798	7828.4	0.60851
126.08	28.768	3623.6	12596.	0.00021897	7827.5	0.60856
126.12	28.776	3622.2	12588.	0.00017490	7826.7	0.60860
126.16	28.784	3621.0	12580.	0.00013576	7825.9	0.60864
126.20	28.793	3619.9	12572.	0.00010155	7825.3	0.60867
126.24	28.801	3618.8	12565.	7.2287e-05	7824.6	0.60870
126.28	28.809	3617.9	12558.	4.7957e-05	7824.1	0.60873
126.32	28.817	3617.1	12552.	2.8563e-05	7823.6	0.60875
126.36	28.825	3616.4	12546.	1.4106e-05	7823.2	0.60877
126.40	28.833	3615.8	12541.	4.5847e-06	7822.9	0.60879
126.44	28.841	3615.5	12536.	0.00000	7822.6	0.60880
126.48	28.850	3615.5	12532.	0.00000	7822.6	0.60881
126.52	28.858	3615.5	12529.	0.00000	7822.5	0.60881
126.56	28.867	3615.5	12525.	0.00000	7822.4	0.60882
126.60	28.875	3615.5	12522.	0.00000	7822.2	0.60882
126.64	28.884	3615.5	12518.	0.00000	7822.1	0.60883
126.68	28.892	3615.5	12514.	0.00000	7821.9	0.60884
126.72	28.901	3615.4	12510.	0.00000	7821.7	0.60885
126.76	28.910	3615.3	12506.	0.00000	7821.5	0.60886
126.80	28.918	3614.8	12500.	0.00000	7821.2	0.60888
126.84	28.927	3613.9	12494.	0.00000	7820.6	0.60890
126.88	28.935	3612.8	12486.	0.00000	7820.0	0.60893
126.92	28.944	3611.7	12478.	0.00000	7819.3	0.60897
126.96	28.953	3610.5	12471.	0.00000	7818.6	0.60900
127.00	28.962	3609.3	12463.	0.00000	7817.8	0.60904
127.04	28.970	3608.0	12454.	0.00000	7817.1	0.60908
127.08	28.979	3606.7	12446.	0.00000	7816.2	0.60912
127.12	28.989	3605.4	12438.	0.00000	7815.4	0.60917
127.16	28.998	3604.0	12429.	0.00000	7814.5	0.60921
127.20	29.007	3602.6	12420.	0.00000	7813.5	0.60926
127.24	29.017	3601.1	12411.	0.00000	7812.6	0.60931
127.28	29.026	3599.6	12402.	0.00000	7811.5	0.60936
127.32	29.036	3598.3	12393.	0.00000	7810.5	0.60941
127.36	29.046	3597.6	12386.	0.00000	7809.7	0.60945
127.40	29.057	3597.6	12382.	0.00000	7808.9	0.60949
127.44	29.068	3598.2	12379.	0.00000	7808.3	0.60952
127.48	29.080	3599.5	12378.	0.00000	7807.8	0.60955
127.52	29.092	3601.3	12379.	0.00000	7807.4	0.60956
127.56	29.104	3603.8	12382.	0.00000	7807.1	0.60958
127.60	29.117	3606.6	12386.	4.0918e-06	7806.9	0.60959
127.64	29.131	3609.3	12390.	1.5453e-05	7806.8	0.60960
127.68	29.144	3611.9	12394.	3.4082e-05	7806.6	0.60961
127.72	29.157	3614.2	12396.	5.9981e-05	7806.3	0.60962
127.76	29.170	3616.1	12397.	9.3148e-05	7806.0	0.60964
127.80	29.183	3617.6	12396.	0.00013358	7805.5	0.60966
127.84	29.196	3618.7	12395.	0.00018129	7805.0	0.60968
127.88	29.209	3619.5	12392.	0.00023626	7804.4	0.60971
127.92	29.222	3619.9	12388.	0.00029851	7803.8	0.60975
127.96	29.234	3620.0	12383.	0.00036529	7803.0	0.60978

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
128.00	29.247	3620.0	12377.	0.00042878	7802.2	0.60982
128.04	29.259	3620.0	12372.	0.00048896	7801.4	0.60986
128.08	29.271	3620.3	12368.	0.00054585	7800.7	0.60990
128.12	29.284	3620.8	12365.	0.00059944	7800.1	0.60993
128.16	29.296	3621.4	12362.	0.00064973	7799.6	0.60996
128.20	29.308	3622.2	12359.	0.00069673	7799.1	0.60998
128.24	29.320	3623.2	12357.	0.00074043	7798.6	0.61000
128.28	29.332	3624.4	12356.	0.00078083	7798.3	0.61002
128.32	29.344	3625.7	12356.	0.00081793	7798.0	0.61003
128.36	29.356	3627.2	12356.	0.00085173	7797.8	0.61004
128.40	29.368	3628.9	12357.	0.00088224	7797.6	0.61005
128.44	29.380	3630.8	12358.	0.00090944	7797.5	0.61006
128.48	29.392	3632.8	12360.	0.00093335	7797.5	0.61006
128.52	29.403	3635.1	12363.	0.00095397	7797.6	0.61006
128.56	29.415	3637.2	12365.	0.00097128	7797.6	0.61005
128.60	29.426	3638.9	12366.	0.00098530	7797.6	0.61005
128.64	29.437	3640.0	12366.	0.00099601	7797.5	0.61006
128.68	29.447	3640.7	12364.	0.0010034	7797.3	0.61007
128.72	29.457	3640.9	12360.	0.0010076	7796.9	0.61009
128.76	29.466	3640.5	12355.	0.0010084	7796.5	0.61011
128.80	29.475	3639.7	12348.	0.0010084	7796.0	0.61013
128.84	29.484	3638.7	12341.	0.0010043	7795.4	0.61017
128.88	29.494	3637.9	12335.	0.00099293	7794.7	0.61020
128.92	29.503	3637.3	12329.	0.00097430	7794.0	0.61023
128.96	29.512	3636.8	12323.	0.00094840	7793.2	0.61027
129.00	29.521	3636.5	12318.	0.00091523	7792.4	0.61031
129.04	29.531	3636.3	12314.	0.00087480	7791.5	0.61036
129.08	29.540	3636.3	12310.	0.00082709	7790.6	0.61040
129.12	29.550	3636.3	12306.	0.00077212	7789.7	0.61045
129.16	29.559	3636.5	12303.	0.00070987	7788.7	0.61050
129.20	29.568	3636.7	12299.	0.00064309	7787.8	0.61054
129.24	29.577	3636.8	12296.	0.00057961	7786.8	0.61059
129.28	29.586	3636.8	12292.	0.00051942	7785.8	0.61064
129.32	29.596	3636.7	12288.	0.00046253	7784.8	0.61069
129.36	29.605	3636.6	12284.	0.00040894	7783.8	0.61074
129.40	29.614	3636.3	12279.	0.00035865	7782.8	0.61080
129.44	29.624	3636.0	12274.	0.00031165	7781.7	0.61085
129.48	29.633	3635.6	12269.	0.00026795	7780.6	0.61090
129.52	29.643	3635.1	12263.	0.00022756	7779.6	0.61096
129.56	29.653	3634.6	12257.	0.00019045	7778.5	0.61101
129.60	29.662	3633.9	12251.	0.00015665	7777.3	0.61107
129.64	29.672	3633.1	12245.	0.00012614	7776.2	0.61113
129.68	29.681	3632.2	12237.	9.8937e-05	7775.0	0.61118
129.72	29.691	3631.1	12230.	7.5027e-05	7773.8	0.61124
129.76	29.700	3629.9	12222.	5.4415e-05	7772.6	0.61131
129.80	29.710	3628.5	12213.	3.7101e-05	7771.3	0.61137
129.84	29.719	3627.0	12205.	2.3085e-05	7770.1	0.61143
129.88	29.729	3625.4	12195.	1.2367e-05	7768.8	0.61150
129.92	29.738	3623.6	12185.	4.9469e-06	7767.4	0.61156
129.96	29.747	3621.6	12175.	8.2448e-07	7766.1	0.61163

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

Direct Simple Shear Test

Shear Phase

Elapsed Time min	Shear Strain %	Shear Stress psf	Shear Modulus psf	Normal Strain %	Normal Stress psf	Pressure Ratio
130.00	29.756	3619.6	12164.	0.00000	7764.7	0.61170
130.04	29.765	3617.3	12153.	0.00000	7763.3	0.61177
130.08	29.774	3615.0	12142.	0.00000	7762.0	0.61183
130.12	29.782	3612.5	12130.	0.00000	7760.7	0.61190
130.16	29.790	3609.9	12118.	0.00000	7759.4	0.61196
130.20	29.798	3607.1	12106.	0.00000	7758.2	0.61203
130.24	29.806	3604.2	12093.	0.00000	7756.9	0.61209
130.28	29.813	3601.2	12080.	0.00000	7755.8	0.61215
130.32	29.821	3598.5	12067.	0.00000	7754.6	0.61220
130.36	29.829	3595.9	12056.	0.00000	7753.5	0.61226
130.40	29.837	3593.7	12045.	0.00000	7752.5	0.61231
130.44	29.845	3591.7	12035.	0.00000	7751.4	0.61236
130.48	29.853	3589.9	12026.	0.00000	7750.4	0.61241
130.52	29.861	3588.4	12017.	0.00000	7749.5	0.61246
130.56	29.870	3587.2	12010.	0.00000	7748.5	0.61251
130.60	29.879	3586.2	12003.	0.00000	7747.6	0.61255

Project Name: Hermosa	Location:	Project Number: TU201-00777/03
Boring Number: Combined Bulk T	Tester: ICloud	Checker: JBruce
Sample Number:	Test Date: 8/11/20	Depth:
Test Number:	Preparation: Reconstituted	Elevation:
Description:		
Remarks:		

FLEXIBLE WALL PERMEABILITY TEST
ASTM D 5084, Method C
Falling Head, rising tailwater elevation

CLIENT:	South 32 - Hermosa Project		
PROJECT:	Hermosa	PROJECT NO. :	TU101-00777/03
LOCATION:	Combined Bulk Tailings	LAB NO. :	L2020-035
DEPTH:		SAMPLE ID:	2020-035-05
SAMPLE NO.:		TEST STARTED :	06/29/20
SAMPLE TYPE:	Reconstituted	TEST FINISHED :	07/02/20
CONF. PRESSURE. (ksf):	2	SATURATED TEST:	Yes

MOISTURE/DENSITY DATA	BEFORE TEST	AFTER TEST
Wt. Soil + Moisture (g)	761.80	807.70
Wt. Wet Soil & Pan (g)	761.80	919.90
Wt. Dry Soil & Pan (g)	682.50	794.70
Wt. Moisture Lost (g)	79.30	125.20
Wt. of Pan Only (g)	0.00	112.20
Wt. of Dry Soil (g)	682.50	682.50
Moisture Content %	11.6	18.3
Wet Density (pcf)	127.0	139.8
Dry Density (pcf)	113.8	118.2

Init. Diameter (in)	2.415	(cm)	6.134
Init. Area (sq in)	4.581	(sq cm)	29.552
Init. Height (in)	4.987	(cm)	12.667
Height Change (in)	0.013	(cm)	0.032
Consol. Height (in)	4.975	(cm)	12.635
Area After Consol. (sq in)	4.423	(sq cm)	28.538

Vol. Before Consol. (cu ft)	0.01322	Specific Gravity	2.866
Vol. Before Consol. (cc)	374.3	Assumed?	No
Change in Vol. (cc)	13.8		
Cell Exp. (cc)	0.0	Init. Saturation	58.2
Vol. After Consol. (cc)	360.6	Init. Void Ratio	0.572
Vol. After Consol. (cu ft)	0.01273	Final Saturation	100.0
Effective Porosity %	36.38	Final Void Ratio	0.514
Pressure Difference (psi):	0.00	Inflow Buret Constant, a, cm2	0.922
C = (a*L/2*A)	0.20411	Outflow Buret Constant, a, cm2	0.922
k, cm/s = C/t*ln(h1/h2)			

Permeability Test Trials

Time min.	Cap Elevation cc	Pedestal Elevation cc	Elevation Head cm	Total Head cm	Coefficient of Permeability, k cm/sec
0.0	47.9	2.3	49.5	49.5	
0.5	46.0	4.3	45.2	45.2	6.1E-04
0.5	44.3	5.9	41.7	41.7	5.6E-04
0.5	42.8	7.5	38.3	38.3	5.7E-04
0.5	41.5	8.8	35.5	35.5	5.2E-04
0.5	40.2	10.1	32.7	32.7	5.6E-04
			Avg.of Last 4 Rdgs.		**5.5E-04**
			Max.Hyd.Gradient:	3.7	

General Test Notes:
1) Tap water was used as the permeant.
2) Back pressure saturation continued until 'B' parameter a minimum of 0.95.
3) Target remolding parameters: 113.2 pcf @ 10.8% moisture content.
Tested By: Jstaley Checked By: JBruce

FLEXIBLE WALL PERMEABILITY TEST
ASTM D 5084, Method C
Falling Head, rising tailwater elevation

CLIENT:	South 32 - Hermosa Project		
PROJECT:	Hermosa	PROJECT NO. :	TU101-00777/03
LOCATION:	Combined Bulk Tailings	LAB NO. :	L2020-035
DEPTH:		SAMPLE ID:	2020-035-05
SAMPLE NO.:		TEST STARTED :	06/29/20
SAMPLE TYPE:	Reconstituted	TEST FINISHED :	07/02/20
CONF. PRESSURE. (ksf):	20	SATURATED TEST:	Yes

MOISTURE/DENSITY DATA	BEFORE TEST	AFTER TEST
Wt. Soil + Moisture (g)	761.80	799.02
Wt. Wet Soil & Pan (g)	761.90	914.50
Wt. Dry Soil & Pan (g)	683.22	798.70
Wt. Moisture Lost (g)	78.68	115.80
Wt. of Pan Only (g)	0.00	115.48
Wt. of Dry Soil (g)	683.22	683.22
Moisture Content %	11.5	16.9
Wet Density (pcf)	126.2	141.5
Dry Density (pcf)	113.2	121.0

Init. Diameter (in)	2.415	(cm)	6.134
Init. Area (sq in)	4.581	(sq cm)	29.552
Init. Height (in)	5.020	(cm)	12.751
Height Change (in)	0.124	(cm)	0.315
Consol. Height (in)	4.896	(cm)	12.436
Area After Consol. (sq in)	4.394	(sq cm)	28.351

Vol. Before Consol. (cu ft)	0.01331	Specific Gravity	2.866
Vol. Before Consol. (cc)	376.8	Assumed?	No
Change in Vol. (cc)	24.3		
Cell Exp. (cc)	0.0	Init. Saturation	56.8
Vol. After Consol. (cc)	352.6	Init. Void Ratio	0.581
Vol. After Consol. (cu ft)	0.01245	Final Saturation	100.0
Effective Porosity %	36.74	Final Void Ratio	0.479
Pressure Difference (psi):	0.00	Inflow Buret Constant, a, cm2	0.922
C = (a*L/2*A)	0.20221	Outflow Buret Constant, a, cm2	0.922
k, cm/s = C/t*ln(h1/h2)			

Permeability Test Trials

Time min.	Cap Elevation cc	Pedestal Elevation cc	Elevation Head cm	Total Head cm	Coefficient of Permeability, k cm/sec
0.0	48.8	1.1	51.8	51.8	
2.0	46.9	3.0	47.6	47.6	1.4E-04
4.0	43.5	6.4	40.3	40.3	1.4E-04
3.0	41.3	8.6	35.5	35.5	1.4E-04
4.0	38.8	11.1	30.1	30.1	1.4E-04

Avg.of Last 4 Rdgs. **1.4E-04**
Max.Hyd.Gradient: 4.0

General Test Notes:
1) Tap water was used as the permeant.
2) Back pressure saturation continued until 'B' parameter a minimum of 0.95.
3) Target remolding parameters: 113.2 pcf @ 10.8% moisture content.

Tested By: Jstaley Checked By: JBruce

FLEXIBLE WALL PERMEABILITY TEST
ASTM D 5084-16a
Method F, Constant Volume-Falling Head (by mercury), rising tailwater elevation

CLIENT:	South 32 - Hermosa Project		
PROJECT:	Hermosa	PROJECT NO. :	TU101-00777/03
LOCATION:	Combined Bulk Tailings	LAB NO. :	L2020-035
DEPTH:		SAMPLE ID:	2020-035-05
SAMPLE NO.:		TEST STARTED :	06/29/20
SAMPLE TYPE:	Reconstituted	TEST FINISHED :	07/08/20
CONF. PRESSURE. (ksf):	50	SATURATED TEST:	Yes

MOISTURE/DENSITY DATA	BEFORE TEST	AFTER TEST
Wt. Soil + Moisture (g)	762.20	788.57
Wt. Wet Soil & Pan (g)	762.20	933.90
Wt. Dry Soil & Pan (g)	684.57	828.90
Wt. Moisture Lost (g)	77.63	105.00
Wt. of Pan Only (g)	0.00	145.33
Wt. of Dry Soil (g)	684.57	683.57
Moisture Content %	11.3	15.4
Wet Density (pcf)	127.3	143.1
Dry Density (pcf)	114.3	124.0

Init. Diameter (in)	2.415	(cm)	6.134
Init. Area (sq in)	4.581	(sq cm)	29.552
Init. Height (in)	4.980	(cm)	12.649
Height Change (in)	0.172	(cm)	0.436
Consol. Height (in)	4.808	(cm)	12.213
Area After Consol. (sq in)	4.366	(sq cm)	28.168

Vol. Before Consol. (cu ft)	0.01320	Specific Gravity	2.87
Vol. Before Consol. (cc)	373.8	Assumed?	No
Change in Vol. (cc)	29.8		
Cell Exp. (cc)	0.0	Init. Saturation	57.5
Vol. After Consol. (cc)	344.0	Init. Void Ratio	0.565
Vol. After Consol. (cu ft)	0.01215	Final Saturation	99.9
Effective Porosity %	36.10	Final Void Ratio	0.440
Pressure Difference (psi):	0.00	Pipette area (a_{out}), cm2	0.0314
		Annulus area (a_{in}), cm2	0.767

Permeability Flow Trials

Time Sec.	Pipette Elevation cm	Annulus Elevation cm	Z1 cm	D zp cm	Coefficient of Permeability, k cm/sec
0.00	22.00	0.50	21.5		
7.53	17.00	0.60	16.4	5.0	5.3E-05
0.00	22.00	0.50	21.5		
6.84	17.00	0.60	16.4	5.0	5.8E-05
0.00	22.00	0.50	21.5		
6.22	17.00	0.60	16.4	5.0	6.4E-05
0.00	22.00	0.50	21.5		
6.41	17.00	0.60	16.4	5.0	6.2E-05

Avg.of Last 4 Rdgs. **6.1E-05**

Max.Hyd.Gradient: 22.4

General Test Notes:
1) Tap water was used as the permeant.
2) Back pressure saturation continued until 'B' parameter a minimum of 0.95.
3) Target remolding parameters: 113.4 pcf @ 10.8% moisture content.

Tested By: JStaley   Checked By: JBruce

FLEXIBLE WALL PERMEABILITY TEST
ASTM D 5084-16a
Method F, Constant Volume-Falling Head (by mercury), rising tailwater elevation

CLIENT:	South 32 - Hermosa Project		
PROJECT:	Hermosa	PROJECT NO. :	TU101-00777/03
LOCATION:	Combined Bulk Tailings	LAB NO. :	L2020-035
DEPTH:		SAMPLE ID:	2020-035-05
SAMPLE NO.:		TEST STARTED :	06/29/20
SAMPLE TYPE:	Reconstituted @ 95%MDD	TEST FINISHED :	07/23/20
CONF. PRESSURE. (ksf):	50	SATURATED TEST:	Yes

MOISTURE/DENSITY DATA	BEFORE TEST	AFTER TEST
Wt. Soil + Moisture (g)	804.70	824.55
Wt. Wet Soil & Pan (g)	398.18	942.40
Wt. Dry Soil & Pan (g)	373.02	840.90
Wt. Moisture Lost (g)	25.16	101.50
Wt. of Pan Only (g)	144.20	117.85
Wt. of Dry Soil (g)	228.82	723.05
Moisture Content %	11.0	14.0
Wet Density (pcf)	132.9	145.1
Dry Density (pcf)	119.8	127.2

Init. Diameter (in)	2.420	(cm)	6.147
Init. Area (sq in)	4.600	(sq cm)	29.675
Init. Height (in)	5.013	(cm)	12.733
Height Change (in)	0.123	(cm)	0.313
Consol. Height (in)	4.890	(cm)	12.420
Area After Consol. (sq in)	4.427	(sq cm)	28.564

Vol. Before Consol. (cu ft)	0.01334	Specific Gravity	2.866
Vol. Before Consol. (cc)	377.8	Assumed?	No
Change in Vol. (cc)	23.1		
Cell Exp. (cc)	0.0	Init. Saturation	63.8
Vol. After Consol. (cc)	354.7	Init. Void Ratio	0.494
Vol. After Consol. (cu ft)	0.01253	Final Saturation	99.7
Effective Porosity %	33.05	Final Void Ratio	0.402
Pressure Difference (psi):	0.00	Pipette area (a_{out}), cm2	0.0314
		Annulus area (a_{in}), cm2	0.767

Permeability Flow Trials

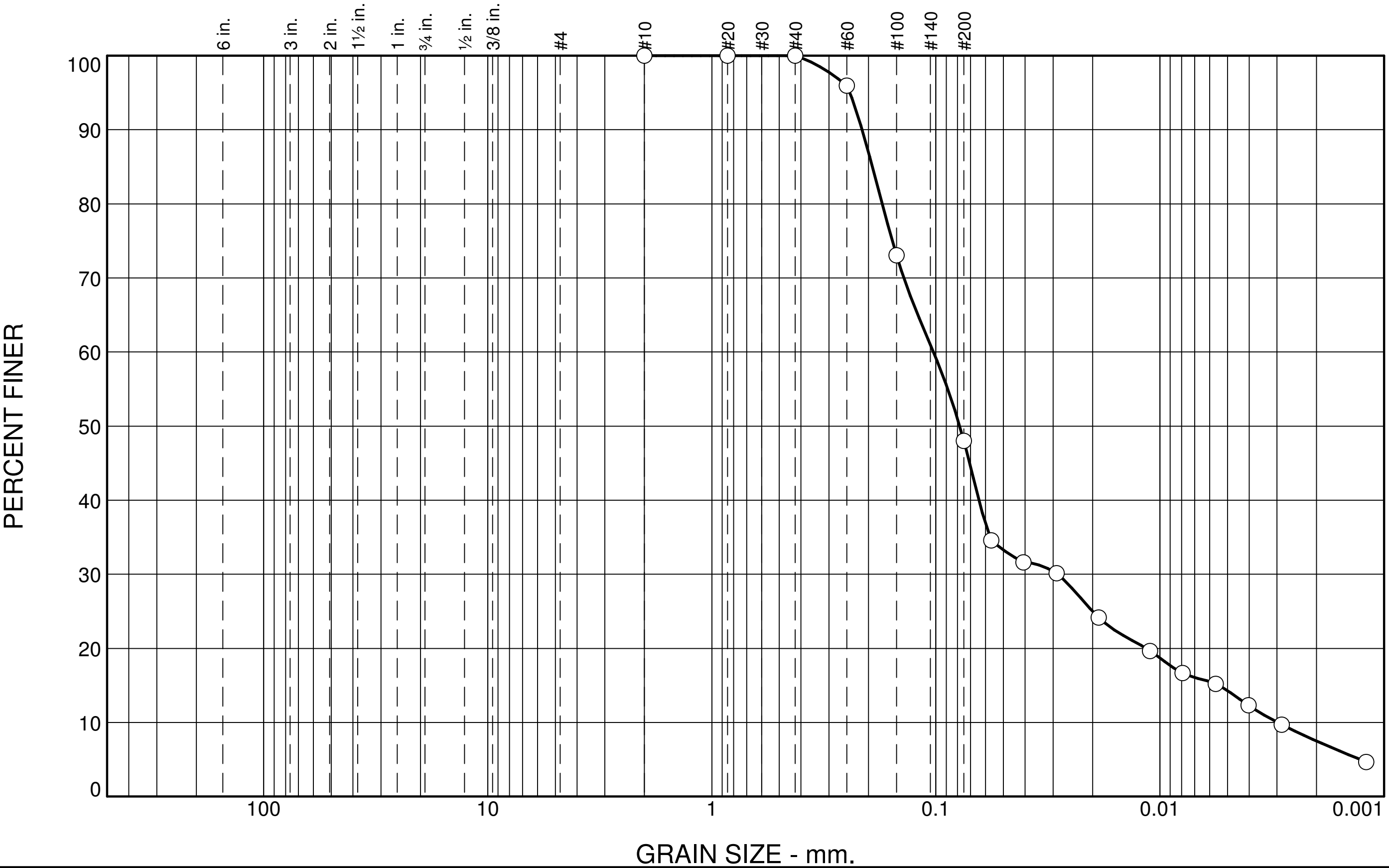
Time Sec.	Pipette Elevation cm	Annulus Elevation cm	Z1 cm	D zp cm	Coefficient of Permeability, k cm/sec
0.00	19.00	0.50	18.5		
14.97	16.00	0.60	15.4	3.0	1.6E-05
0.00	19.00	0.50	18.5		
13.85	16.00	0.60	15.4	3.0	1.7E-05
0.00	19.00	0.50	18.5		
13.13	16.00	0.60	15.4	3.0	1.8E-05
0.00	19.00	0.50	18.5		
13.29	16.00	0.60	15.4	3.0	1.8E-05
			Avg.of Last 4 Rdgs.		**1.8E-05**
			Max.Hyd.Gradient:	18.9	

General Test Notes:

1) Tap water was used as the permeant.
2) Back pressure saturation continued until 'B' parameter a minimum of 0.95.
3) Target remolding parameters: 119.7 pcf @ 10.8% moisture content.

Tested By: JStaley Checked By: JBruce

Particle Size Distribution Report ASTM D6913



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.0	52.0	40.5	7.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	100.0		
#40	100.0		
#60	96.0		
#100	73.1		
#200	48.0		
0.0567 mm.	34.6		
0.0406 mm.	31.6		
0.0289 mm.	30.1		
0.0188 mm.	24.2		
0.0111 mm.	19.7		
0.0079 mm.	16.7		
0.0056 mm.	15.2		
0.0040 mm.	12.3		
0.0029 mm.	9.7		
0.0012 mm.	4.7		

* (no specification provided)

Soil Description

silty sand

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 0.2136 D_{85}= 0.1922 D_{60}= 0.1025
D_{50}= 0.0783 D_{30}= 0.0286 D_{15}= 0.0055
D_{10}= 0.0030 C_u= 34.40 C_c= 2.68

Classification

USCS= SM AASHTO= A-4(0)

Remarks

Sample No.:
Location: Concha
Source of Sample:
Date: 6/2/20
Elev./Depth:

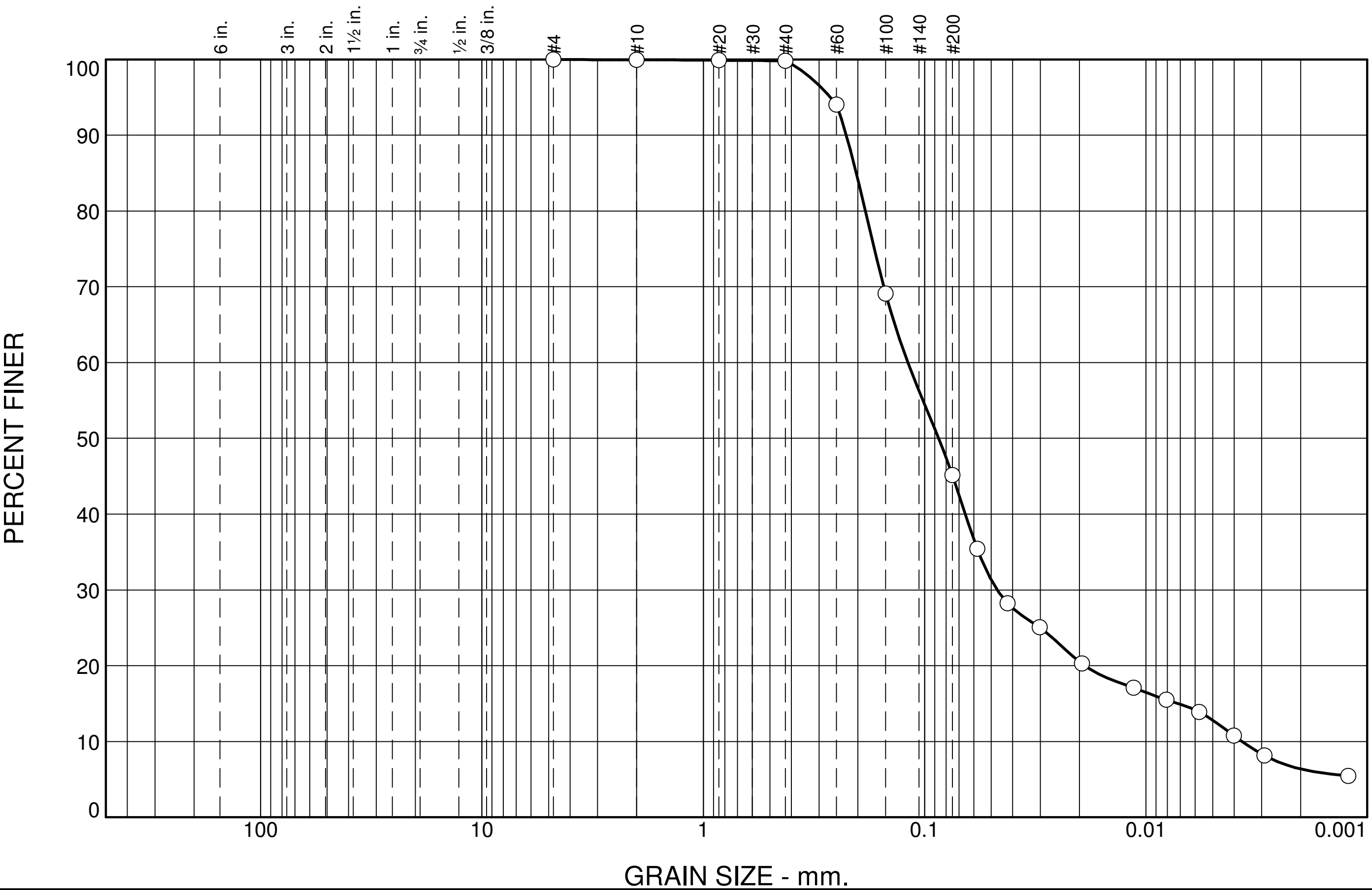
Knight Piésold CONSULTING

Client: South 32 - Hermosa Project
Project: Hermosa
Project No: 101-00777.03 **Figure**

Cursory interpretations require review by a professional engineer. Knight Piesold accepts no responsibility in subsequent analyses.

Tested By: ICloud **Checked By:** JBruce

Particle Size Distribution Report ASTM D6913



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	0.1	54.6	38.8	6.4

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.9		
#20	99.9		
#40	99.8		
#60	94.1		
#100	69.1		
#200	45.2		
0.0578 mm.	35.4		
0.0422 mm.	28.2		
0.0302 mm.	25.1		
0.0195 mm.	20.3		
0.0114 mm.	17.1		
0.0081 mm.	15.5		
0.0058 mm.	13.9		
0.0040 mm.	10.8		
0.0029 mm.	8.1		
0.0012 mm.	5.4		

* (no specification provided)

Soil Description

silty sand

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 0.2255 D_{85}= 0.2034 D_{60}= 0.1191
D_{50}= 0.0865 D_{30}= 0.0469 D_{15}= 0.0072
D_{10}= 0.0037 C_u= 32.34 C_c= 5.02

Classification

USCS= SM AASHTO= A-4(0)

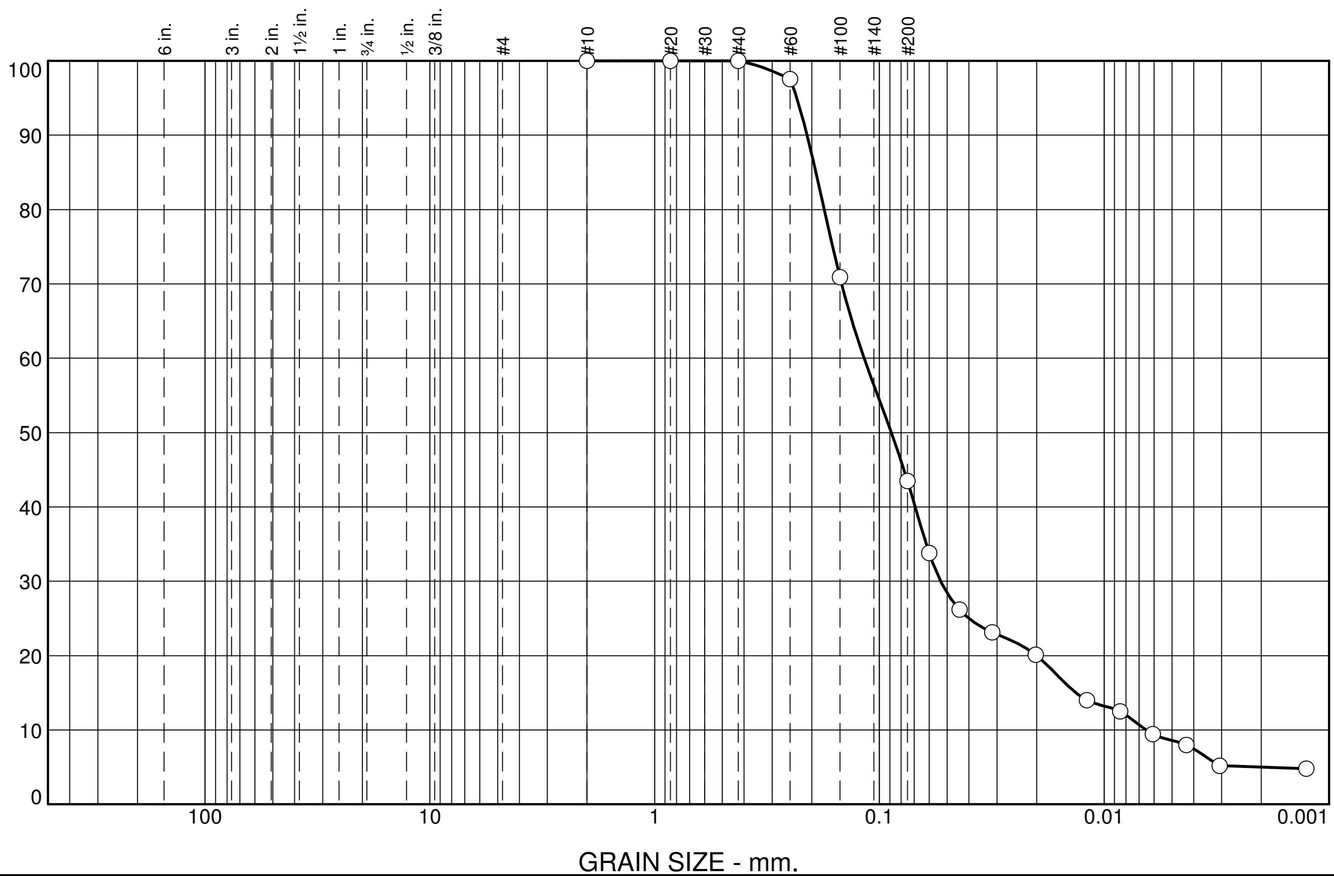
Remarks

Sample No.: CU **Source of Sample:** **Date:** 6/16/20
Location: Combined Bulk Sample **Elev./Depth:**

Knight Piésold CONSULTING

Client: South 32 - Hermosa Project
Project: Hermosa
Project No: 101-00777.03 **Figure**

Particle Size Distribution Report ASTM D6913



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.0	56.5	38.5	5.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	100.0		
#40	100.0		
#60	97.5		
#100	70.9		
#200	43.5		
0.0601 mm.	33.8		
0.0440 mm.	26.2		
0.0315 mm.	23.1		
0.0202 mm.	20.1		
0.0119 mm.	14.0		
0.0085 mm.	12.5		
0.0061 mm.	9.4		
0.0043 mm.	8.0		
0.0031 mm.	5.2		
0.0013 mm.	4.8		

* (no specification provided)

Soil Description

silty sand

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 0.2099 D_{85}= 0.1918 D_{60}= 0.1169
D_{50}= 0.0884 D_{30}= 0.0534 D_{15}= 0.0133
D_{10}= 0.0065 C_u= 17.98 C_c= 3.75

Classification

USCS= SM AASHTO= A-4(0)

Remarks

Sample No.: **Source of Sample:** **Date:** 6/2/20
Location: Deeps **Elev./Depth:**

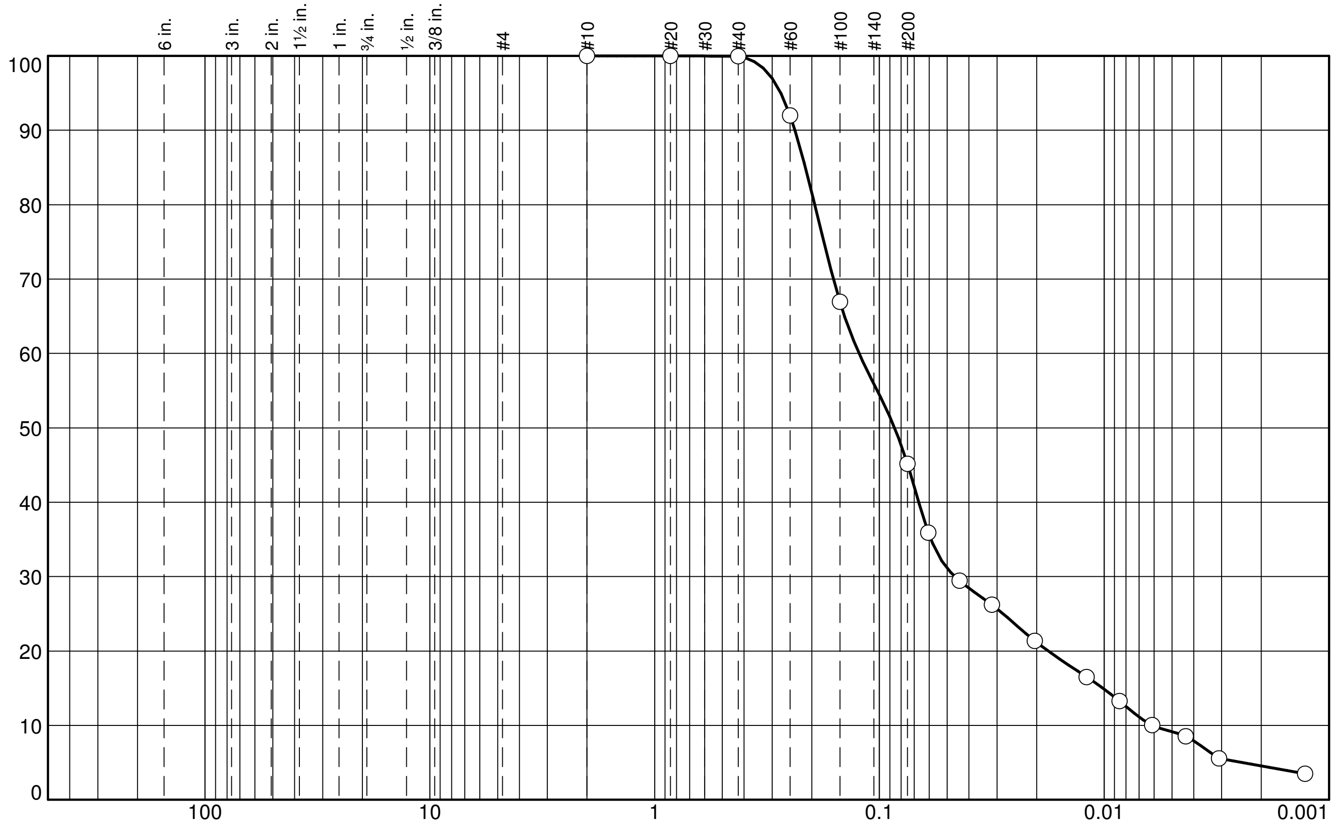
Knight Piésold CONSULTING

Client: South 32 - Hermosa Project
Project: Hermosa
Project No: 101-00777.03 **Figure**

Tested By: lCloud **Checked By:** JBruce

Cursory interpretations require review by a professional engineer. Knight Piesold accepts no responsibility in subsequent analyses.

Particle Size Distribution Report ASTM D6913



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.0	54.8	40.6	4.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	100.0		
#40	100.0		
#60	92.0		
#100	67.0		
#200	45.2		
0.0606 mm.	35.9		
0.0440 mm.	29.5		
0.0316 mm.	26.2		
0.0203 mm.	21.4		
0.0120 mm.	16.5		
0.0086 mm.	13.3		
0.0061 mm.	10.0		
0.0043 mm.	8.5		
0.0031 mm.	5.6		
0.0013 mm.	3.5		

* (no specification provided)

Soil Description

silty sand

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 0.2378 D_{85}= 0.2137 D_{60}= 0.1230
D_{50}= 0.0856 D_{30}= 0.0462 D_{15}= 0.0101
D_{10}= 0.0061 C_u= 20.24 C_c= 2.85

Classification

USCS= SM AASHTO= A-4(0)

Remarks

Sample No.: **Source of Sample:** **Date:** 6/2/20
Location: Epitaph **Elev./Depth:**

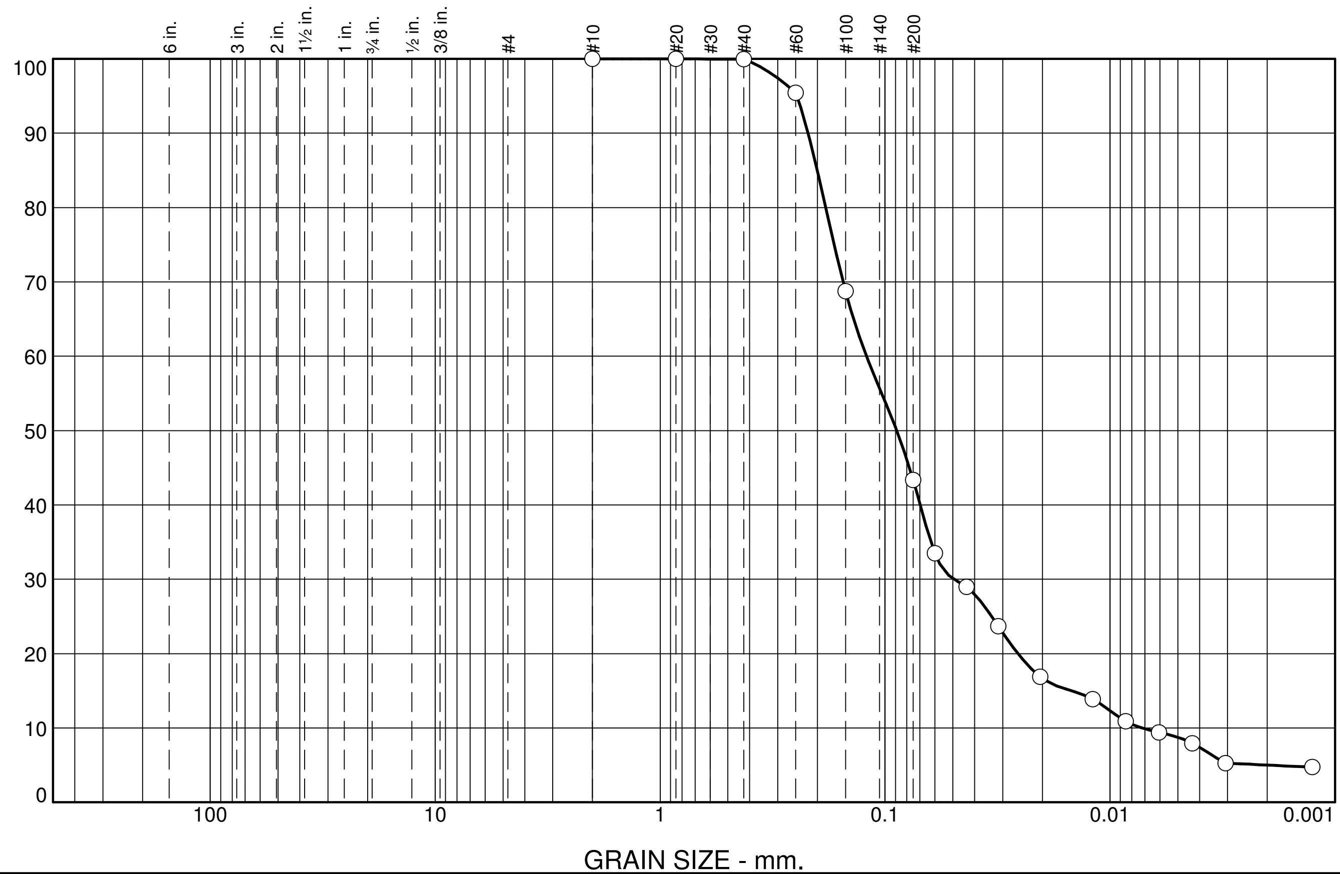
Knight Piésold CONSULTING

Client: South 32 - Hermosa Project
Project: Hermosa
Project No: 101-00777.03 **Figure**

Cursory interpretations require review by a professional engineer. Knight Piesold accepts no responsibility in subsequent analyses.

Tested By: ICloud **Checked By:** JBruce

Particle Size Distribution Report ASTM D6913



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.1	56.6	38.3	5.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	100.0		
#40	99.9		
#60	95.4		
#100	68.7		
#200	43.3		
0.0601 mm.	33.5		
0.0434 mm.	29.0		
0.0314 mm.	23.7		
0.0204 mm.	16.9		
0.0119 mm.	13.9		
0.0085 mm.	10.9		
0.0061 mm.	9.4		
0.0043 mm.	8.0		
0.0031 mm.	5.3		
0.0013 mm.	4.7		

* (no specification provided)

Soil Description

silty sand

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 0.2202 D_{85}= 0.2005 D_{60}= 0.1209
D_{50}= 0.0887 D_{30}= 0.0494 D_{15}= 0.0148
D_{10}= 0.0072 C_u= 16.73 C_c= 2.80

Classification

USCS= SM AASHTO= A-4(0)

Remarks

Sample No.:
Location: Scherler
Source of Sample:
Date: 6/2/20
Elev./Depth:

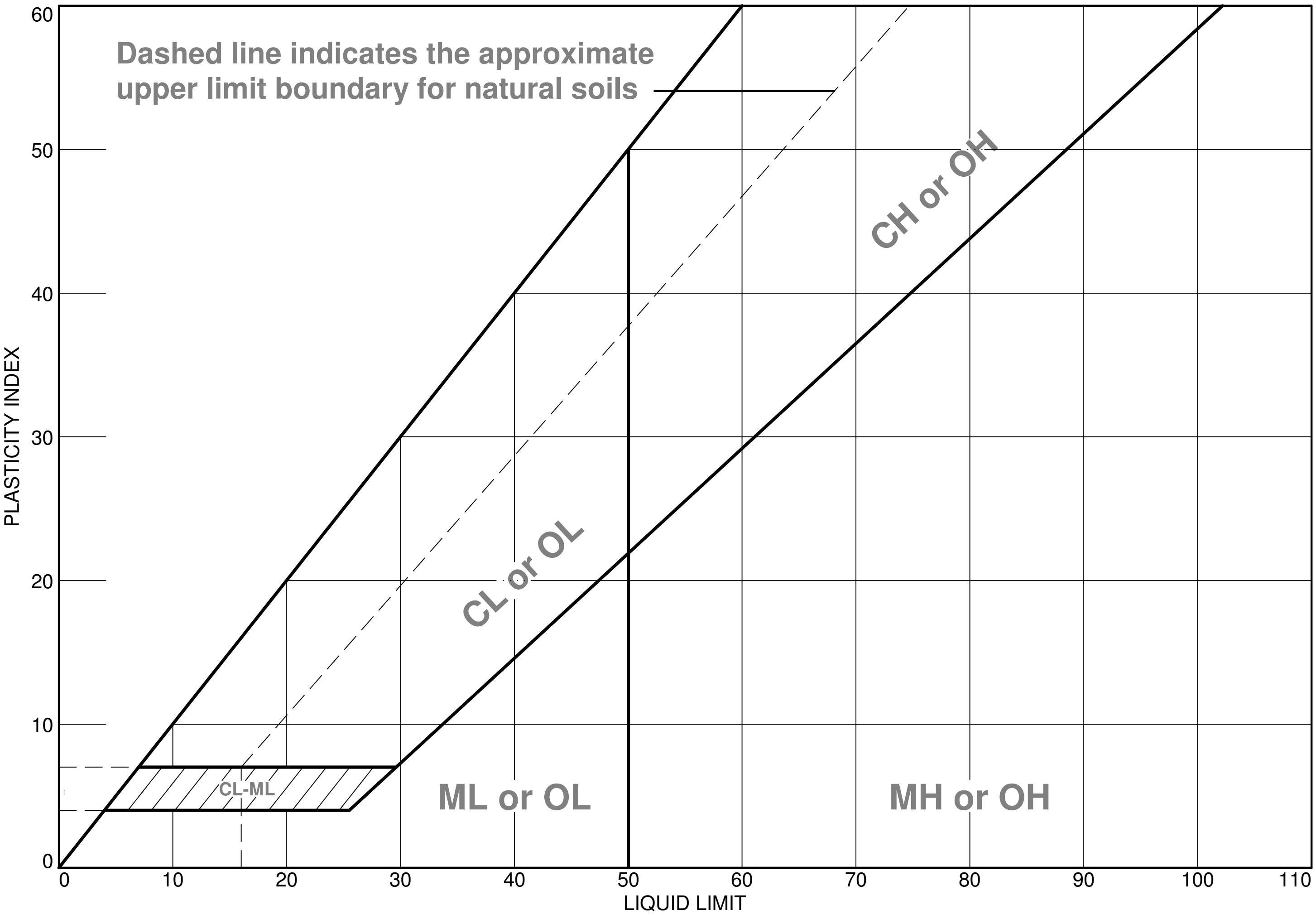
Knight Piésold CONSULTING

Client: South 32 - Hermosa Project
Project: Hermosa
Project No: 101-00777.03 **Figure**

Cursory interpretations require review by a professional engineer. Knight Piesold accepts no responsibility in subsequent analyses.

Tested By: ICloud **Checked By:** JBruce

LIQUID AND PLASTIC LIMITS TEST REPORT ASTM D4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	silty sand	NP	NP	NP	100.0	48.0	SM
■	silty sand	NP	NP	NP	100.0	43.5	SM
▲	silty sand	NP	NP	NP	100.0	45.2	SM
◆	silty sand	NP	NP	NP	99.9	43.3	SM
▼	silty sand	NP	NP	NP	99.8	45.2	SM

Project No. 101- **Client:** South 32 - Hermosa Project

Project: Hermosa

● **Location:** Concha
■ **Location:** Deeps
▲ **Location:** Epitaph
◆ **Location:** Scherler
▼ **Location:** Combined Bulk Sample **Sample Number:** CU

Knight Piésold CONSULTING

Remarks:

Figure

Tested By: MFreund **Checked By:** JBruce

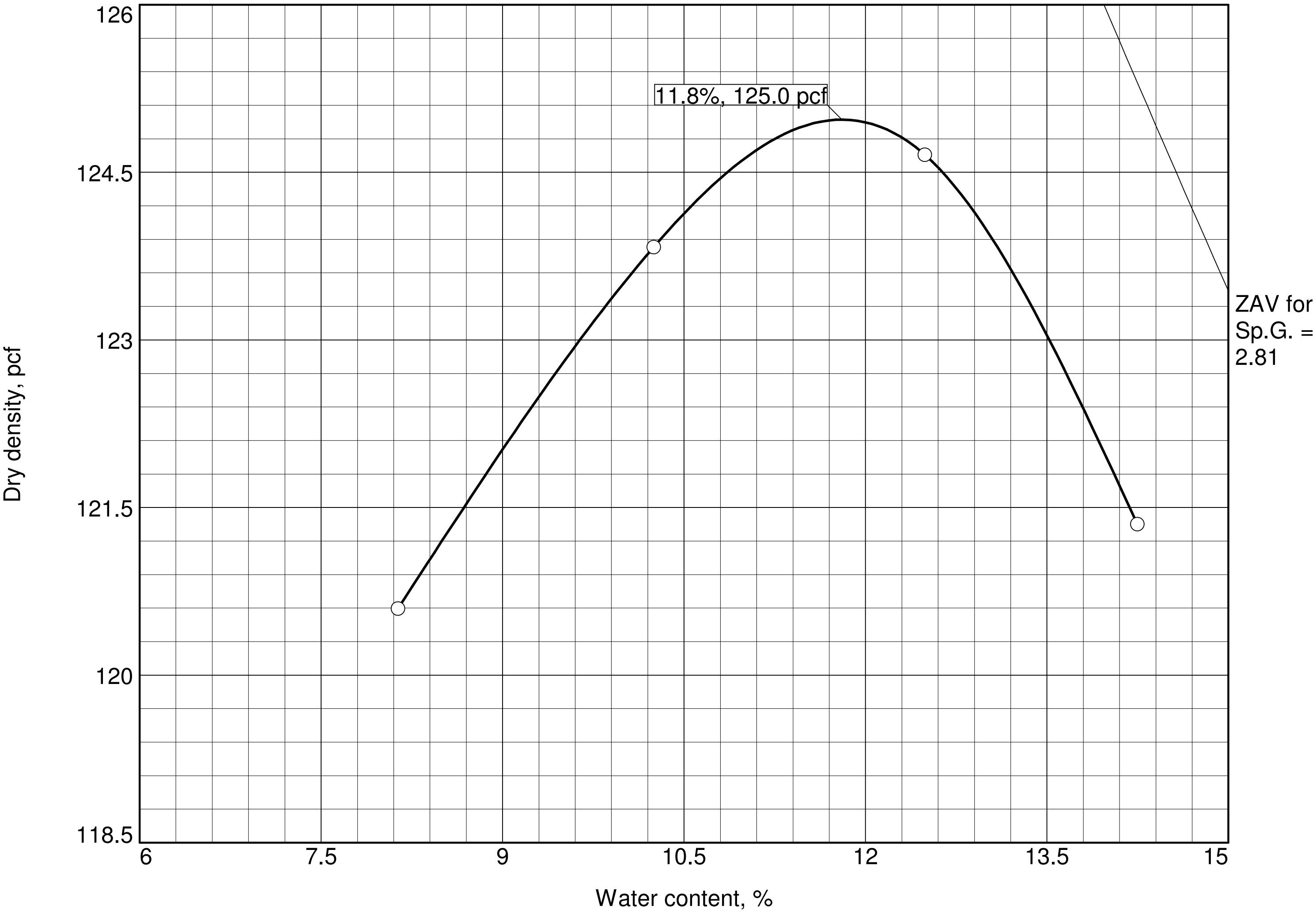
Knight Piésold CONSULTING

Specific Gravity - Soil
ASTM D 854

Project	Hermosa	**Project No.**	TU101-000777/03
Date Staged	3/3/2020		
Date Completed	6/5/2020	**Lab No.**	L2020-035
Tested By	Icloud	**Checked By**	Jbruce

Sample No.	Concha		Deeps		Epitaph		Scherler		Bulk Sample	
Sample Prep. (Wet or Dry)	wet		wet		wet					
Flask No.										
1) Wt. of Flask + Soil										
2) Wt. of Flask										
3) Wt. of Soil (1-2)	31.02	31.03	31.13	31.12	31.04	31.02	31.11	31.06	28.98	29.04
4) Calibrated Wt. of Flask + Water	335.66	338.86	337.73	338.71	337.40	365.91	338.53	338.18	338.02	337.57
5) #3 + #4	366.68	369.89	368.86	369.83	368.44	396.93	369.64	369.24	367.00	366.61
6) Wt. of Flask + Water + Soil	356.16	359.47	357.48	358.76	357.23	385.53	358.43	358.04	356.83	356.57
7) Volume of Soil (5 - 6)	10.52	10.42	11.38	11.07	11.21	11.40	11.21	11.20	10.17	10.04
8) Test Temperature, deg. C	24	24	24.7	24.6	23	23.1	24.5	24.6	27.1	27.1
9) Temperature Correction, k	0.999088	0.999088	0.998916	0.998942	0.999339	0.999315	0.998968	0.998942	0.998279	0.998279
10) Specific Gravity ((3 / 7) * k)	2.946	2.975	2.733	2.808	2.767	2.719	2.772	2.770	2.845	2.887
Reported Average, G_s @ 20 deg.C	2.961		2.770		2.743		2.771		2.866	
Tare	3	17	10	13	6	2	20	1	10	13
Dry Soil + tare, g	433.46	426.08	433.96	433.97	406.84	423.91	426.26	425.44	431.82	431.92
Tare, g	402.44	395.05	402.83	402.85	375.8	392.89	395.15	394.38	402.84	402.88

General Notes: Line 9, k, is determined by dividing the density of water at test temperature recorded, by the density of water at 20 deg. C.



Test specification: ASTM D 698-12 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
				2.811	NP	NP	0	

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 125.0 pcf Optimum moisture = 11.8 %	

Project No. 101-00777.03 **Client:** South 32 - Hermosa Project

Project: Hermosa

Date: 6/11/20

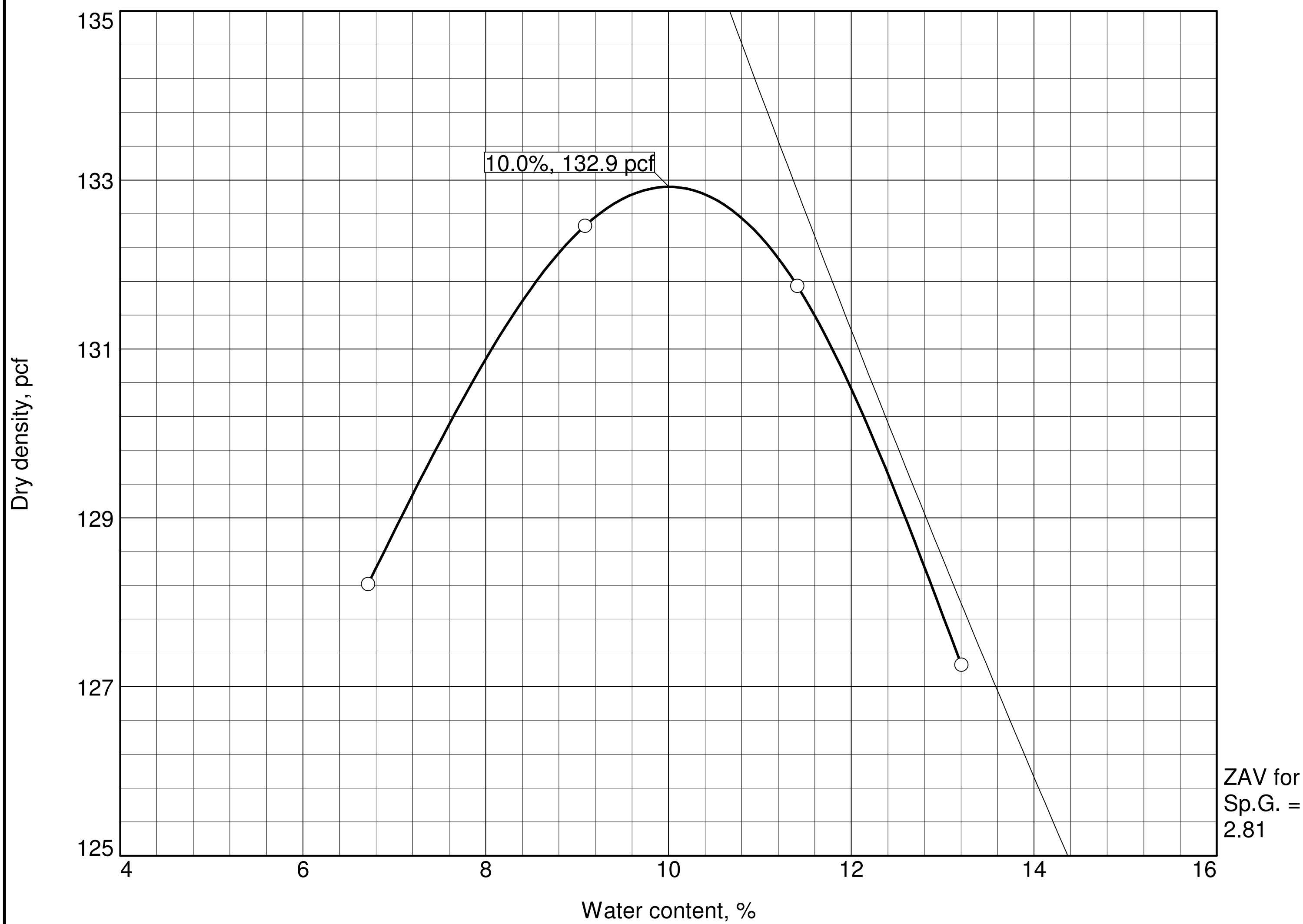
○ **Location:** Combined Bulk Sample **Sample Number:** D698-1

Knight Piésold CONSULTING

Remarks:

Figure

Tested By: ICloud **Checked By:** JBruce



Test specification: ASTM D 1557-12 Method A Modified

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
	SM			2.811	np		0	45.2

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 132.9 pcf Optimum moisture = 10.0 %	silty sand

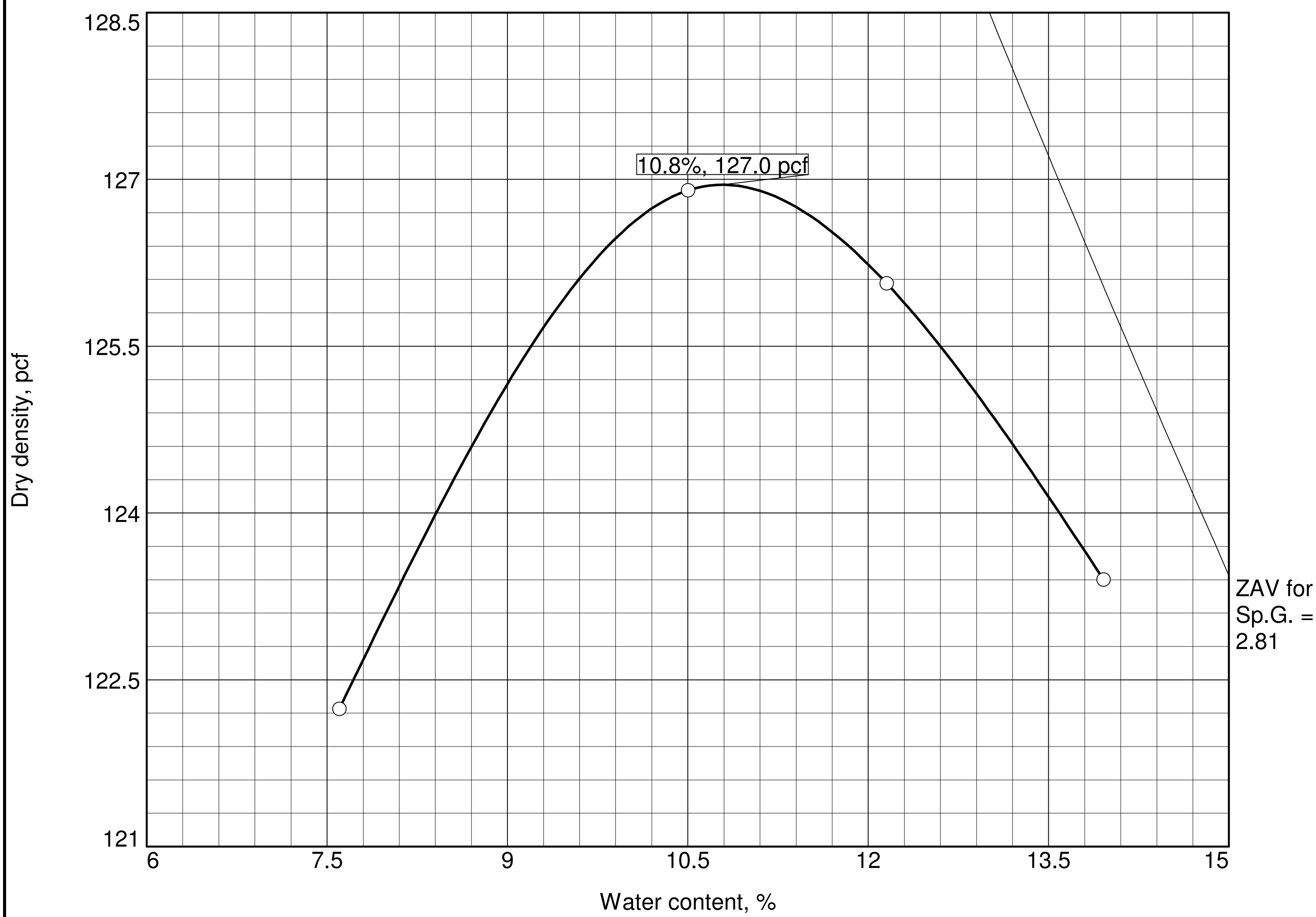
Project No. 101-00777.03 **Client:** South 32 - Hermosa Project
Project: Hermosa
Date: 6/12/20
○ **Location:** Combined Bulk Sample **Sample Number:** D1557

Knight Piésold CONSULTING

Remarks:

Figure

Tested By: MFreund **Checked By:** Jbruce



Test specification: ASTM D 698-12 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
				2.811	NP		0	45.2

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 127.0 pcf Optimum moisture = 10.8 %	silty sand

Project No. 101-00777.03 **Client:** South 32 - Hermosa Project

Project: Hermosa

Date: 6/11/20

○ **Location:** Combined Bulk Sample **Sample Number:** D698-2

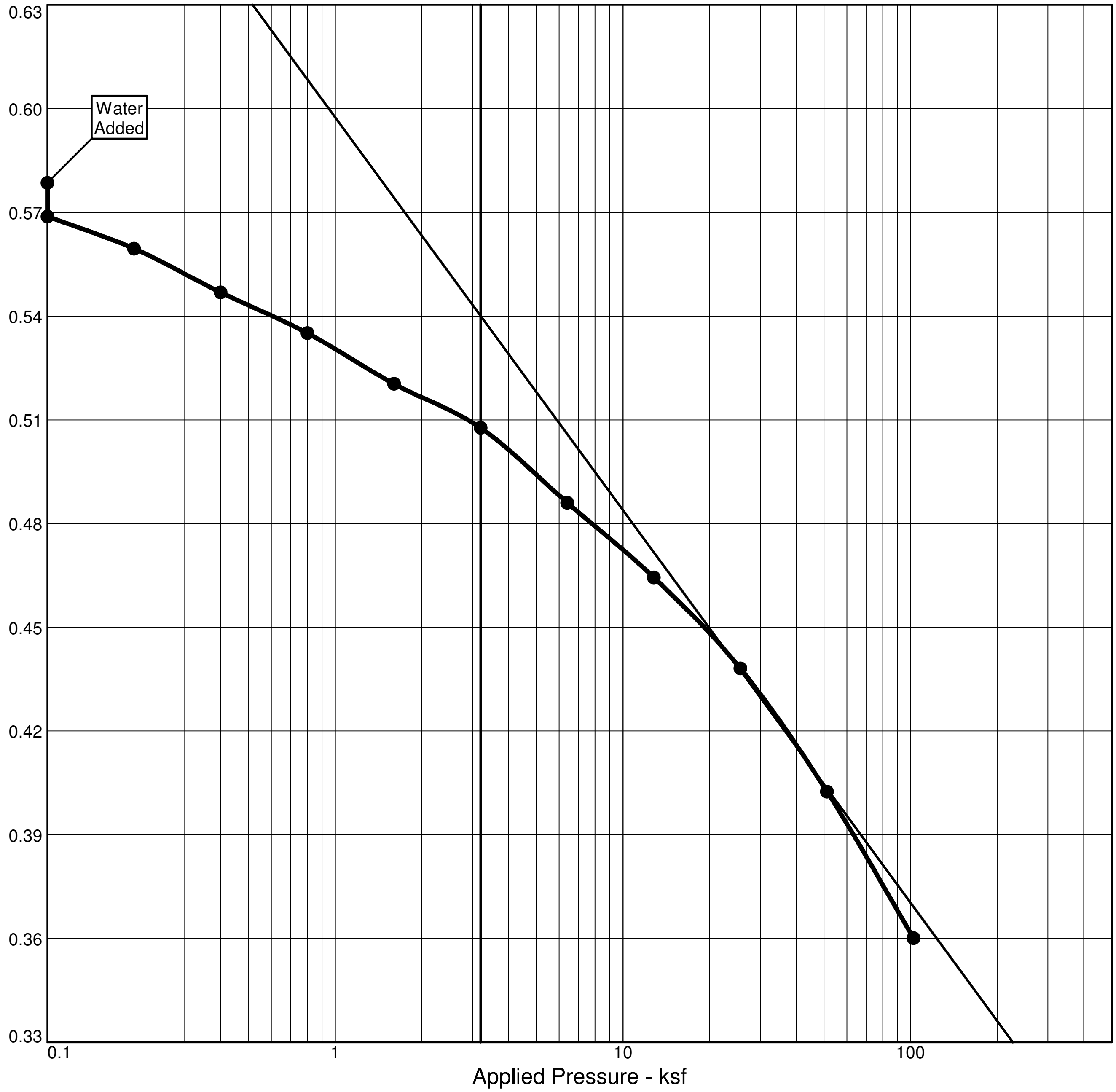
Knight Piésold CONSULTING

Remarks:

Figure

Tested By: MFreund **Checked By:** JBruce

One Dimensional Consolidation ASTM D2435



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (ksf)	P_c (ksf)	C_c	C_r	Swell Press. (ksf)	Clpse. %	e_o
Sat.	Moist.											
61.0 %	12.3 %	113.3	NP		2.866		7.6	0.11			0.6	0.580

MATERIAL DESCRIPTION	USCS	AASHTO
silty sand		

Project No. 10100777.03 **Client:** South 32 - Hermosa Project

Project: Hermosa

Location: Combined Bulk **Sample Number:** 90% MDD @ 12.4% MC

Knight Piésold CONSULTING

Remarks:

Figure

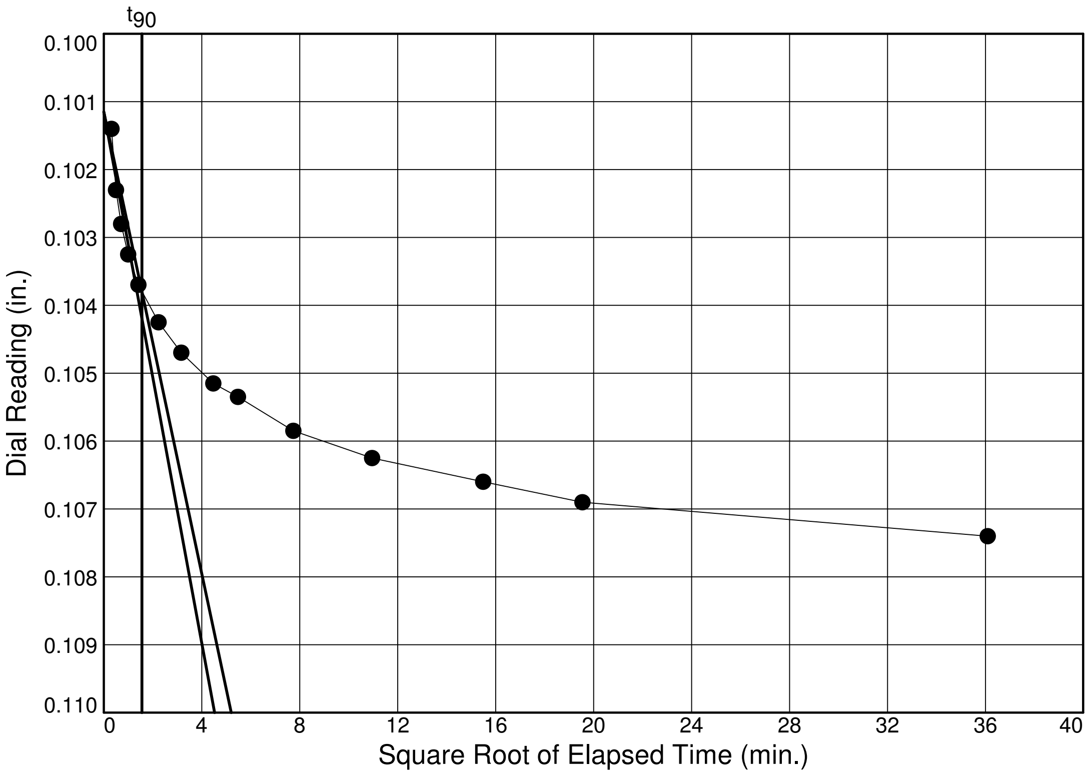
Cursory interpretations require review by a professional engineer. Knight Piésold accepts no responsibility in subsequent analyses.

Tested By: JBruce/JStaley **Checked By:** JBruce

Dial Reading vs. Time

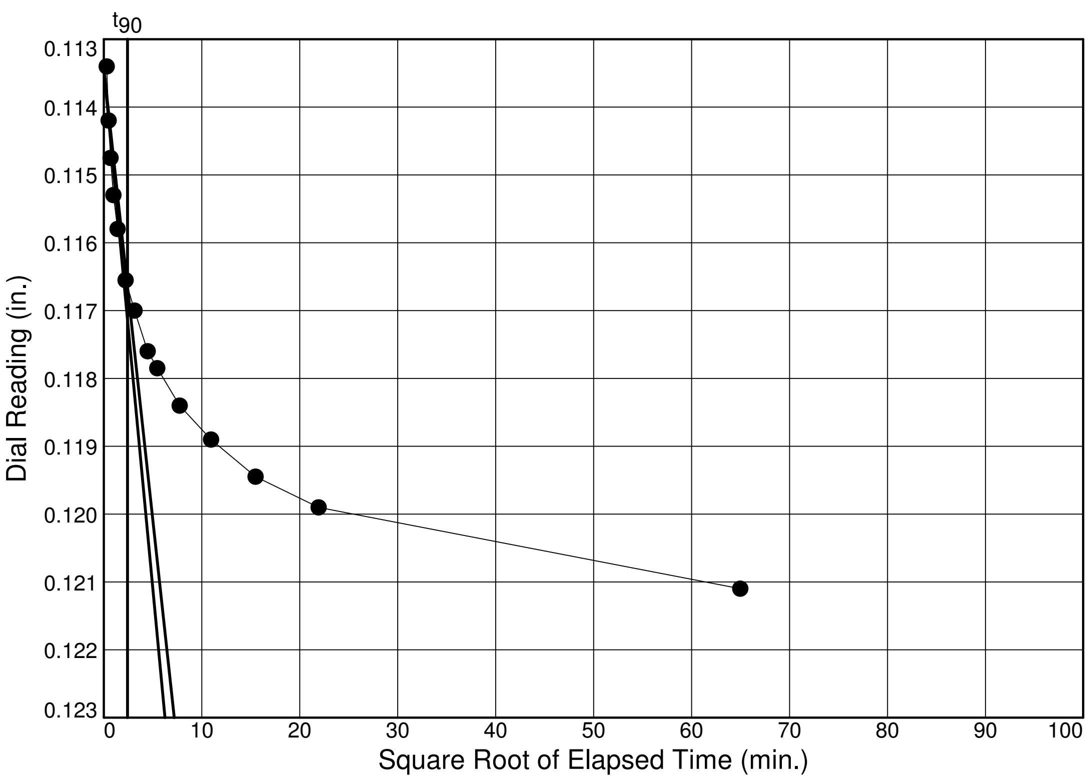
Project No.: 10100777.03
Project: Hermosa

Location: Combined Bulk Sample Number: 90% MDD @ 12.4% MC



Load No.= 8
Load= 6.40 ksf
D_0 = 0.1012
D_{90} = 0.1038
D_{100} = 0.1041
T_{90} = 2.42 min.

C_v @ T_{90}
0.786 ft.^{2}/day



Load No.= 9
Load= 12.80 ksf
D_0 = 0.1134
D_{90} = 0.1166
D_{100} = 0.1170
T_{90} = 5.84 min.

C_v @ T_{90}
0.317 ft.^{2}/day

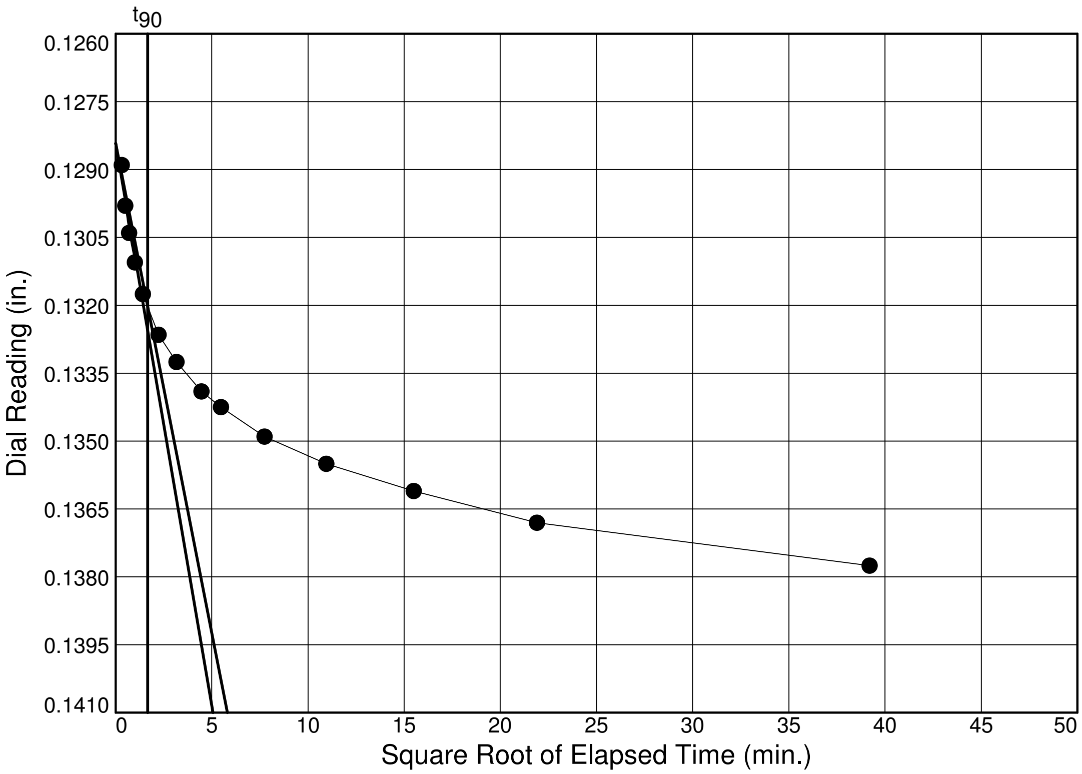
Figure

Knight Piesold Geotechnical Lab.

Dial Reading vs. Time

Project No.: 10100777.03
Project: Hermosa

Location: Combined Bulk   Sample Number: 90% MDD @ 12.4% MC



Load No.= 10

Load= 25.60 ksf

D_0 = 0.1284

D_{90} = 0.1320

D_{100} = 0.1324

T_{90} = 2.78 min.

C_v @ T_{90}

0.644 ft.^{2}/day

Figure

Knight Piesold Geotechnical Lab.

SWELL/CONSOLIDATION TEST DATA

3/29/2021

Client: South 32 - Hermosa Project
Project: Hermosa
Project Number: 10100777.03
Location: Combined Bulk
Sample Number: 90% MDD @ 12.4% MC
Material Description: silty sand
Liquid Limit: NP
Tested by: JBruce/JStaley **Checked by:** JBruce

Test Specimen Data

NATURAL MOISTURE		VOID RATIO		AFTER TEST	
Wet w+t =	274.53 g.	Spec. Gr.	= 2.866	Wet w+t =	273.22 g.
Dry w+t =	257.00 g.	Est. Ht. Solids	= 0.633 in.	Dry w+t =	254.61 g.
Tare Wt. =	114.88 g.	Init. V.R.	= 0.580	Tare Wt. =	117.85 g.
Moisture =	12.3 %	Init. Sat.	= 61.0 %	Moisture =	13.6 %

UNIT WEIGHT		TEST START			
Height =	1.000 in.	Height	= 1.000 in.	Dry Wt. =	136.76* g.
Diameter =	2.420 in.	Diameter	= 2.420 in.		
Weight =	153.73 g.				
Dry Dens. =	113.3 pcf				

* Final dry weight used as mineral solids weight

End-Of-Load Summary

Pressure (ksf)	Final Dial (in.)	Machine Defl. (in.)	Deformation (in.)	C_v (ft.^{2}/day)	C_α	Void Ratio	% Strain
start	0.04820		0.00000			0.580	
0.10	0.04885	0.00000	0.00065			0.579	0.1 Comprs.
water	0.05500	0.00000	0.00680			0.569	0.7 Comprs.
0.20	0.06090	0.00000	0.01270			0.560	1.3 Comprs.
0.40	0.06900	0.00010	0.02070			0.547	2.1 Comprs.
0.80	0.07765	0.00130	0.02815			0.535	2.8 Comprs.
1.60	0.08875	0.00310	0.03745			0.520	3.7 Comprs.
3.20	0.09900	0.00530	0.04550			0.508	4.6 Comprs.
6.40	0.11540	0.00800	0.05920	0.786		0.486	5.9 Comprs.
12.80	0.13140	0.01030	0.07290	0.317		0.464	7.3 Comprs.
25.60	0.15085	0.01310	0.08955	0.644		0.438	9.0 Comprs.
51.20	0.17650	0.01620	0.11210			0.403	11.2 Comprs.
102.40	0.20755	0.02040	0.13895			0.360	13.9 Comprs.

Compression index (C_c), ksf = 0.11 **Preconsolidation pressure (P_p), ksf =** 7.6 **Void ratio at P_p (e_m) =** 0.480
Clpse. (ε_s), % = -0.6

Pressure: 0.10 ksf — **TEST READINGS** — **Load No. 1**

No.	Elapsed Time	Dial Reading
1	0	0.04820
2	(final)	0.04885

Void Ratio = 0.579 **Compression =** 0.1%

Pressure: 0.10 ksf	TEST READINGS	Load No. 2

No.	Elapsed Time	Dial Reading
1	0	0.04885
2	(final)	0.05500

Void Ratio = 0.569 **Compression =** 0.7%

Pressure: 0.20 ksf	TEST READINGS	Load No. 3

No.	Elapsed Time	Dial Reading
1	0	0.05500
2	(final)	0.06090

Void Ratio = 0.560 **Compression =** 1.3%

Pressure: 0.40 ksf	TEST READINGS	Load No. 4

No.	Elapsed Time	Dial Reading
1	0	0.06090
2	(final)	0.06900

Void Ratio = 0.547 **Compression =** 2.1%

Pressure: 0.80 ksf	TEST READINGS	Load No. 5

No.	Elapsed Time	Dial Reading
1	0	0.06900
2	(final)	0.07765

Void Ratio = 0.535 **Compression =** 2.8%

Pressure: 1.60 ksf	TEST READINGS	Load No. 6

No.	Elapsed Time	Dial Reading
1	0	0.07765
2	(final)	0.08875

Void Ratio = 0.520 **Compression =** 3.7%

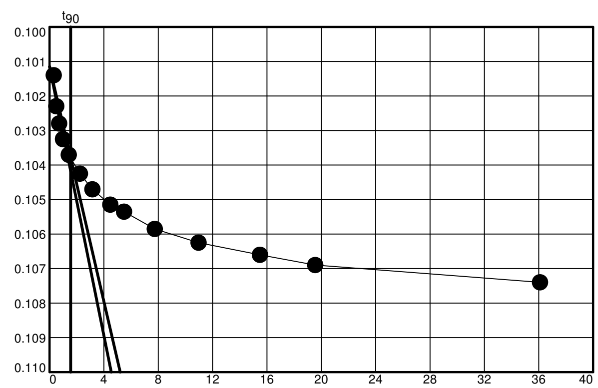
Pressure: 3.20 ksf **TEST READINGS** **Load No. 7**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.08875	11	60	0.09860
2	.1	0.09510	12	120	0.09900
3	.25	0.09580			
4	.5	0.09615			
5	1	0.09650			
6	2	0.09695			
7	5	0.09740			
8	10	0.09780			
9	20	0.09810			
10	30	0.09825			

Void Ratio = 0.508 **Compression =** 4.6%

Pressure: 6.40 ksf **TEST READINGS** **Load No. 8**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.09900	11	60	0.11385
2	.1	0.10940	12	120	0.11425
3	.25	0.11030	13	240	0.11460
4	.5	0.11080	14	382	0.11490
5	1	0.11125	15	1303	0.11540
6	2	0.11170			
7	5	0.11225			
8	10	0.11270			
9	20	0.11315			
10	30	0.11335			

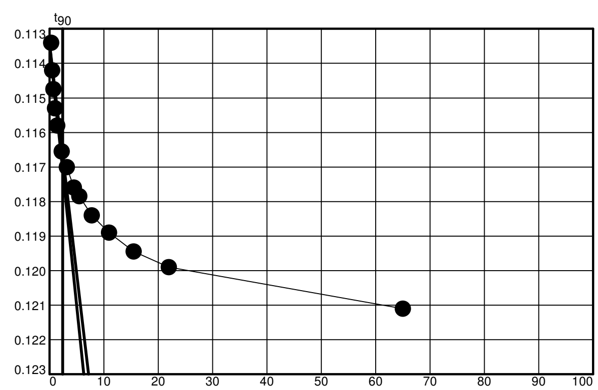


Void Ratio = 0.486 **Compression =** 5.9%

D_0 = 0.1012 **D_{90} =** 0.1038 **D_{100} =** 0.1041 **C_v at 2.42 min. =** 0.786 ft.^{2}/day

Pressure: 12.80 ksf **TEST READINGS** **Load No. 9**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.11540	11	60	0.12870
2	.1	0.12370	12	120	0.12920
3	.25	0.12450	13	240	0.12975
4	.5	0.12505	14	482	0.13020
5	1	0.12560	15	4222	0.13140
6	2	0.12610			
7	5	0.12685			
8	10	0.12730			
9	20	0.12790			
10	30	0.12815			

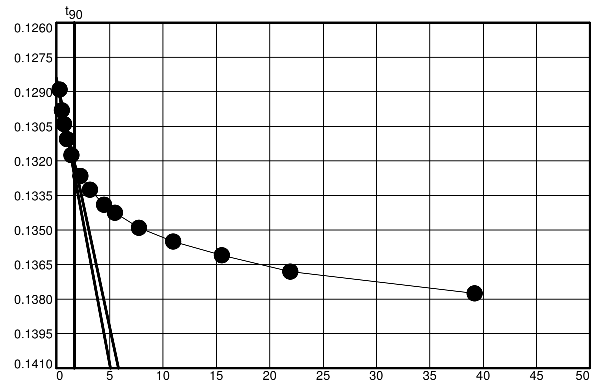


Void Ratio = 0.464 **Compression =** 7.3%

D_0 = 0.1134 **D_{90} =** 0.1166 **D_{100} =** 0.1170 **C_v at 5.84 min. =** 0.317 ft.^{2}/day

Pressure: 25.60 ksf	TEST READINGS	Load No. 10

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.13140	11	60	0.14800
2	.1	0.14200	12	120	0.14860
3	.25	0.14290	13	240	0.14920
4	.5	0.14350	14	480	0.14990
5	1	0.14415	15	1536	0.15085
6	2	0.14485			
7	5	0.14575			
8	10	0.14635			
9	20	0.14700			
10	30	0.14735			



Void Ratio = 0.438 **Compression =** 9.0%

D_0 = 0.1284 **D_{90} =** 0.1320 **D_{100} =** 0.1324 **C_V at 2.78 min. =** 0.644 $ft.^2$/day

Pressure: 51.20 ksf	TEST READINGS	Load No. 11

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.15085	11	60	0.17305
2	.1	0.16550	12	123	0.17400
3	.25	0.16670	13	250	0.17475
4	.5	0.16740	14	480	0.17550
5	1	0.16820	15	1443	0.17650
6	2	0.16900			
7	5	0.17000			
8	10	0.17090			
9	20	0.17175			
10	30	0.17220			

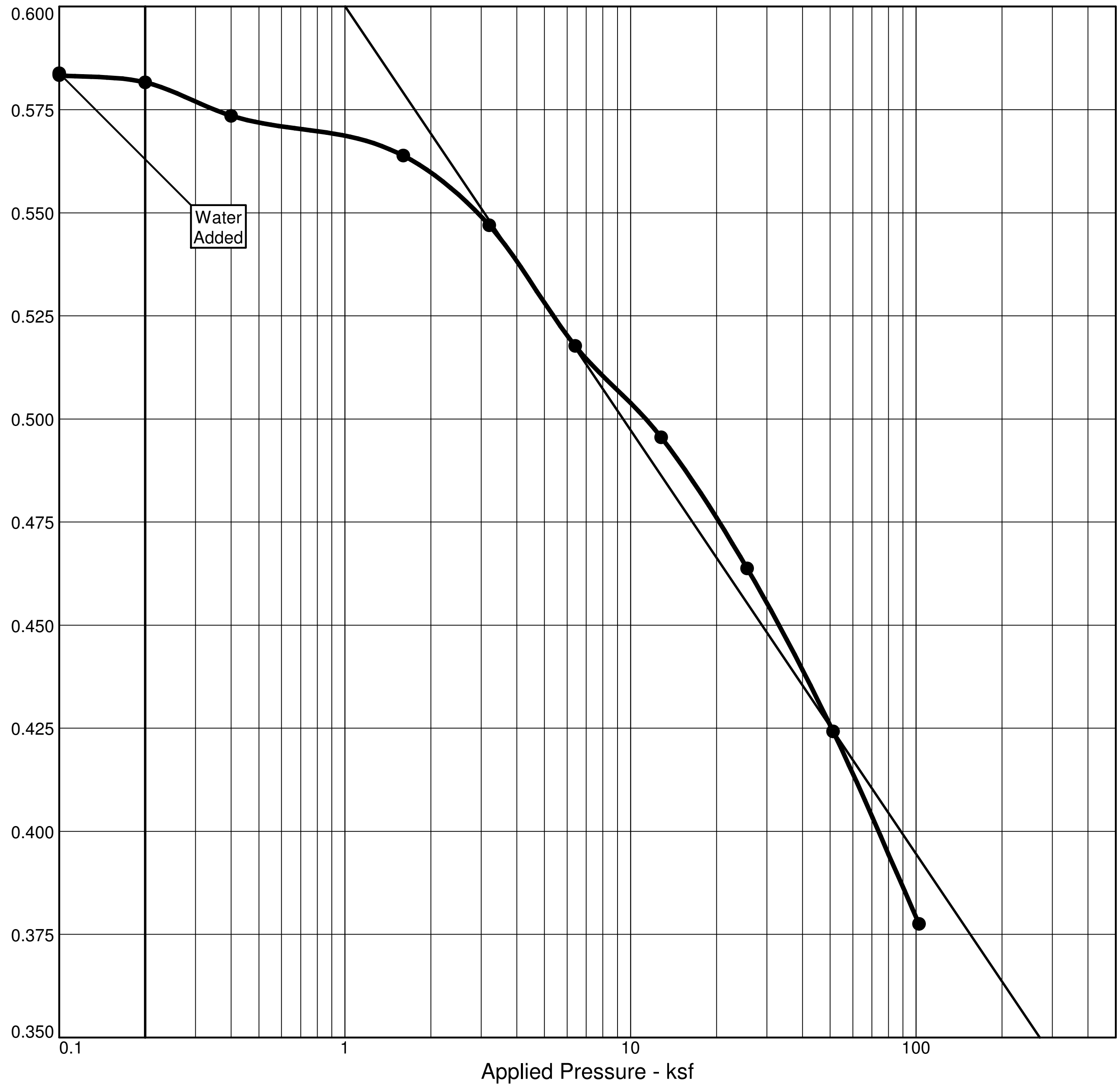
Void Ratio = 0.403 **Compression =** 11.2%

Pressure: 102.40 ksf	TEST READINGS	Load No. 12

No.	Elapsed Time	Dial Reading
1	0	0.17650
2	(final)	0.20755

Void Ratio = 0.360 **Compression =** 13.9%

One Dimensional Consolidation ASTM D2435



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (ksf)	P_c (ksf)	C_c	C_r	Swell Press. (ksf)	Clpse. %	e_o
Sat.	Moist.											
75.0 %	15.3 %	113.1	np		2.866		1.9	0.10			0.0	0.585

MATERIAL DESCRIPTION	USCS	AASHTO
silty sand	SM	

Project No. 10100777.03 **Client:** South 32 - Hermosa Project

Project: Hermosa

Location: Combined Bulk **Sample Number:** 90% MDD @ 15.6% MC

Knight Piésold CONSULTING

Remarks:

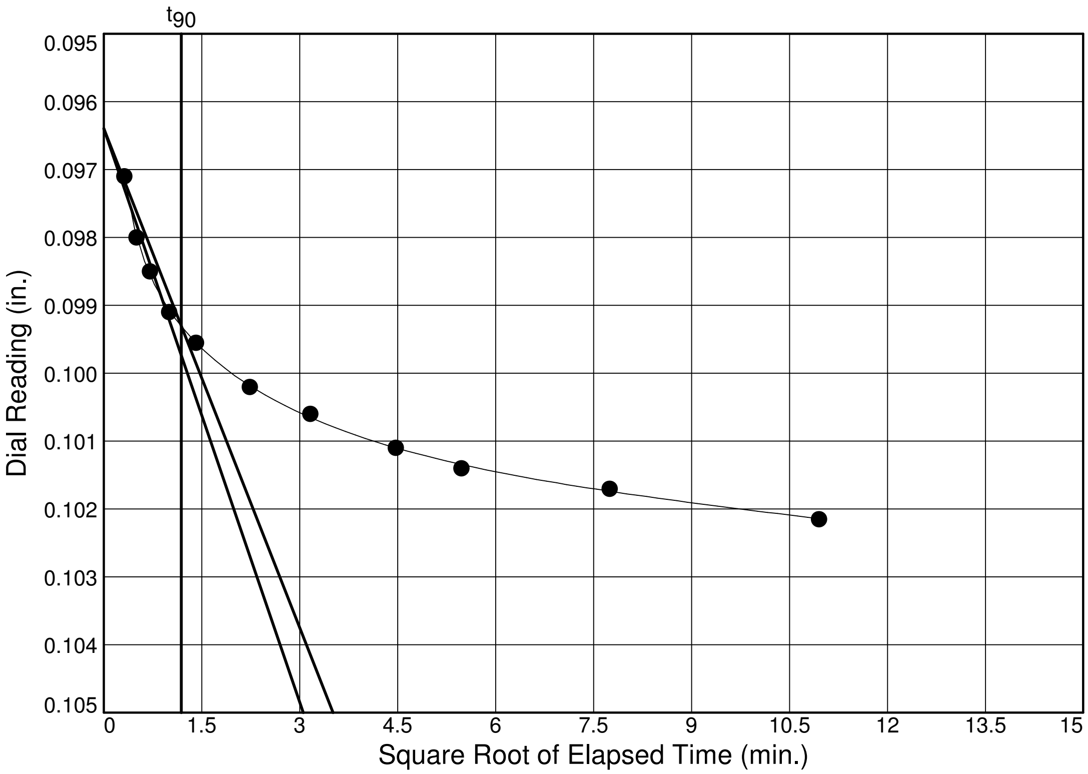
Figure

Tested By: JBruce/JStaley **Checked By:** JBruce

Dial Reading vs. Time

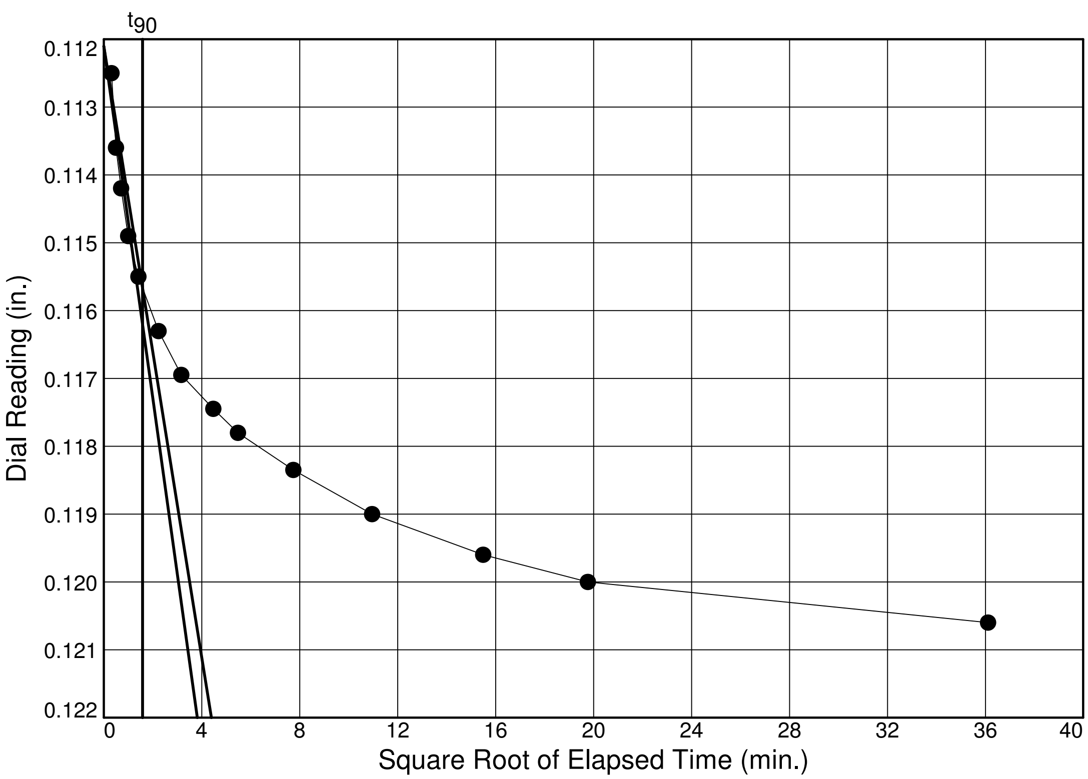
Project No.: 10100777.03
Project: Hermosa

Location: Combined Bulk   Sample Number: 90% MDD @ 15.6% MC



Load No.= 6
Load= 3.20 ksf
D_0 = 0.0964
D_{90} = 0.0993
D_{100} = 0.0996
T_{90} = 1.41 min.

C_v @ T_{90}
1.444 ft.^{2}/day



Load No.= 7
Load= 6.40 ksf
D_0 = 0.1121
D_{90} = 0.1157
D_{100} = 0.1161
T_{90} = 2.51 min.

C_v @ T_{90}
0.789 ft.^{2}/day

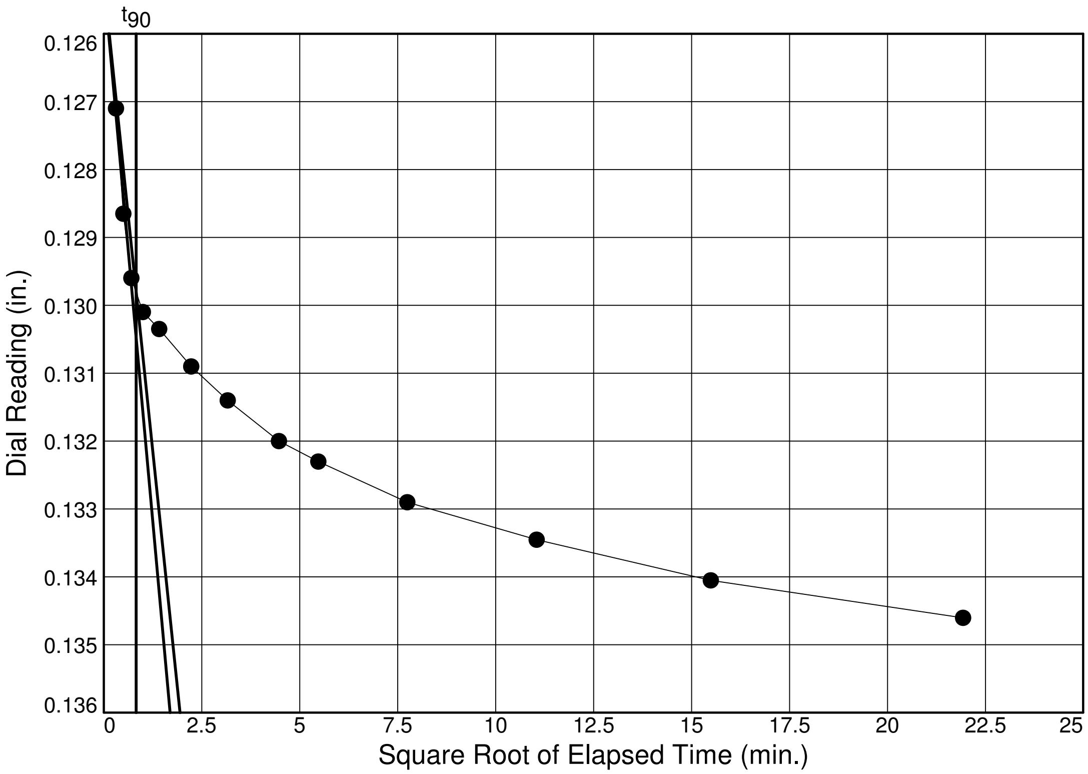
Figure

Knight Piesold Geotechnical Lab.

Dial Reading vs. Time

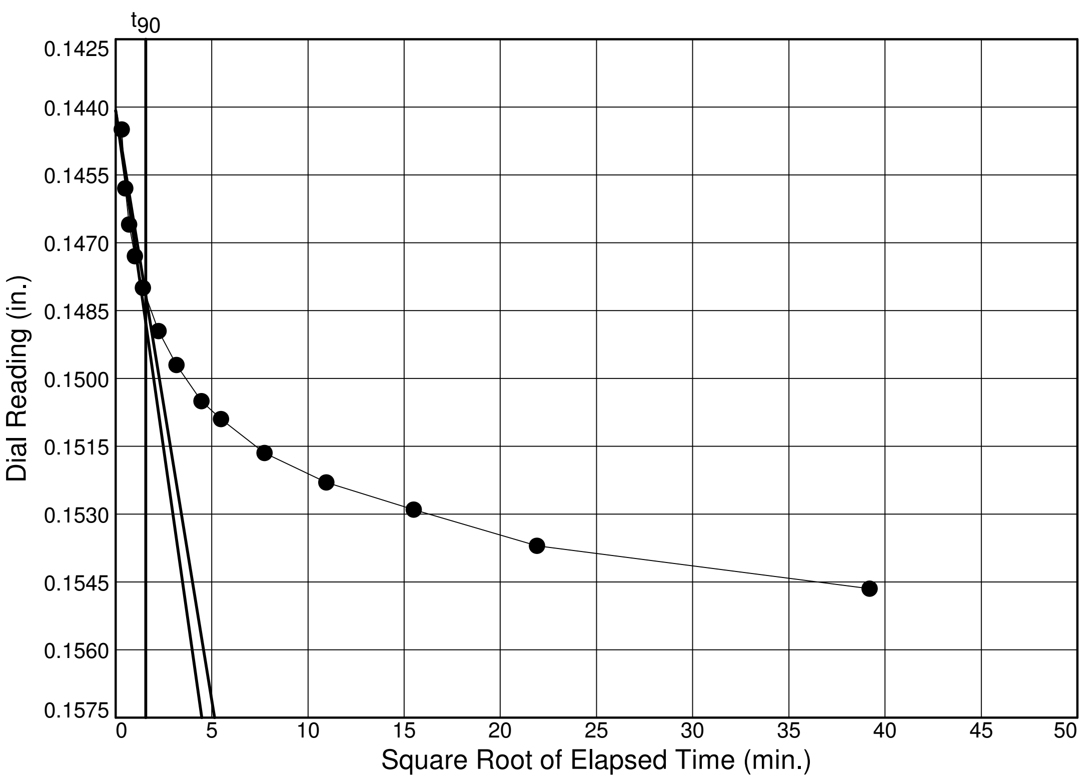
Project No.: 10100777.03
Project: Hermosa

Location: Combined Bulk Sample Number: 90% MDD @ 15.6% MC



Load No.= 8
Load= 12.80 ksf
D_0 = 0.1252
D_{90} = 0.1298
D_{100} = 0.1303
T_{90} = 0.69 min.

C_v @ T_{90}
2.781 ft.^{2}/day



Load No.= 9
Load= 25.60 ksf
D_0 = 0.1441
D_{90} = 0.1482
D_{100} = 0.1486
T_{90} = 2.48 min.

C_v @ T_{90}
0.744 ft.^{2}/day

Figure

Knight Piesold Geotechnical Lab.

SWELL/CONSOLIDATION TEST DATA

3/29/2021

Client: South 32 - Hermosa Project
Project: Hermosa
Project Number: 10100777.03
Location: Combined Bulk
Sample Number: 90% MDD @ 15.6% MC
Material Description: silty sand
Liquid Limit: np
USCS: SM
Tested by: JBruce/JStaley **Checked by:** JBruce

Test Specimen Data

NATURAL MOISTURE		VOID RATIO		AFTER TEST	
Wet w+t =	290.64 g.	**Spec. Gr.**	= 2.866	**Wet w+t** =	275.40 g.
Dry w+t =	268.05 g.	**Est. Ht. Solids**	= 0.631 in.	**Dry w+t** =	257.16 g.
Tare Wt. =	120.49 g.	**Init. V.R.**	= 0.585	**Tare Wt.** =	120.85 g.
Moisture =	15.3 %	**Init. Sat.**	= 75.0 %	**Moisture** =	13.4 %

UNIT WEIGHT		TEST START			
				Dry Wt. =	136.31* g.
Height =	1.000 in.	**Height**	= 1.000 in.		
Diameter =	2.420 in.	**Diameter**	= 2.420 in.		
Weight =	157.48 g.				
Dry Dens. =	113.1 pcf				

* **Final dry weight used as mineral solids weight**

End-Of-Load Summary

Pressure (ksf)	Final Dial (in.)	Machine Defl. (in.)	Deformation (in.)	C_v (ft.^{2}/day)	C_α	Void Ratio	% Strain
start	0.07830		0.00000			0.585	
0.10	0.07890	0.00000	0.00060			0.584	0.1 Comprs.
water	0.07920	0.00000	0.00090			0.583	0.1 Comprs.
0.20	0.08120	0.00090	0.00200			0.582	0.2 Comprs.
0.40	0.08660	0.00120	0.00710			0.574	0.7 Comprs.
1.60	0.10850	0.01700	0.01320			0.564	1.3 Comprs.
3.20	0.12175	0.01960	0.02385	1.444		0.547	2.4 Comprs.
6.40	0.14280	0.02220	0.04230	0.789		0.518	4.2 Comprs.
12.80	0.15930	0.02470	0.05630	2.781		0.496	5.6 Comprs.
25.60	0.18205	0.02740	0.07635	0.744		0.464	7.6 Comprs.
51.20	0.21040	0.03080	0.10130			0.424	10.1 Comprs.
102.40	0.24415	0.03510	0.13075			0.378	13.1 Comprs.

Compression index (C_c), ksf = 0.10 **Preconsolidation pressure (P_p), ksf** = 1.9 **Void ratio at P_p (e_m)** = 0.562
Clpse. (ε_s), % = 0.0

Pressure: 0.10 ksf — **TEST READINGS** — **Load No. 1**

No.	Elapsed Time	Dial Reading
1	0	0.07830
2	(final)	0.07890

Void Ratio = 0.584 **Compression** = 0.1%

Pressure: 0.10 ksf	TEST READINGS	Load No. 2

No.	Elapsed Time	Dial Reading
1	0	0.07890
2	(final)	0.07920

Void Ratio = 0.583 **Compression =** 0.1%

Pressure: 0.20 ksf	TEST READINGS	Load No. 3

No.	Elapsed Time	Dial Reading
1	0	0.07920
2	(final)	0.08120

Void Ratio = 0.582 **Compression =** 0.2%

Pressure: 0.40 ksf	TEST READINGS	Load No. 4

No.	Elapsed Time	Dial Reading
1	0	0.08120
2	(final)	0.08660

Void Ratio = 0.574 **Compression =** 0.7%

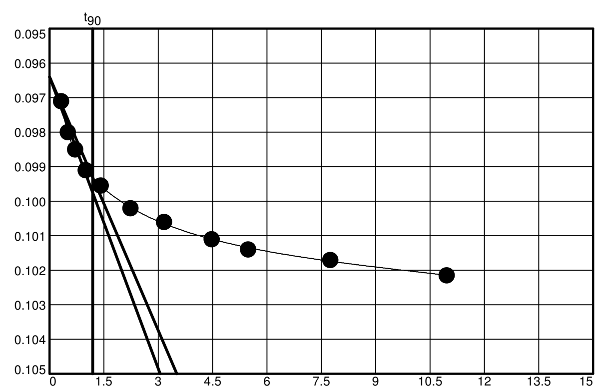
Pressure: 1.60 ksf	TEST READINGS	Load No. 5

No.	Elapsed Time	Dial Reading
1	0	0.08660
2	(final)	0.10850

Void Ratio = 0.564 **Compression =** 1.3%

Pressure: 3.20 ksf	TEST READINGS	Load No. 6

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.10850	11	60	0.12130
2	.1	0.11670	12	120	0.12175
3	.25	0.11760			
4	.5	0.11810			
5	1	0.11870			
6	2	0.11915			
7	5	0.11980			
8	10	0.12020			
9	20	0.12070			
10	30	0.12100			

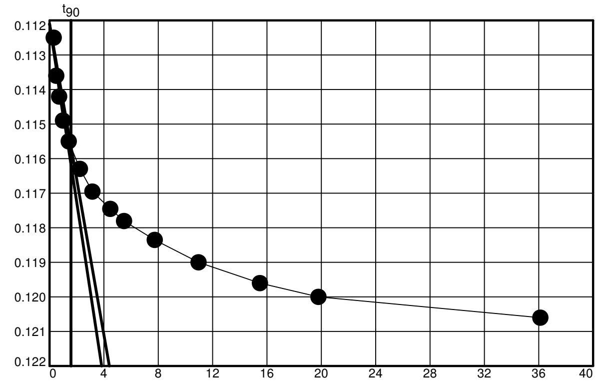


Void Ratio = 0.547 **Compression =** 2.4%

D_0 = 0.0964 **D_{90} =** 0.0993 **D_{100} =** 0.0996 **C_V at 1.41 min. =** 1.444 $ft.^2$/day

Pressure: 6.40 ksf	TEST READINGS	Load No. 7

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.12175	11	60	0.14055
2	.1	0.13470	12	120	0.14120
3	.25	0.13580	13	240	0.14180
4	.5	0.13640	14	391	0.14220
5	1	0.13710	15	1304	0.14280
6	2	0.13770			
7	5	0.13850			
8	10	0.13915			
9	20	0.13965			
10	30	0.14000			

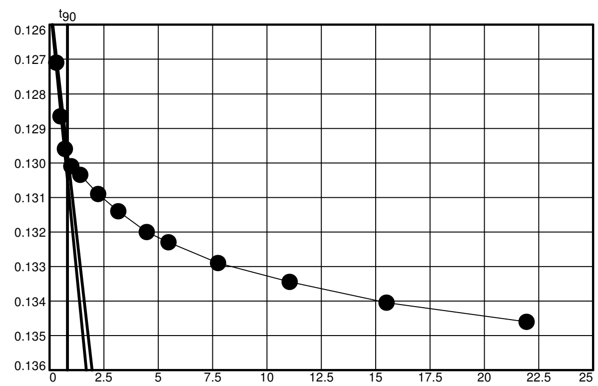


Void Ratio = 0.518 **Compression =** 4.2%

D_0 **=** 0.1121 D_{90} **=** 0.1157 D_{100} **=** 0.1161 C_v **at 2.51 min. =** 0.789 ft.^{2}/day

Pressure: 12.80 ksf	TEST READINGS	Load No. 8

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.14280	11	60	0.15760
2	.1	0.15180	12	122	0.15815
3	.25	0.15335	13	240	0.15875
4	.5	0.15430	14	481	0.15930
5	1	0.15480			
6	2	0.15505			
7	5	0.15560			
8	10	0.15610			
9	20	0.15670			
10	30	0.15700			

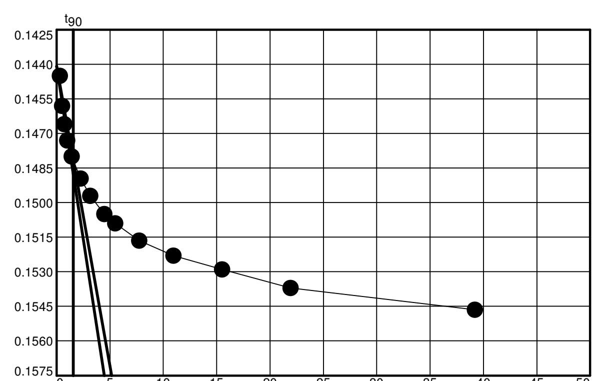


Void Ratio = 0.496 **Compression =** 5.6%

D_0 **=** 0.1252 D_{90} **=** 0.1298 D_{100} **=** 0.1303 C_v **at 0.69 min. =** 2.781 ft.^{2}/day

Pressure: 25.60 ksf	TEST READINGS	Load No. 9

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.15930	11	60	0.17905
2	.1	0.17190	12	120	0.17970
3	.25	0.17320	13	240	0.18030
4	.5	0.17400	14	480	0.18110
5	1	0.17470	15	1536	0.18205
6	2	0.17540			
7	5	0.17635			
8	10	0.17710			
9	20	0.17790			
10	30	0.17830			



Void Ratio = 0.464 **Compression =** 7.6%

D_0 **=** 0.1441 D_{90} **=** 0.1482 D_{100} **=** 0.1486 C_v **at 2.48 min. =** 0.744 ft.^{2}/day

Pressure: 51.20 ksf	TEST READINGS	Load No. 10

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.18205	11	60	0.20700
2	.1	0.19960	12	120	0.20790
3	.25	0.20060	13	260	0.20880
4	.5	0.20135	14	481	0.20950
5	1	0.20215	15	1451	0.21040
6	2	0.20310			
7	5	0.20410			
8	10	0.20490			
9	20	0.20570			
10	30	0.20620			

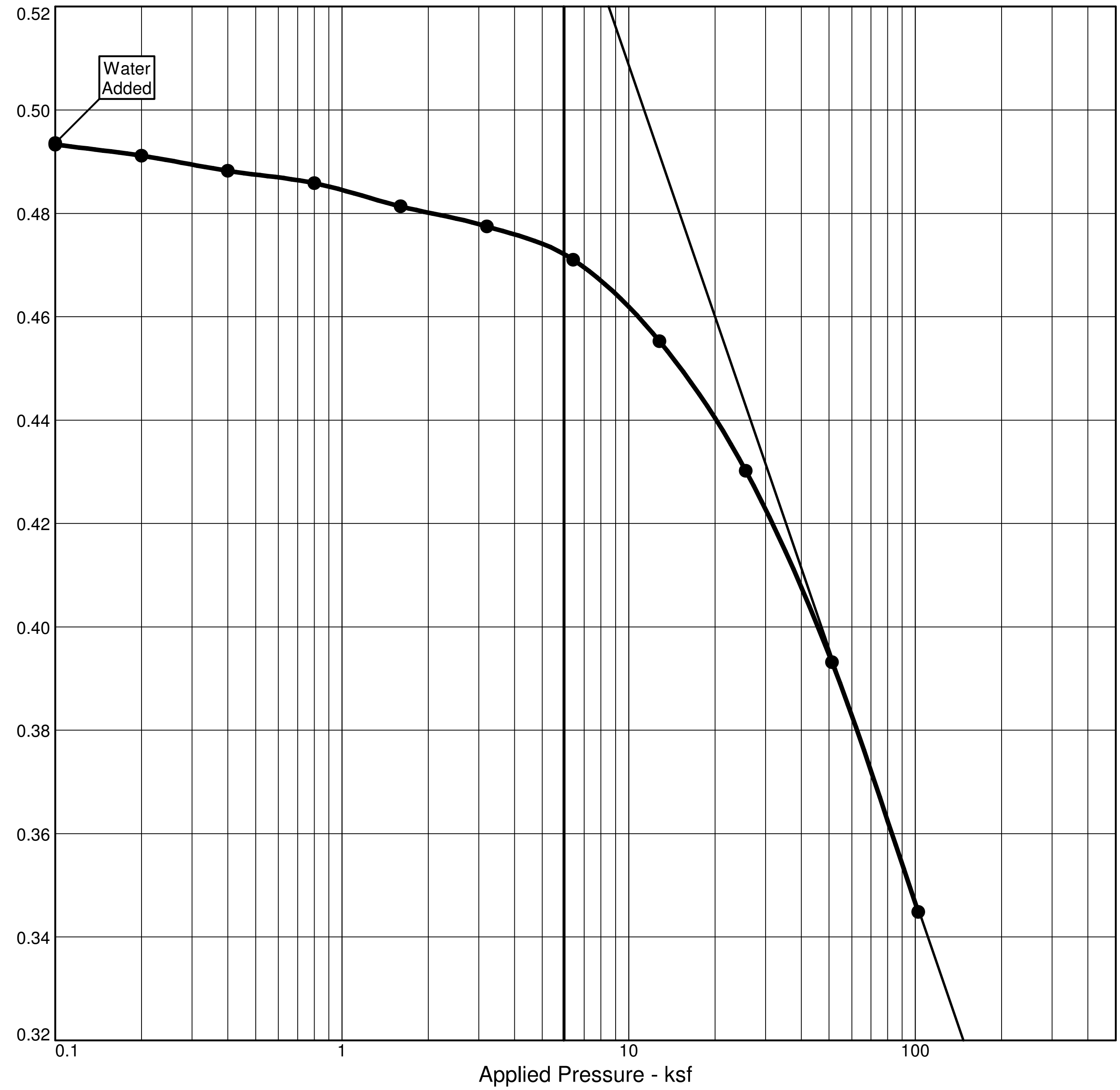
Void Ratio = 0.424 **Compression =** 10.1%

Pressure: 102.40 ksf	TEST READINGS	Load No. 11

No.	Elapsed Time	Dial Reading
1	0	0.21040
2	(final)	0.24415

Void Ratio = 0.378 **Compression =** 13.1%

One Dimensional Consolidation ASTM D2435



Cursory interpretations require review by a professional engineer. Knight Piésold accepts no responsibility in subsequent analyses.

Natural Sat.	Natural Moist.	Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (ksf)	P_c (ksf)	C_c	C_r	Swell Press. (ksf)	Clpse. %	e_o
71.4 %	12.3 %	119.7	np		2.866		18.8	0.16			0.0	0.495

MATERIAL DESCRIPTION	USCS	AASHTO
silty sand	SM	

Project No. 10100777.03 **Client:** South 32 - Hermosa Project

Project: Hermosa

Location: Combined Bulk **Sample Number:** 95% MDD @ 12.4% MC

Knight Piésold CONSULTING

Remarks:

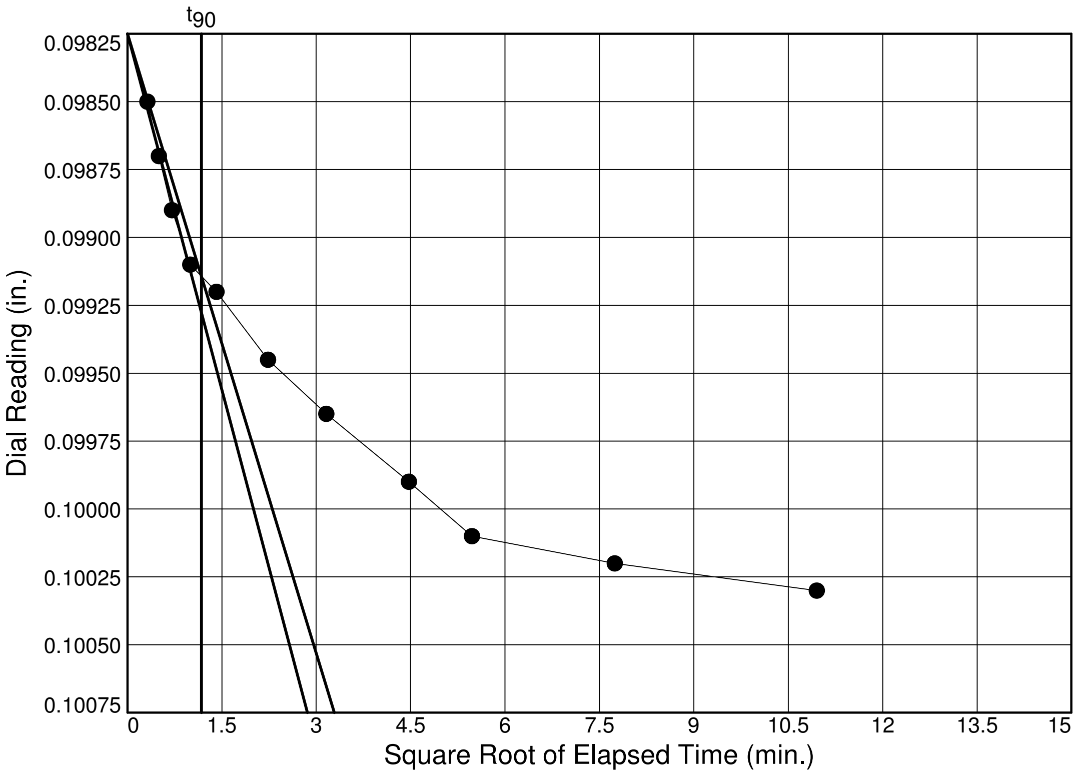
Figure

Tested By: JBruce/JStaley **Checked By:** JBruce

Dial Reading vs. Time

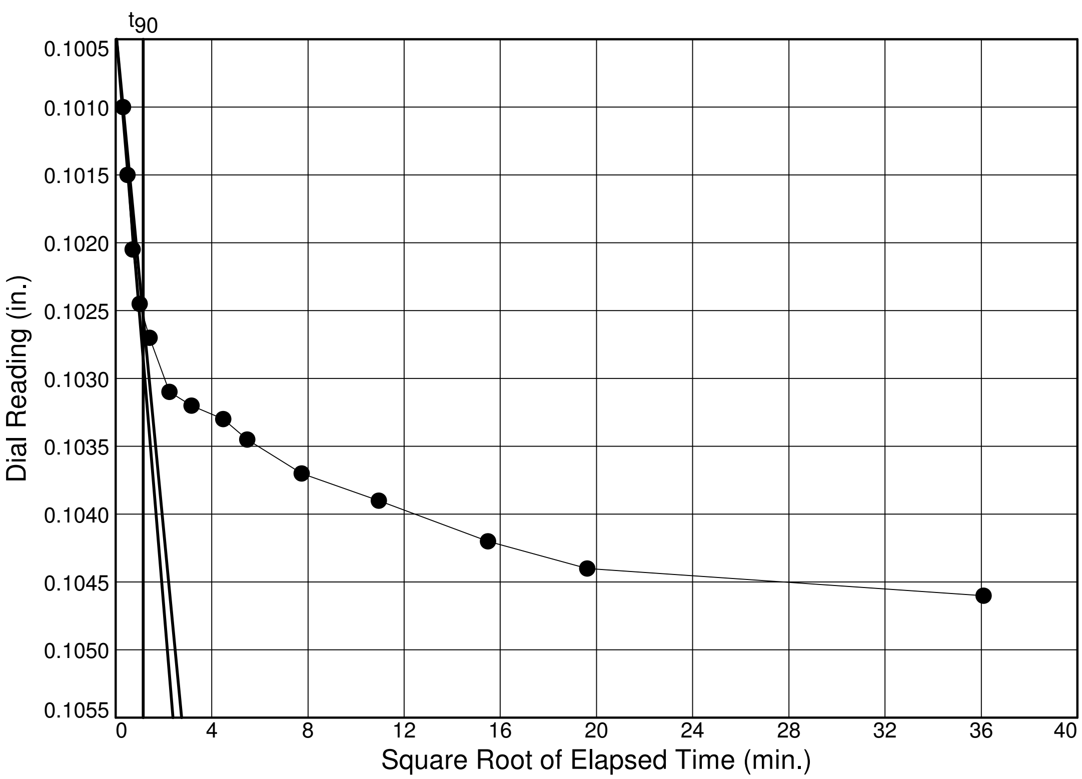
Project No.: 10100777.03
Project: Hermosa

Location: Combined Bulk   Sample Number: 95% MDD @ 12.4% MC



Load No.= 7
Load= 3.20 ksf
D_0 = 0.0982
D_{90} = 0.0991
D_{100} = 0.0992
T_{90} = 1.38 min.

C_v @ T_{90}
1.501 ft.^{2}/day



Load No.= 8
Load= 6.40 ksf
D_0 = 0.1004
D_{90} = 0.1025
D_{100} = 0.1028
T_{90} = 1.33 min.

C_v @ T_{90}
1.552 ft.^{2}/day

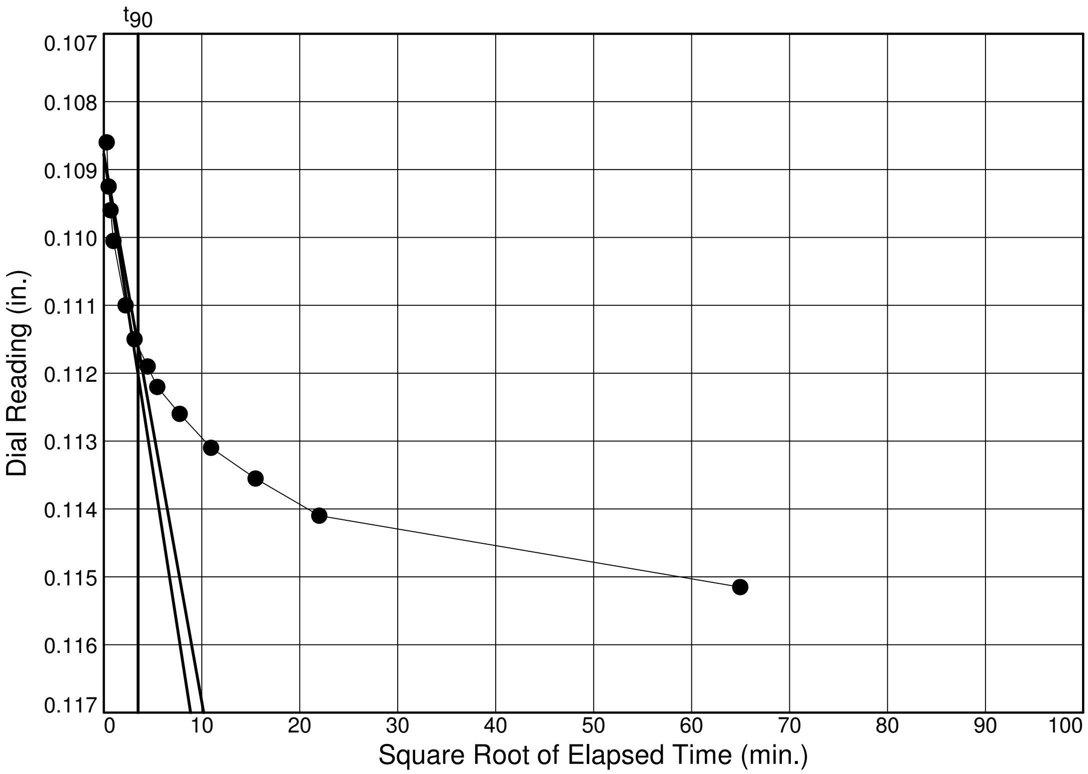
Figure

Knight Piesold Geotechnical Lab.

Dial Reading vs. Time

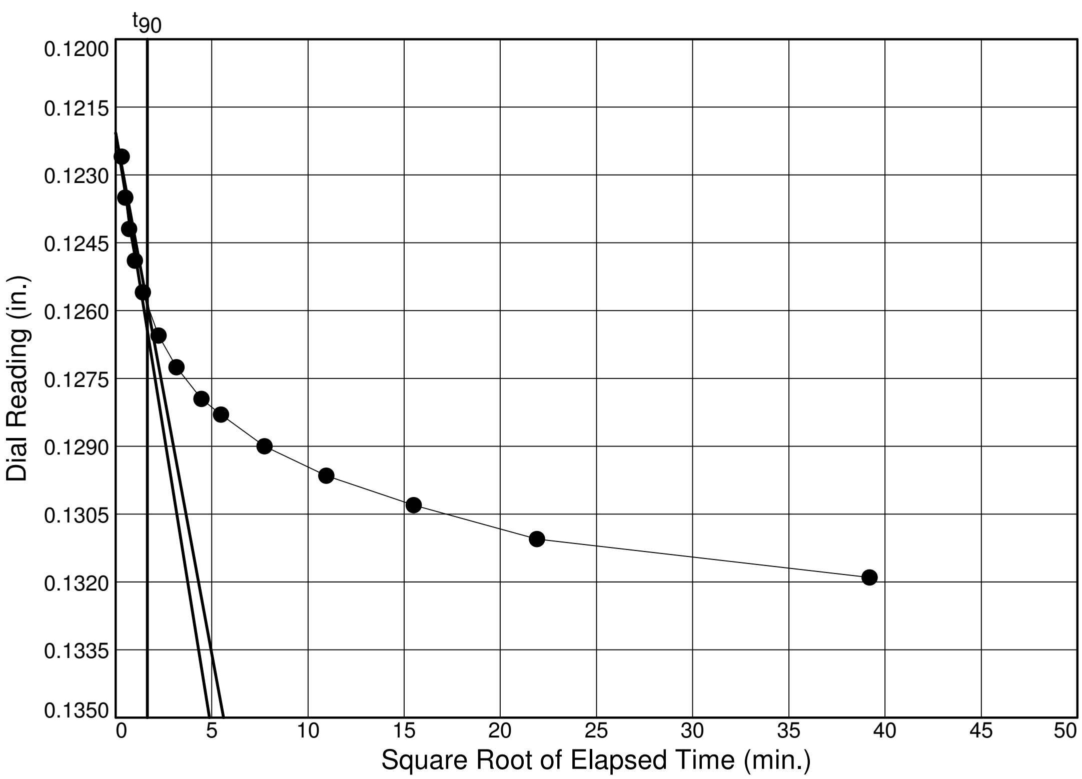
Project No.: 10100777.03
Project: Hermosa

Location: Combined Bulk   Sample Number: 95% MDD @ 12.4% MC



Load No.= 9
Load= 12.80 ksf
D_0 = 0.1088
D_{90} = 0.1116
D_{100} = 0.1119
T_{90} = 12.32 min.

C_v @ T_{90}
0.165 ft.^{2}/day



Load No.= 10
Load= 25.60 ksf
D_0 = 0.1221
D_{90} = 0.1259
D_{100} = 0.1263
T_{90} = 2.72 min.

C_v @ T_{90}
0.725 ft.^{2}/day

Figure

Knight Piesold Geotechnical Lab.

SWELL/CONSOLIDATION TEST DATA

3/29/2021

Client: South 32 - Hermosa Project
Project: Hermosa
Project Number: 10100777.03
Location: Combined Bulk
Sample Number: 95% MDD @ 12.4% MC
Material Description: silty sand
Liquid Limit: np
USCS: SM
Tested by: JBruce/JStaley **Checked by:** JBruce

Test Specimen Data

NATURAL MOISTURE		VOID RATIO		AFTER TEST	
Wet w+t =	274.53 g.	Spec. Gr.	= 2.866	Wet w+t =	281.91 g.
Dry w+t =	257.00 g.	Est. Ht. Solids	= 0.669 in.	Dry w+t =	262.37 g.
Tare Wt. =	114.88 g.	Init. V.R.	= 0.495	Tare Wt. =	117.87 g.
Moisture =	12.3 %	Init. Sat.	= 71.4 %	Moisture =	13.5 %
UNIT WEIGHT		**TEST START**		Dry Wt. =	144.50* g.
Height =	1.000 in.	Height	= 1.000 in.		
Diameter =	2.420 in.	Diameter	= 2.420 in.		
Weight =	162.39 g.				
Dry Dens. =	119.7 pcf				

* Final dry weight used as mineral solids weight

End-Of-Load Summary

Pressure (ksf)	Final Dial (in.)	Machine Defl. (in.)	Deformation (in.)	C_v (ft.^{2}/day)	C_α	Void Ratio	% Strain
start	0.08860		0.00000			0.495	
0.10	0.08950	0.00000	0.00090			0.494	0.1 Comprs.
water	0.08970	0.00000	0.00110			0.493	0.1 Comprs.
0.20	0.09135	0.00020	0.00255			0.491	0.3 Comprs.
0.40	0.09400	0.00090	0.00450			0.488	0.5 Comprs.
0.80	0.09720	0.00250	0.00610			0.486	0.6 Comprs.
1.60	0.10210	0.00440	0.00910			0.481	0.9 Comprs.
3.20	0.10700	0.00670	0.01170	1.501		0.477	1.2 Comprs.
6.40	0.11430	0.00970	0.01600	1.552		0.471	1.6 Comprs.
12.80	0.12765	0.01250	0.02655	0.165		0.455	2.7 Comprs.
25.60	0.14770	0.01580	0.04330	0.725		0.430	4.3 Comprs.
51.20	0.17700	0.02030	0.06810			0.393	6.8 Comprs.
102.40	0.21480	0.02580	0.10040			0.345	10.0 Comprs.

Compression index (C_c), ksf = 0.16 **Preconsolidation pressure (P_p), ksf =** 18.8 **Void ratio at P_p (e_m) =** 0.443
Clpse. (ε_s), % = 0.0

Pressure: 0.10 ksf | **TEST READINGS** | **Load No. 1**

No.	Elapsed Time	Dial Reading
1	0	0.08860
2	(final)	0.08950

Void Ratio = 0.494 **Compression =** 0.1%

Pressure: 0.10 ksf | **TEST READINGS** | **Load No. 2**

No.	Elapsed Time	Dial Reading
1	0	0.08950
2	(final)	0.08970

Void Ratio = 0.493 **Compression =** 0.1%

Pressure: 0.20 ksf | **TEST READINGS** | **Load No. 3**

No.	Elapsed Time	Dial Reading
1	0	0.08970
2	(final)	0.09135

Void Ratio = 0.491 **Compression =** 0.3%

Pressure: 0.40 ksf | **TEST READINGS** | **Load No. 4**

No.	Elapsed Time	Dial Reading
1	0	0.09135
2	(final)	0.09400

Void Ratio = 0.488 **Compression =** 0.5%

Pressure: 0.80 ksf | **TEST READINGS** | **Load No. 5**

No.	Elapsed Time	Dial Reading
1	0	0.09400
2	(final)	0.09720

Void Ratio = 0.486 **Compression =** 0.6%

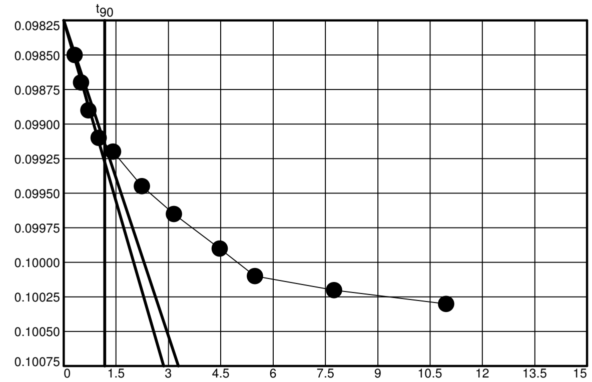
Pressure: 1.60 ksf | **TEST READINGS** | **Load No. 6**

No.	Elapsed Time	Dial Reading
1	0	0.09720
2	(final)	0.10210

Void Ratio = 0.481 **Compression =** 0.9%

Pressure: 3.20 ksf | **TEST READINGS** | **Load No. 7**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.10210	11	60	0.10690
2	.1	0.10520	12	120	0.10700
3	.25	0.10540			
4	.5	0.10560			
5	1	0.10580			
6	2	0.10590			
7	5	0.10615			
8	10	0.10635			
9	20	0.10660			
10	30	0.10680			

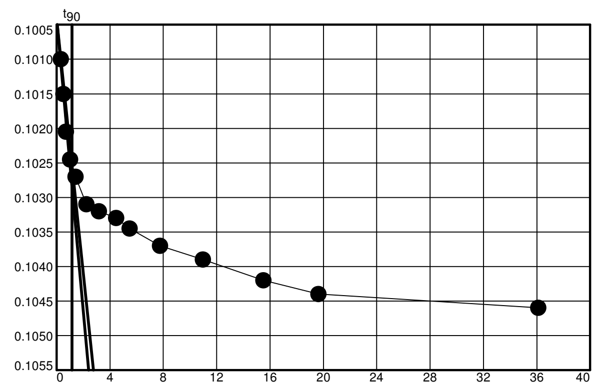


Void Ratio = 0.477 **Compression =** 1.2%

D_0 = 0.0982 D_{90} = 0.0991 D_{100} = 0.0992 C_v **at 1.38 min. =** 1.501 ft.^{2}/day

Pressure: 6.40 ksf | **TEST READINGS** | **Load No. 8**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.10700	11	60	0.11340
2	.1	0.11070	12	120	0.11360
3	.25	0.11120	13	240	0.11390
4	.5	0.11175	14	385	0.11410
5	1	0.11215	15	1303	0.11430
6	2	0.11240			
7	5	0.11280			
8	10	0.11290			
9	20	0.11300			
10	30	0.11315			

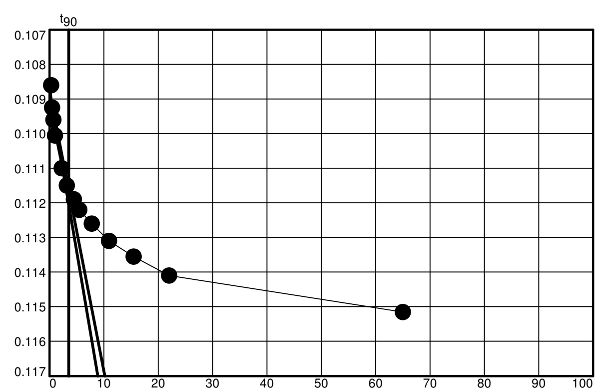


Void Ratio = 0.471 **Compression =** 1.6%

D_0 = 0.1004 D_{90} = 0.1025 D_{100} = 0.1028 C_v **at 1.33 min. =** 1.552 ft.^{2}/day

Pressure: 12.80 ksf | **TEST READINGS** | **Load No. 9**

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.11430	11	120	0.12560
2	.1	0.12110	12	240	0.12605
3	.25	0.12175	13	484	0.12660
4	.5	0.12210	14	4222	0.12765
5	1	0.12255			
6	5	0.12350			
7	10	0.12400			
8	20	0.12440			
9	30	0.12470			
10	60	0.12510			

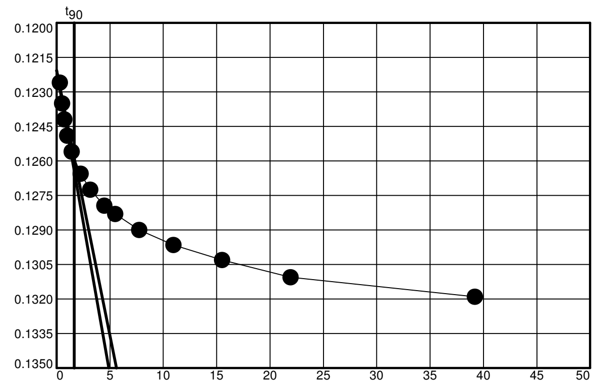


Void Ratio = 0.455 **Compression =** 2.7%

D_0 = 0.1088 D_{90} = 0.1116 D_{100} = 0.1119 C_v **at 12.32 min. =** 0.165 ft.^{2}/day

Pressure: 25.60 ksf	TEST READINGS	Load No. 10

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.12765	11	60	0.14480
2	.1	0.13840	12	120	0.14545
3	.25	0.13930	13	240	0.14610
4	.5	0.14000	14	480	0.14685
5	1	0.14070	15	1537	0.14770
6	2	0.14140			
7	5	0.14235			
8	10	0.14305			
9	20	0.14375			
10	30	0.14410			



Void Ratio = 0.430 **Compression =** 4.3%

D_0 = 0.1221 D_{90} = 0.1259 D_{100} = 0.1263 **C_V at 2.72 min. =** 0.725 ft.^{2}/day

Pressure: 51.20 ksf	TEST READINGS	Load No. 11

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.14770	11	60	0.17335
2	.1	0.16470	12	118	0.17420
3	.25	0.16610	13	254	0.17510
4	.5	0.16710	14	480	0.17600
5	1	0.16800	15	1446	0.17700
6	2	0.16890			
7	5	0.17010			
8	10	0.17100			
9	20	0.17200			
10	30	0.17250			

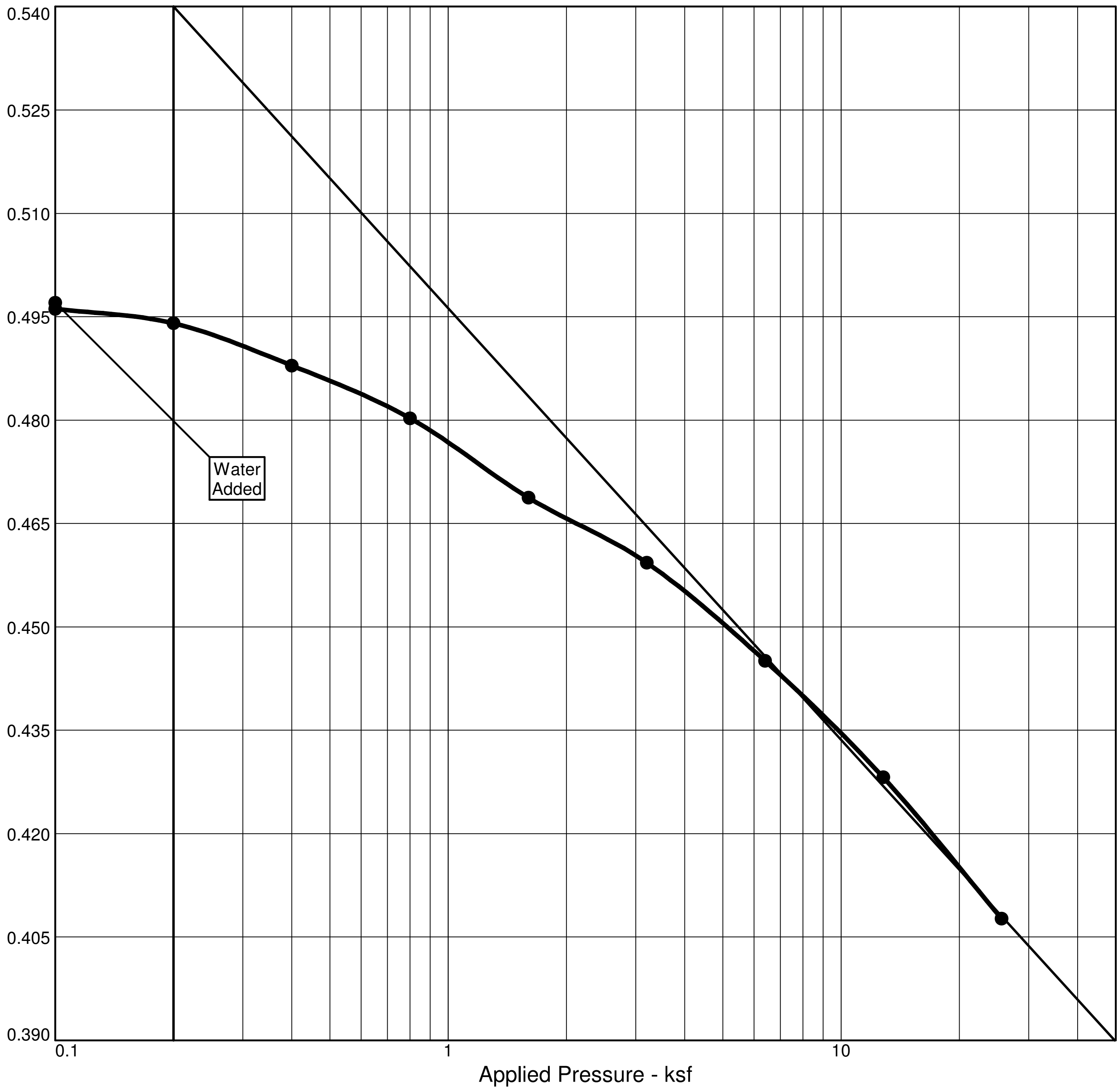
Void Ratio = 0.393 **Compression =** 6.8%

Pressure: 102.40 ksf	TEST READINGS	Load No. 12

No.	Elapsed Time	Dial Reading
1	0	0.17700
2	(final)	0.21480

Void Ratio = 0.345 **Compression =** 10.0%

One Dimensional Consolidation ASTM D2435



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (ksf)	P_c (ksf)	C_c	C_r	Swell Press. (ksf)	Clpse. %	e_o
Sat.	Moist.											
88.2 %	15.3 %	119.5	NP	NP	2.866		1.3	0.06			0.1	0.497

MATERIAL DESCRIPTION	USCS	AASHTO
silty sand	SM	

Project No. 10100777.03 **Client:** South 32 - Hermosa Project

Project: Hermosa

Location: Combined Bulk **Sample Number:** 95% MDD @ 15.6% MC

Remarks:

Knight Piésold CONSULTING

Figure

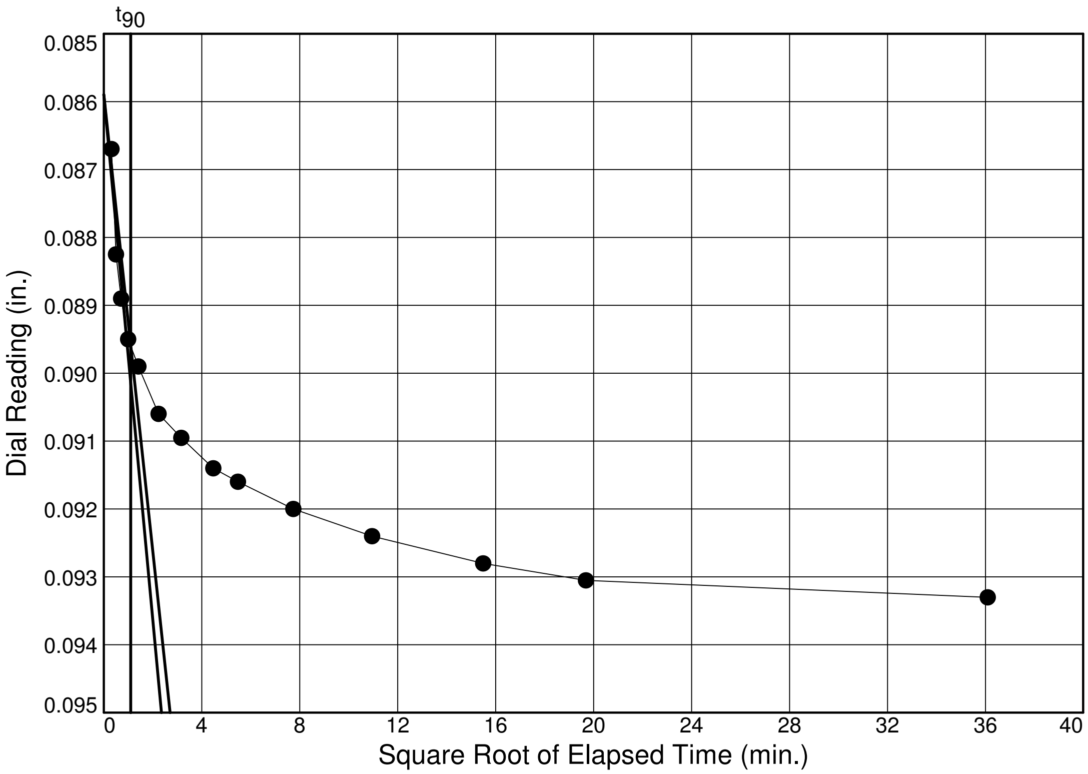
Cursory interpretations require review by a professional engineer. Knight Piesold accepts no responsibility in subsequent analyses.

Tested By: JBruce/Staley **Checked By:** JBruce

Dial Reading vs. Time

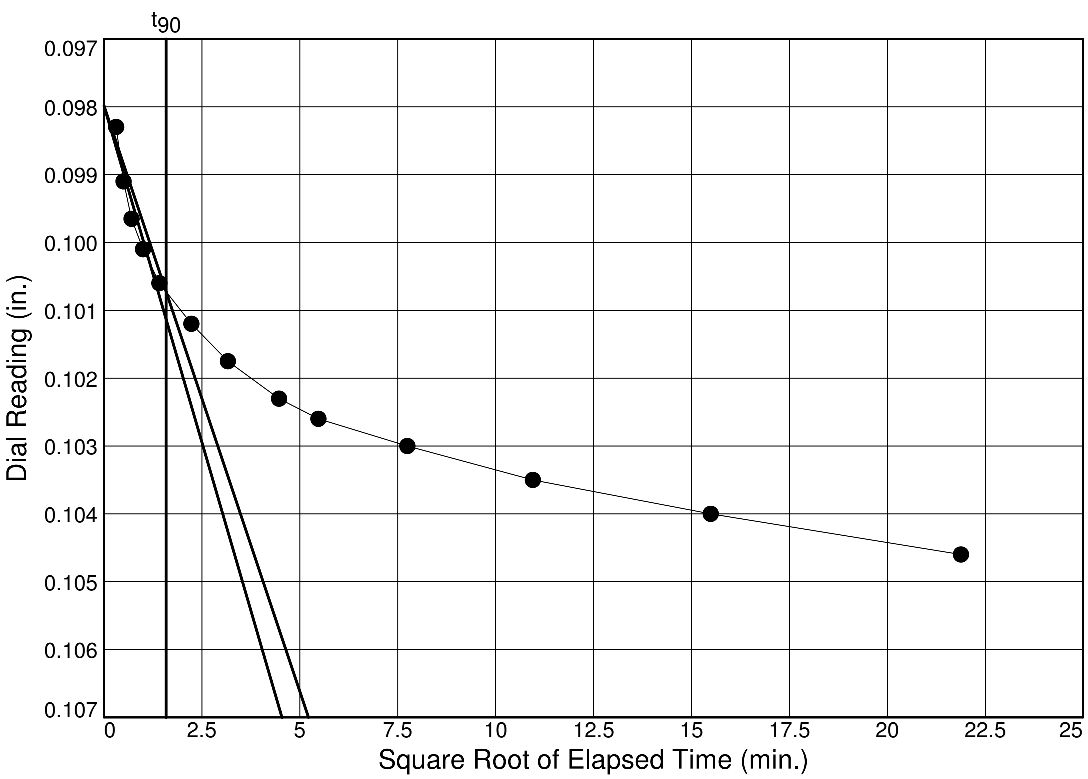
Project No.: 10100777.03
Project: Hermosa

Location: Combined Bulk   Sample Number: 95% MDD @ 15.6% MC



Load No.= 8
Load= 6.40 ksf
D_0 = 0.0859
D_{90} = 0.0896
D_{100} = 0.0900
T_{90} = 1.21 min.

C_v @ T_{90}
1.649 ft.^{2}/day



Load No.= 9
Load= 12.80 ksf
D_0 = 0.0980
D_{90} = 0.1007
D_{100} = 0.1010
T_{90} = 2.52 min.

C_v @ T_{90}
0.773 ft.^{2}/day

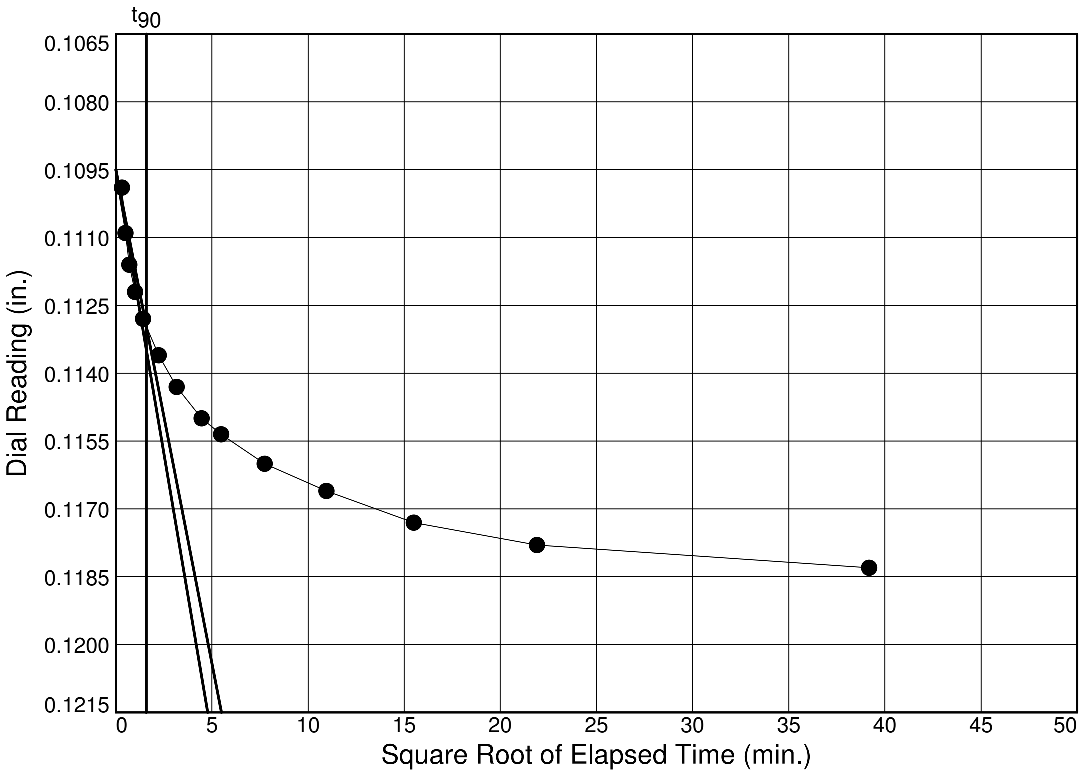
Figure

Knight Piesold Geotechnical Lab.

Dial Reading vs. Time

Project No.: 10100777.03
Project: Hermosa

Location: Combined Bulk   Sample Number: 95% MDD @ 15.6% MC



Load No.= 10
Load= 25.60 ksf
D_0 = 0.1095
D_{90} = 0.1130
D_{100} = 0.1134
T_{90} = 2.52 min.

C_v @ T_{90}
0.755 ft.^{2}/day

Figure

SWELL/CONSOLIDATION TEST DATA

3/29/2021

Client: South 32 - Hermosa Project
Project: Hermosa
Project Number: 10100777.03
Location: Combined Bulk
Sample Number: 95% MDD @ 15.6% MC
Material Description: silty sand
Liquid Limit: NP **Plasticity Index:** NP
USCS: SM
Tested by: JBruce/Staley **Checked by:** JBruce

Test Specimen Data

NATURAL MOISTURE		VOID RATIO		AFTER TEST	
Wet w+t =	290.64 g.	**Spec. Gr.**	= 2.866	**Wet w+t** =	285.83 g.
Dry w+t =	268.05 g.	**Est. Ht. Solids**	= 0.668 in.	**Dry w+t** =	265.13 g.
Tare Wt. =	120.49 g.	**Init. V.R.**	= 0.497	**Tare Wt.** =	120.86 g.
Moisture =	15.3 %	**Init. Sat.**	= 88.2 %	**Moisture** =	14.3 %

UNIT WEIGHT		TEST START			
				Dry Wt. =	144.27* g.
Height =	1.000 in.	**Height**	= 1.000 in.		
Diameter =	2.420 in.	**Diameter**	= 2.420 in.		
Weight =	166.35 g.				
Dry Dens. =	119.5 pcf				

* Final dry weight used as mineral solids weight

End-Of-Load Summary

Pressure (ksf)	Final Dial (in.)	Machine Defl. (in.)	Deformation (in.)	C_v (ft.^{2}/day)	C_α	Void Ratio	% Strain
start	0.05840		0.00000			0.497	
0.10	0.05860	0.00000	0.00020			0.497	0.0 Comprs.
water	0.05920	0.00000	0.00080			0.496	0.1 Comprs.
0.20	0.06060	0.00000	0.00220			0.494	0.2 Comprs.
0.40	0.06540	0.00070	0.00630			0.488	0.6 Comprs.
0.80	0.07140	0.00160	0.01140			0.480	1.1 Comprs.
1.60	0.08030	0.00280	0.01910			0.469	1.9 Comprs.
3.20	0.08950	0.00570	0.02540			0.459	2.5 Comprs.
6.40	0.10290	0.00960	0.03490	1.649		0.445	3.5 Comprs.
12.80	0.11700	0.01240	0.04620	0.773		0.428	4.6 Comprs.
25.60	0.13610	0.01780	0.05990	0.755		0.408	6.0 Comprs.

Compression index (C_c), ksf = 0.06 **Preconsolidation pressure (P_p), ksf** = 1.3 **Void ratio at P_p (e_m)** = 0.472
Clpse. (ε_s), % = -0.1

Pressure: 0.10 ksf — **TEST READINGS** — **Load No. 1**

No.	Elapsed Time	Dial Reading
1	0	0.05840
2	(final)	0.05860

Void Ratio = 0.497 **Compression** = 0.0%

Pressure: 0.10 ksf	TEST READINGS	Load No. 2

No.	Elapsed Time	Dial Reading
1	0	0.05860
2	(final)	0.05920

Void Ratio = 0.496 **Compression =** 0.1%

Pressure: 0.20 ksf	TEST READINGS	Load No. 3

No.	Elapsed Time	Dial Reading
1	0	0.05920
2	(final)	0.06060

Void Ratio = 0.494 **Compression =** 0.2%

Pressure: 0.40 ksf	TEST READINGS	Load No. 4

No.	Elapsed Time	Dial Reading
1	0	0.06060
2	(final)	0.06540

Void Ratio = 0.488 **Compression =** 0.6%

Pressure: 0.80 ksf	TEST READINGS	Load No. 5

No.	Elapsed Time	Dial Reading
1	0	0.06540
2	(final)	0.07140

Void Ratio = 0.480 **Compression =** 1.1%

Pressure: 1.60 ksf	TEST READINGS	Load No. 6

No.	Elapsed Time	Dial Reading
1	0	0.07140
2	(final)	0.08030

Void Ratio = 0.469 **Compression =** 1.9%

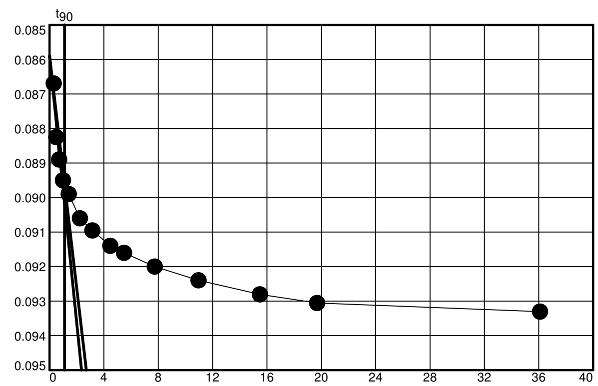
Pressure: 3.20 ksf	TEST READINGS	Load No. 7

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.08030	11	60	0.08920
2	.1	0.08640	12	120	0.08950
3	.25	0.08680			
4	.5	0.08710			
5	1	0.08735			
6	2	0.08770			
7	5	0.08810			
8	10	0.08840			
9	20	0.08875			
10	30	0.08900			

Void Ratio = 0.459 **Compression =** 2.5%

Pressure: 6.40 ksf	TEST READINGS	Load No. 8

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.08950	11	60	0.10160
2	.1	0.09630	12	120	0.10200
3	.25	0.09785	13	240	0.10240
4	.5	0.09850	14	388	0.10265
5	1	0.09910	15	1303	0.10290
6	2	0.09950			
7	5	0.10020			
8	10	0.10055			
9	20	0.10100			
10	30	0.10120			

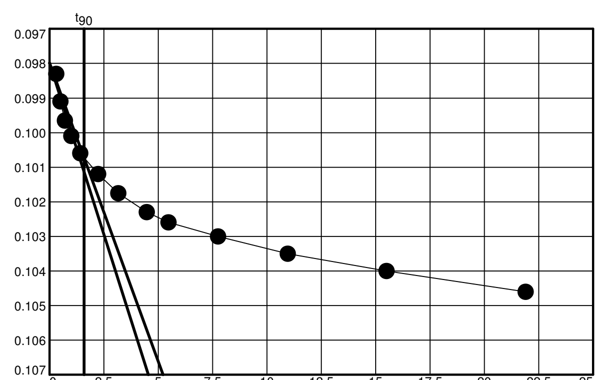


Void Ratio = 0.445 **Compression =** 3.5%

D_0 = 0.0859 **D_{90} =** 0.0896 **D_{100} =** 0.0900 **C_v at 1.21 min. =** 1.649 ft.^{2}/day

Pressure: 12.80 ksf	TEST READINGS	Load No. 9

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.10290	11	60	0.11540
2	.1	0.11070	12	120	0.11590
3	.25	0.11150	13	240	0.11640
4	.5	0.11205	14	479	0.11700
5	1	0.11250			
6	2	0.11300			
7	5	0.11360			
8	10	0.11415			
9	20	0.11470			
10	30	0.11500			

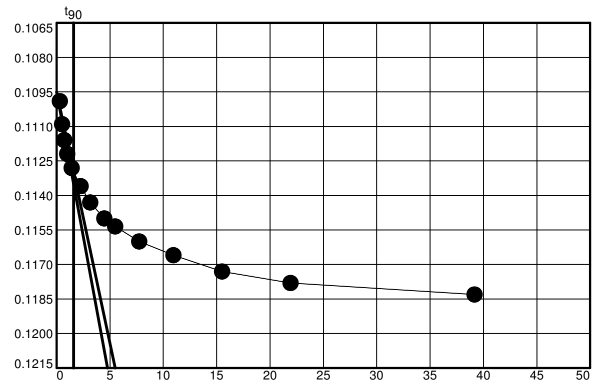


Void Ratio = 0.428 **Compression =** 4.6%

D_0 = 0.0980 **D_{90} =** 0.1007 **D_{100} =** 0.1010 **C_v at 2.52 min. =** 0.773 ft.^{2}/day

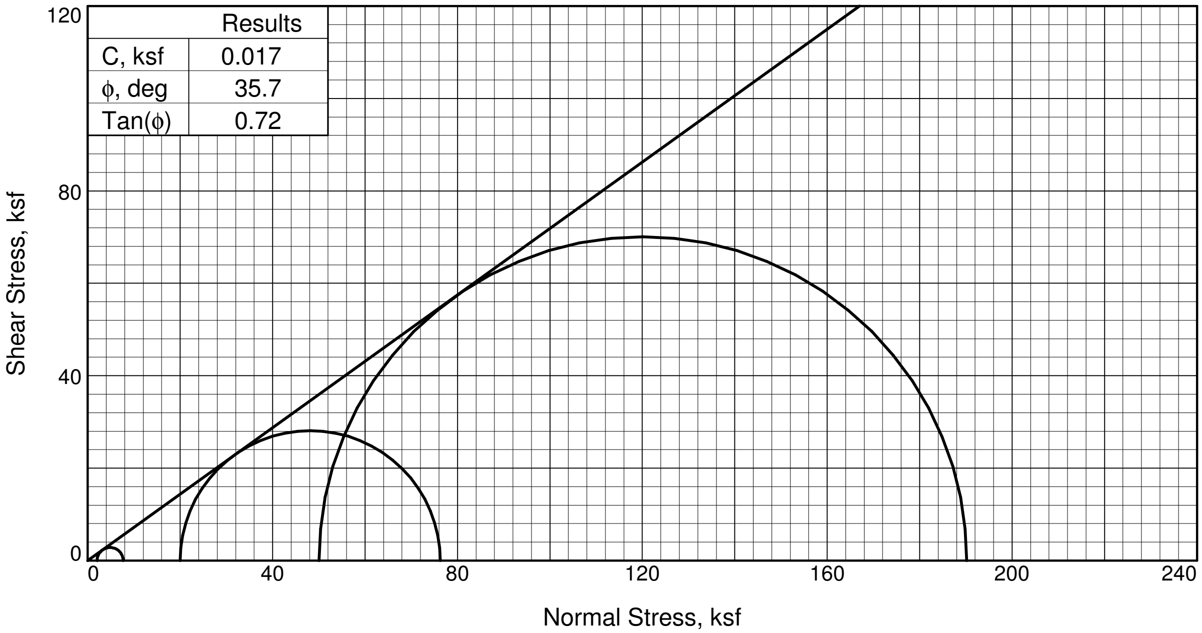
Pressure: 25.60 ksf	TEST READINGS	Load No. 10

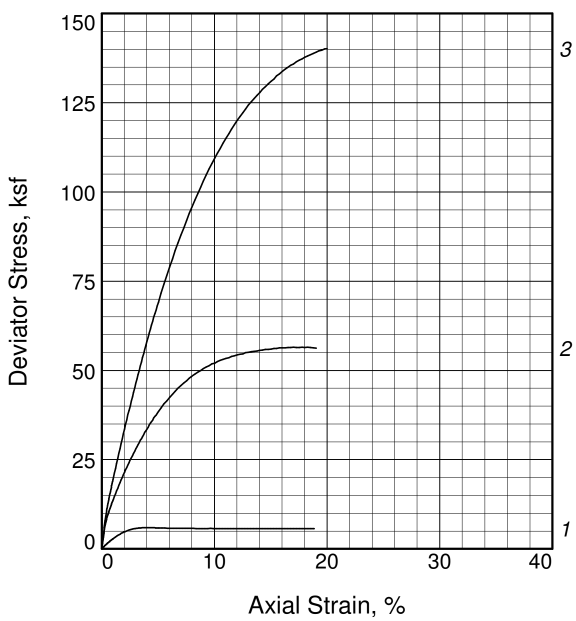
No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0	0.11700	11	60	0.13380
2	.1	0.12770	12	120	0.13440
3	.25	0.12870	13	240	0.13510
4	.5	0.12940	14	480	0.13560
5	1	0.13000	15	1535	0.13610
6	2	0.13060			
7	5	0.13140			
8	10	0.13210			
9	20	0.13280			
10	30	0.13315			



Void Ratio = 0.408 **Compression =** 6.0%

D_0 = 0.1095 **D_{90} =** 0.1130 **D_{100} =** 0.1134 **C_V at 2.52 min. =** 0.755 ft.^{2}/day





Specimen No.		1	2	3
Initial	Water Content, %	11.3	11.2	11.1
	Dry Density, pcf	113.9	113.8	113.3
	Saturation, %	56.6	55.9	55.0
	Void Ratio	0.5709	0.5722	0.5794
	Diameter, in.	2.42	2.42	2.42
	Height, in.	5.00	5.01	5.03
At Test	Water Content, %	17.3	14.8	12.8
	Dry Density, pcf	119.5	123.9	130.2
	Saturation, %	100.0	95.7	98.3
	Void Ratio	0.4968	0.4438	0.3739
	Diameter, in.	2.37	2.34	2.28
	Height, in.	4.93	4.89	4.89
Strain rate, %/min.		0.02	0.02	0.02
Back Pressure, ksf		7.2	7.2	7.2
Cell Pressure, ksf		9.2	27.2	57.2
Fail. Stress, ksf		5.6	56.3	140.2
Strain, %		18.8	19.0	20.0
Ult. Stress, ksf				
Strain, %				
σ_1 Failure, ksf		7.7	76.3	190.2
σ_3 Failure, ksf		2.0	20.0	50.0

Type of Test:
Consolidated Drained
Sample Type: Reconstituted
Description: silty sand

LL= NP **PI=** NP
Specific Gravity= 2.866
Remarks: Failure chosen at 19% strain.

Figure ________

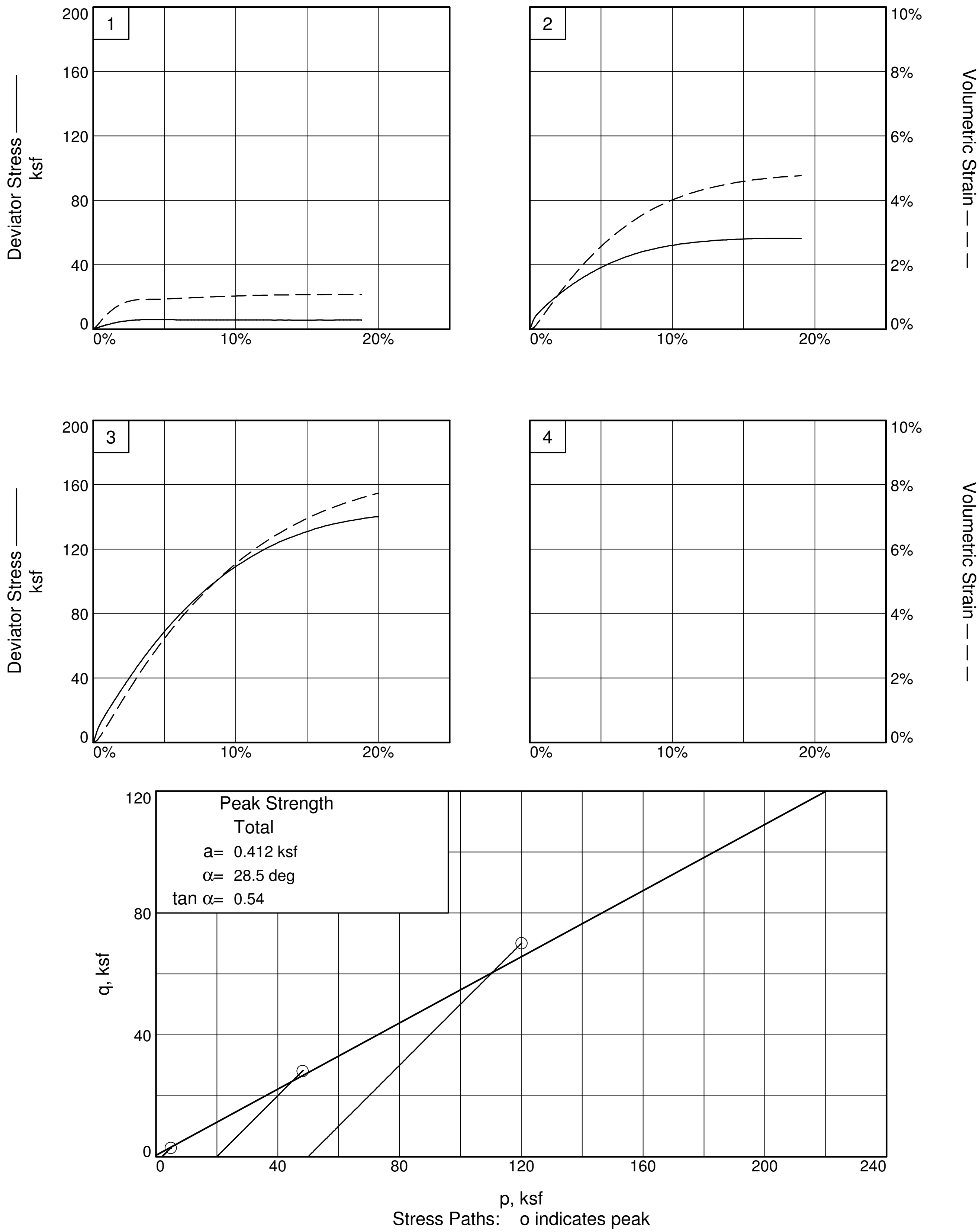
Client: South 32 - Hermosa Project

Project: Hermosa

Location: Combined Bulk Sample
Sample Number: CD
Proj. No.: 101-00777.03 **Date Sampled:** 6/16/20

Knight Piésold
CONSULTING

Tested By: JStaley **Checked By:** Jbruce



Client: South 32 - Hermosa Project
Project: Hermosa
Location: Combined Bulk Sample
Sample Number: CD
Project No.: 101-00777.03
Figure ________

Knight Piesold Geotechnical Lab.

Tested By: JStaley **Checked By:** Jbruce

TRIAXIAL COMPRESSION TEST

Consolidated Drained

3/29/2021
12:31 PM

Date: 6/16/20
Client: South 32 - Hermosa Project
Project: Hermosa
Project No.: 101-00777.03
Location: Combined Bulk Sample
Sample Number: CD
Description: silty sand
Remarks: Failure chosen at 19% strain.
Type of Sample: Reconstituted
Specific Gravity=2.866 **LL=**NP **PL=** **PI=**NP
Test Method: ASTM D 4767 Method A

Parameters for Specimen No. 1

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	762.000			951.600
Moisture content: Dry soil+tare, gms.	684.740			832.900
Moisture content: Tare, gms.	0.000			148.160
Moisture, %	11.3	19.9	17.3	17.3
Moist specimen weight, gms.	762.0			
Diameter, in.	2.42	2.42	2.37	2.62
Area, in.^{2}	4.58	4.58	4.43	5.40
Height, in.	5.00	5.00	4.93	4.00
Net decrease in height, in.		0.00	0.07	0.93
Net decrease in water volume, cc.			17.70	3.86
Wet density, pcf	126.7	136.6	140.3	141.8
Dry density, pcf	113.9	113.9	119.5	120.8
Void ratio	0.5709	0.5709	0.4968	0.4806
Saturation, %	56.6	100.0	100.0	103.4

Test Readings for Specimen No. 1

Membrane modulus = 0.124105 kN/cm^2
Membrane thickness = 0.04 cm
Consolidation cell pressure = 64.010 psi (9.217 ksf)
Consolidation back pressure = 50.000 psi (7.200 ksf)
Consolidation effective confining stress = 2.017 ksf
Strain rate, %/min. = 0.02
Fail. Stress = 5.648 ksf **at reading no.** 136

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Princ. Stress ksf	Major Princ. Stress ksf	1:3 Ratio	Buret Read. cc's	Vol. Strain %	P ksf	Q ksf
0	0.0733	25.680	0.0	0.0	0.000	2.017	2.017	1.00	144.4	0.0	2.017	0.000
1	0.0746	29.665	4.0	0.0	0.130	2.017	2.147	1.06	144.4	0.0	2.082	0.065
2	0.0758	32.620	6.9	0.1	0.226	2.017	2.243	1.11	144.4	0.0	2.130	0.113
3	0.0771	35.808	10.1	0.1	0.329	2.017	2.346	1.16	144.3	0.0	2.182	0.165
4	0.0783	37.123	11.4	0.1	0.372	2.017	2.389	1.18	144.3	0.0	2.203	0.186
5	0.0796	40.111	14.4	0.1	0.469	2.017	2.486	1.23	144.3	0.0	2.252	0.234
6	0.0808	42.569	16.9	0.2	0.549	2.017	2.566	1.27	144.2	0.1	2.292	0.274
7	0.0821	44.167	18.5	0.2	0.600	2.017	2.618	1.30	144.2	0.1	2.318	0.300
8	0.0833	46.026	20.3	0.2	0.661	2.017	2.678	1.33	144.1	0.1	2.348	0.330
9	0.0846	47.894	22.2	0.2	0.721	2.017	2.739	1.36	144.1	0.1	2.378	0.361
10	0.0858	51.306	25.6	0.3	0.832	2.017	2.849	1.41	144.1	0.1	2.433	0.416
11	0.0871	53.483	27.8	0.3	0.902	2.017	2.920	1.45	144.0	0.1	2.469	0.451
12	0.0883	56.110	30.4	0.3	0.987	2.017	3.005	1.49	144.0	0.1	2.511	0.494
13	0.0896	58.065	32.4	0.3	1.051	2.017	3.068	1.52	143.9	0.1	2.543	0.525
14	0.0908	60.854	35.2	0.4	1.141	2.017	3.159	1.57	143.9	0.2	2.588	0.571
15	0.0921	62.294	36.6	0.4	1.188	2.017	3.205	1.59	143.8	0.2	2.611	0.594
16	0.0933	64.427	38.7	0.4	1.257	2.017	3.274	1.62	143.8	0.2	2.646	0.628
17	0.0946	66.972	41.3	0.4	1.339	2.017	3.357	1.66	143.7	0.2	2.687	0.670
18	0.0958	69.805	44.1	0.5	1.431	2.017	3.448	1.71	143.7	0.2	2.733	0.715
19	0.0971	71.355	45.7	0.5	1.481	2.017	3.498	1.73	143.6	0.2	2.758	0.741
20	0.0983	74.675	49.0	0.5	1.588	2.017	3.606	1.79	143.6	0.2	2.812	0.794
21	0.0996	75.828	50.1	0.5	1.626	2.017	3.643	1.81	143.5	0.3	2.830	0.813
22	0.1008	78.193	52.5	0.6	1.702	2.017	3.720	1.84	143.5	0.3	2.868	0.851
23	0.1021	79.900	54.2	0.6	1.757	2.017	3.775	1.87	143.4	0.3	2.896	0.879
24	0.1033	82.370	56.7	0.6	1.837	2.017	3.854	1.91	143.4	0.3	2.936	0.919
25	0.1046	84.929	59.2	0.6	1.920	2.017	3.937	1.95	143.3	0.3	2.977	0.960
26	0.1058	86.839	61.2	0.7	1.981	2.017	3.999	1.98	143.3	0.3	3.008	0.991
27	0.1071	87.973	62.3	0.7	2.018	2.017	4.035	2.00	143.3	0.3	3.026	1.009
28	0.1083	90.291	64.6	0.7	2.093	2.017	4.110	2.04	143.2	0.3	3.064	1.046
29	0.1096	92.450	66.8	0.7	2.162	2.017	4.180	2.07	143.2	0.4	3.099	1.081
30	0.1108	94.432	68.8	0.8	2.226	2.017	4.244	2.10	143.1	0.4	3.130	1.113
31	0.1121	96.913	71.2	0.8	2.306	2.017	4.324	2.14	143.1	0.4	3.171	1.153
32	0.1133	98.602	72.9	0.8	2.360	2.017	4.378	2.17	143.0	0.4	3.198	1.180
33	0.1146	100.911	75.2	0.8	2.435	2.017	4.452	2.21	143.0	0.4	3.235	1.217
34	0.1159	103.045	77.4	0.9	2.504	2.017	4.521	2.24	142.9	0.4	3.269	1.252
35	0.1171	105.381	79.7	0.9	2.579	2.017	4.596	2.28	142.9	0.4	3.307	1.289
36	0.1184	107.329	81.6	0.9	2.642	2.017	4.659	2.31	142.9	0.4	3.338	1.321
37	0.1196	109.186	83.5	0.9	2.701	2.017	4.719	2.34	142.8	0.4	3.368	1.351
38	0.1209	110.841	85.2	1.0	2.754	2.017	4.772	2.37	142.8	0.5	3.395	1.377
39	0.1221	112.018	86.3	1.0	2.792	2.017	4.810	2.38	142.7	0.5	3.413	1.396
40	0.1234	113.629	87.9	1.0	2.844	2.017	4.861	2.41	142.7	0.5	3.439	1.422
41	0.1246	116.469	90.8	1.0	2.935	2.017	4.953	2.45	142.7	0.5	3.485	1.468
42	0.1296	122.954	97.3	1.1	3.143	2.017	5.160	2.56	142.5	0.5	3.589	1.571
43	0.1346	129.771	104.1	1.2	3.361	2.017	5.378	2.67	142.4	0.6	3.698	1.680
44	0.1396	137.568	111.9	1.3	3.610	2.017	5.628	2.79	142.3	0.6	3.823	1.805
45	0.1446	144.222	118.5	1.4	3.822	2.017	5.840	2.89	142.1	0.6	3.929	1.911
46	0.1496	149.125	123.4	1.5	3.978	2.017	5.995	2.97	142.0	0.7	4.006	1.989

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Princ. Stress ksf	Major Princ. Stress ksf	1:3 Ratio	Buret Read. cc's	Vol. Strain %	P ksf	Q ksf
47	0.1546	155.835	130.2	1.6	4.191	2.017	6.208	3.08	141.9	0.7	4.113	2.095
48	0.1596	161.931	136.3	1.8	4.384	2.017	6.401	3.17	141.8	0.7	4.209	2.192
49	0.1646	167.287	141.6	1.9	4.552	2.017	6.570	3.26	141.7	0.8	4.294	2.276
50	0.1696	171.201	145.5	2.0	4.674	2.017	6.692	3.32	141.7	0.8	4.355	2.337
51	0.1746	175.893	150.2	2.1	4.821	2.017	6.839	3.39	141.6	0.8	4.428	2.411
52	0.1796	180.554	154.9	2.2	4.967	2.017	6.984	3.46	141.5	0.8	4.501	2.483
53	0.1846	184.376	158.7	2.3	5.085	2.017	7.102	3.52	141.5	0.8	4.560	2.542
54	0.1896	188.555	162.9	2.4	5.214	2.017	7.232	3.58	141.4	0.8	4.624	2.607
55	0.1946	191.832	166.2	2.5	5.314	2.017	7.332	3.63	141.3	0.9	4.675	2.657
56	0.1996	194.860	169.2	2.6	5.406	2.017	7.423	3.68	141.3	0.9	4.720	2.703
57	0.2046	197.987	172.3	2.7	5.501	2.017	7.518	3.73	141.3	0.9	4.768	2.750
58	0.2096	200.293	174.6	2.8	5.569	2.017	7.587	3.76	141.2	0.9	4.802	2.785
59	0.2146	202.649	177.0	2.9	5.639	2.017	7.656	3.80	141.2	0.9	4.837	2.819
60	0.2196	204.296	178.6	3.0	5.686	2.017	7.703	3.82	141.2	0.9	4.860	2.843
61	0.2246	206.932	181.3	3.1	5.764	2.017	7.781	3.86	141.2	0.9	4.899	2.882
62	0.2296	208.366	182.7	3.2	5.804	2.017	7.821	3.88	141.1	0.9	4.919	2.902
63	0.2346	209.177	183.5	3.3	5.824	2.017	7.841	3.89	141.1	0.9	4.929	2.912
64	0.2396	210.851	185.2	3.4	5.871	2.017	7.888	3.91	141.1	0.9	4.953	2.935
65	0.2446	211.671	186.0	3.5	5.891	2.017	7.908	3.92	141.1	0.9	4.963	2.945
66	0.2496	212.833	187.2	3.6	5.921	2.017	7.939	3.94	141.1	0.9	4.978	2.961
67	0.2546	212.840	187.2	3.7	5.915	2.017	7.933	3.93	141.1	0.9	4.975	2.958
68	0.2596	214.637	189.0	3.8	5.966	2.017	7.983	3.96	141.1	0.9	5.000	2.983
69	0.2646	214.059	188.4	3.9	5.941	2.017	7.959	3.94	141.1	0.9	4.988	2.971
70	0.2696	214.156	188.5	4.0	5.938	2.017	7.956	3.94	141.1	0.9	4.986	2.969
71	0.2746	213.993	188.3	4.1	5.927	2.017	7.944	3.94	141.1	0.9	4.981	2.963
72	0.2796	214.210	188.5	4.2	5.927	2.017	7.945	3.94	141.1	0.9	4.981	2.964
73	0.2846	215.155	189.5	4.3	5.951	2.017	7.968	3.95	141.1	0.9	4.993	2.975
74	0.2896	214.640	189.0	4.4	5.928	2.017	7.946	3.94	141.1	0.9	4.982	2.964
75	0.2946	214.478	188.8	4.5	5.917	2.017	7.934	3.93	141.1	0.9	4.976	2.959
76	0.2996	214.710	189.0	4.6	5.918	2.017	7.936	3.93	141.1	0.9	4.976	2.959
77	0.3046	215.137	189.5	4.7	5.925	2.017	7.943	3.94	141.1	0.9	4.980	2.963
78	0.3096	214.110	188.4	4.8	5.887	2.017	7.904	3.92	141.1	0.9	4.961	2.943
79	0.3146	213.891	188.2	4.9	5.874	2.017	7.891	3.91	141.1	0.9	4.954	2.937
80	0.3196	213.415	187.7	5.0	5.853	2.017	7.870	3.90	141.1	0.9	4.944	2.926
81	0.3246	214.174	188.5	5.1	5.870	2.017	7.888	3.91	141.1	0.9	4.953	2.935
82	0.3371	213.987	188.3	5.4	5.849	2.017	7.867	3.90	141.0	0.9	4.942	2.925
83	0.3496	214.199	188.5	5.6	5.840	2.017	7.858	3.89	141.0	0.9	4.938	2.920
84	0.3621	213.447	187.8	5.9	5.802	2.017	7.819	3.88	141.0	1.0	4.918	2.901
85	0.3746	213.770	188.1	6.1	5.796	2.017	7.814	3.87	141.0	1.0	4.916	2.898
86	0.3871	213.800	188.1	6.4	5.782	2.017	7.799	3.87	141.0	1.0	4.908	2.891
87	0.3997	214.022	188.3	6.6	5.773	2.017	7.791	3.86	141.0	1.0	4.904	2.887
88	0.4122	213.507	187.8	6.9	5.742	2.017	7.759	3.85	140.9	1.0	4.888	2.871
89	0.4247	213.870	188.2	7.1	5.738	2.017	7.755	3.84	140.9	1.0	4.886	2.869
90	0.4372	214.768	189.1	7.4	5.750	2.017	7.767	3.85	140.9	1.0	4.892	2.875
91	0.4497	214.792	189.1	7.6	5.735	2.017	7.752	3.84	140.9	1.0	4.885	2.867
92	0.4622	215.326	189.6	7.9	5.736	2.017	7.753	3.84	140.9	1.0	4.885	2.868
93	0.4747	216.170	190.5	8.1	5.746	2.017	7.763	3.85	140.8	1.0	4.890	2.873

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Princ. Stress ksf	Major Princ. Stress ksf	1:3 Ratio	Buret Read. cc's	Vol. Strain %	P ksf	Q ksf
94	0.4872	215.692	190.0	8.4	5.716	2.017	7.733	3.83	140.8	1.0	4.875	2.858
95	0.4997	215.633	190.0	8.7	5.698	2.017	7.716	3.82	140.8	1.0	4.867	2.849
96	0.5122	216.440	190.8	8.9	5.707	2.017	7.724	3.83	140.8	1.0	4.871	2.853
97	0.5247	217.113	191.4	9.2	5.711	2.017	7.729	3.83	140.8	1.0	4.873	2.856
98	0.5372	217.899	192.2	9.4	5.719	2.017	7.736	3.83	140.8	1.0	4.877	2.859
99	0.5497	218.581	192.9	9.7	5.723	2.017	7.741	3.84	140.8	1.0	4.879	2.862
100	0.5622	218.165	192.5	9.9	5.695	2.017	7.713	3.82	140.7	1.0	4.865	2.848
101	0.5747	219.050	193.4	10.2	5.705	2.017	7.723	3.83	140.7	1.0	4.870	2.853
102	0.5872	218.737	193.1	10.4	5.680	2.017	7.698	3.82	140.7	1.0	4.858	2.840
103	0.5997	219.699	194.0	10.7	5.693	2.017	7.710	3.82	140.7	1.0	4.864	2.846
104	0.6122	220.050	194.4	10.9	5.687	2.017	7.704	3.82	140.7	1.0	4.861	2.843
105	0.6247	220.303	194.6	11.2	5.678	2.017	7.696	3.81	140.7	1.0	4.857	2.839
106	0.6372	221.607	195.9	11.4	5.700	2.017	7.718	3.83	140.7	1.0	4.867	2.850
107	0.6497	221.968	196.3	11.7	5.694	2.017	7.712	3.82	140.7	1.1	4.865	2.847
108	0.6622	221.950	196.3	12.0	5.678	2.017	7.695	3.81	140.7	1.1	4.856	2.839
109	0.6747	222.725	197.0	12.2	5.684	2.017	7.701	3.82	140.7	1.1	4.859	2.842
110	0.6872	223.339	197.7	12.5	5.685	2.017	7.703	3.82	140.6	1.1	4.860	2.843
111	0.6997	223.395	197.7	12.7	5.670	2.017	7.688	3.81	140.6	1.1	4.853	2.835
112	0.7122	224.672	199.0	13.0	5.691	2.017	7.708	3.82	140.6	1.1	4.863	2.845
113	0.7247	225.020	199.3	13.2	5.684	2.017	7.701	3.82	140.6	1.1	4.859	2.842
114	0.7372	225.121	199.4	13.5	5.670	2.017	7.688	3.81	140.6	1.1	4.853	2.835
115	0.7497	226.476	200.8	13.7	5.692	2.017	7.710	3.82	140.6	1.1	4.864	2.846
116	0.7622	226.543	200.9	14.0	5.677	2.017	7.695	3.81	140.6	1.1	4.856	2.839
117	0.7747	227.112	201.4	14.2	5.677	2.017	7.694	3.81	140.6	1.1	4.856	2.838
118	0.7872	227.395	201.7	14.5	5.668	2.017	7.685	3.81	140.6	1.1	4.851	2.834
119	0.7997	227.420	201.7	14.7	5.652	2.017	7.669	3.80	140.6	1.1	4.843	2.826
120	0.8122	227.998	202.3	15.0	5.651	2.017	7.669	3.80	140.6	1.1	4.843	2.826
121	0.8247	229.198	203.5	15.3	5.668	2.017	7.685	3.81	140.6	1.1	4.851	2.834
122	0.8372	229.980	204.3	15.5	5.673	2.017	7.690	3.81	140.6	1.1	4.854	2.836
123	0.8497	230.969	205.3	15.8	5.683	2.017	7.700	3.82	140.6	1.1	4.859	2.841
124	0.8622	231.715	206.0	16.0	5.686	2.017	7.704	3.82	140.6	1.1	4.861	2.843
125	0.8747	231.559	205.9	16.3	5.665	2.017	7.683	3.81	140.6	1.1	4.850	2.833
126	0.8872	232.408	206.7	16.5	5.671	2.017	7.689	3.81	140.6	1.1	4.853	2.836
127	0.8997	232.834	207.2	16.8	5.666	2.017	7.683	3.81	140.6	1.1	4.850	2.833
128	0.9122	234.001	208.3	17.0	5.680	2.017	7.698	3.82	140.6	1.1	4.858	2.840
129	0.9247	235.161	209.5	17.3	5.695	2.017	7.712	3.82	140.6	1.1	4.865	2.847
130	0.9372	235.552	209.9	17.5	5.688	2.017	7.705	3.82	140.6	1.1	4.861	2.844
131	0.9497	236.823	211.1	17.8	5.704	2.017	7.722	3.83	140.6	1.1	4.870	2.852
132	0.9622	236.986	211.3	18.0	5.691	2.017	7.709	3.82	140.6	1.1	4.863	2.846
133	0.9747	237.568	211.9	18.3	5.689	2.017	7.707	3.82	140.6	1.1	4.862	2.845
134	0.9872	238.559	212.9	18.5	5.698	2.017	7.716	3.82	140.6	1.1	4.867	2.849
135	0.9997	238.757	213.1	18.8	5.686	2.017	7.703	3.82	140.6	1.1	4.860	2.843
136	1.0004	237.390	211.7	18.8	5.648	2.017	7.666	3.80	140.6	1.1	4.842	2.824

Parameters for Specimen No. 2

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	761.600			904.500
Moisture content: Dry soil+tare, gms.	685.140			803.000
Moisture content: Tare, gms.	0.000			117.860
Moisture, %	11.2	19.3	14.8	14.8
Moist specimen weight, gms.	761.6			
Diameter, in.	2.42	2.42	2.34	2.54
Area, in.²	4.58	4.58	4.31	5.07
Height, in.	5.01	5.01	4.89	3.96
Net decrease in height, in.		0.00	0.12	0.93
Net decrease in water volume, cc.			30.70	16.45
Wet density, pcf	126.5	135.8	142.3	149.4
Dry density, pcf	113.8	113.8	123.9	130.1
Void ratio	0.5722	0.5722	0.4438	0.3749
Saturation, %	55.9	96.7	95.7	113.2

Test Readings for Specimen No. 2

Membrane modulus = 0.124105 kN/cm²

Membrane thickness = 0.04 cm

Consolidation cell pressure = 188.970 psi (27.212 ksf)

Consolidation back pressure = 50.000 psi (7.200 ksf)

Consolidation effective confining stress = 20.012 ksf

Strain rate, %/min. = 0.02

Fail. Stress = 56.251 ksf **at reading no.** 137

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Princ. Stress ksf	Major Princ. Stress ksf	1:3 Ratio	Buret Read. cc's	Vol. Strain %	P ksf	Q ksf
0	0.1174	69.700	0.0	0.0	0.000	20.012	20.012	1.00	148.0	0.0	20.012	0.000
1	0.1187	85.896	16.2	0.0	0.541	20.012	20.553	1.03	148.0	0.0	20.282	0.271
2	0.1199	101.472	31.8	0.1	1.062	20.012	21.073	1.05	148.0	0.0	20.543	0.531
3	0.1211	112.533	42.8	0.1	1.431	20.012	21.443	1.07	148.0	0.0	20.727	0.715
4	0.1223	131.130	61.4	0.1	2.052	20.012	22.063	1.10	148.0	0.0	21.038	1.026
5	0.1236	149.974	80.3	0.1	2.681	20.012	22.692	1.13	148.0	0.0	21.352	1.340
6	0.1248	167.657	98.0	0.2	3.270	20.012	23.282	1.16	147.9	0.0	21.647	1.635
7	0.1260	185.202	115.5	0.2	3.855	20.012	23.867	1.19	147.9	0.0	21.939	1.928
8	0.1272	203.334	133.6	0.2	4.460	20.012	24.471	1.22	147.9	0.0	22.242	2.230
9	0.1285	219.625	149.9	0.2	5.002	20.012	25.014	1.25	147.9	0.0	22.513	2.501
10	0.1297	235.608	165.9	0.3	5.535	20.012	25.546	1.28	147.9	0.0	22.779	2.767
11	0.1309	250.702	181.0	0.3	6.037	20.012	26.049	1.30	147.8	0.1	23.030	3.019
12	0.1321	263.397	193.7	0.3	6.460	20.012	26.472	1.32	147.8	0.1	23.242	3.230
13	0.1334	275.914	206.2	0.3	6.876	20.012	26.888	1.34	147.8	0.1	23.450	3.438
14	0.1346	288.050	218.4	0.4	7.280	20.012	27.292	1.36	147.7	0.1	23.652	3.640
15	0.1358	297.539	227.8	0.4	7.595	20.012	27.607	1.38	147.7	0.1	23.809	3.798
16	0.1370	306.931	237.2	0.4	7.907	20.012	27.919	1.40	147.6	0.1	23.965	3.954
17	0.1383	316.966	247.3	0.4	8.241	20.012	28.253	1.41	147.6	0.1	24.132	4.120
18	0.1395	325.062	255.4	0.5	8.510	20.012	28.522	1.43	147.5	0.1	24.267	4.255
19	0.1407	334.301	264.6	0.5	8.817	20.012	28.828	1.44	147.5	0.1	24.420	4.408
20	0.1419	342.101	272.4	0.5	9.076	20.012	29.087	1.45	147.4	0.2	24.550	4.538
21	0.1431	349.510	279.8	0.5	9.322	20.012	29.333	1.47	147.4	0.2	24.672	4.661
22	0.1444	357.880	288.2	0.6	9.599	20.012	29.611	1.48	147.3	0.2	24.811	4.800
23	0.1456	363.172	293.5	0.6	9.775	20.012	29.786	1.49	147.3	0.2	24.899	4.887

Test Readings for Specimen No. 2

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Princ. Stress ksf	Major Princ. Stress ksf	1:3 Ratio	Buret Read. cc's	Vol. Strain %	P ksf	Q ksf
24	0.1468	371.009	301.3	0.6	10.035	20.012	30.046	1.50	147.2	0.2	25.029	5.017
25	0.1480	377.663	308.0	0.6	10.255	20.012	30.267	1.51	147.2	0.2	25.139	5.128
26	0.1493	384.985	315.3	0.7	10.498	20.012	30.509	1.52	147.1	0.2	25.261	5.249
27	0.1505	392.088	322.4	0.7	10.733	20.012	30.745	1.54	147.1	0.3	25.378	5.367
28	0.1517	398.846	329.1	0.7	10.957	20.012	30.969	1.55	147.0	0.3	25.490	5.479
29	0.1529	406.256	336.6	0.7	11.203	20.012	31.214	1.56	147.0	0.3	25.613	5.601
30	0.1541	413.852	344.2	0.8	11.454	20.012	31.466	1.57	146.9	0.3	25.739	5.727
31	0.1554	420.517	350.8	0.8	11.675	20.012	31.687	1.58	146.9	0.3	25.849	5.838
32	0.1566	428.513	358.8	0.8	11.940	20.012	31.952	1.60	146.8	0.3	25.982	5.970
33	0.1578	434.928	365.2	0.8	12.152	20.012	32.164	1.61	146.8	0.4	26.088	6.076
34	0.1590	441.423	371.7	0.9	12.367	20.012	32.379	1.62	146.7	0.4	26.195	6.184
35	0.1603	448.329	378.6	0.9	12.596	20.012	32.607	1.63	146.7	0.4	26.310	6.298
36	0.1615	453.702	384.0	0.9	12.773	20.012	32.785	1.64	146.6	0.4	26.398	6.387
37	0.1627	460.917	391.2	0.9	13.012	20.012	33.024	1.65	146.6	0.4	26.518	6.506
38	0.1639	467.068	397.4	1.0	13.215	20.012	33.227	1.66	146.5	0.4	26.619	6.608
39	0.1652	472.745	403.0	1.0	13.403	20.012	33.414	1.67	146.4	0.4	26.713	6.701
40	0.1664	479.933	410.2	1.0	13.640	20.012	33.652	1.68	146.4	0.5	26.832	6.820
41	0.1676	485.154	415.5	1.0	13.813	20.012	33.824	1.69	146.3	0.5	26.918	6.906
42	0.1725	509.896	440.2	1.1	14.629	20.012	34.641	1.73	146.1	0.5	27.326	7.315
43	0.1774	534.953	465.3	1.2	15.456	20.012	35.467	1.77	145.9	0.6	27.740	7.728
44	0.1823	559.947	490.2	1.3	16.280	20.012	36.292	1.81	145.7	0.7	28.152	8.140
45	0.1872	581.771	512.1	1.4	16.998	20.012	37.010	1.85	145.5	0.7	28.511	8.499
46	0.1921	605.083	535.4	1.5	17.764	20.012	37.776	1.89	145.3	0.8	28.894	8.882
47	0.1969	629.262	559.6	1.6	18.559	20.012	38.571	1.93	145.1	0.8	29.291	9.280
48	0.2018	652.303	582.6	1.7	19.316	20.012	39.327	1.97	144.9	0.9	29.669	9.658
49	0.2067	673.287	603.6	1.8	20.003	20.012	40.015	2.00	144.7	1.0	30.013	10.002
50	0.2116	694.731	625.0	1.9	20.705	20.012	40.717	2.03	144.5	1.0	30.364	10.352
51	0.2165	717.485	647.8	2.0	21.450	20.012	41.461	2.07	144.3	1.1	30.736	10.725
52	0.2214	738.967	669.3	2.1	22.151	20.012	42.163	2.11	144.1	1.1	31.087	11.076
53	0.2263	759.747	690.0	2.2	22.829	20.012	42.841	2.14	143.9	1.2	31.426	11.415
54	0.2312	778.919	709.2	2.3	23.453	20.012	43.465	2.17	143.7	1.3	31.738	11.727
55	0.2361	800.869	731.2	2.4	24.168	20.012	44.179	2.21	143.5	1.3	32.095	12.084
56	0.2410	822.651	753.0	2.5	24.876	20.012	44.888	2.24	143.3	1.4	32.450	12.438
57	0.2459	842.242	772.5	2.6	25.512	20.012	45.524	2.27	143.1	1.4	32.768	12.756
58	0.2507	860.796	791.1	2.7	26.112	20.012	46.124	2.30	142.9	1.5	33.068	13.056
59	0.2556	879.731	810.0	2.8	26.724	20.012	46.736	2.34	142.7	1.5	33.374	13.362
60	0.2605	900.034	830.3	2.9	27.381	20.012	47.392	2.37	142.5	1.6	33.702	13.690
61	0.2654	919.489	849.8	3.0	28.009	20.012	48.021	2.40	142.3	1.6	34.016	14.005
62	0.2703	937.401	867.7	3.1	28.585	20.012	48.597	2.43	142.1	1.7	34.304	14.293
63	0.2752	955.266	885.6	3.2	29.159	20.012	49.170	2.46	142.0	1.7	34.591	14.579
64	0.2801	974.542	904.8	3.3	29.778	20.012	49.790	2.49	141.8	1.8	34.901	14.889
65	0.2850	994.117	924.4	3.4	30.407	20.012	50.419	2.52	141.6	1.8	35.215	15.203
66	0.2899	1009.998	940.3	3.5	30.913	20.012	50.925	2.54	141.4	1.9	35.468	15.457
67	0.2948	1026.877	957.2	3.6	31.451	20.012	51.463	2.57	141.3	1.9	35.737	15.726
68	0.2997	1045.660	976.0	3.7	32.051	20.012	52.063	2.60	141.1	2.0	36.037	16.025
69	0.3045	1063.854	994.2	3.8	32.631	20.012	52.642	2.63	140.9	2.0	36.327	16.315
70	0.3094	1079.560	1009.9	3.9	33.128	20.012	53.140	2.66	140.8	2.1	36.576	16.564

Test Readings for Specimen No. 2

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Princ. Stress ksf	Major Princ. Stress ksf	1:3 Ratio	Buret Read. cc's	Vol. Strain %	P ksf	Q ksf
71	0.3143	1094.103	1024.4	4.0	33.586	20.012	53.598	2.68	140.6	2.1	36.805	16.793
72	0.3192	1111.163	1041.5	4.1	34.126	20.012	54.138	2.71	140.5	2.2	37.075	17.063
73	0.3241	1129.422	1059.7	4.2	34.704	20.012	54.716	2.73	140.3	2.2	37.364	17.352
74	0.3290	1145.861	1076.2	4.3	35.223	20.012	55.234	2.76	140.1	2.3	37.623	17.611
75	0.3339	1158.726	1089.0	4.4	35.623	20.012	55.634	2.78	140.0	2.3	37.823	17.811
76	0.3388	1174.209	1104.5	4.5	36.107	20.012	56.119	2.80	139.8	2.4	38.065	18.054
77	0.3437	1191.967	1122.3	4.6	36.666	20.012	56.677	2.83	139.7	2.4	38.345	18.333
78	0.3486	1206.028	1136.3	4.7	37.103	20.012	57.115	2.85	139.5	2.5	38.563	18.551
79	0.3535	1219.556	1149.9	4.8	37.522	20.012	57.533	2.87	139.4	2.5	38.772	18.761
80	0.3583	1234.198	1164.5	4.9	37.976	20.012	57.987	2.90	139.2	2.5	38.999	18.988
81	0.3632	1249.760	1180.1	5.0	38.459	20.012	58.470	2.92	139.1	2.6	39.241	19.229
82	0.3755	1283.996	1214.3	5.3	39.511	20.012	59.523	2.97	138.7	2.7	39.767	19.756
83	0.3877	1319.492	1249.8	5.5	40.600	20.012	60.611	3.03	138.4	2.8	40.312	20.300
84	0.3999	1348.719	1279.0	5.8	41.479	20.012	61.491	3.07	138.1	2.9	40.751	20.740
85	0.4121	1381.723	1312.0	6.0	42.476	20.012	62.488	3.12	137.8	3.0	41.250	21.238
86	0.4244	1410.482	1340.8	6.3	43.331	20.012	63.342	3.17	137.5	3.0	41.677	21.665
87	0.4366	1438.565	1368.9	6.5	44.159	20.012	64.171	3.21	137.2	3.1	42.091	22.080
88	0.4488	1469.218	1399.5	6.8	45.064	20.012	65.076	3.25	136.9	3.2	42.544	22.532
89	0.4611	1492.474	1422.8	7.0	45.727	20.012	65.739	3.29	136.6	3.3	42.875	22.864
90	0.4733	1519.368	1449.7	7.3	46.503	20.012	66.515	3.32	136.4	3.4	43.263	23.251
91	0.4855	1540.754	1471.1	7.5	47.099	20.012	67.111	3.35	136.1	3.4	43.561	23.549
92	0.4977	1565.543	1495.8	7.8	47.799	20.012	67.810	3.39	135.9	3.5	43.911	23.899
93	0.5100	1588.230	1518.5	8.0	48.425	20.012	68.437	3.42	135.6	3.6	44.224	24.213
94	0.5222	1607.761	1538.1	8.3	48.948	20.012	68.959	3.45	135.4	3.6	44.486	24.474
95	0.5344	1630.322	1560.6	8.5	49.561	20.012	69.573	3.48	135.2	3.7	44.792	24.781
96	0.5466	1646.879	1577.2	8.8	49.980	20.012	69.992	3.50	135.0	3.8	45.002	24.990
97	0.5589	1666.900	1597.2	9.0	50.505	20.012	70.517	3.52	134.8	3.8	45.264	25.252
98	0.5711	1685.612	1615.9	9.3	50.984	20.012	70.996	3.55	134.6	3.9	45.504	25.492
99	0.5833	1700.122	1630.4	9.5	51.327	20.012	71.339	3.56	134.5	3.9	45.675	25.664
100	0.5955	1719.589	1649.9	9.8	51.822	20.012	71.834	3.59	134.3	4.0	45.923	25.911
101	0.6078	1731.032	1661.3	10.0	52.062	20.012	72.074	3.60	134.1	4.0	46.043	26.031
102	0.6200	1749.191	1679.5	10.3	52.508	20.012	72.520	3.62	134.0	4.1	46.266	26.254
103	0.6322	1763.348	1693.6	10.5	52.826	20.012	72.838	3.64	133.8	4.1	46.425	26.413
104	0.6444	1775.313	1705.6	10.8	53.073	20.012	73.084	3.65	133.7	4.1	46.548	26.536
105	0.6567	1789.953	1720.3	11.0	53.399	20.012	73.411	3.67	133.6	4.2	46.711	26.700
106	0.6689	1799.818	1730.1	11.3	53.575	20.012	73.587	3.68	133.4	4.2	46.799	26.787
107	0.6811	1815.094	1745.4	11.5	53.915	20.012	73.926	3.69	133.3	4.3	46.969	26.957
108	0.6933	1825.715	1756.0	11.8	54.108	20.012	74.120	3.70	133.2	4.3	47.066	27.054
109	0.7056	1837.048	1767.3	12.0	54.320	20.012	74.332	3.71	133.1	4.3	47.172	27.160
110	0.7178	1848.576	1778.9	12.3	54.536	20.012	74.548	3.73	133.0	4.3	47.280	27.268
111	0.7300	1857.271	1787.6	12.5	54.663	20.012	74.674	3.73	132.9	4.4	47.343	27.331
112	0.7423	1871.210	1801.5	12.8	54.947	20.012	74.959	3.75	132.8	4.4	47.485	27.473
113	0.7545	1879.046	1809.3	13.0	55.043	20.012	75.055	3.75	132.7	4.4	47.533	27.521
114	0.7667	1891.193	1821.5	13.3	55.267	20.012	75.279	3.76	132.6	4.4	47.645	27.633
115	0.7789	1898.984	1829.3	13.5	55.357	20.012	75.369	3.77	132.6	4.5	47.690	27.678
116	0.7911	1907.107	1837.4	13.8	55.455	20.012	75.467	3.77	132.5	4.5	47.739	27.728
117	0.8034	1918.650	1848.9	14.0	55.654	20.012	75.666	3.78	132.4	4.5	47.839	27.827

Test Readings for Specimen No. 2

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Princ. Stress ksf	Major Princ. Stress ksf	1:3 Ratio	Buret Read. cc's	Vol. Strain %	P ksf	Q ksf
118	0.8156	1923.845	1854.1	14.3	55.660	20.012	75.672	3.78	132.3	4.5	47.842	27.830
119	0.8278	1935.777	1866.1	14.5	55.866	20.012	75.877	3.79	132.3	4.6	47.945	27.933
120	0.8401	1942.095	1872.4	14.8	55.902	20.012	75.913	3.79	132.2	4.6	47.962	27.951
121	0.8523	1950.283	1880.6	15.0	55.991	20.012	76.003	3.80	132.1	4.6	48.007	27.996
122	0.8645	1960.659	1891.0	15.3	56.144	20.012	76.156	3.81	132.1	4.6	48.084	28.072
123	0.8767	1966.237	1896.5	15.5	56.153	20.012	76.165	3.81	132.0	4.6	48.088	28.077
124	0.8890	1976.391	1906.7	15.8	56.295	20.012	76.307	3.81	132.0	4.6	48.159	28.148
125	0.9012	1982.754	1913.1	16.0	56.324	20.012	76.335	3.81	131.9	4.7	48.173	28.162
126	0.9134	1989.716	1920.0	16.3	56.368	20.012	76.379	3.82	131.9	4.7	48.196	28.184
127	0.9256	1996.067	1926.4	16.5	56.392	20.012	76.404	3.82	131.9	4.7	48.208	28.196
128	0.9379	2001.355	1931.7	16.8	56.384	20.012	76.396	3.82	131.8	4.7	48.204	28.192
129	0.9501	2010.466	1940.8	17.0	56.486	20.012	76.498	3.82	131.8	4.7	48.255	28.243
130	0.9623	2014.794	1945.1	17.3	56.447	20.012	76.459	3.82	131.7	4.7	48.235	28.224
131	0.9745	2021.087	1951.4	17.5	56.464	20.012	76.476	3.82	131.7	4.7	48.244	28.232
132	0.9868	2027.212	1957.5	17.8	56.475	20.012	76.487	3.82	131.7	4.7	48.249	28.238
133	0.9990	2030.680	1961.0	18.0	56.408	20.012	76.420	3.82	131.7	4.7	48.216	28.204
134	1.0112	2039.477	1969.8	18.3	56.493	20.012	76.505	3.82	131.6	4.7	48.258	28.247
135	1.0235	2041.888	1972.2	18.5	56.395	20.012	76.406	3.82	131.6	4.8	48.209	28.197
136	1.0357	2046.637	1976.9	18.8	56.361	20.012	76.372	3.82	131.6	4.8	48.192	28.180
137	1.0479	2048.705	1979.0	19.0	56.251	20.012	76.262	3.81	131.5	4.8	48.137	28.125

Parameters for Specimen No. 3

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	760.900			884.700
Moisture content: Dry soil+tare, gms.	684.740			796.900
Moisture content: Tare, gms.	0.000			112.160
Moisture, %	11.1	20.0	12.8	12.8
Moist specimen weight, gms.	760.9			
Diameter, in.	2.42	2.42	2.28	2.45
Area, in.²	4.58	4.58	4.10	4.73
Height, in.	5.03	5.03	4.89	3.91
Net decrease in height, in.		0.00	0.14	0.98
Net decrease in water volume, cc.			49.10	25.40
Wet density, pcf	125.9	135.9	146.9	159.3
Dry density, pcf	113.3	113.3	130.2	141.2
Void ratio	0.5794	0.5794	0.3739	0.2676
Saturation, %	55.0	98.9	98.3	137.4

Test Readings for Specimen No. 3

Membrane modulus = 0.124105 kN/cm²

Membrane thickness = 0.04 cm

Consolidation cell pressure = 397.350 psi (57.218 ksf)

Consolidation back pressure = 50.000 psi (7.200 ksf)

Consolidation effective confining stress = 50.018 ksf

Strain rate, %/min. = 0.02

Fail. Stress = 140.168 ksf **at reading no.** 141

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Princ. Stress ksf	Major Princ. Stress ksf	1:3 Ratio	Buret Read. cc's	Vol. Strain %	P ksf	Q ksf
0	0.1386	109.987	0.0	0.0	0.000	50.018	50.018	1.00	85.0	0.0	50.018	0.000
1	0.1398	117.726	7.7	0.0	0.272	50.018	50.290	1.01	85.0	0.0	50.154	0.136
2	0.1410	132.620	22.6	0.0	0.795	50.018	50.813	1.02	85.0	0.0	50.416	0.398
3	0.1422	152.129	42.1	0.1	1.480	50.018	51.498	1.03	85.0	0.0	50.758	0.740
4	0.1435	177.684	67.7	0.1	2.377	50.018	52.395	1.05	84.9	0.0	51.207	1.189
5	0.1447	198.952	89.0	0.1	3.123	50.018	53.142	1.06	84.9	0.0	51.580	1.562
6	0.1459	218.629	108.6	0.2	3.813	50.018	53.832	1.08	84.9	0.0	51.925	1.907
7	0.1471	237.668	127.7	0.2	4.481	50.018	54.499	1.09	84.9	0.0	52.259	2.240
8	0.1484	259.501	149.5	0.2	5.246	50.018	55.265	1.10	84.8	0.0	52.641	2.623
9	0.1496	282.550	172.6	0.2	6.054	50.018	56.072	1.12	84.8	0.1	53.045	3.027
10	0.1508	297.903	187.9	0.3	6.591	50.018	56.610	1.13	84.8	0.1	53.314	3.296
11	0.1520	317.519	207.5	0.3	7.279	50.018	57.297	1.15	84.7	0.1	53.658	3.639
12	0.1532	334.967	225.0	0.3	7.889	50.018	57.908	1.16	84.7	0.1	53.963	3.945
13	0.1545	348.294	238.3	0.3	8.355	50.018	58.374	1.17	84.7	0.1	54.196	4.178
14	0.1557	365.762	255.8	0.4	8.967	50.018	58.985	1.18	84.6	0.1	54.502	4.483
15	0.1569	380.142	270.2	0.4	9.470	50.018	59.489	1.19	84.6	0.1	54.753	4.735
16	0.1581	393.614	283.6	0.4	9.941	50.018	59.960	1.20	84.5	0.1	54.989	4.971
17	0.1594	407.471	297.5	0.4	10.426	50.018	60.444	1.21	84.5	0.2	55.231	5.213
18	0.1606	420.514	310.5	0.5	10.882	50.018	60.900	1.22	84.4	0.2	55.459	5.441
19	0.1618	434.080	324.1	0.5	11.356	50.018	61.375	1.23	84.4	0.2	55.697	5.678
20	0.1630	442.002	332.0	0.5	11.633	50.018	61.651	1.23	84.3	0.2	55.835	5.816
21	0.1643	457.578	347.6	0.5	12.177	50.018	62.196	1.24	84.3	0.2	56.107	6.089
22	0.1655	471.469	361.5	0.6	12.663	50.018	62.681	1.25	84.2	0.2	56.350	6.331
23	0.1667	483.106	373.1	0.6	13.070	50.018	63.088	1.26	84.2	0.3	56.553	6.535

Test Readings for Specimen No. 3

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Princ. Stress ksf	Major Princ. Stress ksf	1:3 Ratio	Buret Read. cc's	Vol. Strain %	P ksf	Q ksf
24	0.1679	493.565	383.6	0.6	13.435	50.018	63.453	1.27	84.1	0.3	56.736	6.718
25	0.1691	506.023	396.0	0.6	13.870	50.018	63.889	1.28	84.0	0.3	56.954	6.935
26	0.1704	512.631	402.6	0.7	14.101	50.018	64.119	1.28	84.0	0.3	57.069	7.050
27	0.1716	523.275	413.3	0.7	14.472	50.018	64.491	1.29	83.9	0.3	57.255	7.236
28	0.1728	538.179	428.2	0.7	14.993	50.018	65.011	1.30	83.9	0.3	57.515	7.497
29	0.1740	548.857	438.9	0.7	15.366	50.018	65.384	1.31	83.8	0.4	57.701	7.683
30	0.1753	556.326	446.3	0.8	15.626	50.018	65.645	1.31	83.8	0.4	57.831	7.813
31	0.1765	567.650	457.7	0.8	16.022	50.018	66.040	1.32	83.7	0.4	58.029	8.011
32	0.1777	581.773	471.8	0.8	16.515	50.018	66.533	1.33	83.6	0.4	58.276	8.257
33	0.1789	588.989	479.0	0.8	16.766	50.018	66.785	1.34	83.6	0.4	58.402	8.383
34	0.1802	600.458	490.5	0.9	17.166	50.018	67.185	1.34	83.5	0.4	58.602	8.583
35	0.1814	614.673	504.7	0.9	17.662	50.018	67.681	1.35	83.5	0.5	58.850	8.831
36	0.1826	620.601	510.6	0.9	17.869	50.018	67.887	1.36	83.4	0.5	58.953	8.934
37	0.1838	633.157	523.2	0.9	18.307	50.018	68.325	1.37	83.3	0.5	59.172	9.153
38	0.1850	646.224	536.2	1.0	18.763	50.018	68.781	1.38	83.3	0.5	59.400	9.381
39	0.1863	651.348	541.4	1.0	18.941	50.018	68.959	1.38	83.2	0.5	59.489	9.470
40	0.1875	666.979	557.0	1.0	19.486	50.018	69.505	1.39	83.2	0.6	59.762	9.743
41	0.1887	676.194	566.2	1.0	19.807	50.018	69.826	1.40	83.1	0.6	59.922	9.904
42	0.1936	715.934	605.9	1.1	21.192	50.018	71.210	1.42	82.9	0.6	60.614	10.596
43	0.1985	755.539	645.6	1.2	22.570	50.018	72.588	1.45	82.6	0.7	61.303	11.285
44	0.2034	794.633	684.6	1.3	23.930	50.018	73.949	1.48	82.4	0.8	61.983	11.965
45	0.2083	836.802	726.8	1.4	25.397	50.018	75.416	1.51	82.2	0.9	62.717	12.699
46	0.2132	876.379	766.4	1.5	26.773	50.018	76.791	1.54	81.9	0.9	63.405	13.386
47	0.2181	915.389	805.4	1.6	28.128	50.018	78.146	1.56	81.7	1.0	64.082	14.064
48	0.2230	952.403	842.4	1.7	29.411	50.018	79.430	1.59	81.4	1.1	64.724	14.706
49	0.2278	994.994	885.0	1.8	30.889	50.018	80.908	1.62	81.2	1.2	65.463	15.445
50	0.2327	1032.203	922.2	1.9	32.179	50.018	82.198	1.64	81.0	1.2	66.108	16.090
51	0.2376	1072.676	962.7	2.0	33.582	50.018	83.600	1.67	80.7	1.3	66.809	16.791
52	0.2425	1111.322	1001.3	2.1	34.919	50.018	84.937	1.70	80.5	1.4	67.478	17.460
53	0.2474	1146.129	1036.1	2.2	36.123	50.018	86.141	1.72	80.3	1.4	68.080	18.061
54	0.2523	1189.379	1079.4	2.3	37.619	50.018	87.637	1.75	80.0	1.5	68.828	18.809
55	0.2572	1222.917	1112.9	2.4	38.778	50.018	88.796	1.78	79.8	1.6	69.407	19.389
56	0.2621	1259.602	1149.6	2.5	40.041	50.018	90.059	1.80	79.6	1.7	70.039	20.021
57	0.2670	1297.113	1187.1	2.6	41.334	50.018	91.352	1.83	79.3	1.7	70.685	20.667
58	0.2718	1335.329	1225.3	2.7	42.651	50.018	92.670	1.85	79.1	1.8	71.344	21.326
59	0.2767	1371.890	1261.9	2.8	43.909	50.018	93.927	1.88	78.9	1.9	71.973	21.954
60	0.2816	1406.076	1296.1	2.9	45.084	50.018	95.102	1.90	78.7	1.9	72.560	22.542
61	0.2865	1444.873	1334.9	3.0	46.416	50.018	96.435	1.93	78.4	2.0	73.226	23.208
62	0.2914	1479.533	1369.5	3.1	47.605	50.018	97.624	1.95	78.2	2.1	73.821	23.803
63	0.2963	1515.651	1405.7	3.2	48.843	50.018	98.861	1.98	78.0	2.1	74.440	24.422
64	0.3012	1549.189	1439.2	3.3	49.992	50.018	100.010	2.00	77.8	2.2	75.014	24.996
65	0.3061	1584.604	1474.6	3.4	51.202	50.018	101.220	2.02	77.6	2.3	75.619	25.601
66	0.3110	1619.466	1509.5	3.5	52.394	50.018	102.413	2.05	77.4	2.3	76.215	26.197
67	0.3159	1655.558	1545.6	3.6	53.626	50.018	103.645	2.07	77.1	2.4	76.832	26.813
68	0.3207	1687.244	1577.3	3.7	54.704	50.018	104.722	2.09	76.9	2.4	77.370	27.352
69	0.3256	1720.971	1611.0	3.8	55.852	50.018	105.870	2.12	76.7	2.5	77.944	27.926
70	0.3305	1759.248	1649.3	3.9	57.157	50.018	107.175	2.14	76.5	2.6	78.597	28.578

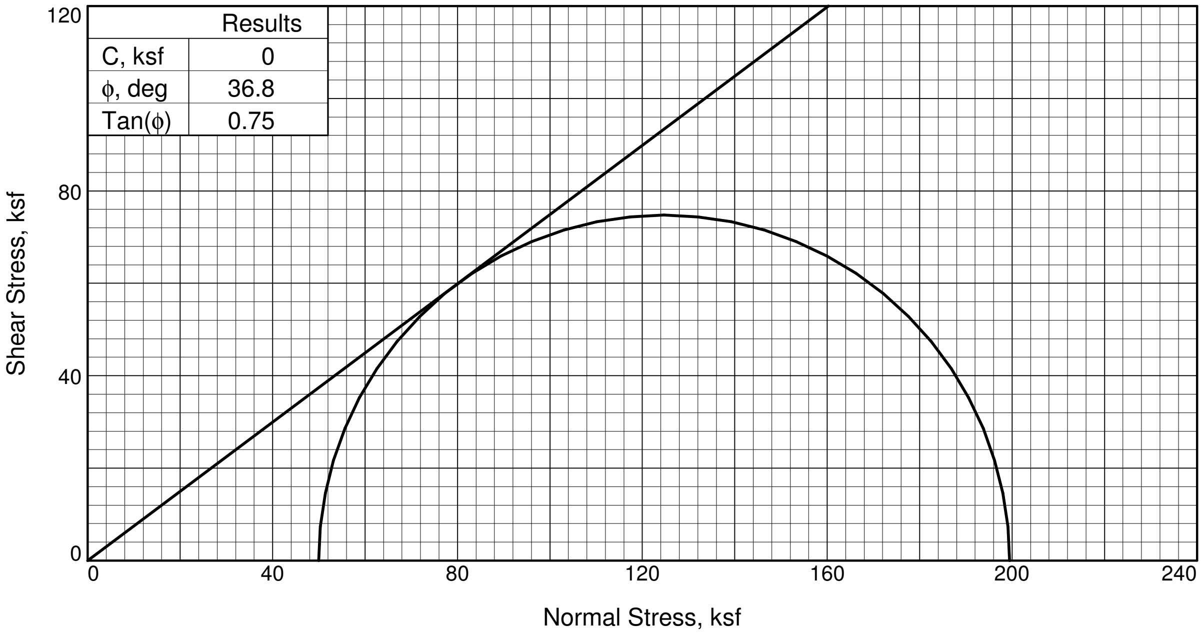
Test Readings for Specimen No. 3

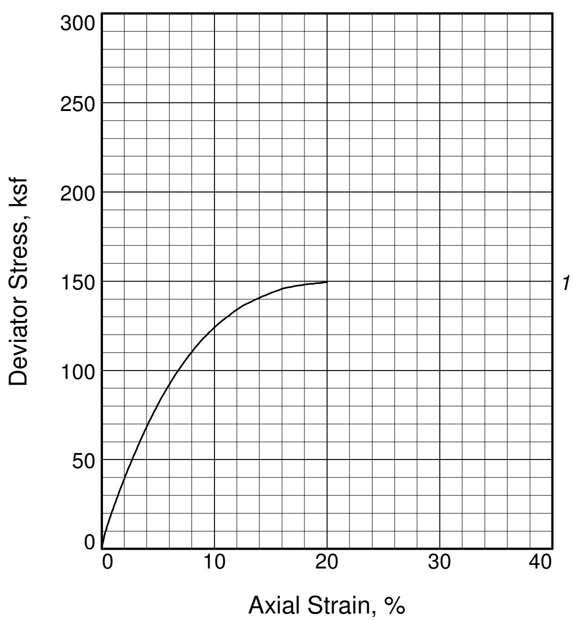
No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Princ. Stress ksf	Major Princ. Stress ksf	1:3 Ratio	Buret Read. cc's	Vol. Strain %	P ksf	Q ksf
71	0.3354	1790.289	1680.3	4.0	58.210	50.018	108.229	2.16	76.3	2.6	79.124	29.105
72	0.3403	1824.759	1714.8	4.1	59.379	50.018	109.397	2.19	76.1	2.7	79.708	29.689
73	0.3452	1855.337	1745.4	4.2	60.414	50.018	110.433	2.21	75.9	2.8	80.226	30.207
74	0.3501	1890.280	1780.3	4.3	61.597	50.018	111.616	2.23	75.7	2.8	80.817	30.799
75	0.3550	1924.034	1814.0	4.4	62.739	50.018	112.757	2.25	75.5	2.9	81.388	31.369
76	0.3599	1954.518	1844.5	4.5	63.766	50.018	113.784	2.27	75.3	2.9	81.901	31.883
77	0.3648	1988.633	1878.6	4.6	64.917	50.018	114.936	2.30	75.1	3.0	82.477	32.459
78	0.3696	2018.117	1908.1	4.7	65.907	50.018	115.925	2.32	74.9	3.1	82.972	32.953
79	0.3745	2051.087	1941.1	4.8	67.016	50.018	117.034	2.34	74.7	3.1	83.526	33.508
80	0.3794	2082.858	1972.9	4.9	68.083	50.018	118.102	2.36	74.5	3.2	84.060	34.042
81	0.3843	2113.072	2003.1	5.0	69.094	50.018	119.112	2.38	74.3	3.2	84.565	34.547
82	0.3965	2189.849	2079.9	5.3	71.660	50.018	121.678	2.43	73.9	3.4	85.848	35.830
83	0.4088	2264.933	2154.9	5.5	74.157	50.018	124.176	2.48	73.4	3.5	87.097	37.079
84	0.4210	2339.332	2229.3	5.8	76.625	50.018	126.643	2.53	73.0	3.7	88.331	38.312
85	0.4332	2411.654	2301.7	6.0	79.008	50.018	129.026	2.58	72.5	3.8	89.522	39.504
86	0.4454	2479.509	2369.5	6.3	81.236	50.018	131.254	2.62	72.1	3.9	90.636	40.618
87	0.4577	2551.033	2441.0	6.5	83.570	50.018	133.589	2.67	71.7	4.0	91.804	41.785
88	0.4699	2618.284	2508.3	6.8	85.754	50.018	135.773	2.71	71.3	4.2	92.896	42.877
89	0.4821	2683.721	2573.7	7.0	87.873	50.018	137.892	2.76	70.9	4.3	93.955	43.937
90	0.4943	2746.165	2636.2	7.3	89.870	50.018	139.889	2.80	70.5	4.4	94.954	44.935
91	0.5065	2812.375	2702.4	7.5	91.986	50.018	142.005	2.84	70.1	4.5	96.012	45.993
92	0.5188	2876.596	2766.6	7.8	94.032	50.018	144.050	2.88	69.7	4.6	97.034	47.016
93	0.5310	2935.716	2825.7	8.0	95.894	50.018	145.913	2.92	69.4	4.8	97.966	47.947
94	0.5432	2995.319	2885.3	8.3	97.762	50.018	147.781	2.95	69.0	4.9	98.899	48.881
95	0.5554	3051.665	2941.7	8.5	99.513	50.018	149.532	2.99	68.7	5.0	99.775	49.757
96	0.5677	3109.549	2999.6	8.8	101.304	50.018	151.322	3.03	68.3	5.1	100.670	50.652
97	0.5799	3167.422	3057.4	9.0	103.084	50.018	153.102	3.06	68.0	5.2	101.560	51.542
98	0.5921	3223.039	3113.1	9.3	104.780	50.018	154.799	3.09	67.7	5.3	102.408	52.390
99	0.6043	3276.966	3167.0	9.5	106.410	50.018	156.429	3.13	67.3	5.4	103.224	53.205
100	0.6166	3328.705	3218.7	9.8	107.959	50.018	157.977	3.16	67.0	5.5	103.998	53.979
101	0.6288	3380.069	3270.1	10.0	109.485	50.018	159.503	3.19	66.7	5.6	104.761	54.742
102	0.6410	3426.551	3316.6	10.3	110.839	50.018	160.858	3.22	66.4	5.7	105.438	55.420
103	0.6532	3474.061	3364.1	10.5	112.218	50.018	162.237	3.24	66.1	5.7	106.127	56.109
104	0.6654	3524.985	3415.0	10.8	113.700	50.018	163.718	3.27	65.9	5.8	106.868	56.850
105	0.6777	3571.454	3461.5	11.0	115.026	50.018	165.044	3.30	65.6	5.9	107.531	57.513
106	0.6899	3618.494	3508.5	11.3	116.355	50.018	166.373	3.33	65.3	6.0	108.196	58.178
107	0.7021	3661.639	3551.7	11.5	117.555	50.018	167.574	3.35	65.1	6.1	108.796	58.778
108	0.7143	3706.848	3596.9	11.8	118.814	50.018	168.833	3.38	64.8	6.1	109.426	59.407
109	0.7266	3751.685	3641.7	12.0	120.049	50.018	170.067	3.40	64.6	6.2	110.043	60.024
110	0.7388	3793.492	3683.5	12.3	121.175	50.018	171.193	3.42	64.3	6.3	110.606	60.588
111	0.7510	3834.015	3724.0	12.5	122.249	50.018	172.268	3.44	64.1	6.4	111.143	61.125
112	0.7632	3871.931	3761.9	12.8	123.232	50.018	173.251	3.46	63.9	6.4	111.635	61.616
113	0.7754	3914.846	3804.9	13.0	124.366	50.018	174.384	3.49	63.7	6.5	112.201	62.183
114	0.7877	3952.380	3842.4	13.3	125.319	50.018	175.337	3.51	63.5	6.6	112.678	62.659
115	0.7999	3987.151	3877.2	13.5	126.175	50.018	176.194	3.52	63.3	6.6	113.106	63.088
116	0.8121	4023.864	3913.9	13.8	127.082	50.018	177.101	3.54	63.1	6.7	113.559	63.541
117	0.8243	4056.023	3946.0	14.0	127.836	50.018	177.854	3.56	62.9	6.7	113.936	63.918

Test Readings for Specimen No. 3

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Princ. Stress ksf	Major Princ. Stress ksf	1:3 Ratio	Buret Read. cc's	Vol. Strain %	P ksf	Q ksf
118	0.8366	4093.652	3983.7	14.3	128.760	50.018	178.778	3.57	62.7	6.8	114.398	64.380
119	0.8488	4126.652	4016.7	14.5	129.524	50.018	179.543	3.59	62.5	6.9	114.781	64.762
120	0.8610	4160.592	4050.6	14.8	130.314	50.018	180.333	3.61	62.3	6.9	115.176	65.157
121	0.8732	4191.714	4081.7	15.0	131.005	50.018	181.023	3.62	62.1	7.0	115.521	65.502
122	0.8855	4222.454	4112.5	15.3	131.675	50.018	181.693	3.63	62.0	7.0	115.856	65.838
123	0.8977	4258.789	4148.8	15.5	132.518	50.018	182.537	3.65	61.8	7.1	116.278	66.259
124	0.9099	4287.270	4177.3	15.8	133.101	50.018	183.119	3.66	61.6	7.1	116.569	66.550
125	0.9221	4319.419	4209.4	16.0	133.796	50.018	183.815	3.67	61.5	7.2	116.917	66.898
126	0.9343	4350.588	4240.6	16.3	134.453	50.018	184.471	3.69	61.3	7.2	117.245	67.226
127	0.9466	4378.225	4268.2	16.5	134.987	50.018	185.005	3.70	61.2	7.2	117.512	67.493
128	0.9588	4404.030	4294.0	16.8	135.459	50.018	185.477	3.71	61.1	7.3	117.748	67.730
129	0.9710	4428.892	4318.9	17.0	135.895	50.018	185.913	3.72	60.9	7.3	117.966	67.947
130	0.9832	4458.596	4348.6	17.3	136.476	50.018	186.494	3.73	60.8	7.4	118.256	68.238
131	0.9955	4483.225	4373.2	17.5	136.892	50.018	186.911	3.74	60.7	7.4	118.465	68.446
132	1.0077	4507.835	4397.8	17.8	137.299	50.018	187.318	3.74	60.5	7.4	118.668	68.650
133	1.0199	4534.373	4424.4	18.0	137.761	50.018	187.779	3.75	60.4	7.5	118.899	68.880
134	1.0321	4556.570	4446.6	18.3	138.083	50.018	188.101	3.76	60.3	7.5	119.060	69.041
135	1.0444	4581.568	4471.6	18.5	138.488	50.018	188.506	3.77	60.2	7.6	119.262	69.244
136	1.0566	4603.215	4493.2	18.8	138.784	50.018	188.802	3.77	60.1	7.6	119.410	69.392
137	1.0688	4627.622	4517.6	19.0	139.156	50.018	189.175	3.78	60.0	7.6	119.596	69.578
138	1.0810	4651.214	4541.2	19.3	139.498	50.018	189.517	3.79	59.9	7.7	119.767	69.749
139	1.0932	4672.124	4562.1	19.5	139.752	50.018	189.771	3.79	59.8	7.7	119.895	69.876
140	1.1055	4696.426	4586.4	19.8	140.108	50.018	190.127	3.80	59.7	7.7	120.073	70.054
141	1.1165	4710.152	4600.2	20.0	140.168	50.018	190.187	3.80	59.6	7.7	120.103	70.084

Cursory interpretations provided require review by a professional engineer. Knight Piesold accepts no responsibility in subsequent analyses.





Specimen No.		1
Initial	Water Content, %	11.0
	Dry Density, pcf	119.8
	Saturation, %	63.9
	Void Ratio	0.4932
	Diameter, in.	2.42
	Height, in.	5.01
At Test	Water Content, %	12.0
	Dry Density, pcf	133.1
	Saturation, %	100.0
	Void Ratio	0.3445
	Diameter, in.	2.32
	Height, in.	4.89
Strain rate, %/min.		0.02
Back Pressure, ksf		7.2
Cell Pressure, ksf		57.1
Fail. Stress, ksf		149.5
Strain, %		20.0
Ult. Stress, ksf		
Strain, %		
σ_1 Failure, ksf		199.4
σ_3 Failure, ksf		50.0

Type of Test:
Consolidated Drained

Sample Type: Reconstituted

Description: silty sand

Assumed Specific Gravity= 2.866

Remarks: Failure chosen at 20% strain.

Figure ________

Client: South 32 - Hermosa Project

Project: Hermosa

Location: Combined Bulk Sample

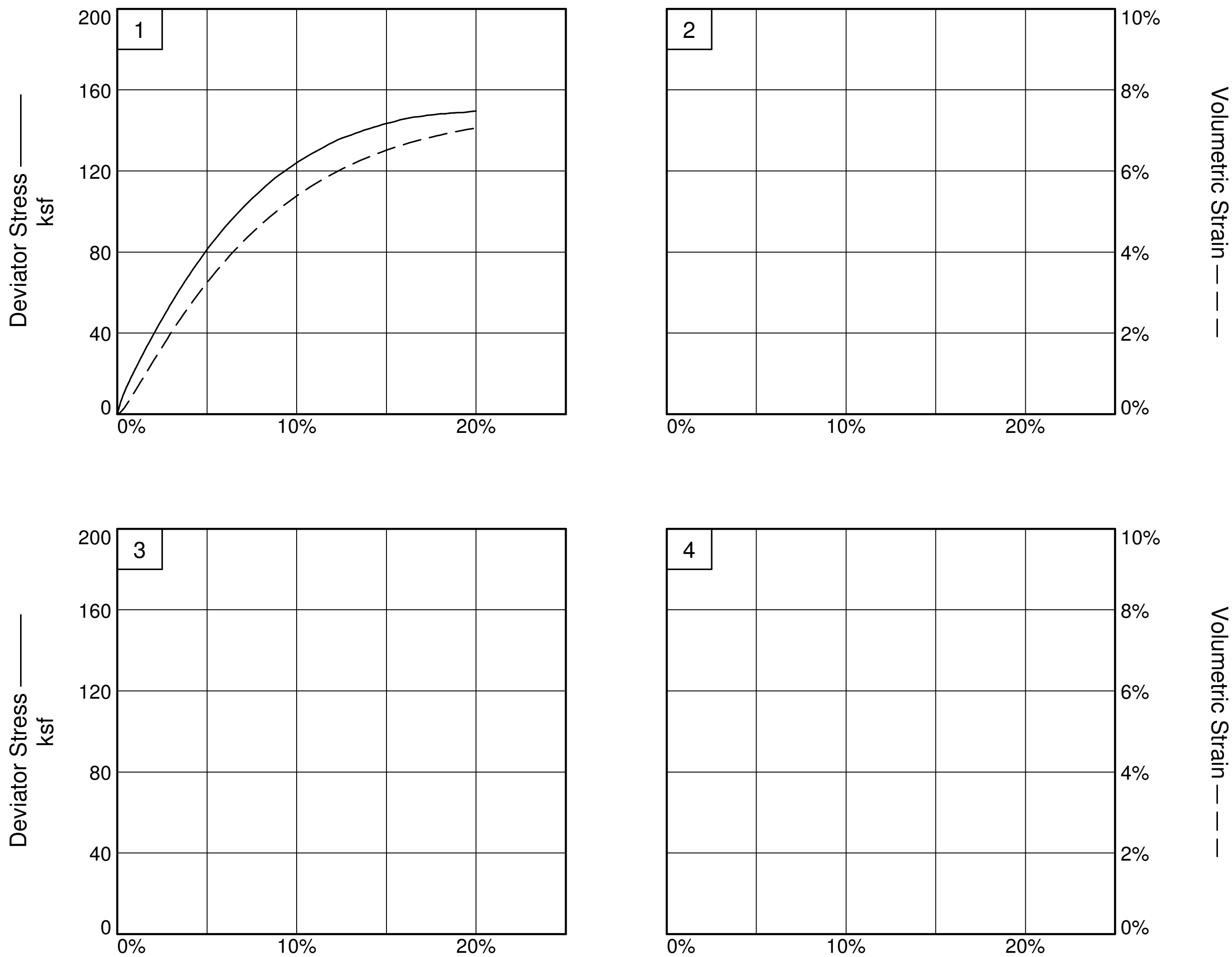
Sample Number: CD @ 95%MDD

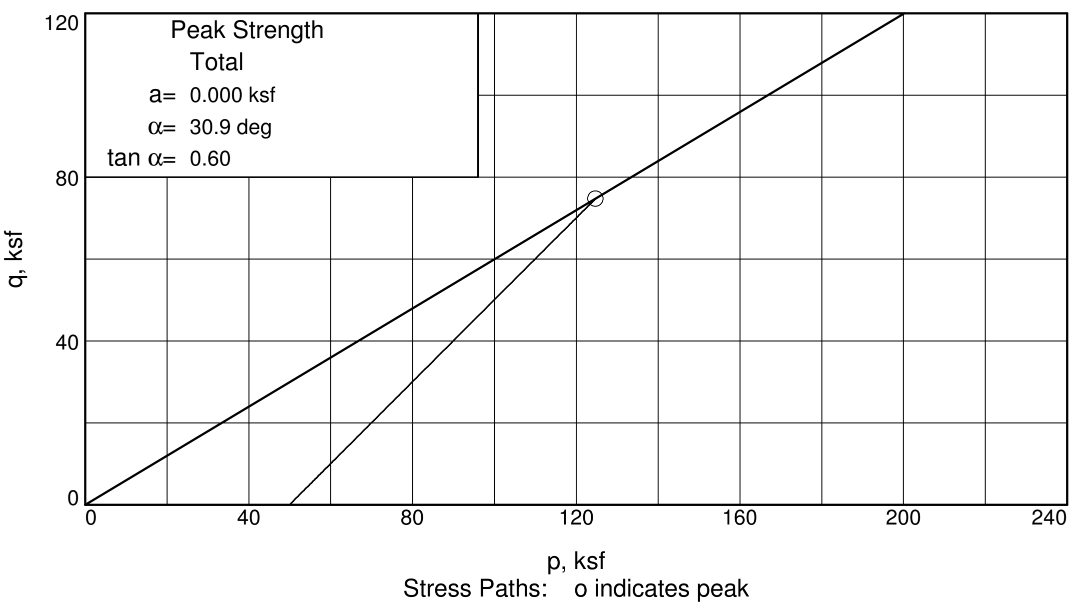
Proj. No.: 101-00777.03 **Date Sampled:**

Knight Piésold CONSULTING

Tested By: JStaley **Checked By:** JBruce

Cursory interpretations provided require review by a professional engineer. Knight Piesold accepts no responsibility in subsequent analyses.





Client: South 32 - Hermosa Project

Project: Hermosa

Location: Combined Bulk Sample **Sample Number:** CD @ 95%MDD

Project No.: 101-00777.03 **Figure** ________

Knight Piesold Geotechnical Lab.

Tested By: JStaley **Checked By:** JBruce

TRIAXIAL COMPRESSION TEST 3/29/2021
Consolidated Drained 12:32 PM

Date:
Client: South 32 - Hermosa Project
Project: Hermosa
Project No.: 101-00777.03
Location: Combined Bulk Sample
Sample Number: CD @ 95%MDD
Description: silty sand
Remarks: Failure chosen at 20% strain.
Type of Sample: Reconstituted
Assumed Specific Gravity=2.866 **LL=** **PL=** **PI=**
Test Method: ASTM D 4767 Method A

Parameters for Specimen No. 1

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	398.180			922.800
Moisture content: Dry soil+tare, gms.	373.020			835.800
Moisture content: Tare, gms.	144.200			112.180
Moisture, %	11.0	17.2	12.0	12.0
Moist specimen weight, gms.	804.0			
Diameter, in.	2.42	2.42	2.32	2.50
Area, in.^{2}	4.60	4.60	4.24	4.92
Height, in.	5.01	5.01	4.89	3.92
Net decrease in height, in.		0.00	0.11	0.98
Net decrease in water volume, cc.			37.60	24.00
Wet density, pcf	133.0	140.4	149.1	160.4
Dry density, pcf	119.8	119.8	133.1	143.2
Void ratio	0.4932	0.4932	0.3445	0.2495
Saturation, %	63.9	100.0	100.0	138.1

Test Readings for Specimen No. 1

Membrane modulus = 0.124105 kN/cm^2
Membrane thickness = 0.02 cm
Filter paper coefficient = 0.001926 kN/cm
Filter paper coverage = 40%
Consolidation cell pressure = 396.810 psi (57.141 ksf)
Consolidation back pressure = 49.930 psi (7.190 ksf)
Consolidation effective confining stress = 49.951 ksf
Strain rate, %/min. = 0.02
Fail. Stress = 149.492 ksf **at reading no.** 141

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Princ. Stress ksf	Major Princ. Stress ksf	1:3 Ratio	Buret Read. cc's	Vol. Strain %	P ksf	Q ksf
0	0.1120	130.719	0.0	0.0	0.000	49.951	49.951	1.00	120.2	0.0	49.951	0.000
1	0.1132	152.771	22.1	0.0	0.749	49.951	50.700	1.02	120.2	0.0	50.325	0.375
2	0.1145	180.555	49.8	0.1	1.693	49.951	51.644	1.03	120.1	0.0	50.797	0.847
3	0.1157	205.448	74.7	0.1	2.539	49.951	52.490	1.05	120.1	0.0	51.220	1.269
4	0.1169	229.209	98.5	0.1	3.345	49.951	53.296	1.07	120.1	0.0	51.623	1.673
5	0.1181	249.397	118.7	0.1	4.030	49.951	53.981	1.08	120.1	0.0	51.966	2.015
6	0.1194	273.998	143.3	0.2	4.865	49.951	54.816	1.10	120.0	0.0	52.383	2.433
7	0.1206	298.573	167.9	0.2	5.699	49.951	55.649	1.11	120.0	0.0	52.800	2.849
8	0.1218	316.952	186.2	0.2	6.322	49.951	56.272	1.13	120.0	0.1	53.112	3.161
9	0.1230	336.811	206.1	0.2	6.995	49.951	56.946	1.14	119.9	0.1	53.448	3.497
10	0.1243	354.443	223.7	0.3	7.592	49.951	57.543	1.15	119.9	0.1	53.747	3.796
11	0.1255	371.806	241.1	0.3	8.181	49.951	58.131	1.16	119.9	0.1	54.041	4.090
12	0.1267	392.896	262.2	0.3	8.895	49.951	58.846	1.18	119.8	0.1	54.398	4.448
13	0.1279	410.748	280.0	0.3	9.500	49.951	59.450	1.19	119.8	0.1	54.701	4.750
14	0.1292	422.840	292.1	0.4	9.909	49.951	59.860	1.20	119.7	0.1	54.905	4.954
15	0.1304	437.768	307.0	0.4	10.414	49.951	60.365	1.21	119.7	0.1	55.158	5.207
16	0.1316	452.850	322.1	0.4	10.924	49.951	60.875	1.22	119.6	0.2	55.413	5.462
17	0.1328	469.773	339.1	0.4	11.497	49.951	61.448	1.23	119.6	0.2	55.699	5.749
18	0.1341	488.703	358.0	0.5	12.138	49.951	62.089	1.24	119.5	0.2	56.020	6.069
19	0.1353	502.317	371.6	0.5	12.598	49.951	62.549	1.25	119.5	0.2	56.250	6.299
20	0.1365	516.778	386.1	0.5	13.087	49.951	63.038	1.26	119.4	0.2	56.494	6.544
21	0.1377	530.195	399.5	0.5	13.541	49.951	63.492	1.27	119.4	0.2	56.721	6.771
22	0.1390	543.760	413.0	0.6	14.000	49.951	63.951	1.28	119.3	0.3	56.951	7.000
23	0.1402	557.742	427.0	0.6	14.473	49.951	64.423	1.29	119.2	0.3	57.187	7.236
24	0.1414	572.401	441.7	0.6	14.968	49.951	64.919	1.30	119.2	0.3	57.435	7.484
25	0.1426	589.907	459.2	0.6	15.560	49.951	65.511	1.31	119.1	0.3	57.731	7.780
26	0.1439	596.393	465.7	0.7	15.778	49.951	65.729	1.32	119.1	0.3	57.840	7.889
27	0.1451	614.306	483.6	0.7	16.384	49.951	66.335	1.33	119.0	0.3	58.143	8.192
28	0.1463	626.645	495.9	0.7	16.801	49.951	66.752	1.34	118.9	0.4	58.351	8.401
29	0.1475	643.436	512.7	0.7	17.368	49.951	67.319	1.35	118.9	0.4	58.635	8.684
30	0.1488	657.111	526.4	0.8	17.830	49.951	67.781	1.36	118.8	0.4	58.866	8.915
31	0.1500	670.720	540.0	0.8	18.290	49.951	68.241	1.37	118.8	0.4	59.096	9.145
32	0.1512	683.779	553.1	0.8	18.731	49.951	68.682	1.37	118.7	0.4	59.316	9.366
33	0.1524	696.932	566.2	0.8	19.176	49.951	69.126	1.38	118.6	0.5	59.539	9.588
34	0.1537	708.013	577.3	0.9	19.549	49.951	69.500	1.39	118.6	0.5	59.725	9.774
35	0.1549	723.601	592.9	0.9	20.076	49.951	70.026	1.40	118.5	0.5	59.989	10.038
36	0.1561	738.391	607.7	0.9	20.575	49.951	70.526	1.41	118.5	0.5	60.238	10.287
37	0.1573	750.841	620.1	0.9	20.995	49.951	70.946	1.42	118.4	0.5	60.448	10.497
38	0.1585	764.318	633.6	1.0	21.449	49.951	71.400	1.43	118.3	0.5	60.675	10.725
39	0.1598	775.613	644.9	1.0	21.830	49.951	71.781	1.44	118.3	0.6	60.866	10.915
40	0.1610	790.832	660.1	1.0	22.344	49.951	72.295	1.45	118.2	0.6	61.123	11.172
41	0.1622	804.749	674.0	1.0	22.814	49.951	72.765	1.46	118.2	0.6	61.358	11.407
42	0.1671	856.832	726.1	1.1	24.570	49.951	74.521	1.49	117.9	0.7	62.236	12.285
43	0.1720	906.673	776.0	1.2	26.249	49.951	76.200	1.53	117.7	0.7	63.075	13.124
44	0.1769	960.428	829.7	1.3	28.060	49.951	78.010	1.56	117.4	0.8	63.981	14.030
45	0.1818	1009.213	878.5	1.4	29.701	49.951	79.652	1.59	117.2	0.9	64.801	14.851
46	0.1867	1059.884	929.2	1.5	31.406	49.951	81.356	1.63	116.9	1.0	65.654	15.703

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Princ. Stress ksf	Major Princ. Stress ksf	1:3 Ratio	Buret Read. cc's	Vol. Strain %	P ksf	Q ksf
47	0.1916	1112.825	982.1	1.6	33.186	49.951	83.137	1.66	116.7	1.0	66.544	16.593
48	0.1965	1156.598	1025.9	1.7	34.656	49.951	84.606	1.69	116.4	1.1	67.279	17.328
49	0.2014	1206.467	1075.7	1.8	36.330	49.951	86.280	1.73	116.2	1.2	68.116	18.165
50	0.2063	1255.384	1124.7	1.9	37.972	49.951	87.922	1.76	115.9	1.3	68.937	18.986
51	0.2112	1303.115	1172.4	2.0	39.571	49.951	89.522	1.79	115.7	1.3	69.736	19.786
52	0.2161	1352.670	1222.0	2.1	41.232	49.951	91.182	1.83	115.4	1.4	70.566	20.616
53	0.2210	1399.675	1269.0	2.2	42.805	49.951	92.755	1.86	115.2	1.5	71.353	21.402
54	0.2259	1447.911	1317.2	2.3	44.418	49.951	94.369	1.89	114.9	1.5	72.160	22.209
55	0.2308	1493.575	1362.9	2.4	45.945	49.951	95.896	1.92	114.7	1.6	72.923	22.973
56	0.2357	1537.128	1406.4	2.5	47.397	49.951	97.348	1.95	114.5	1.7	73.649	23.699
57	0.2406	1585.232	1454.5	2.6	49.004	49.951	98.954	1.98	114.2	1.8	74.453	24.502
58	0.2455	1630.187	1499.5	2.7	50.501	49.951	100.452	2.01	114.0	1.8	75.201	25.250
59	0.2504	1674.839	1544.1	2.8	51.988	49.951	101.939	2.04	113.8	1.9	75.945	25.994
60	0.2553	1718.568	1587.8	2.9	53.443	49.951	103.394	2.07	113.5	2.0	76.672	26.722
61	0.2602	1759.247	1628.5	3.0	54.793	49.951	104.744	2.10	113.3	2.0	77.347	27.397
62	0.2651	1803.833	1673.1	3.1	56.274	49.951	106.224	2.13	113.1	2.1	78.088	28.137
63	0.2700	1849.777	1719.1	3.2	57.799	49.951	107.750	2.16	112.8	2.2	78.850	28.900
64	0.2748	1895.199	1764.5	3.3	59.304	49.951	109.255	2.19	112.6	2.2	79.603	29.652
65	0.2797	1936.576	1805.9	3.4	60.672	49.951	110.623	2.21	112.4	2.3	80.287	30.336
66	0.2846	1977.804	1847.1	3.5	62.034	49.951	111.985	2.24	112.2	2.4	80.968	31.017
67	0.2895	2017.812	1887.1	3.6	63.354	49.951	113.304	2.27	112.0	2.4	81.628	31.677
68	0.2944	2061.722	1931.0	3.7	64.802	49.951	114.753	2.30	111.8	2.5	82.352	32.401
69	0.2993	2102.873	1972.2	3.8	66.157	49.951	116.108	2.32	111.5	2.5	83.029	33.079
70	0.3042	2144.910	2014.2	3.9	67.541	49.951	117.491	2.35	111.3	2.6	83.721	33.770
71	0.3091	2181.609	2050.9	4.0	68.745	49.951	118.695	2.38	111.1	2.7	84.323	34.372
72	0.3140	2224.810	2094.1	4.1	70.163	49.951	120.113	2.40	110.9	2.7	85.032	35.081
73	0.3189	2265.917	2135.2	4.2	71.512	49.951	121.463	2.43	110.7	2.8	85.707	35.756
74	0.3238	2303.078	2172.4	4.3	72.723	49.951	122.674	2.46	110.5	2.8	86.312	36.362
75	0.3287	2341.635	2210.9	4.4	73.982	49.951	123.932	2.48	110.3	2.9	86.942	36.991
76	0.3336	2380.198	2249.5	4.5	75.240	49.951	125.190	2.51	110.1	3.0	87.571	37.620
77	0.3385	2417.617	2286.9	4.6	76.457	49.951	126.408	2.53	109.9	3.0	88.179	38.229
78	0.3434	2455.872	2325.2	4.7	77.701	49.951	127.652	2.56	109.7	3.1	88.801	38.851
79	0.3483	2494.461	2363.7	4.8	78.955	49.951	128.906	2.58	109.5	3.1	89.428	39.477
80	0.3532	2533.222	2402.5	4.9	80.212	49.951	130.163	2.61	109.3	3.2	90.057	40.106
81	0.3581	2572.818	2442.1	5.0	81.495	49.951	131.446	2.63	109.1	3.3	90.698	40.748
82	0.3703	2661.595	2530.9	5.3	84.356	49.951	134.307	2.69	108.6	3.4	92.129	42.178
83	0.3826	2744.298	2613.6	5.5	87.005	49.951	136.955	2.74	108.2	3.5	93.453	43.502
84	0.3948	2832.174	2701.5	5.8	89.814	49.951	139.764	2.80	107.7	3.7	94.858	44.907
85	0.4070	2915.081	2784.4	6.0	92.446	49.951	142.397	2.85	107.3	3.8	96.174	46.223
86	0.4193	2997.510	2866.8	6.3	95.054	49.951	145.005	2.90	106.9	3.9	97.478	47.527
87	0.4315	3073.992	2943.3	6.5	97.449	49.951	147.400	2.95	106.5	4.0	98.675	48.725
88	0.4438	3149.820	3019.1	6.8	99.814	49.951	149.765	3.00	106.1	4.1	99.858	49.907
89	0.4560	3224.109	3093.4	7.0	102.117	49.951	152.067	3.04	105.7	4.3	101.009	51.058
90	0.4682	3296.105	3165.4	7.3	104.332	49.951	154.283	3.09	105.3	4.4	102.117	52.166
91	0.4805	3366.662	3235.9	7.5	106.491	49.951	156.442	3.13	105.0	4.5	103.196	53.246
92	0.4927	3433.284	3302.6	7.8	108.506	49.951	158.457	3.17	104.6	4.6	104.204	54.253
93	0.5050	3501.103	3370.4	8.0	110.552	49.951	160.502	3.21	104.3	4.7	105.227	55.276

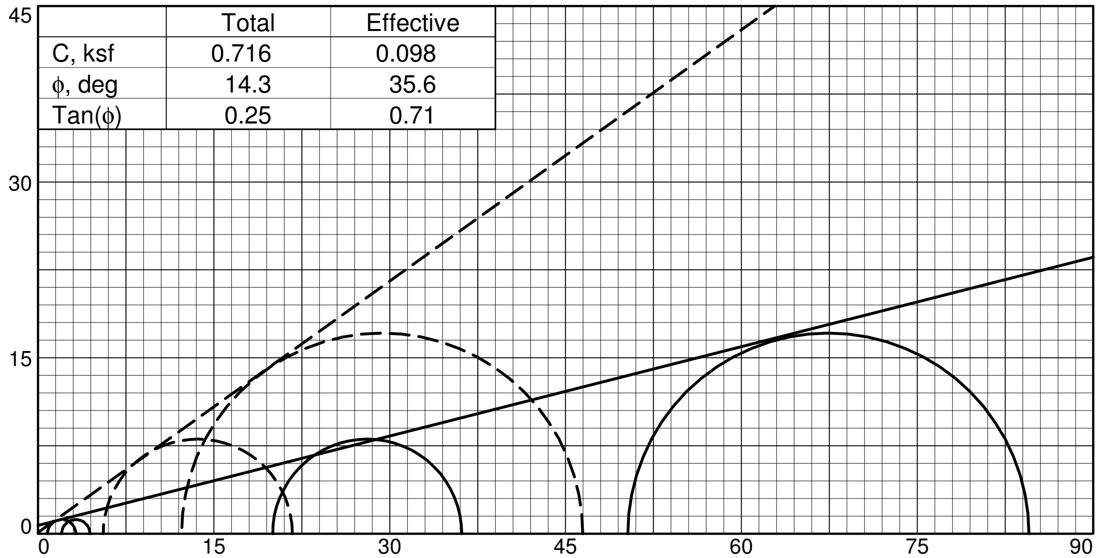
Test Readings for Specimen No. 1

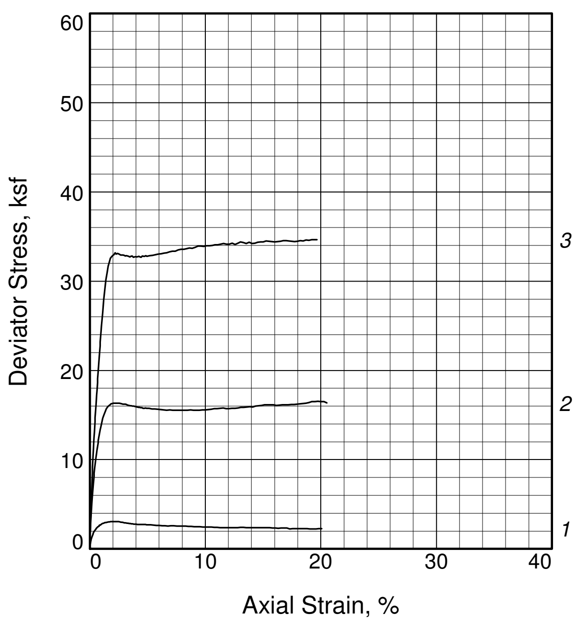
No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Princ. Stress ksf	Major Princ. Stress ksf	1:3 Ratio	Buret Read. cc's	Vol. Strain %	P ksf	Q ksf
94	0.5172	3568.560	3437.8	8.3	112.574	49.951	162.524	3.25	103.9	4.8	106.238	56.287
95	0.5294	3634.599	3503.9	8.5	114.537	49.951	164.488	3.29	103.6	4.9	107.219	57.269
96	0.5417	3700.555	3569.8	8.8	116.487	49.951	166.438	3.33	103.3	5.0	108.194	58.244
97	0.5539	3756.442	3625.7	9.0	118.099	49.951	168.050	3.36	103.0	5.1	109.000	59.049
98	0.5662	3807.778	3677.1	9.3	119.552	49.951	169.503	3.39	102.7	5.1	109.727	59.776
99	0.5784	3865.078	3734.4	9.5	121.190	49.951	171.141	3.43	102.4	5.2	110.546	60.595
100	0.5906	3917.601	3786.9	9.8	122.660	49.951	172.611	3.46	102.1	5.3	111.281	61.330
101	0.6029	3974.560	3843.8	10.0	124.266	49.951	174.217	3.49	101.8	5.4	112.084	62.133
102	0.6151	4023.296	3892.6	10.3	125.589	49.951	175.540	3.51	101.6	5.5	112.745	62.795
103	0.6274	4073.983	3943.3	10.5	126.969	49.951	176.920	3.54	101.3	5.5	113.435	63.485
104	0.6396	4122.873	3992.2	10.8	128.284	49.951	178.235	3.57	101.1	5.6	114.093	64.142
105	0.6518	4169.153	4038.4	11.0	129.500	49.951	179.451	3.59	100.9	5.7	114.701	64.750
106	0.6641	4214.360	4083.6	11.3	130.673	49.951	180.624	3.62	100.6	5.7	115.287	65.336
107	0.6763	4258.589	4127.9	11.5	131.807	49.951	181.758	3.64	100.4	5.8	115.854	65.904
108	0.6886	4308.013	4177.3	11.8	133.096	49.951	183.047	3.66	100.2	5.9	116.499	66.548
109	0.7008	4349.851	4219.1	12.0	134.134	49.951	184.084	3.69	100.0	5.9	117.017	67.067
110	0.7130	4397.191	4266.5	12.3	135.336	49.951	185.287	3.71	99.8	6.0	117.619	67.668
111	0.7253	4437.617	4306.9	12.5	136.311	49.951	186.262	3.73	99.6	6.0	118.106	68.155
112	0.7375	4470.556	4339.8	12.8	137.040	49.951	186.990	3.74	99.4	6.1	118.471	68.520
113	0.7498	4501.556	4370.8	13.0	137.700	49.951	187.651	3.76	99.3	6.2	118.801	68.850
114	0.7620	4539.349	4408.6	13.3	138.566	49.951	188.517	3.77	99.1	6.2	119.234	69.283
115	0.7742	4577.114	4446.4	13.5	139.423	49.951	189.374	3.79	98.9	6.3	119.662	69.712
116	0.7865	4612.187	4481.5	13.8	140.185	49.951	190.136	3.81	98.8	6.3	120.043	70.093
117	0.7987	4644.588	4513.9	14.0	140.860	49.951	190.811	3.82	98.6	6.3	120.381	70.430
118	0.8110	4677.329	4546.6	14.3	141.534	49.951	191.485	3.83	98.5	6.4	120.718	70.767
119	0.8232	4707.290	4576.6	14.5	142.115	49.951	192.066	3.85	98.3	6.4	121.008	71.057
120	0.8354	4741.829	4611.1	14.8	142.829	49.951	192.780	3.86	98.2	6.5	121.365	71.415
121	0.8477	4773.136	4642.4	15.0	143.439	49.951	193.390	3.87	98.0	6.5	121.670	71.720
122	0.8599	4802.075	4671.4	15.3	143.967	49.951	193.918	3.88	97.9	6.6	121.934	71.984
123	0.8722	4833.668	4702.9	15.5	144.568	49.951	194.519	3.89	97.8	6.6	122.235	72.284
124	0.8844	4866.267	4735.5	15.8	145.195	49.951	195.146	3.91	97.7	6.6	122.548	72.598
125	0.8966	4897.140	4766.4	16.0	145.760	49.951	195.711	3.92	97.6	6.7	122.831	72.880
126	0.9089	4922.225	4791.5	16.3	146.143	49.951	196.094	3.93	97.4	6.7	123.022	73.072
127	0.9211	4948.861	4818.1	16.5	146.564	49.951	196.515	3.93	97.3	6.7	123.233	73.282
128	0.9334	4968.549	4837.8	16.8	146.770	49.951	196.721	3.94	97.2	6.8	123.336	73.385
129	0.9456	4990.798	4860.1	17.0	147.050	49.951	197.001	3.94	97.1	6.8	123.476	73.525
130	0.9578	5016.317	4885.6	17.3	147.420	49.951	197.371	3.95	97.0	6.8	123.661	73.710
131	0.9701	5034.439	4903.7	17.5	147.562	49.951	197.513	3.95	96.9	6.8	123.732	73.781
132	0.9823	5058.865	4928.1	17.8	147.891	49.951	197.842	3.96	96.9	6.9	123.896	73.946
133	0.9946	5081.922	4951.2	18.0	148.171	49.951	198.122	3.97	96.8	6.9	124.036	74.086
134	1.0068	5099.010	4968.3	18.3	148.269	49.951	198.220	3.97	96.7	6.9	124.085	74.134
135	1.0190	5122.469	4991.7	18.5	148.551	49.951	198.502	3.97	96.6	6.9	124.226	74.276
136	1.0313	5138.474	5007.8	18.8	148.607	49.951	198.558	3.98	96.5	7.0	124.254	74.304
137	1.0435	5160.542	5029.8	19.0	148.836	49.951	198.787	3.98	96.5	7.0	124.369	74.418
138	1.0558	5176.069	5045.3	19.3	148.869	49.951	198.819	3.98	96.4	7.0	124.385	74.434
139	1.0680	5198.423	5067.7	19.5	149.104	49.951	199.055	3.99	96.3	7.0	124.503	74.552
140	1.0802	5224.959	5094.2	19.8	149.446	49.951	199.397	3.99	96.2	7.0	124.674	74.723

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Princ. Stress ksf	Major Princ. Stress ksf	1:3 Ratio	Buret Read. cc's	Vol. Strain %	P ksf	Q ksf
141	1.0911	5239.623	5108.9	20.0	149.492	49.951	199.442	3.99	96.2	7.1	124.697	74.746

	Total	Effective
C, ksf	0.716	0.098
ϕ, deg	14.3	35.6
Tan(ϕ)	0.25	0.71





	Specimen No.	1	2	3
Initial	Water Content, %	11.6	11.5	11.3
	Dry Density, pcf	113.8	113.2	114.3
	Saturation, %	58.2	56.2	57.5
	Void Ratio	0.5719	0.5917	0.5650
	Diameter, in.	2.42	2.42	2.42
	Height, in.	4.99	5.02	4.98
At Test	Water Content, %	18.3	16.9	15.4
	Dry Density, pcf	117.3	121.0	124.2
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.5258	0.4893	0.4402
	Diameter, in.	2.38	2.37	2.36
	Height, in.	4.97	4.90	4.81
	Strain rate, %/min.	0.03	0.03	0.03
	Eff. Cell Pressure, ksf	2.01	20.01	50.30
	Fail. Stress, ksf	2.41	16.13	34.23
	Excess Pore Pr., ksf	1.21	14.45	38.07
	Strain, %	13.0	15.1	11.6
	Ult. Stress, ksf			
	Excess Pore Pr., ksf			
	Strain, %			
	$\bar{\sigma}_1$ Failure, ksf	3.20	21.69	46.46
	$\bar{\sigma}_3$ Failure, ksf	0.80	5.55	12.23

Type of Test:
CU with Pore Pressures

Sample Type: Reconstituted

Description: silty sand

LL= NP **PI=** NP

Specific Gravity= 2.866

Remarks: Failure chosen at peak principal stress ratio.

Figure ________

Client: South 32 - Hermosa Project

Project: Hermosa

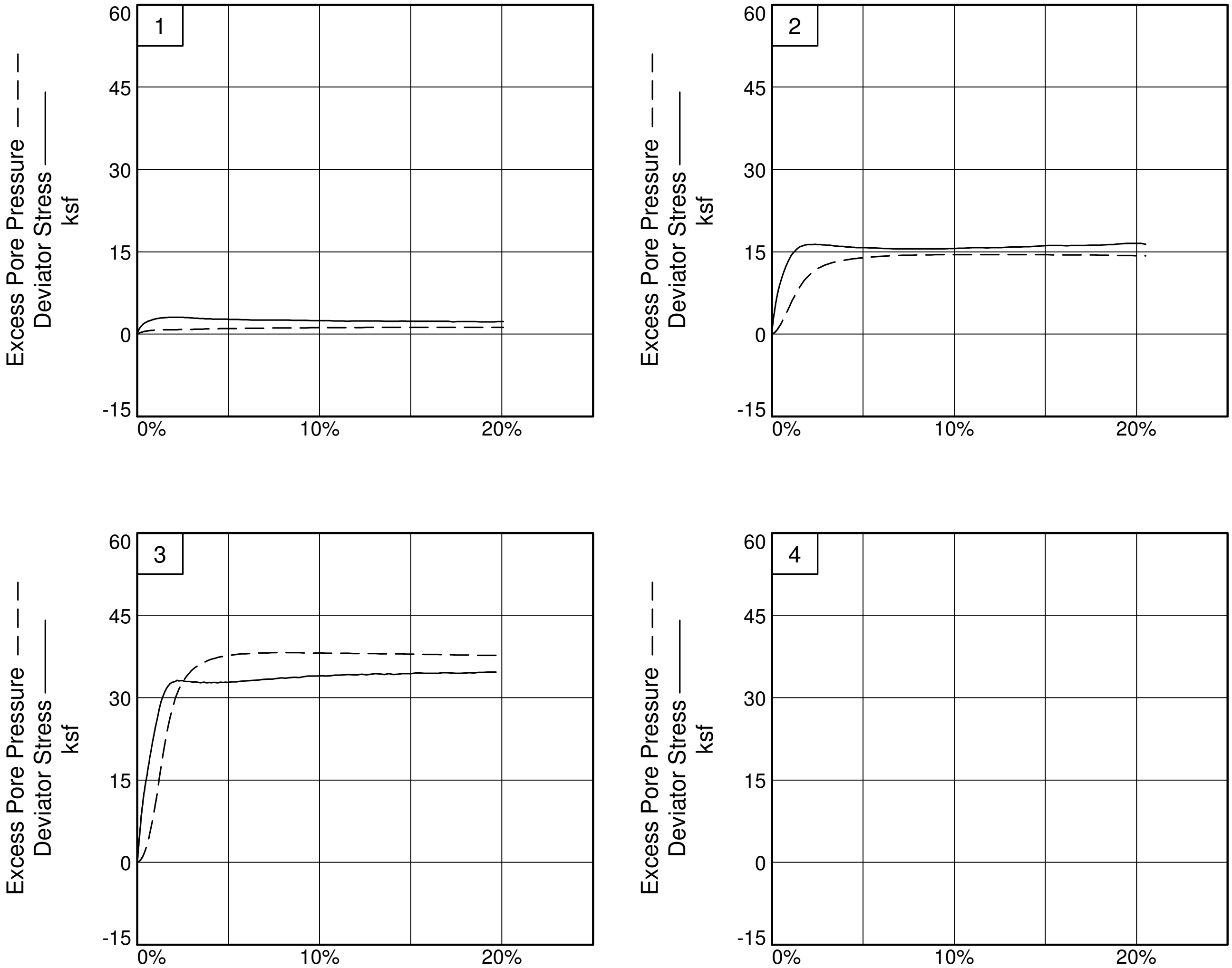
Location: Combined Bulk Sample

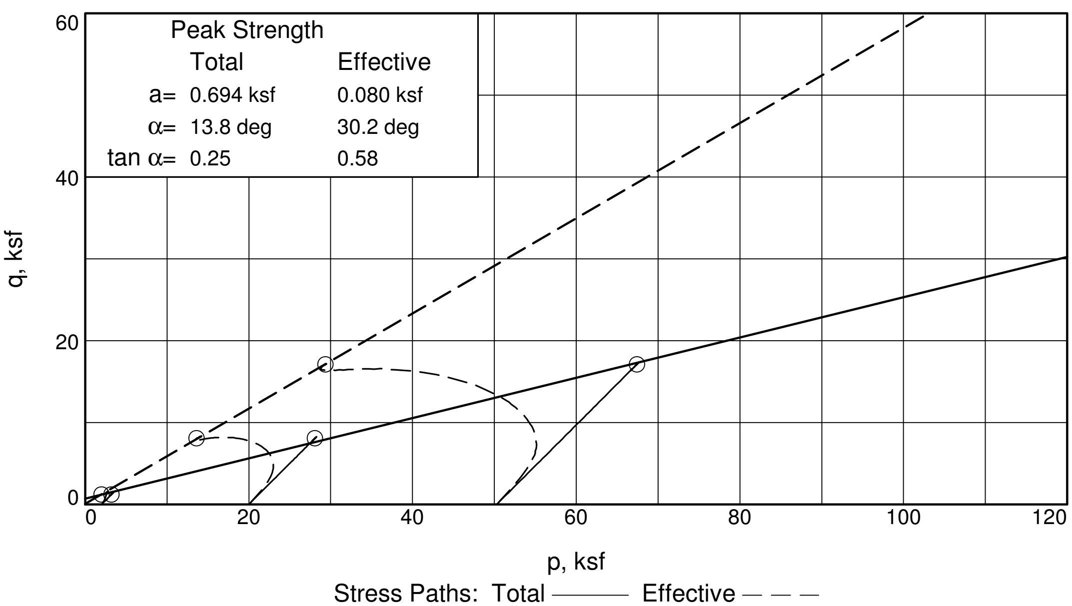
Sample Number: CU

Proj. No.: TU101-00777/03 **Date Sampled:** 6/16/20

Knight Piésold CONSULTING

Tested By: JStaley **Checked By:** JBruce





Client: South 32 - Hermosa Project

Project: Hermosa

Location: Combined Bulk Sample

Sample Number: CU

Project No.: TU101-00777/03

Figure ________

Knight Piesold Geotechnical Lab.

Tested By: JStaley

Checked By: JBruce

7/14/2020
11:44 AM

TRIAXIAL COMPRESSION TEST

CU with Pore Pressures

Date: 6/16/20
Client: South 32 - Hermosa Project
Project: Hermosa
Project No.: TU101-00777/03
Location: Combined Bulk Sample
Sample Number: CU
Description: silty sand
Remarks: Failure chosen at peak principal stress ratio.
Type of Sample: Reconstituted
Specific Gravity=2.866 **LL=**NP **PL=** **PI=**NP
Test Method: ASTM D 4767 Method A

Parameters for Specimen No. 1

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	761.800			919.900
Moisture content: Dry soil+tare, gms.	682.500			794.700
Moisture content: Tare, gms.	0.000			112.200
Moisture, %	11.6	20.0	18.3	18.3
Moist specimen weight, gms.	761.8			
Diameter, in.	2.42	2.42	2.38	
Area, in.²	4.58	4.58	4.46	
Height, in.	4.99	4.99	4.97	
Net decrease in height, in.		0.00	0.01	
Net decrease in water volume, cc.			11.00	
Wet density, pcf	127.0	136.5	138.8	
Dry density, pcf	113.8	113.8	117.3	
Void ratio	0.5719	0.5719	0.5258	
Saturation, %	58.2	100.0	100.0	

Test Readings for Specimen No. 1

Membrane modulus = 0.124105 kN/cm²
Membrane thickness = 0.04 cm
Consolidation cell pressure = 64.010 psi (9.217 ksf)
Consolidation back pressure = 50.060 psi (7.209 ksf)
Consolidation effective confining stress = 2.009 ksf
Strain rate, %/min. = 0.03
Fail. Stress = 2.406 ksf **at reading no.** 112

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0467	0.000	0.0	0.0	0.000	2.009	2.009	1.00	50.059	2.009	0.000
1	0.0479	10.577	10.6	0.0	0.342	1.967	2.308	1.17	50.353	2.137	0.171
2	0.0492	17.468	17.5	0.1	0.564	1.926	2.490	1.29	50.636	2.208	0.282
3	0.0504	23.052	23.1	0.1	0.744	1.885	2.630	1.39	50.916	2.258	0.372
4	0.0517	28.654	28.7	0.1	0.925	1.845	2.770	1.50	51.199	2.307	0.462
5	0.0529	33.375	33.4	0.1	1.077	1.805	2.882	1.60	51.473	2.344	0.538
6	0.0542	37.162	37.2	0.2	1.199	1.769	2.968	1.68	51.725	2.368	0.599
7	0.0554	40.680	40.7	0.2	1.312	1.736	3.048	1.76	51.955	2.392	0.656
8	0.0567	43.605	43.6	0.2	1.406	1.706	3.112	1.82	52.161	2.409	0.703
9	0.0579	46.402	46.4	0.2	1.496	1.678	3.174	1.89	52.358	2.426	0.748
10	0.0592	49.408	49.4	0.3	1.592	1.651	3.243	1.96	52.547	2.447	0.796
11	0.0604	51.933	51.9	0.3	1.673	1.625	3.298	2.03	52.729	2.461	0.837
12	0.0617	54.682	54.7	0.3	1.761	1.599	3.361	2.10	52.904	2.480	0.881
13	0.0629	56.539	56.5	0.3	1.821	1.577	3.397	2.15	53.061	2.487	0.910
14	0.0642	58.373	58.4	0.4	1.879	1.556	3.435	2.21	53.203	2.496	0.940
15	0.0654	60.188	60.2	0.4	1.937	1.537	3.474	2.26	53.335	2.506	0.969
16	0.0667	62.082	62.1	0.4	1.998	1.518	3.516	2.32	53.465	2.517	0.999
17	0.0679	63.881	63.9	0.4	2.055	1.501	3.556	2.37	53.588	2.528	1.028
18	0.0692	65.105	65.1	0.5	2.094	1.485	3.578	2.41	53.700	2.532	1.047
19	0.0704	66.669	66.7	0.5	2.144	1.469	3.613	2.46	53.807	2.541	1.072
20	0.0716	68.280	68.3	0.5	2.195	1.455	3.650	2.51	53.905	2.553	1.097
21	0.0729	69.335	69.3	0.5	2.228	1.441	3.669	2.55	54.003	2.555	1.114
22	0.0741	70.964	71.0	0.6	2.280	1.428	3.708	2.60	54.093	2.568	1.140
23	0.0754	72.103	72.1	0.6	2.316	1.415	3.731	2.64	54.181	2.573	1.158
24	0.0766	72.829	72.8	0.6	2.339	1.403	3.742	2.67	54.265	2.573	1.169
25	0.0779	74.064	74.1	0.6	2.378	1.393	3.771	2.71	54.333	2.582	1.189
26	0.0791	75.079	75.1	0.7	2.410	1.384	3.793	2.74	54.402	2.588	1.205
27	0.0804	76.031	76.0	0.7	2.440	1.374	3.813	2.78	54.471	2.593	1.220
28	0.0816	76.998	77.0	0.7	2.470	1.364	3.834	2.81	54.536	2.599	1.235
29	0.0829	78.015	78.0	0.7	2.502	1.356	3.858	2.85	54.597	2.607	1.251
30	0.0841	78.911	78.9	0.8	2.530	1.347	3.878	2.88	54.654	2.612	1.265
31	0.0854	79.611	79.6	0.8	2.552	1.339	3.891	2.91	54.709	2.615	1.276
32	0.0866	80.224	80.2	0.8	2.571	1.332	3.903	2.93	54.758	2.618	1.285
33	0.0879	81.410	81.4	0.8	2.608	1.325	3.934	2.97	54.806	2.630	1.304
34	0.0891	82.695	82.7	0.9	2.649	1.320	3.969	3.01	54.844	2.644	1.324
35	0.0904	82.745	82.7	0.9	2.650	1.313	3.962	3.02	54.895	2.637	1.325
36	0.0916	83.412	83.4	0.9	2.670	1.306	3.977	3.04	54.939	2.641	1.335
37	0.0929	84.276	84.3	0.9	2.697	1.301	3.999	3.07	54.974	2.650	1.349
38	0.0941	84.930	84.9	1.0	2.718	1.296	4.014	3.10	55.011	2.655	1.359
39	0.0954	85.625	85.6	1.0	2.739	1.291	4.030	3.12	55.047	2.660	1.370
40	0.0966	86.418	86.4	1.0	2.764	1.286	4.050	3.15	55.078	2.668	1.382
41	0.1016	88.471	88.5	1.1	2.827	1.269	4.095	3.23	55.199	2.682	1.413
42	0.1066	90.446	90.4	1.2	2.887	1.256	4.143	3.30	55.287	2.699	1.443
43	0.1116	92.110	92.1	1.3	2.937	1.245	4.182	3.36	55.363	2.714	1.468
44	0.1166	93.196	93.2	1.4	2.969	1.236	4.205	3.40	55.426	2.720	1.484
45	0.1216	94.006	94.0	1.5	2.991	1.228	4.219	3.44	55.484	2.723	1.496
46	0.1266	95.070	95.1	1.6	3.022	1.221	4.243	3.48	55.531	2.732	1.511

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
47	0.1316	95.625	95.6	1.7	3.037	1.216	4.253	3.50	55.566	2.734	1.518
48	0.1366	96.153	96.2	1.8	3.050	1.211	4.262	3.52	55.598	2.736	1.525
49	0.1416	96.379	96.4	1.9	3.054	1.206	4.260	3.53	55.635	2.733	1.527
50	0.1465	96.972	97.0	2.0	3.070	1.203	4.273	3.55	55.658	2.738	1.535
51	0.1515	96.671	96.7	2.1	3.057	1.196	4.253	3.56	55.704	2.725	1.529
52	0.1565	96.919	96.9	2.2	3.062	1.191	4.253	3.57	55.738	2.722	1.531
53	0.1615	96.904	96.9	2.3	3.058	1.188	4.246	3.58	55.762	2.717	1.529
54	0.1665	96.567	96.6	2.4	3.045	1.181	4.225	3.58	55.811	2.703	1.522
55	0.1715	97.017	97.0	2.5	3.056	1.176	4.231	3.60	55.845	2.704	1.528
56	0.1765	96.384	96.4	2.6	3.033	1.169	4.202	3.59	55.889	2.686	1.516
57	0.1815	95.107	95.1	2.7	2.989	1.160	4.149	3.58	55.954	2.655	1.495
58	0.1865	95.350	95.4	2.8	2.994	1.153	4.147	3.60	56.002	2.650	1.497
59	0.1915	94.483	94.5	2.9	2.964	1.145	4.108	3.59	56.062	2.626	1.482
60	0.1965	93.378	93.4	3.0	2.926	1.135	4.061	3.58	56.125	2.598	1.463
61	0.2014	93.277	93.3	3.1	2.920	1.128	4.048	3.59	56.176	2.588	1.460
62	0.2064	92.657	92.7	3.2	2.897	1.118	4.016	3.59	56.243	2.567	1.449
63	0.2114	92.184	92.2	3.3	2.880	1.109	3.989	3.60	56.307	2.549	1.440
64	0.2164	91.700	91.7	3.4	2.861	1.101	3.963	3.60	56.362	2.532	1.431
65	0.2214	91.370	91.4	3.5	2.848	1.094	3.943	3.60	56.411	2.518	1.424
66	0.2264	90.610	90.6	3.6	2.822	1.086	3.907	3.60	56.470	2.497	1.411
67	0.2314	90.101	90.1	3.7	2.803	1.077	3.880	3.60	56.530	2.479	1.401
68	0.2364	89.696	89.7	3.8	2.787	1.068	3.855	3.61	56.594	2.462	1.394
69	0.2414	89.338	89.3	3.9	2.773	1.059	3.833	3.62	56.653	2.446	1.387
70	0.2464	89.048	89.0	4.0	2.761	1.051	3.812	3.63	56.711	2.432	1.381
71	0.2514	88.617	88.6	4.1	2.745	1.044	3.789	3.63	56.763	2.416	1.373
72	0.2564	88.777	88.8	4.2	2.747	1.039	3.786	3.65	56.797	2.412	1.374
73	0.2614	88.739	88.7	4.3	2.743	1.034	3.777	3.65	56.830	2.405	1.372
74	0.2664	88.712	88.7	4.4	2.739	1.029	3.768	3.66	56.864	2.399	1.370
75	0.2714	88.405	88.4	4.5	2.727	1.022	3.749	3.67	56.916	2.385	1.364
76	0.2764	88.271	88.3	4.6	2.720	1.017	3.737	3.67	56.948	2.377	1.360
77	0.2813	88.404	88.4	4.7	2.721	1.012	3.734	3.69	56.980	2.373	1.361
78	0.2863	88.464	88.5	4.8	2.720	1.008	3.729	3.70	57.009	2.368	1.360
79	0.2913	88.121	88.1	4.9	2.707	1.004	3.711	3.69	57.035	2.358	1.353
80	0.2963	87.854	87.9	5.0	2.696	0.999	3.695	3.70	57.070	2.347	1.348
81	0.3088	87.853	87.9	5.3	2.689	0.989	3.677	3.72	57.145	2.333	1.344
82	0.3213	87.202	87.2	5.5	2.662	0.976	3.638	3.73	57.229	2.307	1.331
83	0.3338	86.746	86.7	5.8	2.641	0.967	3.607	3.73	57.298	2.287	1.320
84	0.3462	86.530	86.5	6.0	2.627	0.955	3.583	3.75	57.375	2.269	1.314
85	0.3587	85.526	85.5	6.3	2.590	0.945	3.535	3.74	57.447	2.240	1.295
86	0.3712	85.439	85.4	6.5	2.580	0.936	3.516	3.76	57.513	2.226	1.290
87	0.3837	85.473	85.5	6.8	2.574	0.925	3.499	3.78	57.589	2.212	1.287
88	0.3961	86.008	86.0	7.0	2.583	0.918	3.502	3.81	57.633	2.210	1.292
89	0.4086	86.236	86.2	7.3	2.583	0.909	3.493	3.84	57.694	2.201	1.292
90	0.4211	85.548	85.5	7.5	2.556	0.902	3.457	3.83	57.749	2.180	1.278
91	0.4336	85.997	86.0	7.8	2.562	0.896	3.458	3.86	57.790	2.177	1.281
92	0.4461	85.886	85.9	8.0	2.552	0.888	3.440	3.87	57.845	2.164	1.276
93	0.4585	86.046	86.0	8.3	2.550	0.882	3.432	3.89	57.882	2.157	1.275

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
94	0.4710	85.481	85.5	8.5	2.526	0.875	3.401	3.89	57.934	2.138	1.263
95	0.4835	84.953	85.0	8.8	2.504	0.871	3.375	3.87	57.962	2.123	1.252
96	0.4960	84.714	84.7	9.0	2.490	0.865	3.355	3.88	58.001	2.110	1.245
97	0.5084	84.934	84.9	9.3	2.489	0.860	3.349	3.90	58.040	2.104	1.245
98	0.5209	84.602	84.6	9.5	2.473	0.856	3.328	3.89	58.067	2.092	1.236
99	0.5334	84.372	84.4	9.8	2.459	0.850	3.309	3.89	58.107	2.080	1.230
100	0.5459	84.224	84.2	10.0	2.448	0.846	3.294	3.89	58.134	2.070	1.224
101	0.5583	84.327	84.3	10.3	2.444	0.841	3.285	3.91	58.170	2.063	1.222
102	0.5708	84.193	84.2	10.5	2.433	0.836	3.270	3.91	58.204	2.053	1.217
103	0.5833	83.985	84.0	10.8	2.421	0.834	3.255	3.90	58.218	2.044	1.210
104	0.5958	83.893	83.9	11.0	2.411	0.829	3.241	3.91	58.250	2.035	1.206
105	0.6083	83.482	83.5	11.3	2.393	0.826	3.218	3.90	58.276	2.022	1.196
106	0.6207	82.750	82.8	11.5	2.365	0.818	3.183	3.89	58.331	2.000	1.182
107	0.6332	83.465	83.5	11.8	2.379	0.814	3.192	3.92	58.358	2.003	1.189
108	0.6457	83.450	83.4	12.0	2.371	0.808	3.179	3.94	58.401	1.993	1.186
109	0.6582	83.918	83.9	12.3	2.378	0.803	3.181	3.96	58.431	1.992	1.189
110	0.6706	84.272	84.3	12.5	2.381	0.801	3.182	3.97	58.447	1.992	1.191
111	0.6831	84.829	84.8	12.8	2.390	0.799	3.189	3.99	58.458	1.994	1.195
112	0.6956	85.656	85.7	13.0	2.406	0.797	3.203	4.02	58.474	2.000	1.203
113	0.7081	85.595	85.6	13.3	2.398	0.796	3.194	4.01	58.481	1.995	1.199
114	0.7206	84.752	84.8	13.5	2.367	0.793	3.160	3.99	58.505	1.976	1.184
115	0.7330	84.929	84.9	13.8	2.365	0.794	3.159	3.98	58.499	1.976	1.183
116	0.7455	85.205	85.2	14.0	2.366	0.792	3.158	3.99	58.510	1.975	1.183
117	0.7580	85.247	85.2	14.3	2.360	0.790	3.150	3.99	58.526	1.970	1.180
118	0.7705	85.967	86.0	14.5	2.373	0.789	3.163	4.01	58.528	1.976	1.187
119	0.7829	85.912	85.9	14.8	2.365	0.786	3.150	4.01	58.555	1.968	1.182
120	0.7954	86.013	86.0	15.1	2.361	0.788	3.148	4.00	58.538	1.968	1.180
121	0.8079	86.402	86.4	15.3	2.364	0.785	3.149	4.01	58.561	1.967	1.182
122	0.8204	86.637	86.6	15.6	2.364	0.783	3.147	4.02	58.569	1.965	1.182
123	0.8328	86.560	86.6	15.8	2.355	0.783	3.138	4.01	58.573	1.960	1.177
124	0.8453	85.904	85.9	16.1	2.330	0.782	3.111	3.98	58.582	1.947	1.165
125	0.8578	85.808	85.8	16.3	2.320	0.783	3.103	3.96	58.575	1.943	1.160
126	0.8703	86.322	86.3	16.6	2.327	0.780	3.107	3.98	58.595	1.943	1.164
127	0.8828	87.258	87.3	16.8	2.345	0.780	3.125	4.01	58.592	1.953	1.173
128	0.8952	87.711	87.7	17.1	2.350	0.777	3.128	4.02	58.613	1.952	1.175
129	0.9077	88.623	88.6	17.3	2.249	0.778	3.027	3.89	58.607	1.903	1.124
130	0.9202	89.357	89.4	17.6	2.260	0.779	3.039	3.90	58.598	1.909	1.130
131	0.9327	90.346	90.3	17.8	2.277	0.778	3.055	3.93	58.605	1.917	1.138
132	0.9451	91.015	91.0	18.1	2.286	0.779	3.065	3.93	58.598	1.922	1.143
133	0.9576	91.154	91.2	18.3	2.280	0.779	3.059	3.93	58.603	1.919	1.140
134	0.9701	90.957	91.0	18.6	2.266	0.779	3.045	3.91	58.600	1.912	1.133
135	0.9826	90.837	90.8	18.8	2.254	0.783	3.036	3.88	58.576	1.909	1.127
136	0.9951	91.134	91.1	19.1	2.252	0.781	3.033	3.88	58.586	1.907	1.126
137	1.0075	91.377	91.4	19.3	2.250	0.782	3.032	3.88	58.578	1.907	1.125
138	1.0200	91.733	91.7	19.6	2.250	0.783	3.032	3.87	58.574	1.908	1.125
139	1.0325	92.497	92.5	19.8	2.260	0.785	3.045	3.88	58.559	1.915	1.130
140	1.0450	92.928	92.9	20.1	2.262	0.788	3.050	3.87	58.537	1.919	1.131

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
141	1.0452	92.872	92.9	20.1	2.261	0.788	3.049	3.87	58.537	1.918	1.130

Parameters for Specimen No. 2

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	761.900			914.500
Moisture content: Dry soil+tare, gms.	683.220			798.700
Moisture content: Tare, gms.	0.000			115.480
Moisture, %	11.5	20.5	16.9	16.9
Moist specimen weight, gms.	761.9			
Diameter, in.	2.42	2.42	2.37	
Area, in.²	4.58	4.58	4.39	
Height, in.	5.02	5.02	4.90	
Net decrease in height, in.		0.00	0.12	
Net decrease in water volume, cc.			24.25	
Wet density, pcf	126.2	136.4	141.5	
Dry density, pcf	113.2	113.2	121.0	
Void ratio	0.5917	0.5917	0.4893	
Saturation, %	56.2	100.0	100.0	

Test Readings for Specimen No. 2

Membrane modulus = 0.124105 kN/cm²

Membrane thickness = 0.04 cm

Consolidation cell pressure = 189.030 psi (27.220 ksf)

Consolidation back pressure = 50.090 psi (7.213 ksf)

Consolidation effective confining stress = 20.007 ksf

Strain rate, %/min. = 0.03

Fail. Stress = 16.134 ksf **at reading no.** 119

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0364	2.112	0.0	0.0	0.000	20.008	20.008	1.00	50.088	20.008	0.000
1	0.0376	38.657	36.5	0.0	1.197	19.964	21.162	1.06	50.389	20.563	0.599
2	0.0389	63.122	61.0	0.1	1.998	19.932	21.930	1.10	50.614	20.931	0.999
3	0.0401	84.334	82.2	0.1	2.692	19.884	22.576	1.14	50.947	21.230	1.346
4	0.0414	105.595	103.5	0.1	3.387	19.830	23.218	1.17	51.320	21.524	1.694
5	0.0427	124.393	122.3	0.1	4.002	19.762	23.764	1.20	51.794	21.763	2.001
6	0.0439	141.707	139.6	0.2	4.567	19.687	24.255	1.23	52.312	21.971	2.284
7	0.0452	158.717	156.6	0.2	5.123	19.615	24.738	1.26	52.812	22.177	2.561
8	0.0464	174.686	172.6	0.2	5.643	19.519	25.163	1.29	53.480	22.341	2.822
9	0.0477	189.310	187.2	0.2	6.120	19.435	25.555	1.31	54.065	22.495	3.060
10	0.0489	202.622	200.5	0.3	6.554	19.325	25.878	1.34	54.830	22.602	3.277
11	0.0502	215.661	213.5	0.3	6.978	19.211	26.189	1.36	55.618	22.700	3.489
12	0.0514	228.439	226.3	0.3	7.394	19.100	26.493	1.39	56.392	22.797	3.697
13	0.0527	239.907	237.8	0.3	7.766	18.981	26.747	1.41	57.219	22.864	3.883
14	0.0540	251.368	249.3	0.4	8.138	18.856	26.994	1.43	58.086	22.925	4.069
15	0.0552	261.215	259.1	0.4	8.458	18.721	27.179	1.45	59.022	22.950	4.229
16	0.0565	271.418	269.3	0.4	8.789	18.591	27.380	1.47	59.925	22.985	4.394
17	0.0577	281.344	279.2	0.4	9.110	18.434	27.544	1.49	61.017	22.989	4.555
18	0.0590	290.938	288.8	0.5	9.421	18.286	27.707	1.52	62.044	22.996	4.710

Test Readings for Specimen No. 2

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
19	0.0602	299.857	297.7	0.5	9.709	18.139	27.848	1.54	63.066	22.993	4.855
20	0.0615	307.978	305.9	0.5	9.971	17.986	27.958	1.55	64.125	22.972	4.986
21	0.0627	316.713	314.6	0.5	10.253	17.826	28.080	1.58	65.237	22.953	5.127
22	0.0640	325.133	323.0	0.6	10.525	17.668	28.193	1.60	66.337	22.930	5.263
23	0.0653	332.756	330.6	0.6	10.771	17.509	28.279	1.62	67.443	22.894	5.385
24	0.0665	341.492	339.4	0.6	11.053	17.345	28.398	1.64	68.578	22.871	5.526
25	0.0678	348.447	346.3	0.6	11.276	17.187	28.463	1.66	69.674	22.825	5.638
26	0.0690	355.052	352.9	0.7	11.488	17.011	28.499	1.68	70.898	22.755	5.744
27	0.0703	361.869	359.8	0.7	11.707	16.840	28.547	1.70	72.086	22.693	5.854
28	0.0715	368.849	366.7	0.7	11.931	16.669	28.600	1.72	73.275	22.634	5.966
29	0.0728	375.839	373.7	0.7	12.155	16.504	28.659	1.74	74.421	22.581	6.078
30	0.0740	382.267	380.2	0.8	12.361	16.333	28.694	1.76	75.609	22.513	6.181
31	0.0753	388.189	386.1	0.8	12.551	16.144	28.695	1.78	76.916	22.420	6.275
32	0.0766	394.535	392.4	0.8	12.754	15.964	28.717	1.80	78.171	22.340	6.377
33	0.0778	400.943	398.8	0.8	12.958	15.786	28.744	1.82	79.407	22.265	6.479
34	0.0791	406.544	404.4	0.9	13.137	15.600	28.737	1.84	80.697	22.168	6.569
35	0.0803	413.168	411.1	0.9	13.349	15.419	28.768	1.87	81.955	22.093	6.674
36	0.0816	417.612	415.5	0.9	13.490	15.240	28.729	1.89	83.197	21.985	6.745
37	0.0828	422.240	420.1	0.9	13.636	15.051	28.687	1.91	84.512	21.869	6.818
38	0.0841	427.585	425.5	1.0	13.806	14.873	28.680	1.93	85.743	21.776	6.903
39	0.0853	432.931	430.8	1.0	13.976	14.688	28.664	1.95	87.032	21.676	6.988
40	0.0866	437.612	435.5	1.0	14.124	14.515	28.639	1.97	88.234	21.577	7.062
41	0.0916	453.557	451.4	1.1	14.626	13.811	28.438	2.06	93.117	21.125	7.313
42	0.0966	466.674	464.6	1.2	15.036	13.142	28.177	2.14	97.769	20.659	7.518
43	0.1017	478.241	476.1	1.3	15.394	12.483	27.877	2.23	102.344	20.180	7.697
44	0.1067	487.643	485.5	1.4	15.682	11.879	27.561	2.32	106.534	19.720	7.841
45	0.1117	495.199	493.1	1.5	15.909	11.331	27.240	2.40	110.344	19.285	7.955
46	0.1167	499.482	497.4	1.6	16.031	10.827	26.857	2.48	113.845	18.842	8.015
47	0.1217	504.210	502.1	1.7	16.166	10.360	26.526	2.56	117.083	18.443	8.083
48	0.1268	507.978	505.9	1.8	16.270	9.950	26.220	2.64	119.935	18.085	8.135
49	0.1318	509.065	507.0	1.9	16.288	9.560	25.849	2.70	122.638	17.705	8.144
50	0.1368	510.796	508.7	2.1	16.327	9.220	25.547	2.77	125.001	17.384	8.163
51	0.1418	510.928	508.8	2.2	16.314	8.915	25.229	2.83	127.119	17.072	8.157
52	0.1469	511.854	509.7	2.3	16.327	8.644	24.970	2.89	129.004	16.807	8.163
53	0.1519	512.794	510.7	2.4	16.339	8.408	24.747	2.94	130.644	16.577	8.170
54	0.1569	512.726	510.6	2.5	16.320	8.183	24.503	2.99	132.206	16.343	8.160
55	0.1619	513.164	511.1	2.6	16.317	7.983	24.300	3.04	133.590	16.142	8.158
56	0.1669	512.860	510.7	2.7	16.290	7.804	24.094	3.09	134.836	15.949	8.145
57	0.1720	512.646	510.5	2.8	16.266	7.644	23.910	3.13	135.950	15.777	8.133
58	0.1770	512.145	510.0	2.9	16.233	7.491	23.724	3.17	137.006	15.608	8.117
59	0.1820	512.378	510.3	3.0	16.223	7.368	23.592	3.20	137.861	15.480	8.112
60	0.1870	512.382	510.3	3.1	16.206	7.257	23.463	3.23	138.636	15.360	8.103
61	0.1920	512.082	510.0	3.2	16.180	7.129	23.308	3.27	139.524	15.219	8.090
62	0.1971	511.004	508.9	3.3	16.128	7.035	23.164	3.29	140.172	15.100	8.064
63	0.2021	509.885	507.8	3.4	16.076	6.939	23.015	3.32	140.840	14.977	8.038
64	0.2071	509.337	507.2	3.5	16.041	6.855	22.896	3.34	141.427	14.875	8.021
65	0.2121	509.919	507.8	3.6	16.043	6.769	22.812	3.37	142.022	14.790	8.021

Test Readings for Specimen No. 2

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
66	0.2171	508.983	506.9	3.7	15.996	6.698	22.694	3.39	142.517	14.696	7.998
67	0.2222	509.464	507.4	3.8	15.994	6.637	22.631	3.41	142.942	14.634	7.997
68	0.2272	509.008	506.9	3.9	15.963	6.566	22.529	3.43	143.432	14.547	7.981
69	0.2322	508.458	506.3	4.0	15.928	6.508	22.436	3.45	143.836	14.472	7.964
70	0.2372	507.557	505.4	4.1	15.883	6.454	22.337	3.46	144.208	14.396	7.942
71	0.2423	507.678	505.6	4.2	15.870	6.395	22.265	3.48	144.620	14.330	7.935
72	0.2473	507.409	505.3	4.3	15.845	6.354	22.199	3.49	144.903	14.277	7.922
73	0.2523	507.586	505.5	4.4	15.833	6.311	22.144	3.51	145.206	14.227	7.917
74	0.2573	507.872	505.8	4.5	15.825	6.269	22.094	3.52	145.497	14.181	7.913
75	0.2623	506.552	504.4	4.6	15.767	6.222	21.989	3.53	145.820	14.106	7.883
76	0.2674	507.147	505.0	4.7	15.768	6.188	21.957	3.55	146.056	14.073	7.884
77	0.2724	507.840	505.7	4.8	15.773	6.147	21.920	3.57	146.345	14.033	7.887
78	0.2774	508.078	506.0	4.9	15.763	6.122	21.886	3.57	146.513	14.004	7.882
79	0.2824	507.872	505.8	5.0	15.740	6.089	21.829	3.58	146.744	13.959	7.870
80	0.2874	508.626	506.5	5.1	15.747	6.061	21.808	3.60	146.938	13.935	7.873
81	0.3000	508.377	506.3	5.4	15.696	5.991	21.687	3.62	147.426	13.839	7.848
82	0.3126	509.184	507.1	5.6	15.679	5.931	21.610	3.64	147.842	13.770	7.839
83	0.3251	509.957	507.8	5.9	15.660	5.876	21.536	3.66	148.223	13.706	7.830
84	0.3377	509.832	507.7	6.2	15.613	5.820	21.433	3.68	148.613	13.627	7.807
85	0.3502	510.103	508.0	6.4	15.579	5.777	21.356	3.70	148.911	13.567	7.790
86	0.3628	510.519	508.4	6.7	15.549	5.736	21.285	3.71	149.198	13.510	7.775
87	0.3753	512.236	510.1	6.9	15.559	5.696	21.255	3.73	149.472	13.476	7.779
88	0.3879	512.756	510.6	7.2	15.532	5.667	21.198	3.74	149.678	13.433	7.766
89	0.4004	514.515	512.4	7.4	15.542	5.639	21.181	3.76	149.870	13.410	7.771
90	0.4130	515.834	513.7	7.7	15.539	5.620	21.159	3.76	150.000	13.390	7.769
91	0.4255	516.923	514.8	7.9	15.529	5.604	21.132	3.77	150.115	13.368	7.764
92	0.4381	519.040	516.9	8.2	15.549	5.598	21.147	3.78	150.157	13.372	7.775
93	0.4507	520.688	518.6	8.5	15.555	5.585	21.140	3.79	150.244	13.363	7.778
94	0.4632	522.258	520.1	8.7	15.558	5.571	21.129	3.79	150.343	13.350	7.779
95	0.4758	523.063	521.0	9.0	15.539	5.555	21.094	3.80	150.453	13.324	7.769
96	0.4883	524.818	522.7	9.2	15.547	5.545	21.092	3.80	150.523	13.319	7.774
97	0.5009	526.611	524.5	9.5	15.556	5.540	21.096	3.81	150.558	13.318	7.778
98	0.5134	528.369	526.3	9.7	15.564	5.525	21.089	3.82	150.664	13.307	7.782
99	0.5260	530.825	528.7	10.0	15.593	5.522	21.115	3.82	150.681	13.319	7.796
100	0.5385	533.539	531.4	10.3	15.628	5.520	21.148	3.83	150.697	13.334	7.814
101	0.5511	535.775	533.7	10.5	15.649	5.502	21.151	3.84	150.818	13.327	7.824
102	0.5636	539.761	537.6	10.8	15.721	5.516	21.236	3.85	150.726	13.376	7.860
103	0.5762	541.649	539.5	11.0	15.730	5.516	21.246	3.85	150.727	13.381	7.865
104	0.5888	543.746	541.6	11.3	15.746	5.511	21.257	3.86	150.760	13.384	7.873
105	0.6013	546.360	544.2	11.5	15.776	5.516	21.292	3.86	150.724	13.404	7.888
106	0.6139	546.188	544.1	11.8	15.726	5.515	21.241	3.85	150.731	13.378	7.863
107	0.6264	547.932	545.8	12.1	15.730	5.513	21.243	3.85	150.748	13.378	7.865
108	0.6390	550.341	548.2	12.3	15.754	5.517	21.270	3.86	150.720	13.393	7.877
109	0.6515	552.495	550.4	12.6	15.769	5.508	21.277	3.86	150.782	13.392	7.885
110	0.6641	554.950	552.8	12.8	15.793	5.514	21.307	3.86	150.737	13.411	7.897
111	0.6766	558.512	556.4	13.1	15.848	5.518	21.366	3.87	150.712	13.442	7.924
112	0.6892	560.162	558.0	13.3	15.848	5.522	21.370	3.87	150.685	13.446	7.924

Test Readings for Specimen No. 2

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
113	0.7017	563.052	560.9	13.6	15.883	5.530	21.413	3.87	150.630	13.471	7.942
114	0.7143	566.188	564.1	13.8	15.925	5.534	21.458	3.88	150.600	13.496	7.962
115	0.7268	567.496	565.4	14.1	15.914	5.536	21.450	3.87	150.586	13.493	7.957
116	0.7394	571.911	569.8	14.4	15.990	5.546	21.536	3.88	150.517	13.541	7.995
117	0.7520	574.947	572.8	14.6	16.027	5.545	21.573	3.89	150.522	13.559	8.014
118	0.7645	578.457	576.3	14.9	16.077	5.548	21.625	3.90	150.502	13.587	8.039
119	0.7771	582.229	580.1	15.1	16.134	5.553	21.686	3.91	150.470	13.619	8.067
120	0.7896	584.374	582.3	15.4	16.144	5.559	21.704	3.90	150.424	13.631	8.072
121	0.8022	586.380	584.3	15.6	16.151	5.562	21.713	3.90	150.402	13.638	8.075
122	0.8147	587.806	585.7	15.9	16.141	5.572	21.713	3.90	150.333	13.643	8.071
123	0.8273	587.168	585.1	16.2	16.074	5.576	21.650	3.88	150.308	13.613	8.037
124	0.8398	590.414	588.3	16.4	16.114	5.576	21.690	3.89	150.309	13.633	8.057
125	0.8524	593.060	590.9	16.7	16.137	5.579	21.716	3.89	150.284	13.648	8.068
126	0.8649	595.282	593.2	16.9	16.148	5.588	21.736	3.89	150.223	13.662	8.074
127	0.8775	597.475	595.4	17.2	16.157	5.608	21.765	3.88	150.086	13.687	8.079
128	0.8901	599.888	597.8	17.4	16.173	5.605	21.778	3.89	150.107	13.691	8.086
129	0.9026	601.763	599.7	17.7	16.173	5.610	21.783	3.88	150.074	13.696	8.087
130	0.9152	604.937	602.8	17.9	16.208	5.624	21.832	3.88	149.974	13.728	8.104
131	0.9277	608.284	606.2	18.2	16.247	5.637	21.884	3.88	149.882	13.761	8.124
132	0.9403	611.627	609.5	18.5	16.285	5.653	21.938	3.88	149.774	13.796	8.143
133	0.9528	615.275	613.2	18.7	16.331	5.667	21.998	3.88	149.677	13.833	8.166
134	0.9654	619.589	617.5	19.0	16.394	5.675	22.070	3.89	149.617	13.873	8.197
135	0.9779	625.229	623.1	19.2	16.492	5.694	22.186	3.90	149.489	13.940	8.246
136	0.9905	627.733	625.6	19.5	16.505	5.707	22.212	3.89	149.399	13.960	8.253
137	1.0030	631.142	629.0	19.7	16.543	5.711	22.254	3.90	149.369	13.983	8.271
138	1.0156	632.216	630.1	20.0	16.518	5.725	22.242	3.89	149.276	13.983	8.259
139	1.0282	633.698	631.6	20.3	16.504	5.738	22.242	3.88	149.183	13.990	8.252
140	1.0404	630.761	628.6	20.5	16.375	5.755	22.130	3.85	149.063	13.943	8.188

Parameters for Specimen No. 3

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	762.200			933.900
Moisture content: Dry soil+tare, gms.	684.570			828.900
Moisture content: Tare, gms.	0.000			145.330
Moisture, %	11.3	19.7	15.4	15.4
Moist specimen weight, gms.	762.2			
Diameter, in.	2.42	2.42	2.36	
Area, in.²	4.58	4.58	4.37	
Height, in.	4.98	4.98	4.81	
Net decrease in height, in.		0.00	0.17	
Net decrease in water volume, cc.			29.80	
Wet density, pcf	127.3	136.9	143.3	
Dry density, pcf	114.3	114.3	124.2	
Void ratio	0.5650	0.5650	0.4402	
Saturation, %	57.5	100.0	100.0	

Test Readings for Specimen No. 3

Membrane modulus = 0.124105 kN/cm²
Membrane thickness = 0.04 cm
Consolidation cell pressure = 397.410 psi (57.227 ksf)
Consolidation back pressure = 48.090 psi (6.925 ksf)
Consolidation effective confining stress = 50.302 ksf
Strain rate, %/min. = 0.03
Fail. Stress = 34.229 ksf **at reading no.** 108

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.1717	133.645	0.0	0.0	0.000	50.302	50.302	1.00	48.088	50.302	0.000
1	0.1729	162.585	28.9	0.0	0.954	50.270	51.224	1.02	48.315	50.747	0.477
2	0.1741	198.044	64.4	0.0	2.123	50.214	52.337	1.04	48.701	51.276	1.062
3	0.1753	225.684	92.0	0.1	3.033	50.166	53.199	1.06	49.037	51.682	1.517
4	0.1765	258.022	124.4	0.1	4.098	50.104	54.202	1.08	49.464	52.153	2.049
5	0.1777	281.888	148.2	0.1	4.883	50.043	54.927	1.10	49.888	52.485	2.442
6	0.1788	312.751	179.1	0.1	5.899	49.966	55.865	1.12	50.423	52.915	2.949
7	0.1800	340.059	206.4	0.2	6.796	49.887	56.684	1.14	50.970	53.285	3.398
8	0.1812	364.878	231.2	0.2	7.612	49.792	57.404	1.15	51.632	53.598	3.806
9	0.1824	390.632	257.0	0.2	8.457	49.669	58.126	1.17	52.488	53.897	4.229
10	0.1836	412.049	278.4	0.2	9.160	49.546	58.705	1.18	53.343	54.126	4.580
11	0.1848	433.993	300.3	0.3	9.879	49.419	59.299	1.20	54.219	54.359	4.940
12	0.1859	454.096	320.5	0.3	10.538	49.258	59.796	1.21	55.339	54.527	5.269
13	0.1871	474.368	340.7	0.3	11.202	49.099	60.301	1.23	56.446	54.700	5.601
14	0.1883	499.829	366.2	0.3	12.036	48.906	60.942	1.25	57.784	54.924	6.018
15	0.1895	516.719	383.1	0.4	12.588	48.711	61.299	1.26	59.143	55.005	6.294
16	0.1907	530.688	397.0	0.4	13.044	48.488	61.531	1.27	60.691	55.009	6.522
17	0.1919	548.659	415.0	0.4	13.631	48.280	61.911	1.28	62.134	55.095	6.815
18	0.1930	567.725	434.1	0.4	14.254	48.042	62.295	1.30	63.786	55.169	7.127
19	0.1942	582.399	448.8	0.5	14.732	47.790	62.521	1.31	65.537	55.156	7.366
20	0.1954	595.209	461.6	0.5	15.148	47.551	62.700	1.32	67.191	55.126	7.574
21	0.1966	609.238	475.6	0.5	15.605	47.272	62.877	1.33	69.135	55.074	7.803
22	0.1978	624.169	490.5	0.5	16.091	46.984	63.075	1.34	71.135	55.029	8.045
23	0.1990	641.786	508.1	0.6	16.665	46.695	63.360	1.36	73.136	55.028	8.332

Test Readings for Specimen No. 3

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
24	0.2001	659.599	526.0	0.6	17.245	46.392	63.637	1.37	75.241	55.015	8.622
25	0.2013	672.530	538.9	0.6	17.664	46.064	63.728	1.38	77.521	54.896	8.832
26	0.2025	686.677	553.0	0.6	18.124	45.736	63.860	1.40	79.799	54.798	9.062
27	0.2037	701.730	568.1	0.7	18.612	45.381	63.993	1.41	82.264	54.687	9.306
28	0.2049	716.455	582.8	0.7	19.090	45.024	64.114	1.42	84.746	54.569	9.545
29	0.2061	729.430	595.8	0.7	19.510	44.652	64.163	1.44	87.324	54.407	9.755
30	0.2072	744.132	610.5	0.7	19.987	44.268	64.255	1.45	89.992	54.261	9.993
31	0.2084	758.779	625.1	0.8	20.461	43.865	64.326	1.47	92.794	54.095	10.231
32	0.2096	773.842	640.2	0.8	20.949	43.461	64.410	1.48	95.600	53.935	10.474
33	0.2108	788.016	654.4	0.8	21.407	43.036	64.443	1.50	98.551	53.739	10.704
34	0.2120	803.204	669.6	0.8	21.899	42.619	64.518	1.51	101.444	53.569	10.949
35	0.2132	816.578	682.9	0.9	22.331	42.175	64.506	1.53	104.529	53.340	11.165
36	0.2143	829.557	695.9	0.9	22.749	41.732	64.482	1.55	107.602	53.107	11.375
37	0.2155	843.336	709.7	0.9	23.194	41.266	64.460	1.56	110.842	52.863	11.597
38	0.2167	856.389	722.7	0.9	23.615	40.797	64.412	1.58	114.097	52.604	11.807
39	0.2179	870.009	736.4	1.0	24.054	40.316	64.370	1.60	117.439	52.343	12.027
40	0.2191	882.525	748.9	1.0	24.457	39.828	64.285	1.61	120.825	52.057	12.228
41	0.2203	898.334	764.7	1.0	24.967	39.327	64.293	1.63	124.309	51.810	12.483
42	0.2250	945.479	811.8	1.1	26.480	37.290	63.770	1.71	138.448	50.530	13.240
43	0.2297	988.881	855.2	1.2	27.867	35.140	63.008	1.79	153.382	49.074	13.934
44	0.2345	1030.738	897.1	1.3	29.202	32.998	62.200	1.88	168.257	47.599	14.601
45	0.2392	1061.320	927.7	1.4	30.168	30.891	61.059	1.98	182.889	45.975	15.084
46	0.2439	1087.507	953.9	1.5	30.988	28.929	59.917	2.07	196.516	44.423	15.494
47	0.2486	1109.948	976.3	1.6	31.686	27.078	58.764	2.17	209.369	42.921	15.843
48	0.2534	1125.771	992.1	1.7	32.167	25.407	57.574	2.27	220.970	41.491	16.084
49	0.2581	1138.905	1005.3	1.8	32.560	23.920	56.480	2.36	231.298	40.200	16.280
50	0.2628	1145.634	1012.0	1.9	32.745	22.598	55.343	2.45	240.483	38.970	16.373
51	0.2676	1151.772	1018.1	2.0	32.911	21.443	54.354	2.53	248.497	37.899	16.455
52	0.2723	1154.123	1020.5	2.1	32.954	20.433	53.387	2.61	255.511	36.910	16.477
53	0.2770	1162.379	1028.7	2.2	33.187	19.560	52.747	2.70	261.577	36.154	16.594
54	0.2818	1159.095	1025.5	2.3	33.048	18.762	51.810	2.76	267.119	35.286	16.524
55	0.2865	1161.825	1028.2	2.4	33.102	18.085	51.187	2.83	271.822	34.636	16.551
56	0.2912	1162.416	1028.8	2.5	33.088	17.487	50.575	2.89	275.972	34.031	16.544
57	0.2959	1161.024	1027.4	2.6	33.010	16.967	49.978	2.95	279.580	33.472	16.505
58	0.3007	1159.633	1026.0	2.7	32.932	16.496	49.428	3.00	282.857	32.962	16.466
59	0.3054	1160.474	1026.8	2.8	32.926	16.069	48.995	3.05	285.817	32.532	16.463
60	0.3101	1161.646	1028.0	2.9	32.930	15.710	48.640	3.10	288.313	32.175	16.465
61	0.3148	1161.690	1028.0	3.0	32.898	15.372	48.270	3.14	290.661	31.821	16.449
62	0.3196	1160.214	1026.6	3.1	32.818	15.087	47.905	3.18	292.639	31.496	16.409
63	0.3243	1163.119	1029.5	3.2	32.877	14.812	47.689	3.22	294.546	31.251	16.438
64	0.3290	1162.919	1029.3	3.3	32.837	14.590	47.427	3.25	296.089	31.009	16.419
65	0.3338	1162.349	1028.7	3.4	32.786	14.357	47.142	3.28	297.712	30.749	16.393
66	0.3385	1161.379	1027.7	3.5	32.721	14.176	46.898	3.31	298.963	30.537	16.361
67	0.3432	1164.879	1031.2	3.6	32.799	14.004	46.803	3.34	300.159	30.404	16.400
68	0.3480	1166.622	1033.0	3.7	32.821	13.855	46.677	3.37	301.193	30.266	16.411
69	0.3527	1163.646	1030.0	3.8	32.693	13.712	46.405	3.38	302.190	30.058	16.347
70	0.3574	1165.781	1032.1	3.9	32.728	13.566	46.294	3.41	303.200	29.930	16.364

Test Readings for Specimen No. 3

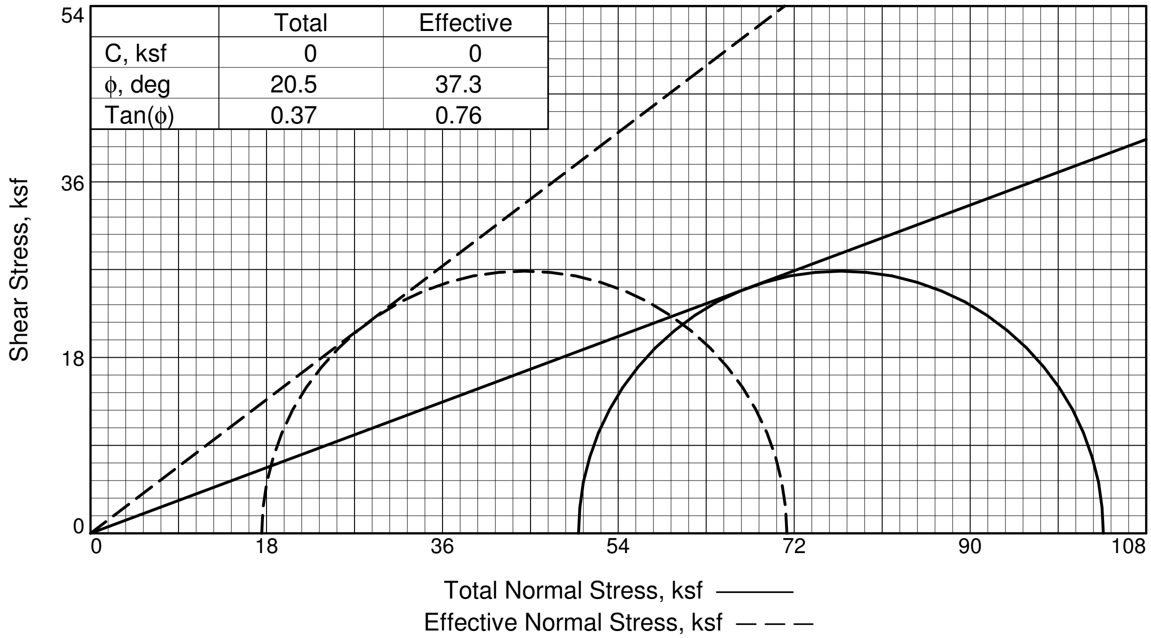
No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
71	0.3621	1167.554	1033.9	4.0	32.750	13.428	46.178	3.44	304.160	29.803	16.375
72	0.3669	1167.027	1033.4	4.1	32.700	13.331	46.032	3.45	304.830	29.682	16.350
73	0.3716	1169.996	1036.4	4.2	32.760	13.224	45.985	3.48	305.574	29.605	16.380
74	0.3763	1171.469	1037.8	4.3	32.773	13.131	45.904	3.50	306.223	29.518	16.387
75	0.3811	1170.902	1037.3	4.4	32.722	13.055	45.777	3.51	306.747	29.416	16.361
76	0.3858	1171.067	1037.4	4.5	32.693	12.955	45.648	3.52	307.447	29.301	16.347
77	0.3905	1176.466	1042.8	4.5	32.830	12.875	45.705	3.55	307.999	29.290	16.415
78	0.3953	1176.053	1042.4	4.6	32.783	12.813	45.596	3.56	308.432	29.204	16.391
79	0.4000	1177.266	1043.6	4.7	32.787	12.761	45.549	3.57	308.789	29.155	16.394
80	0.4047	1180.414	1046.8	4.8	32.852	12.703	45.555	3.59	309.193	29.129	16.426
81	0.4094	1179.310	1045.7	4.9	32.783	12.649	45.432	3.59	309.572	29.040	16.392
82	0.4213	1185.049	1051.4	5.2	32.878	12.545	45.423	3.62	310.294	28.984	16.439
83	0.4331	1188.458	1054.8	5.4	32.899	12.430	45.329	3.65	311.093	28.879	16.450
84	0.4449	1193.792	1060.1	5.7	32.980	12.347	45.327	3.67	311.665	28.837	16.490
85	0.4567	1199.034	1065.4	5.9	33.056	12.296	45.353	3.69	312.019	28.824	16.528
86	0.4686	1202.710	1069.1	6.2	33.084	12.249	45.333	3.70	312.346	28.791	16.542
87	0.4804	1207.557	1073.9	6.4	33.146	12.198	45.344	3.72	312.704	28.771	16.573
88	0.4922	1212.023	1078.4	6.7	33.197	12.170	45.367	3.73	312.895	28.769	16.598
89	0.5040	1218.398	1084.8	6.9	33.305	12.162	45.467	3.74	312.953	28.814	16.653
90	0.5158	1223.411	1089.8	7.2	33.371	12.146	45.517	3.75	313.061	28.832	16.685
91	0.5277	1226.508	1092.9	7.4	33.377	12.124	45.501	3.75	313.218	28.812	16.688
92	0.5395	1233.613	1100.0	7.6	33.505	12.121	45.625	3.76	313.238	28.873	16.752
93	0.5513	1239.251	1105.6	7.9	33.587	12.110	45.696	3.77	313.315	28.903	16.793
94	0.5631	1241.642	1108.0	8.1	33.570	12.123	45.693	3.77	313.222	28.908	16.785
95	0.5750	1246.939	1113.3	8.4	33.640	12.111	45.750	3.78	313.308	28.931	16.820
96	0.5868	1252.526	1118.9	8.6	33.718	12.111	45.829	3.78	313.303	28.970	16.859
97	0.5986	1254.263	1120.6	8.9	33.679	12.119	45.799	3.78	313.247	28.959	16.840
98	0.6104	1261.492	1127.8	9.1	33.805	12.145	45.950	3.78	313.067	29.048	16.903
99	0.6223	1268.451	1134.8	9.4	33.922	12.152	46.074	3.79	313.019	29.113	16.961
100	0.6341	1271.839	1138.2	9.6	33.931	12.186	46.117	3.78	312.783	29.152	16.965
101	0.6459	1274.298	1140.7	9.9	33.911	12.153	46.064	3.79	313.017	29.108	16.956
102	0.6577	1280.031	1146.4	10.1	33.989	12.179	46.168	3.79	312.832	29.174	16.994
103	0.6695	1282.287	1148.6	10.4	33.963	12.184	46.146	3.79	312.802	29.165	16.981
104	0.6814	1287.057	1153.4	10.6	34.010	12.192	46.202	3.79	312.746	29.197	17.005
105	0.6932	1293.053	1159.4	10.8	34.093	12.210	46.303	3.79	312.618	29.257	17.046
106	0.7050	1295.904	1162.3	11.1	34.082	12.214	46.297	3.79	312.588	29.256	17.041
107	0.7168	1301.782	1168.1	11.3	34.160	12.234	46.394	3.79	312.454	29.314	17.080
108	0.7287	1307.407	1173.8	11.6	34.229	12.234	46.463	3.80	312.452	29.349	17.115
109	0.7405	1307.971	1174.3	11.8	34.151	12.238	46.389	3.79	312.421	29.314	17.075
110	0.7523	1311.295	1177.7	12.1	34.152	12.241	46.393	3.79	312.402	29.317	17.076
111	0.7641	1318.392	1184.7	12.3	34.261	12.253	46.514	3.80	312.322	29.383	17.131
112	0.7760	1317.223	1183.6	12.6	34.132	12.275	46.407	3.78	312.165	29.341	17.066
113	0.7878	1325.537	1191.9	12.8	34.275	12.263	46.538	3.79	312.249	29.400	17.137
114	0.7996	1333.215	1199.6	13.1	34.398	12.280	46.679	3.80	312.130	29.479	17.199
115	0.8114	1334.310	1200.7	13.3	34.332	12.307	46.639	3.79	311.944	29.473	17.166
116	0.8232	1334.188	1200.5	13.5	34.232	12.299	46.531	3.78	311.997	29.415	17.116
117	0.8351	1341.904	1208.3	13.8	34.353	12.322	46.675	3.79	311.840	29.499	17.177

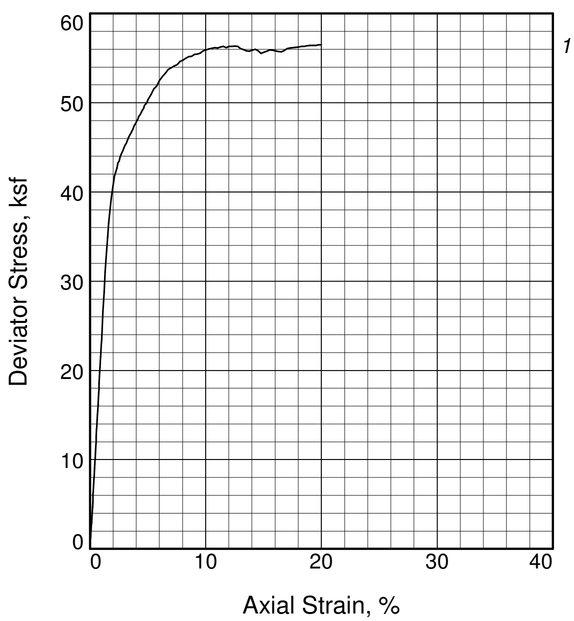
Test Readings for Specimen No. 3

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
118	0.8469	1341.174	1207.5	14.0	34.235	12.323	46.557	3.78	311.836	29.440	17.117
119	0.8587	1345.414	1211.8	14.3	34.257	12.335	46.592	3.78	311.747	29.464	17.128
120	0.8705	1352.295	1218.6	14.5	34.352	12.337	46.689	3.78	311.738	29.513	17.176
121	0.8824	1357.426	1223.8	14.8	34.398	12.354	46.752	3.78	311.616	29.553	17.199
122	0.8942	1360.534	1226.9	15.0	34.386	12.372	46.757	3.78	311.495	29.565	17.193
123	0.9060	1367.939	1234.3	15.3	34.493	12.377	46.871	3.79	311.456	29.624	17.247
124	0.9178	1370.722	1237.1	15.5	34.471	12.397	46.867	3.78	311.321	29.632	17.235
125	0.9296	1372.942	1239.3	15.8	34.432	12.407	46.839	3.78	311.251	29.623	17.216
126	0.9415	1376.005	1242.4	16.0	34.416	12.426	46.843	3.77	311.116	29.634	17.208
127	0.9533	1380.424	1246.8	16.3	34.438	12.440	46.877	3.77	311.023	29.658	17.219
128	0.9651	1384.913	1251.3	16.5	34.460	12.458	46.918	3.77	310.897	29.688	17.230
129	0.9769	1392.031	1258.4	16.7	34.554	12.470	47.024	3.77	310.813	29.747	17.277
130	0.9888	1395.885	1262.2	17.0	34.558	12.487	47.045	3.77	310.693	29.766	17.279
131	1.0006	1397.372	1263.7	17.2	34.496	12.503	46.998	3.76	310.586	29.751	17.248
132	1.0124	1399.818	1266.2	17.5	34.460	12.516	46.976	3.75	310.491	29.746	17.230
133	1.0242	1402.625	1269.0	17.7	34.433	12.525	46.958	3.75	310.433	29.741	17.217
134	1.0360	1408.601	1275.0	18.0	34.492	12.538	47.030	3.75	310.343	29.784	17.246
135	1.0479	1414.641	1281.0	18.2	34.552	12.564	47.116	3.75	310.159	29.840	17.276
136	1.0597	1416.559	1282.9	18.5	34.499	12.575	47.074	3.74	310.083	29.825	17.250
137	1.0715	1424.640	1291.0	18.7	34.612	12.588	47.200	3.75	309.990	29.894	17.306
138	1.0833	1428.085	1294.4	19.0	34.599	12.601	47.201	3.75	309.900	29.901	17.300
139	1.0952	1434.581	1300.9	19.2	34.667	12.597	47.264	3.75	309.933	29.930	17.334
140	1.1070	1437.483	1303.8	19.5	34.639	12.625	47.264	3.74	309.739	29.944	17.320
141	1.1176	1441.192	1307.5	19.7	34.643	12.624	47.266	3.74	309.746	29.945	17.321

Cursory interpretations provided require review by a professional engineer. Knight Piesold accepts no responsibility in subsequent analyses.

	Total	Effective
C, ksf	0	0
ϕ, deg	20.5	37.3
Tan(ϕ)	0.37	0.76





Specimen No.		1
Initial	Water Content, %	11.0
	Dry Density, pcf	119.8
	Saturation, %	63.8
	Void Ratio	0.4937
	Diameter, in.	2.42
	Height, in.	5.01
At Test	Water Content, %	14.0
	Dry Density, pcf	127.6
	Saturation, %	100.0
	Void Ratio	0.4024
	Diameter, in.	2.37
	Height, in.	4.89
Strain rate, %/min.		0.03
Eff. Cell Pressure, ksf		49.91
Fail. Stress, ksf		53.73
Excess Pore Pr., ksf		32.40
Strain, %		6.8
Ult. Stress, ksf		
Excess Pore Pr., ksf		
Strain, %		
$\bar{\sigma}_1$ Failure, ksf		71.24
$\bar{\sigma}_3$ Failure, ksf		17.52

Type of Test:
CU with Pore Pressures

Sample Type: Reconstituted

Description: silty sand

Specific Gravity= 2.866

Remarks:

Figure ________

Client: South 32 - Hermosa Project

Project: Hermosa

Location: Combined Bulk Sample

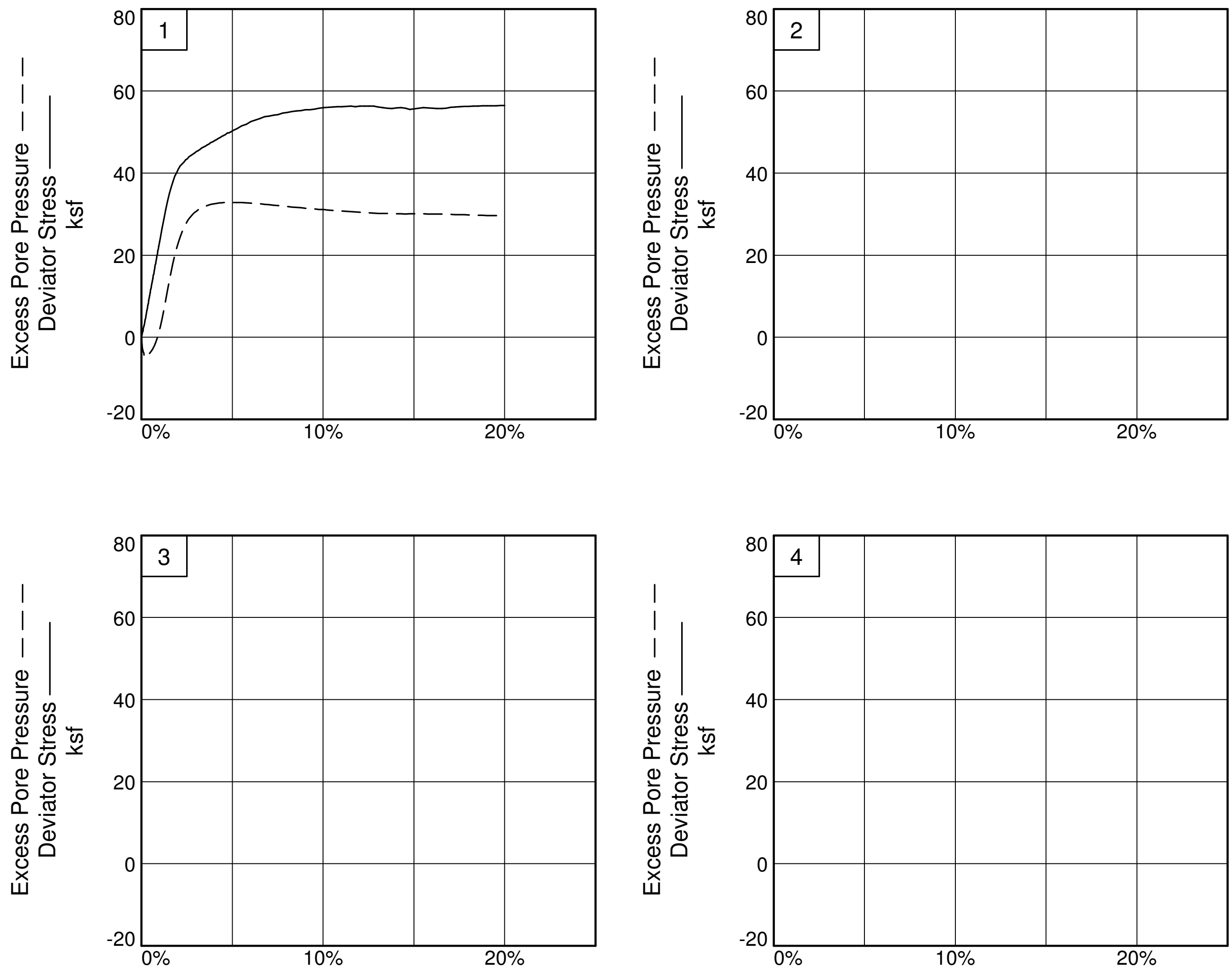
Sample Number: CU @ 95%MDD

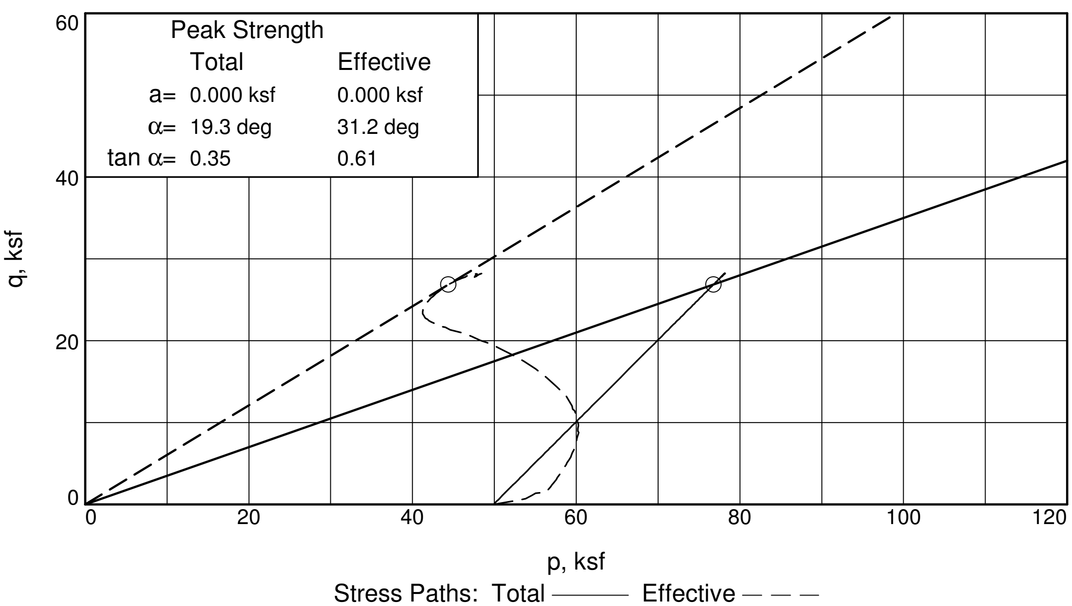
Proj. No.: 101-00777.03 **Date Sampled:** 6/29/20

Knight Piésold CONSULTING

Tested By: JStaley **Checked By:** JBruce

Cursory interpretations provided require review by a professional engineer. Knight Piesold accepts no responsibility in subsequent analyses.





Client: South 32 - Hermosa Project

Project: Hermosa

Location: Combined Bulk Sample **Sample Number:** CU @ 95%MDD

Project No.: 101-00777.03 **Figure** ________

Knight Piesold Geotechnical Lab.

Tested By: JStaley **Checked By:** JBruce

TRIAXIAL COMPRESSION TEST

CU with Pore Pressures

3/29/2021
12:34 PM

Date: 6/29/20
Client: South 32 - Hermosa Project
Project: Hermosa
Project No.: 101-00777.03
Location: Combined Bulk Sample
Sample Number: CU @ 95%MDD
Description: silty sand
Remarks:
Type of Sample: Reconstituted
Specific Gravity=2.866 **LL=** **PL=** **PI=**
Test Method: ASTM D 4767 Method A

Parameters for Specimen No. 1

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	398.180			942.400
Moisture content: Dry soil+tare, gms.	373.020			840.900
Moisture content: Tare, gms.	144.200			117.850
Moisture, %	11.0	17.2	14.0	14.0
Moist specimen weight, gms.	804.7			
Diameter, in.	2.42	2.42	2.37	
Area, in.²	4.60	4.60	4.43	
Height, in.	5.01	5.01	4.89	
Net decrease in height, in.		0.00	0.12	
Net decrease in water volume, cc.			23.10	
Wet density, pcf	133.0	140.4	145.5	
Dry density, pcf	119.8	119.8	127.6	
Void ratio	0.4937	0.4937	0.4024	
Saturation, %	63.8	100.0	100.0	

Test Readings for Specimen No. 1

Membrane modulus = 0.124105 kN/cm²
Membrane thickness = 0.02 cm
Filter paper coefficient = 0.001926 kN/cm
Filter paper coverage = 40%
Consolidation cell pressure = 395.230 psi (56.913 ksf)
Consolidation back pressure = 48.602 psi (6.999 ksf)
Consolidation effective confining stress = 49.914 ksf
Strain rate, %/min. = 0.03
Fail. Stress = 53.726 ksf **at reading no.** 88

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.1234	118.588	0.0	0.0	0.000	49.914	49.914	1.00	48.602	49.914	0.000
1	0.1246	138.414	19.8	0.0	0.645	51.606	52.251	1.01	36.853	51.929	0.322
2	0.1258	152.199	33.6	0.1	1.093	52.556	53.648	1.02	30.261	53.102	0.546
3	0.1271	161.834	43.2	0.1	1.405	53.130	54.536	1.03	26.271	53.833	0.703
4	0.1283	183.786	65.2	0.1	2.118	53.496	55.615	1.04	23.727	54.556	1.059
5	0.1295	200.545	82.0	0.1	2.662	53.721	56.384	1.05	22.165	55.052	1.331
6	0.1307	207.998	89.4	0.2	2.904	54.800	57.703	1.05	14.676	56.252	1.452
7	0.1320	229.989	111.4	0.2	3.617	54.797	58.414	1.07	14.695	56.606	1.808
8	0.1332	249.468	130.9	0.2	4.248	54.741	58.989	1.08	15.086	56.865	2.124
9	0.1344	263.709	145.1	0.2	4.709	54.668	59.377	1.09	15.592	57.023	2.355
10	0.1356	281.325	162.7	0.3	5.280	54.607	59.887	1.10	16.014	57.247	2.640
11	0.1369	305.596	187.0	0.3	6.066	54.524	60.590	1.11	16.590	57.557	3.033
12	0.1381	318.848	200.3	0.3	6.494	54.442	60.936	1.12	17.161	57.689	3.247
13	0.1393	339.690	221.1	0.3	7.168	54.358	61.526	1.13	17.745	57.942	3.584
14	0.1405	359.483	240.9	0.4	7.808	54.254	62.061	1.14	18.468	58.158	3.904
15	0.1417	373.487	254.9	0.4	8.259	54.172	62.431	1.15	19.038	58.301	4.130
16	0.1430	397.050	278.5	0.4	9.021	54.054	63.075	1.17	19.852	58.565	4.510
17	0.1442	418.112	299.5	0.4	9.701	53.938	63.638	1.18	20.663	58.788	4.850
18	0.1454	430.815	312.2	0.5	10.109	53.816	63.925	1.19	21.510	58.870	5.055
19	0.1466	455.141	336.6	0.5	10.894	53.686	64.581	1.20	22.408	59.134	5.447
20	0.1479	476.006	357.4	0.5	11.567	53.552	65.118	1.22	23.344	59.335	5.783
21	0.1491	489.543	371.0	0.5	12.002	53.398	65.399	1.22	24.413	59.399	6.001
22	0.1503	508.621	390.0	0.6	12.616	53.221	65.837	1.24	25.640	59.529	6.308
23	0.1515	531.233	412.6	0.6	13.344	53.045	66.389	1.25	26.860	59.717	6.672
24	0.1527	542.374	423.8	0.6	13.701	52.873	66.574	1.26	28.058	59.723	6.850
25	0.1540	564.975	446.4	0.6	14.428	52.693	67.121	1.27	29.307	59.907	7.214
26	0.1552	585.295	466.7	0.7	15.081	52.493	67.574	1.29	30.693	60.034	7.540
27	0.1564	598.333	479.7	0.7	15.498	52.277	67.775	1.30	32.196	60.026	7.749
28	0.1576	616.427	497.8	0.7	16.079	52.026	68.104	1.31	33.941	60.065	8.039
29	0.1589	640.116	521.5	0.7	16.840	51.786	68.626	1.33	35.604	60.206	8.420
30	0.1601	662.068	543.5	0.8	17.544	51.533	69.077	1.34	37.364	60.305	8.772
31	0.1613	672.814	554.2	0.8	17.886	51.251	69.137	1.35	39.324	60.194	8.943
32	0.1625	692.381	573.8	0.8	18.513	50.954	69.467	1.36	41.381	60.211	9.257
33	0.1638	715.317	596.7	0.8	19.248	50.640	69.888	1.38	43.562	60.264	9.624
34	0.1650	733.983	615.4	0.9	19.845	50.317	70.162	1.39	45.807	60.240	9.923
35	0.1662	750.076	631.5	0.9	20.359	49.969	70.328	1.41	48.225	60.148	10.180
36	0.1674	772.226	653.6	0.9	21.068	49.592	70.660	1.42	50.838	60.126	10.534
37	0.1686	787.891	669.3	0.9	21.567	49.212	70.780	1.44	53.478	59.996	10.784
38	0.1699	808.222	689.6	1.0	22.217	48.804	71.021	1.46	56.311	59.913	11.109
39	0.1711	828.916	710.3	1.0	22.878	48.381	71.259	1.47	59.252	59.820	11.439
40	0.1723	841.689	723.1	1.0	23.283	47.942	71.225	1.49	62.299	59.584	11.642
41	0.1735	864.549	746.0	1.0	24.013	47.476	71.490	1.51	65.533	59.483	12.007
42	0.1784	944.334	825.7	1.1	26.555	45.475	72.030	1.58	79.431	58.752	13.277
43	0.1833	1013.698	895.1	1.2	28.756	43.235	71.991	1.67	94.988	57.613	14.378
44	0.1882	1085.552	967.0	1.3	31.033	40.850	71.883	1.76	111.550	56.367	15.517
45	0.1931	1150.931	1032.3	1.4	33.098	38.474	71.572	1.86	128.052	55.023	16.549
46	0.1980	1210.187	1091.6	1.5	34.962	36.121	71.083	1.97	144.392	53.602	17.481

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
47	0.2029	1260.067	1141.5	1.6	36.523	33.912	70.435	2.08	159.727	52.174	18.261
48	0.2078	1304.939	1186.4	1.7	37.920	31.819	69.739	2.19	174.266	50.779	18.960
49	0.2127	1347.569	1229.0	1.8	39.243	29.935	69.177	2.31	187.350	49.556	19.621
50	0.2175	1374.171	1255.6	1.9	40.051	28.231	68.282	2.42	199.184	48.256	20.026
51	0.2224	1405.396	1286.8	2.0	41.005	26.744	67.749	2.53	209.507	47.247	20.503
52	0.2273	1430.305	1311.7	2.1	41.756	25.423	67.179	2.64	218.682	46.301	20.878
53	0.2322	1446.349	1327.8	2.2	42.224	24.266	66.490	2.74	226.719	45.378	21.112
54	0.2371	1462.140	1343.6	2.3	42.682	23.257	65.940	2.84	233.722	44.598	21.341
55	0.2420	1481.526	1362.9	2.4	43.254	22.396	65.650	2.93	239.701	44.023	21.627
56	0.2469	1490.320	1371.7	2.5	43.488	21.655	65.144	3.01	244.846	43.399	21.744
57	0.2518	1506.397	1387.8	2.6	43.953	21.012	64.965	3.09	249.314	42.988	21.976
58	0.2567	1518.709	1400.1	2.7	44.297	20.458	64.755	3.17	253.164	42.606	22.149
59	0.2616	1529.196	1410.6	2.8	44.583	19.975	64.558	3.23	256.514	42.267	22.292
60	0.2665	1539.919	1421.3	2.9	44.876	19.557	64.433	3.29	259.419	41.995	22.438
61	0.2714	1552.429	1433.8	3.0	45.224	19.196	64.420	3.36	261.927	41.808	22.612
62	0.2762	1561.361	1442.8	3.1	45.459	18.867	64.326	3.41	264.209	41.597	22.729
63	0.2811	1572.199	1453.6	3.2	45.753	18.601	64.354	3.46	266.055	41.478	22.877
64	0.2860	1585.083	1466.5	3.3	46.111	18.352	64.463	3.51	267.786	41.407	23.055
65	0.2909	1593.234	1474.6	3.4	46.319	18.155	64.474	3.55	269.154	41.315	23.160
66	0.2958	1602.979	1484.4	3.5	46.577	17.962	64.539	3.59	270.495	41.250	23.289
67	0.3007	1613.592	1495.0	3.6	46.862	17.818	64.679	3.63	271.495	41.249	23.431
68	0.3056	1622.062	1503.5	3.7	47.078	17.681	64.759	3.66	272.445	41.220	23.539
69	0.3105	1635.858	1517.3	3.8	47.461	17.560	65.021	3.70	273.286	41.290	23.730
70	0.3154	1642.305	1523.7	3.9	47.613	17.445	65.058	3.73	274.082	41.252	23.806
71	0.3203	1652.908	1534.3	4.0	47.894	17.370	65.264	3.76	274.605	41.317	23.947
72	0.3252	1662.516	1543.9	4.1	48.144	17.295	65.439	3.78	275.124	41.367	24.072
73	0.3301	1673.899	1555.3	4.2	48.448	17.249	65.697	3.81	275.445	41.473	24.224
74	0.3349	1681.725	1563.1	4.3	48.641	17.184	65.825	3.83	275.897	41.505	24.321
75	0.3398	1692.256	1573.7	4.4	48.918	17.150	66.068	3.85	276.132	41.609	24.459
76	0.3447	1701.314	1582.7	4.5	49.148	17.114	66.262	3.87	276.384	41.688	24.574
77	0.3496	1709.669	1591.1	4.6	49.355	17.085	66.440	3.89	276.587	41.762	24.678
78	0.3545	1722.926	1604.3	4.7	49.714	17.079	66.794	3.91	276.624	41.937	24.857
79	0.3594	1728.945	1610.4	4.8	49.849	17.061	66.909	3.92	276.753	41.985	24.924
80	0.3643	1737.794	1619.2	4.9	50.070	17.055	67.125	3.94	276.795	42.090	25.035
81	0.3692	1748.786	1630.2	5.0	50.357	17.054	67.411	3.95	276.798	42.233	25.178
82	0.3814	1770.244	1651.7	5.3	50.885	17.078	67.963	3.98	276.633	42.521	25.443
83	0.3936	1795.786	1677.2	5.5	51.536	17.121	68.656	4.01	276.336	42.889	25.768
84	0.4059	1811.467	1692.9	5.8	51.880	17.168	69.048	4.02	276.006	43.108	25.940
85	0.4181	1837.234	1718.6	6.0	52.530	17.233	69.763	4.05	275.554	43.498	26.265
86	0.4303	1855.586	1737.0	6.3	52.949	17.322	70.271	4.06	274.941	43.796	26.475
87	0.4425	1871.460	1752.9	6.5	53.291	17.405	70.696	4.06	274.361	44.050	26.645
88	0.4548	1890.527	1771.9	6.8	53.726	17.517	71.243	4.07	273.586	44.380	26.863
89	0.4670	1901.321	1782.7	7.0	53.909	17.612	71.521	4.06	272.923	44.567	26.954
90	0.4792	1913.787	1795.2	7.3	54.140	17.732	71.872	4.05	272.089	44.802	27.070
91	0.4914	1922.647	1804.1	7.5	54.260	17.838	72.098	4.04	271.357	44.968	27.130
92	0.5037	1939.730	1821.1	7.8	54.626	17.951	72.577	4.04	270.569	45.264	27.313
93	0.5159	1949.008	1830.4	8.0	54.755	18.060	72.815	4.03	269.815	45.437	27.378

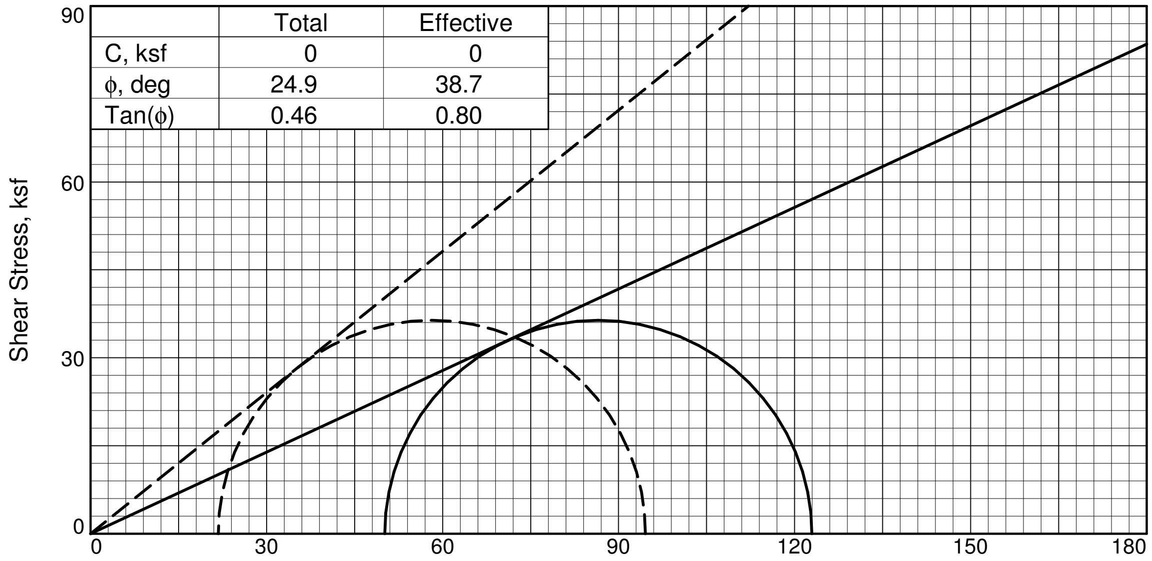
Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
94	0.5281	1962.045	1843.5	8.3	54.995	18.183	73.178	4.02	268.958	45.681	27.498
95	0.5403	1973.302	1854.7	8.5	55.180	18.295	73.475	4.02	268.184	45.885	27.590
96	0.5526	1979.568	1861.0	8.8	55.215	18.369	73.585	4.01	267.664	45.977	27.608
97	0.5648	1991.649	1873.1	9.0	55.421	18.482	73.904	4.00	266.880	46.193	27.711
98	0.5770	1998.052	1879.5	9.3	55.458	18.573	74.031	3.99	266.254	46.302	27.729
99	0.5893	2006.736	1888.1	9.5	55.561	18.658	74.219	3.98	265.660	46.438	27.780
100	0.6015	2021.158	1902.6	9.8	55.830	18.758	74.588	3.98	264.967	46.673	27.915
101	0.6137	2029.738	1911.1	10.0	55.927	18.820	74.746	3.97	264.537	46.783	27.963
102	0.6259	2038.049	1919.5	10.3	56.014	18.925	74.938	3.96	263.809	46.932	28.007
103	0.6382	2046.508	1927.9	10.5	56.104	19.007	75.110	3.95	263.240	47.058	28.052
104	0.6504	2053.785	1935.2	10.8	56.158	19.090	75.248	3.94	262.661	47.169	28.079
105	0.6626	2058.847	1940.3	11.0	56.147	19.186	75.333	3.93	261.995	47.259	28.074
106	0.6748	2067.114	1948.5	11.3	56.228	19.249	75.477	3.92	261.554	47.363	28.114
107	0.6871	2075.133	1956.5	11.5	56.300	19.329	75.629	3.91	261.001	47.479	28.150
108	0.6993	2076.633	1958.0	11.8	56.184	19.401	75.585	3.90	260.504	47.493	28.092
109	0.7115	2086.637	1968.0	12.0	56.311	19.478	75.789	3.89	259.969	47.633	28.156
110	0.7237	2092.880	1974.3	12.3	56.329	19.571	75.901	3.88	259.318	47.736	28.165
111	0.7360	2098.685	1980.1	12.5	56.334	19.631	75.965	3.87	258.901	47.798	28.167
112	0.7482	2103.692	1985.1	12.8	56.315	19.709	76.024	3.86	258.363	47.866	28.157
113	0.7604	2101.120	1982.5	13.0	56.081	19.723	75.804	3.84	258.263	47.764	28.040
114	0.7726	2102.334	1983.7	13.3	55.954	19.725	75.678	3.84	258.253	47.701	27.977
115	0.7849	2103.296	1984.7	13.5	55.819	19.741	75.561	3.83	258.139	47.651	27.910
116	0.7971	2107.193	1988.6	13.8	55.767	19.767	75.535	3.82	257.956	47.651	27.884
117	0.8093	2117.339	1998.8	14.0	55.889	19.816	75.705	3.82	257.617	47.761	27.945
118	0.8216	2126.276	2007.7	14.3	55.976	19.830	75.806	3.82	257.521	47.818	27.988
119	0.8338	2126.210	2007.6	14.5	55.811	19.860	75.671	3.81	257.311	47.766	27.905
120	0.8460	2122.313	2003.7	14.8	55.539	19.796	75.336	3.81	257.756	47.566	27.770
121	0.8582	2132.894	2014.3	15.0	55.669	19.802	75.471	3.81	257.714	47.637	27.834
122	0.8705	2142.848	2024.3	15.3	55.779	19.807	75.587	3.82	257.679	47.697	27.890
123	0.8827	2154.544	2036.0	15.5	55.936	19.836	75.772	3.82	257.477	47.804	27.968
124	0.8949	2158.573	2040.0	15.8	55.881	19.872	75.753	3.81	257.230	47.812	27.940
125	0.9071	2162.464	2043.9	16.0	55.821	19.904	75.725	3.80	257.010	47.814	27.911
126	0.9194	2165.037	2046.4	16.3	55.725	19.915	75.640	3.80	256.929	47.778	27.863
127	0.9316	2170.445	2051.9	16.5	55.705	19.904	75.609	3.80	257.009	47.757	27.853
128	0.9438	2181.592	2063.0	16.8	55.840	19.942	75.782	3.80	256.746	47.862	27.920
129	0.9560	2195.574	2077.0	17.0	56.050	19.967	76.017	3.81	256.568	47.992	28.025
130	0.9683	2204.940	2086.4	17.3	56.133	20.014	76.147	3.80	256.244	48.080	28.067
131	0.9805	2212.349	2093.8	17.5	56.162	20.042	76.204	3.80	256.052	48.123	28.081
132	0.9927	2220.836	2102.2	17.8	56.219	20.066	76.285	3.80	255.883	48.175	28.109
133	1.0049	2227.629	2109.0	18.0	56.229	20.113	76.342	3.80	255.557	48.227	28.114
134	1.0172	2237.193	2118.6	18.3	56.311	20.137	76.448	3.80	255.390	48.293	28.156
135	1.0294	2243.547	2125.0	18.5	56.308	20.160	76.468	3.79	255.230	48.314	28.154
136	1.0416	2253.088	2134.5	18.8	56.387	20.202	76.589	3.79	254.939	48.395	28.193
137	1.0539	2261.217	2142.6	19.0	56.427	20.233	76.661	3.79	254.720	48.447	28.214
138	1.0661	2267.483	2148.9	19.3	56.417	20.266	76.684	3.78	254.492	48.475	28.209
139	1.0783	2273.793	2155.2	19.5	56.408	20.290	76.698	3.78	254.325	48.494	28.204
140	1.0906	2283.643	2165.1	19.8	56.489	20.336	76.826	3.78	254.005	48.581	28.245

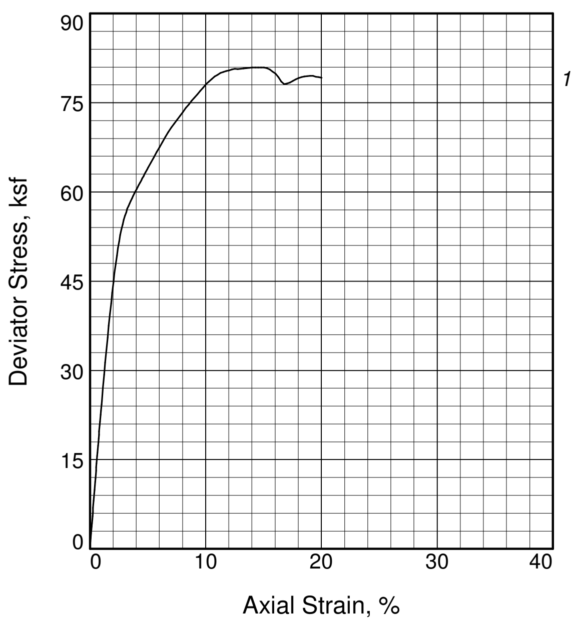
Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
141	1.1014	2289.166	2170.6	20.0	56.477	20.356	76.834	3.77	253.866	48.595	28.239

Cursory interpretations provided require review by a professional engineer. Knight Piesold accepts no responsibility in subsequent analyses.



	Total	Effective
C, ksf	0	0
ϕ, deg	24.9	38.7
Tan(ϕ)	0.46	0.80



Specimen No.		1
Initial	Water Content, %	11.7
	Dry Density, pcf	124.1
	Saturation, %	75.6
	Void Ratio	0.4423
	Diameter, in.	2.42
	Height, in.	4.98
At Test	Water Content, %	13.8
	Dry Density, pcf	128.2
	Saturation, %	100.0
	Void Ratio	0.3956
	Diameter, in.	2.39
	Height, in.	4.91
Strain rate, %/min.		0.03
Eff. Cell Pressure, ksf		50.12
Fail. Stress, ksf		72.81
Excess Pore Pr., ksf		28.35
Strain, %		7.8
Ult. Stress, ksf		
Excess Pore Pr., ksf		
Strain, %		
$\bar{\sigma}_1$ Failure, ksf		94.58
$\bar{\sigma}_3$ Failure, ksf		21.77

Type of Test:
CU with Pore Pressures

Sample Type: Reconstituted

Description: silty sand

LL= NP **PI=** NP

Specific Gravity= 2.866

Remarks: Failure chosen at peak principal stress ratio.

Figure ________

Client: South 32 - Hermosa Project

Project: Hermosa

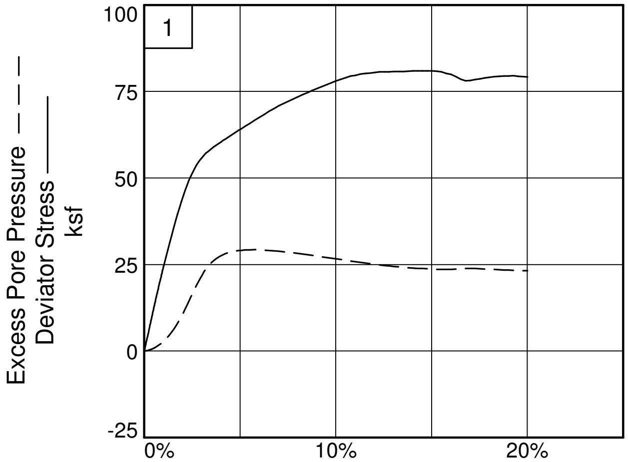
Location: Combined Bulk Sample

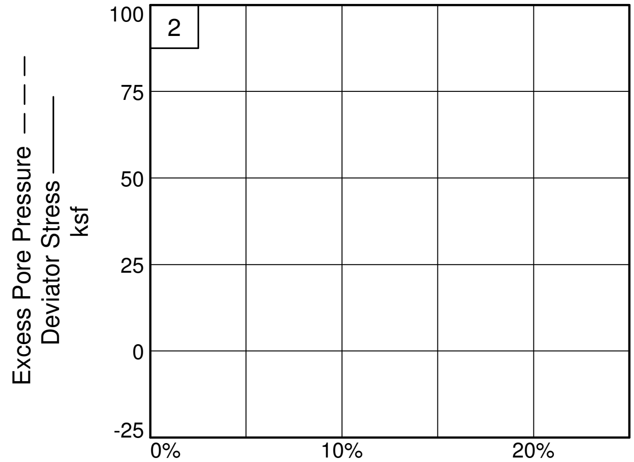
Sample Number: CU @ 98%MDD

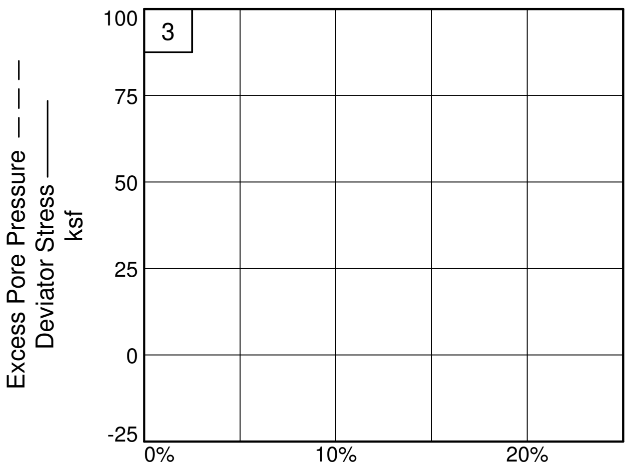
Proj. No.: 101-00777.03 **Date Sampled:** 6/29/20

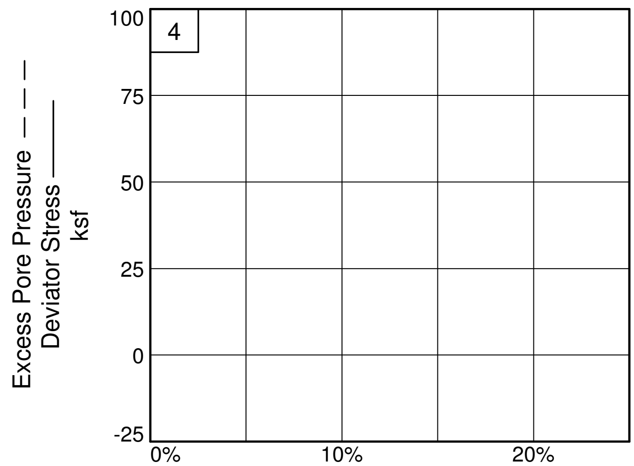
Knight Piésold CONSULTING

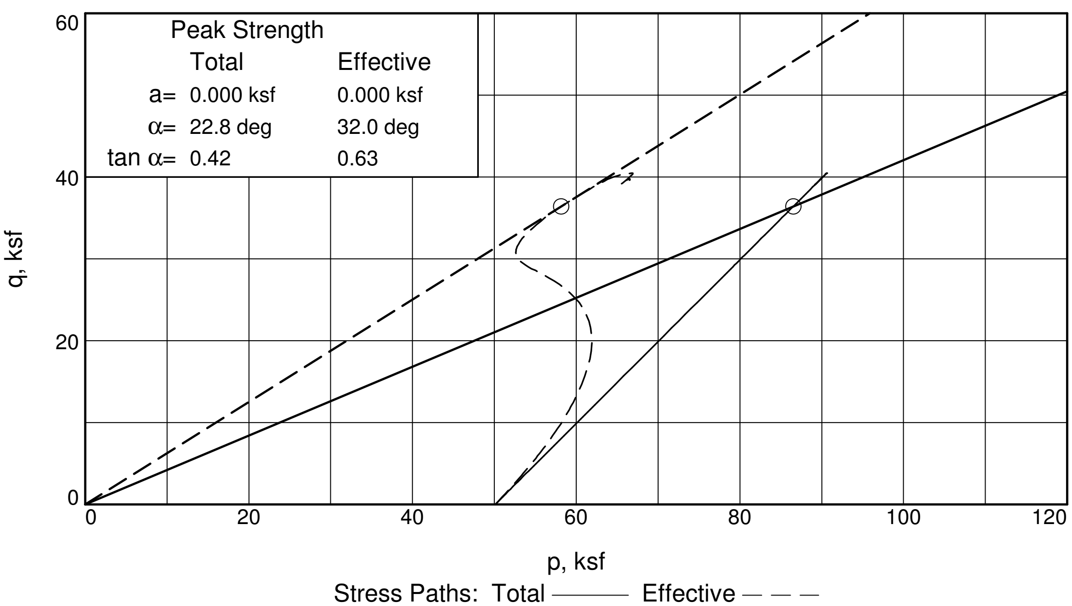
Tested By: JStaley **Checked By:** JBruce











Client: South 32 - Hermosa Project
Project: Hermosa
Location: Combined Bulk Sample
Sample Number: CU @ 98%MDD
Project No.: 101-00777.03
Figure ________

Knight Piesold Geotechnical Lab.

Tested By: JStaley **Checked By:** JBruce

TRIAXIAL COMPRESSION TEST
CU with Pore Pressures

3/29/2021
12:34 PM

Date: 6/29/20
Client: South 32 - Hermosa Project
Project: Hermosa
Project No.: 101-00777.03
Location: Combined Bulk Sample
Sample Number: CU @ 98%MDD
Description: silty sand
Remarks: Failure chosen at peak principal stress ratio.
Type of Sample: Reconstituted
Specific Gravity=2.866 **LL=**NP **PL=** **PI=**NP
Test Method: ASTM D 4767 Method A

Parameters for Specimen No. 1

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	829.500			960.700
Moisture content: Dry soil+tare, gms.	742.820			858.200
Moisture content: Tare, gms.	0.000			115.380
Moisture, %	11.7	15.4	13.8	13.8
Moist specimen weight, gms.	829.5			
Diameter, in.	2.42	2.42	2.39	
Area, in.²	4.58	4.58	4.50	
Height, in.	4.98	4.98	4.91	
Net decrease in height, in.		0.00	0.07	
Net decrease in water volume, cc.			12.10	
Wet density, pcf	138.5	143.2	145.9	
Dry density, pcf	124.1	124.1	128.2	
Void ratio	0.4423	0.4423	0.3956	
Saturation, %	75.6	100.0	100.0	

Test Readings for Specimen No. 1

Membrane modulus = 0.124105 kN/cm²
Membrane thickness = 0.02 cm
Filter paper coefficient = 0.001926 kN/cm
Filter paper coverage = 40%
Consolidation cell pressure = 386.940 psi (55.719 ksf)
Consolidation back pressure = 38.875 psi (5.598 ksf)
Consolidation effective confining stress = 50.121 ksf
Strain rate, %/min. = 0.03
Fail. Stress = 72.810 ksf **at reading no.** 92

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0715	115.169	0.0	0.0	0.000	50.121	50.121	1.00	38.875	50.121	0.000
1	0.0727	131.276	16.1	0.0	0.516	50.129	50.645	1.01	38.822	50.387	0.258
2	0.0739	153.980	38.8	0.0	1.242	50.094	51.336	1.02	39.064	50.715	0.621
3	0.0752	172.286	57.1	0.1	1.828	50.068	51.895	1.04	39.249	50.981	0.914
4	0.0764	194.233	79.1	0.1	2.529	50.054	52.583	1.05	39.343	51.319	1.265
5	0.0776	213.353	98.2	0.1	3.140	50.023	53.163	1.06	39.561	51.593	1.570
6	0.0788	232.240	117.1	0.2	3.743	49.988	53.731	1.07	39.802	51.860	1.872
7	0.0801	249.850	134.7	0.2	4.305	49.963	54.269	1.09	39.972	52.116	2.153
8	0.0813	267.173	152.0	0.2	4.858	49.936	54.794	1.10	40.160	52.365	2.429
9	0.0825	287.465	172.3	0.2	5.505	49.908	55.413	1.11	40.359	52.660	2.752
10	0.0837	307.764	192.6	0.2	6.152	49.857	56.009	1.12	40.711	52.933	3.076
11	0.0850	330.748	215.6	0.3	6.884	49.818	56.702	1.14	40.983	53.260	3.442
12	0.0862	350.527	235.4	0.3	7.514	49.765	57.279	1.15	41.352	53.522	3.757
13	0.0874	368.056	252.9	0.3	8.072	49.715	57.787	1.16	41.694	53.751	4.036
14	0.0887	386.567	271.4	0.4	8.660	49.666	58.326	1.17	42.037	53.996	4.330
15	0.0899	407.890	292.7	0.4	9.338	49.622	58.960	1.19	42.344	54.291	4.669
16	0.0911	426.118	310.9	0.4	9.917	49.555	59.472	1.20	42.807	54.514	4.959
17	0.0923	448.261	333.1	0.4	10.621	49.502	60.123	1.21	43.177	54.812	5.310
18	0.0936	468.182	353.0	0.5	11.253	49.431	60.684	1.23	43.671	55.057	5.627
19	0.0948	486.680	371.5	0.5	11.840	49.367	61.207	1.24	44.111	55.287	5.920
20	0.0960	506.067	390.9	0.5	12.455	49.304	61.759	1.25	44.551	55.531	6.227
21	0.0973	527.312	412.1	0.5	13.128	49.232	62.361	1.27	45.049	55.796	6.564
22	0.0985	546.526	431.4	0.6	13.737	49.161	62.898	1.28	45.544	56.030	6.868
23	0.0997	566.707	451.5	0.6	14.376	49.085	63.461	1.29	46.070	56.273	7.188
24	0.1009	585.736	470.6	0.6	14.978	48.999	63.977	1.31	46.668	56.488	7.489
25	0.1022	606.234	491.1	0.6	15.627	48.924	64.551	1.32	47.188	56.738	7.813
26	0.1034	622.787	507.6	0.7	16.149	48.839	64.988	1.33	47.778	56.914	8.075
27	0.1046	641.721	526.6	0.7	16.747	48.749	65.496	1.34	48.409	57.122	8.374
28	0.1059	660.324	545.2	0.7	17.335	48.652	65.987	1.36	49.077	57.320	8.667
29	0.1071	677.971	562.8	0.7	17.891	48.553	66.444	1.37	49.766	57.499	8.946
30	0.1083	699.469	584.3	0.8	18.570	48.459	67.029	1.38	50.422	57.744	9.285
31	0.1095	719.160	604.0	0.8	19.191	48.355	67.546	1.40	51.141	57.951	9.595
32	0.1108	737.848	622.7	0.8	19.780	48.254	68.034	1.41	51.844	58.144	9.890
33	0.1120	754.306	639.1	0.8	20.297	48.141	68.439	1.42	52.625	58.290	10.149
34	0.1132	771.561	656.4	0.9	20.840	48.050	68.890	1.43	53.263	58.470	10.420
35	0.1145	788.961	673.8	0.9	21.387	47.928	69.315	1.45	54.107	58.621	10.694
36	0.1157	807.220	692.1	0.9	21.961	47.813	69.774	1.46	54.904	58.794	10.981
37	0.1169	826.819	711.7	0.9	22.577	47.702	70.279	1.47	55.679	58.990	11.289
38	0.1181	845.943	730.8	1.0	23.178	47.575	70.753	1.49	56.561	59.164	11.589
39	0.1194	863.630	748.5	1.0	23.733	47.447	71.181	1.50	57.445	59.314	11.867
40	0.1206	881.551	766.4	1.0	24.295	47.324	71.619	1.51	58.304	59.471	12.148
41	0.1218	900.560	785.4	1.0	24.892	47.192	72.084	1.53	59.215	59.638	12.446
42	0.1267	970.449	855.3	1.1	27.079	46.633	73.713	1.58	63.099	60.173	13.540
43	0.1316	1040.091	924.9	1.2	29.255	46.036	75.291	1.64	67.244	60.664	14.627
44	0.1366	1107.352	992.2	1.3	31.350	45.382	76.732	1.69	71.789	61.057	15.675
45	0.1415	1173.647	1058.5	1.4	33.411	44.676	78.087	1.75	76.692	61.381	16.706
46	0.1464	1241.922	1126.8	1.5	35.530	43.906	79.436	1.81	82.040	61.671	17.765

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
47	0.1513	1305.899	1190.7	1.6	37.510	43.083	80.593	1.87	87.750	61.838	18.755
48	0.1562	1369.617	1254.4	1.7	39.476	42.192	81.668	1.94	93.941	61.930	19.738
49	0.1611	1427.351	1312.2	1.8	41.251	41.249	82.500	2.00	100.490	61.874	20.626
50	0.1660	1486.795	1371.6	1.9	43.076	40.233	83.309	2.07	107.544	61.771	21.538
51	0.1709	1541.493	1426.3	2.0	44.748	39.171	83.919	2.14	114.918	61.545	22.374
52	0.1758	1594.691	1479.5	2.1	46.370	38.040	84.410	2.22	122.772	61.225	23.185
53	0.1807	1643.647	1528.5	2.2	47.855	36.908	84.763	2.30	130.636	60.835	23.928
54	0.1857	1691.642	1576.5	2.3	49.307	35.729	85.036	2.38	138.825	60.382	24.654
55	0.1906	1733.652	1618.5	2.4	50.570	34.532	85.101	2.46	147.136	59.817	25.285
56	0.1955	1771.335	1656.2	2.5	51.694	33.353	85.047	2.55	155.322	59.200	25.847
57	0.2004	1807.308	1692.1	2.6	52.762	32.200	84.962	2.64	163.329	58.581	26.381
58	0.2053	1841.653	1726.5	2.7	53.778	31.086	84.864	2.73	171.067	57.975	26.889
59	0.2102	1869.529	1754.4	2.8	54.590	30.015	84.605	2.82	178.501	57.310	27.295
60	0.2151	1895.483	1780.3	2.9	55.341	29.011	84.352	2.91	185.473	56.682	27.670
61	0.2200	1918.470	1803.3	3.0	55.998	28.085	84.083	2.99	191.903	56.084	27.999
62	0.2249	1938.847	1823.7	3.1	56.572	27.221	83.793	3.08	197.902	55.507	28.286
63	0.2299	1960.349	1845.2	3.2	57.180	26.439	83.619	3.16	203.337	55.029	28.590
64	0.2348	1976.266	1861.1	3.3	57.613	25.738	83.351	3.24	208.204	54.545	28.807
65	0.2397	1991.532	1876.4	3.4	58.026	25.106	83.132	3.31	212.594	54.119	29.013
66	0.2446	2008.466	1893.3	3.5	58.489	24.544	83.032	3.38	216.498	53.788	29.244
67	0.2495	2024.785	1909.6	3.6	58.932	24.036	82.968	3.45	220.024	53.502	29.466
68	0.2544	2038.598	1923.4	3.7	59.297	23.596	82.892	3.51	223.082	53.244	29.648
69	0.2593	2053.864	1938.7	3.8	59.705	23.208	82.913	3.57	225.774	53.060	29.853
70	0.2642	2066.745	1951.6	3.9	60.039	22.866	82.905	3.63	228.147	52.886	30.020
71	0.2691	2081.767	1966.6	4.0	60.438	22.556	82.995	3.68	230.300	52.775	30.219
72	0.2740	2097.364	1982.2	4.1	60.854	22.302	83.156	3.73	232.067	52.729	30.427
73	0.2790	2110.038	1994.9	4.2	61.179	22.057	83.237	3.77	233.763	52.647	30.590
74	0.2839	2124.010	2008.8	4.3	61.544	21.846	83.390	3.82	235.232	52.618	30.772
75	0.2888	2138.721	2023.6	4.4	61.930	21.691	83.621	3.86	236.308	52.656	30.965
76	0.2937	2152.396	2037.2	4.5	62.283	21.528	83.811	3.89	237.437	52.670	31.141
77	0.2986	2166.358	2051.2	4.6	62.644	21.394	84.038	3.93	238.372	52.716	31.322
78	0.3035	2180.056	2064.9	4.7	62.996	21.282	84.278	3.96	239.147	52.780	31.498
79	0.3084	2194.744	2079.6	4.8	63.378	21.193	84.571	3.99	239.767	52.882	31.689
80	0.3133	2209.513	2094.3	4.9	63.761	21.111	84.872	4.02	240.333	52.992	31.880
81	0.3182	2221.947	2106.8	5.0	64.072	21.048	85.120	4.04	240.775	53.084	32.036
82	0.3305	2257.157	2142.0	5.3	64.971	20.924	85.894	4.11	241.638	53.409	32.485
83	0.3428	2290.505	2175.3	5.5	65.808	20.867	86.675	4.15	242.031	53.771	32.904
84	0.3551	2325.789	2210.6	5.8	66.699	20.859	87.558	4.20	242.086	54.208	33.349
85	0.3673	2359.408	2244.2	6.0	67.533	20.898	88.431	4.23	241.817	54.664	33.767
86	0.3796	2393.189	2278.0	6.3	68.367	20.969	89.337	4.26	241.319	55.153	34.184
87	0.3919	2429.003	2313.8	6.5	69.257	21.056	90.313	4.29	240.717	55.685	34.629
88	0.4042	2461.774	2346.6	6.8	70.050	21.151	91.201	4.31	240.056	56.176	35.025
89	0.4164	2495.744	2380.6	7.0	70.873	21.310	92.184	4.33	238.952	56.747	35.437
90	0.4287	2524.083	2408.9	7.3	71.524	21.448	92.973	4.33	237.994	57.210	35.762
91	0.4410	2552.280	2437.1	7.5	72.166	21.602	93.769	4.34	236.923	57.686	36.083
92	0.4532	2580.669	2465.5	7.8	72.810	21.767	94.577	4.34	235.780	58.172	36.405
93	0.4655	2609.170	2494.0	8.0	73.452	21.953	95.405	4.35	234.486	58.679	36.726

Test Readings for Specimen No. 1

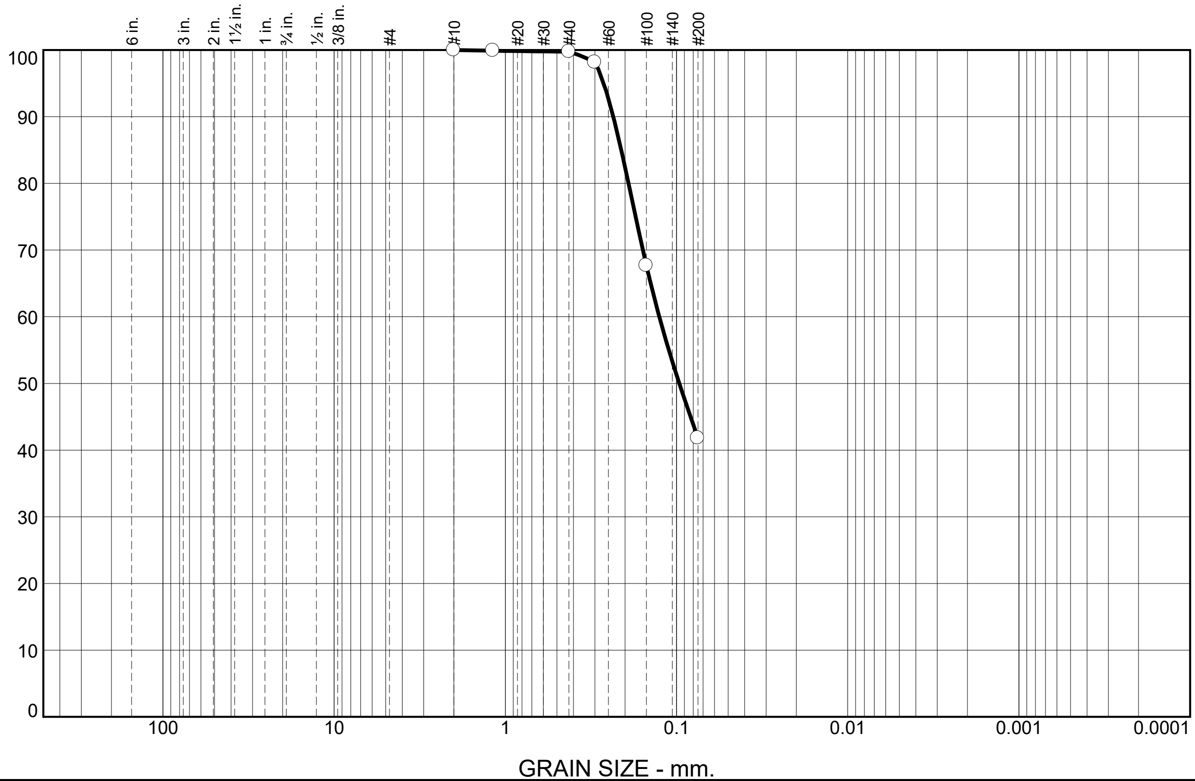
No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
94	0.4778	2639.600	2524.4	8.3	74.146	22.128	96.273	4.35	233.277	59.200	37.073
95	0.4901	2664.500	2549.3	8.5	74.673	22.317	96.989	4.35	231.964	59.653	37.336
96	0.5023	2693.257	2578.1	8.8	75.309	22.511	97.820	4.35	230.611	60.166	37.654
97	0.5146	2719.576	2604.4	9.0	75.869	22.692	98.561	4.34	229.358	60.626	37.934
98	0.5269	2744.841	2629.7	9.3	76.394	22.905	99.299	4.34	227.880	61.102	38.197
99	0.5392	2772.828	2657.7	9.5	76.995	23.104	100.099	4.33	226.495	61.601	38.497
100	0.5514	2799.410	2684.2	9.8	77.550	23.294	100.843	4.33	225.179	62.069	38.775
101	0.5637	2826.418	2711.2	10.0	78.113	23.515	101.628	4.32	223.641	62.572	39.057
102	0.5760	2848.646	2733.5	10.3	78.535	23.706	102.240	4.31	222.318	62.973	39.267
103	0.5883	2872.860	2757.7	10.5	79.009	23.918	102.927	4.30	220.844	63.422	39.505
104	0.6005	2895.236	2780.1	10.8	79.428	24.117	103.545	4.29	219.461	63.831	39.714
105	0.6128	2911.981	2796.8	11.0	79.682	24.320	104.002	4.28	218.052	64.161	39.841
106	0.6251	2931.169	2816.0	11.3	80.004	24.517	104.521	4.26	216.684	64.519	40.002
107	0.6373	2945.776	2830.6	11.5	80.192	24.708	104.900	4.25	215.357	64.804	40.096
108	0.6496	2958.734	2843.6	11.8	80.332	24.904	105.235	4.23	213.998	65.069	40.166
109	0.6619	2971.314	2856.1	12.0	80.458	25.075	105.533	4.21	212.809	65.304	40.229
110	0.6742	2985.097	2869.9	12.3	80.617	25.256	105.873	4.19	211.551	65.564	40.308
111	0.6864	2995.836	2880.7	12.5	80.688	25.428	106.115	4.17	210.359	65.771	40.344
112	0.6987	3003.565	2888.4	12.8	80.673	25.561	106.234	4.16	209.432	65.898	40.336
113	0.7110	3013.658	2898.5	13.0	80.723	25.707	106.430	4.14	208.419	66.068	40.361
114	0.7233	3023.239	2908.1	13.3	80.757	25.826	106.583	4.13	207.591	66.205	40.378
115	0.7355	3032.792	2917.6	13.5	80.788	25.943	106.731	4.11	206.780	66.337	40.394
116	0.7478	3043.385	2928.2	13.8	80.847	26.052	106.899	4.10	206.026	66.475	40.424
117	0.7601	3053.746	2938.6	14.0	80.898	26.149	107.047	4.09	205.351	66.598	40.449
118	0.7723	3063.424	2948.3	14.3	80.929	26.230	107.158	4.09	204.790	66.694	40.464
119	0.7846	3072.423	2957.3	14.5	80.939	26.302	107.241	4.08	204.285	66.772	40.469
120	0.7969	3081.183	2966.0	14.8	80.941	26.389	107.330	4.07	203.680	66.860	40.470
121	0.8092	3089.331	2974.2	15.0	80.925	26.452	107.377	4.06	203.245	66.915	40.463
122	0.8214	3093.844	2978.7	15.3	80.809	26.506	107.316	4.05	202.868	66.911	40.405
123	0.8337	3095.546	2980.4	15.5	80.617	26.551	107.168	4.04	202.557	66.860	40.309
124	0.8460	3090.128	2975.0	15.8	80.232	26.530	106.762	4.02	202.706	66.646	40.116
125	0.8583	3086.257	2971.1	16.0	79.890	26.521	106.411	4.01	202.769	66.466	39.945
126	0.8705	3073.683	2958.5	16.3	79.315	26.484	105.799	3.99	203.025	66.141	39.657
127	0.8828	3054.357	2939.2	16.5	78.561	26.377	104.939	3.98	203.765	65.658	39.281
128	0.8951	3046.240	2931.1	16.8	78.110	26.298	104.408	3.97	204.314	65.353	39.055
129	0.9074	3058.776	2943.6	17.0	78.208	26.270	104.478	3.98	204.509	65.374	39.104
130	0.9196	3075.072	2959.9	17.3	78.404	26.307	104.711	3.98	204.250	65.509	39.202
131	0.9319	3093.938	2978.8	17.5	78.665	26.364	105.029	3.98	203.855	65.697	39.333
132	0.9442	3112.258	2997.1	17.8	78.909	26.437	105.346	3.98	203.353	65.891	39.455
133	0.9565	3129.881	3014.7	18.0	79.132	26.504	105.636	3.99	202.884	66.070	39.566
134	0.9687	3144.877	3029.7	18.3	79.283	26.563	105.846	3.98	202.472	66.205	39.641
135	0.9810	3159.132	3044.0	18.5	79.412	26.643	106.055	3.98	201.917	66.349	39.706
136	0.9933	3170.486	3055.3	18.8	79.464	26.702	106.166	3.98	201.507	66.434	39.732
137	1.0056	3181.495	3066.3	19.0	79.504	26.755	106.259	3.97	201.142	66.507	39.752
138	1.0178	3191.322	3076.2	19.3	79.513	26.817	106.330	3.97	200.712	66.573	39.757
139	1.0301	3195.673	3080.5	19.5	79.379	26.858	106.237	3.96	200.426	66.547	39.689
140	1.0424	3202.321	3087.2	19.8	79.303	26.898	106.200	3.95	200.151	66.549	39.651

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
141	1.0536	3208.199	3093.0	20.0	79.227	26.906	106.132	3.94	200.093	66.519	39.613

NEWFIELDS (2022)

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.2	58.0	41.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#16	99.9		
#40	99.8		
#50	98.2		
#100	67.7		
#200	41.8		

* (no specification provided)

Soil Description

Gray silty sand

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 0.2340 D_{85}= 0.2103 D_{60}= 0.1263
D_{50}= 0.0965 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-4(0)

Remarks

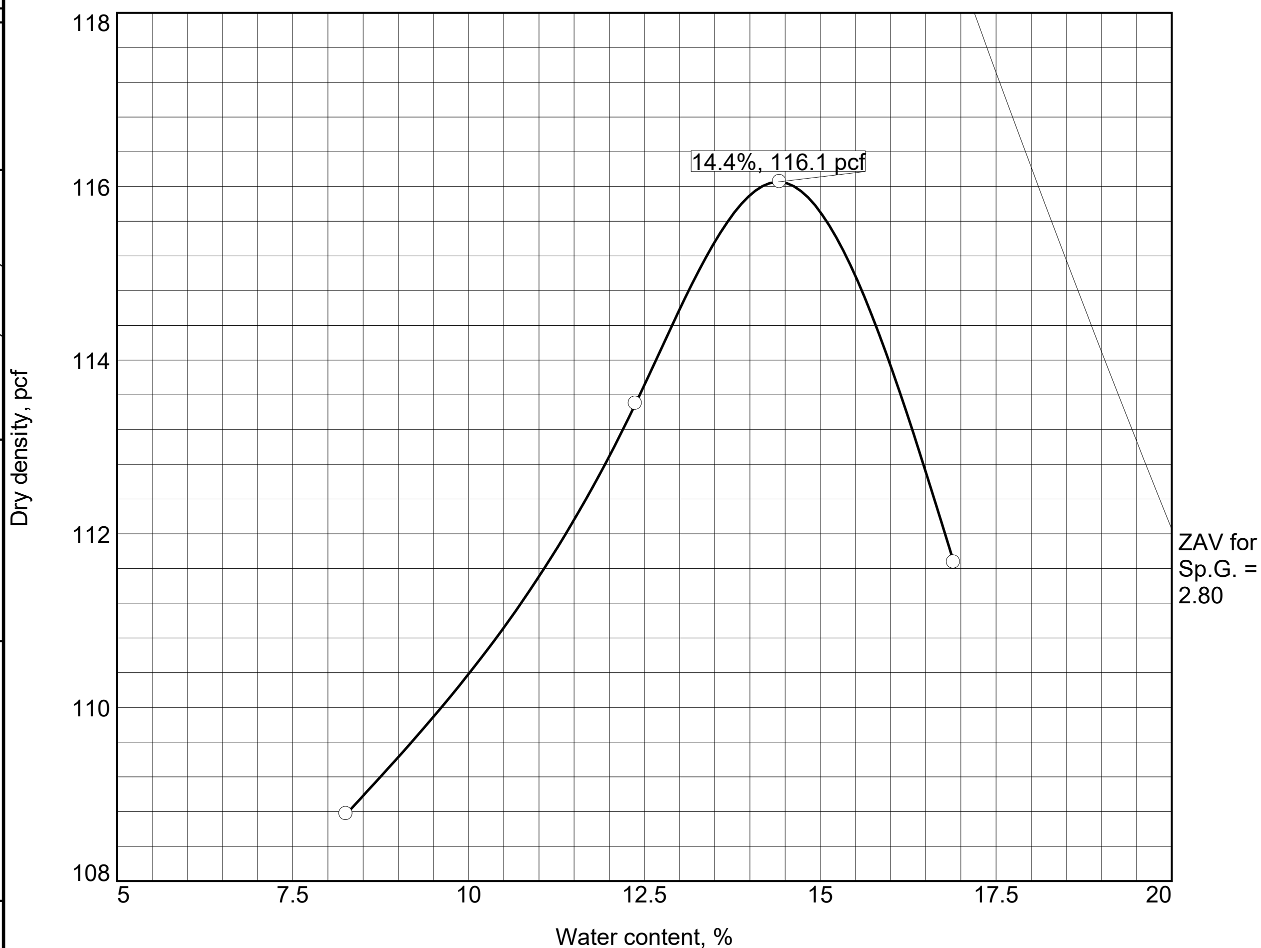
Location: Tailings Comp 1
Sample Number: 22-034-01
Date: 2/24/2022

NewFields

Client: South 32
Project: Hermosa
Project No: 475.0014.024 **Figure** 22-034-01

Tested By: EG **Checked By:** JW

COMPACTION TEST REPORT



Test specification: ASTM D 698-12 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
	SM	A-4(0)		2.8	NP	NP	0.0	41.8

TEST RESULTS

Maximum dry density = 116.1 pcf

Optimum moisture = 14.4 %

MATERIAL DESCRIPTION

Gray silty sand

Project No. 475.0014.024 **Client:** South 32

Project: Hermosa

Date: 2/24/2022

○ **Location:** Tailings Comp 1 **Sample Number:** 22-034-01

NewFields

Remarks:

*Assumed Specific Gravity

Figure 22-034-01

Tested By: ZM **Checked By:** JW

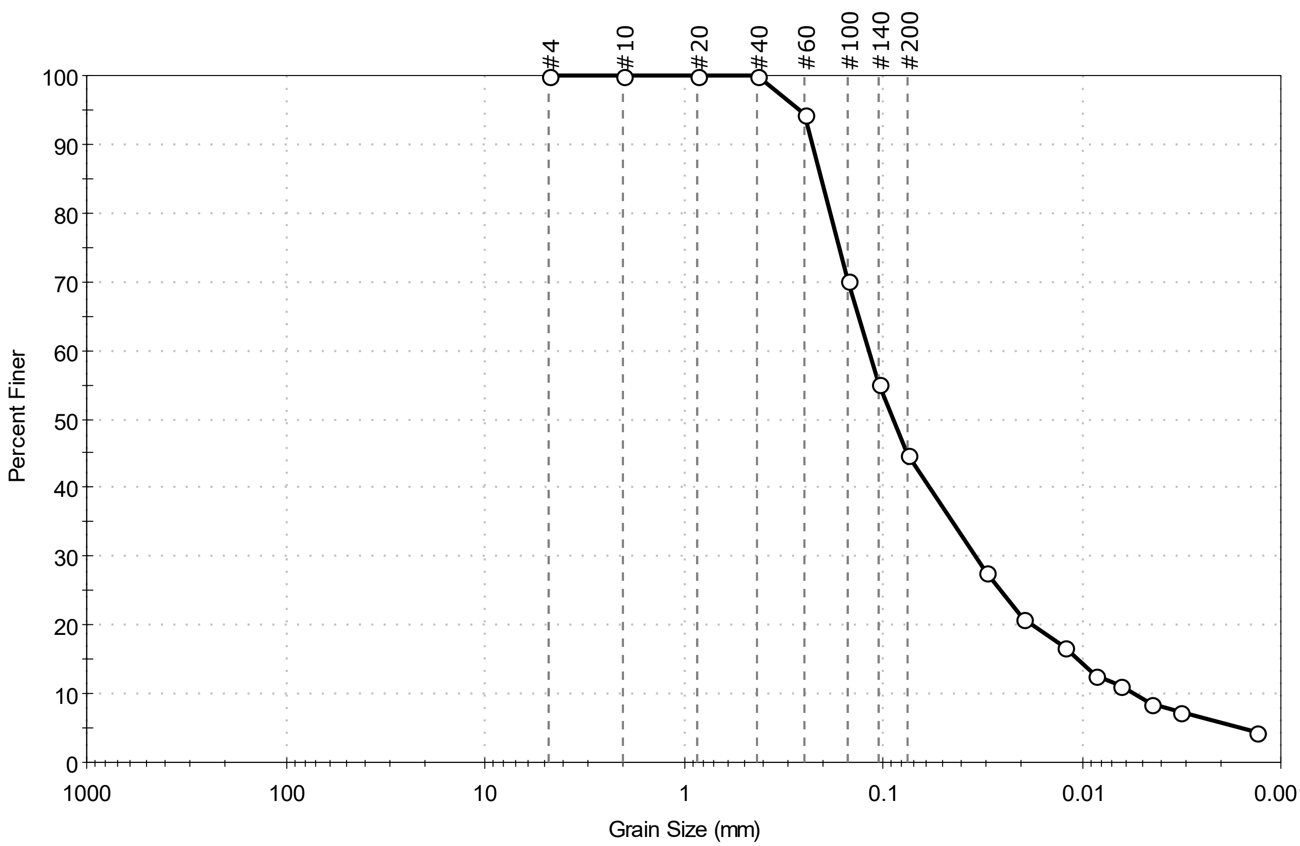
GEOTESTING EXPRESS (2022)

Client:	NewFields		
Project:	Hermosa		
Location:	Patagonia, AZ	Project No:	GTX-315266

Boring ID:	---	Sample Type:	bucket	Tested By:	ckg
Sample ID:	Composite Ore (Taylor De	Test Date:	09/02/22	Checked By:	n/a
Depth :	---	Test Id:	682666		

Test Comment: ---
Visual Description: Moist, gray silty sand
Sample Comment: ---

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	55.3	44.7

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	100		
#60	0.25	94		
#100	0.15	70		
#140	0.11	55		
#200	0.075	45		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0305	28		
---	0.0196	21		
---	0.0124	17		
---	0.0085	13		
---	0.0064	11		
---	0.0045	9		
---	0.0032	7		
---	0.0013	4		

Coefficients

D_{85} =0.2046 mm D_{30} =0.0344 mm
D_{60} =0.1185 mm D_{15} =0.0105 mm
D_{50} =0.0893 mm D_{10} =0.0054 mm
C_u =21.944 C_c =1.849

Classification

ASTM Silty SAND (SM)

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---
Sand/Gravel Hardness : ---
Dispersion Device : Apparatus A - Mech Mixer
Dispersion Period : 1 minute
Est. Specific Gravity : 2.83
Separation of Sample: #200 Sieve

Client:	NewFields				
Project:	Hermosa				
Location:	Patagonia, AZ			Project No:	GTX-315266
Boring ID:	---	Sample Type:	bucket	Tested By:	cam
Sample ID:	Composite Ore (Taylor De	Test Date:	09/01/22	Checked By:	n/a
Depth :	---	Test Id:	682667		

Test Comment: ---
Visual Description: Moist, gray silty sand
Sample Comment: ---

Atterberg Limits - ASTM D4318

Sample Determined to be non-plastic

Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	Composite Ore (Taylor Deposite)	---	---	13	n/a	n/a	n/a	n/a	Silty SAND (SM)

0% Retained on #40 Sieve
Dry Strength: LOW
Dilatancy: RAPID
Toughness: n/a
The sample was determined to be Non-Plastic

Client:	NewFields				
Project:	Hermosa				
Location:	Patagonia, AZ			Project No:	GTX-315266
Boring ID:	---	Sample Type:	bucket	Tested By:	ckg
Sample ID:	Composite Ore (Taylor De	Test Date:	08/29/22	Checked By:	ank
Depth :	---	Test Id:	682665		

Test Comment: ---
Visual Description: Moist, gray silty sand
Sample Comment: ---

Specific Gravity of Soils by ASTM D854

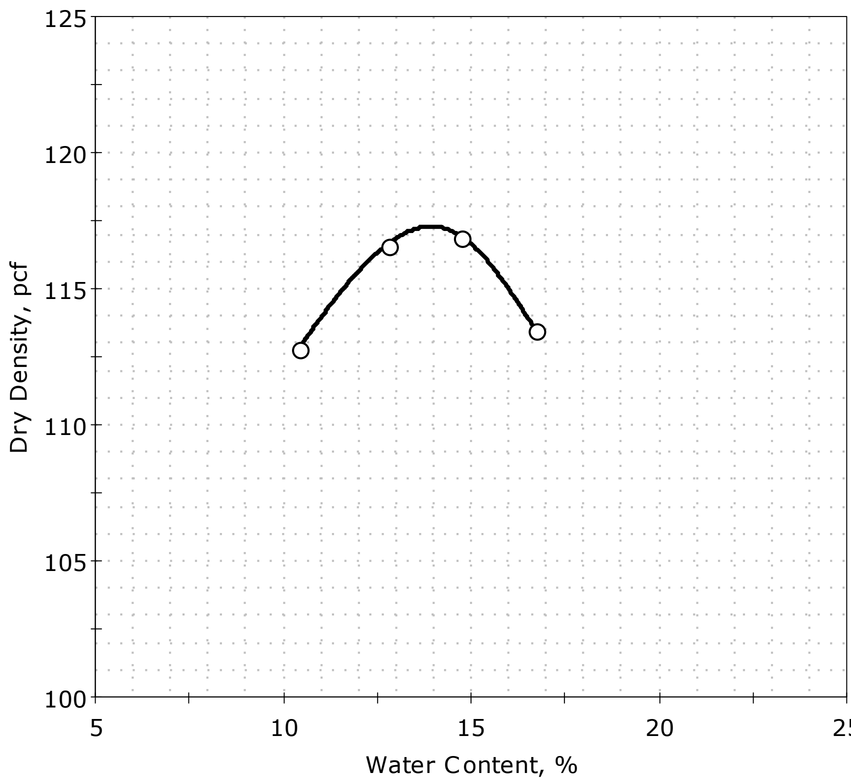
Boring ID	Sample ID	Depth	Visual Description	Specific Gravity
---	Composite Ore (Taylor Deposite)	---	Moist, gray silty sand	2.83

Notes: Specific Gravity performed by using method B (oven dried specimens) of ASTM D854
Moisture Content determined by ASTM D2216.

Client:	NewFields				
Project:	Hermosa				
Location:	Patagonia, AZ			Project No:	GTX-315266
Boring ID:	---	Sample Type:	bucket	Tested By:	cwd
Sample ID:	Composite Ore (Taylor De	Test Date:	08/31/22	Checked By:	n/a
Depth :	---	Test Id:	682945		

Test Comment: ---
Visual Description: Moist, gray silty sand
Sample Comment: ---

Compaction Report - ASTM D698



Data Points	Point 1	Point 2	Point 3	Point 4
Dry density, pcf	112.8	116.6	116.9	113.5
Moisture Content, %	10.4	12.8	14.7	16.7

Method : A

Preparation : DRY

As received Moisture :13 %

Rammer : Manual

Zero voids line based on assumed specific gravity of 2.65

Maximum Dry Density= 117.3 pcf
Optimum Moisture= 13.9 %

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GeoTesting EXPRESS

Consolidated Undrained Direct Simple Shear Testing of Cohesive Soils by ASTM D6528

Client: NewFields | GTX#: 315266
Project Name: Hermosa | Test Date: 10/27/22
Project Location: Patagonia, AZ

Boring ID: ---
Sample ID: Composite Ore
Depth, ft: ---

Visual Description: Moist, gray silty sand

Test Equipment: Top and bottom box (circular) = 4.0 in diameter. Load cells and LVDT's connected to data acquisition system for shear force, normal load, horizontal and vertical displacement; surface area = 12.57 in^2, soil height = 1.5 inch. Stacked rings used. Set up included porous stones with pins.

Test Condition: Inundated prior to consolidating

Sample Type and Preparation: Target Compaction: 90% relative compaction at + 3% moisture content

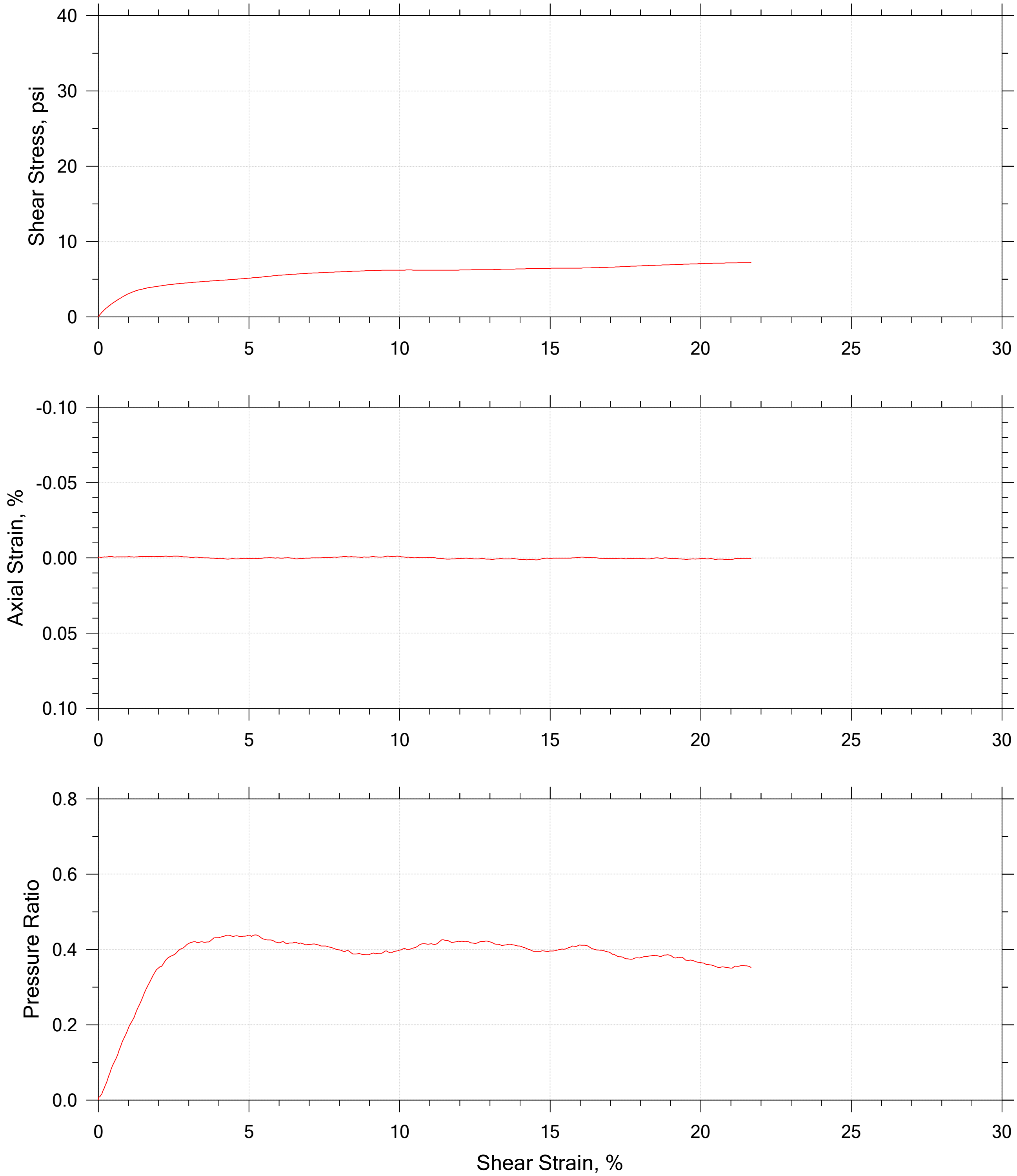
Parameter	Point 1	Point 2	Point 3	Point 4	Point 5
Test No.	DSS-1R	DSS-2RR			
Initial Moisture Content, %	16.8	16.8			
Initial Dry Density, pcf	105.6	105.7			
Nominal Rate of Shear Strain, %/hr	5.0	5.0			
Maximum Vertical Consolidation Stress, psi	20	80			
Vertical Consolidation Stress at time of shear, psi	20	80			
Final Moisture Content, %	19.3	17.1			
Measured Peak Shear Stress, psi	7.07	29.45			
Shear Strain at Peak Shear Stress, %	20.0	20.0			
Membrane Correction, psi	0.33	0.33			
Corrected Peak Shear Stress, psi	6.74	29.12			
S_u / σ'_{vc}	0.34	0.36			

Comments: Target Compaction: 90% of 117.3 pcf at 16.9% moisture content (OPT +3%)

Tested By: jlw | Checked By: as

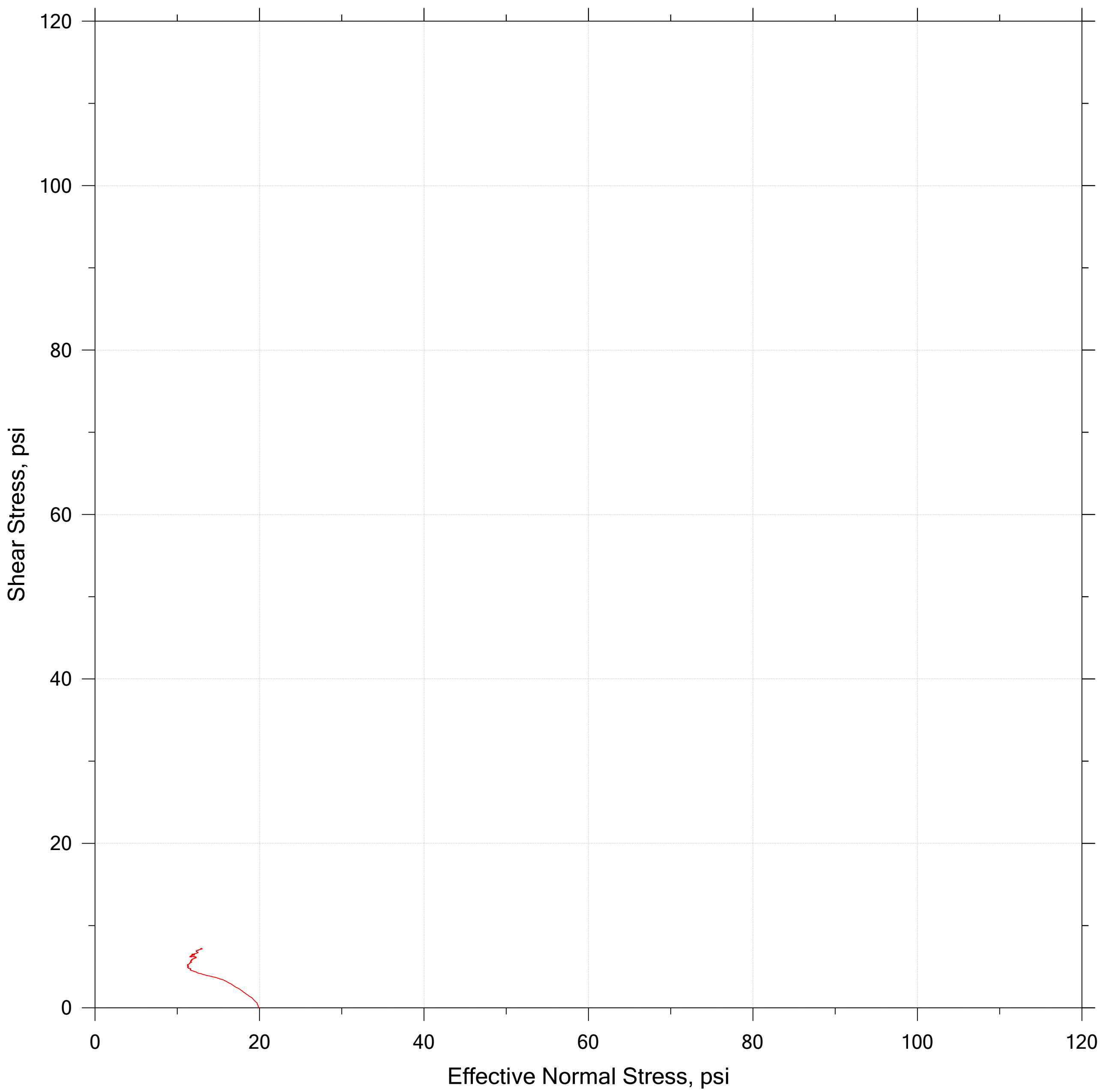
Notes: These results apply only to the sample tested for the specific test conditions. The test procedures employed follow accepted industry practice and the indicated test method. GeoTesting Express has no specific knowledge as to conditioning, origin, sampling procedure or intended use of the material.

Direct Simple Shear Test



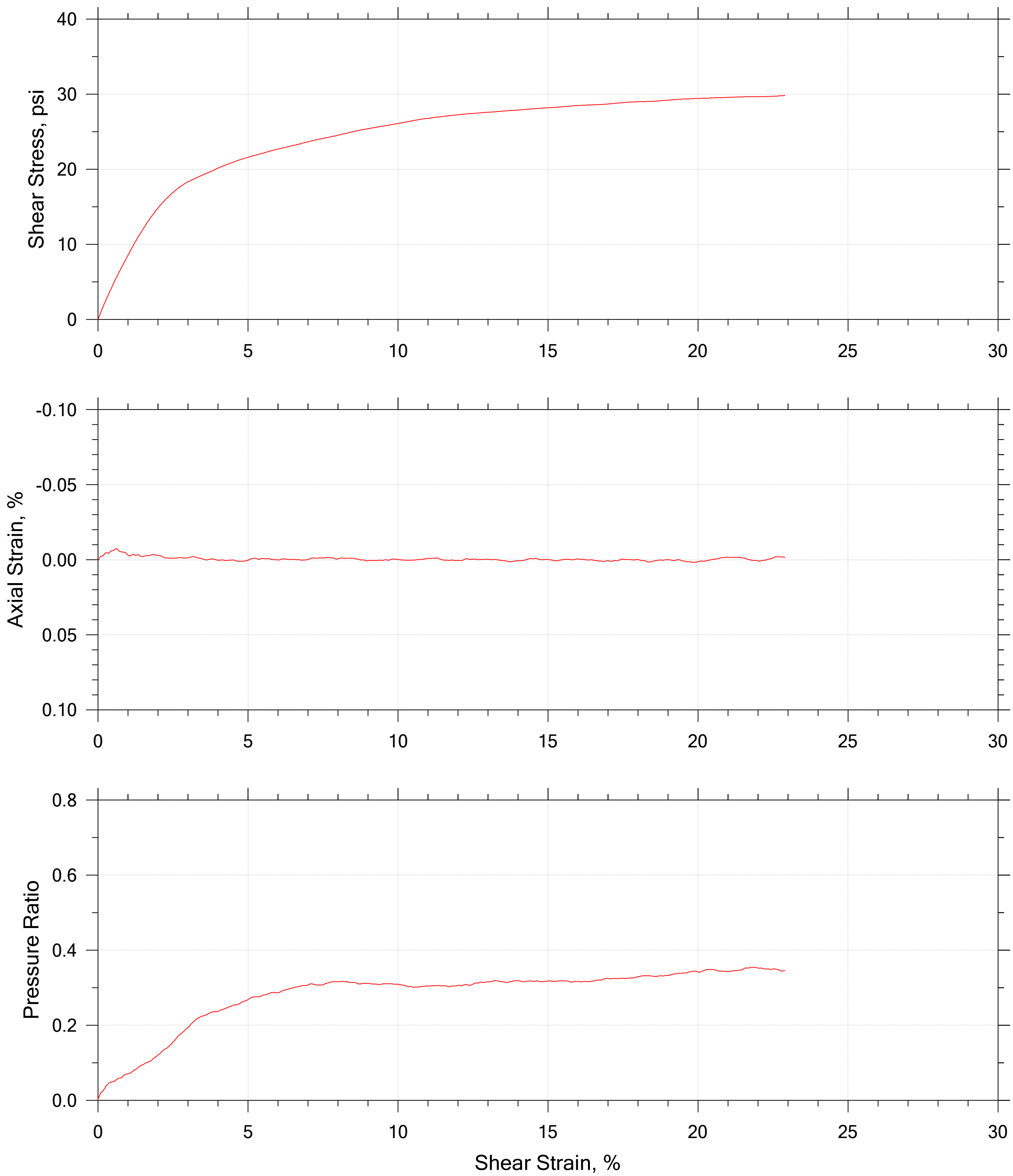
GeoTesting EXPRESS	Project Name: Hermosa	Location: Patagonia, AZ	Project Number: GTX-315266
	Boring Number: ---	Tester: jlw/as	Checker: as
	Sample Number: Composite Ore	Test Date: 10/27/2022	Depth: ---
	Test Number: DSS-1R	Preparation: reconstituted	Elevation: ---
	Description: Moist, gray silty sand		
	Remarks: 4" x 1.5" sample dimensions, Opt MC +3% and 90% of MDD MDD-117.3 pcf OMC-13.9		

Direct Simple Shear Test



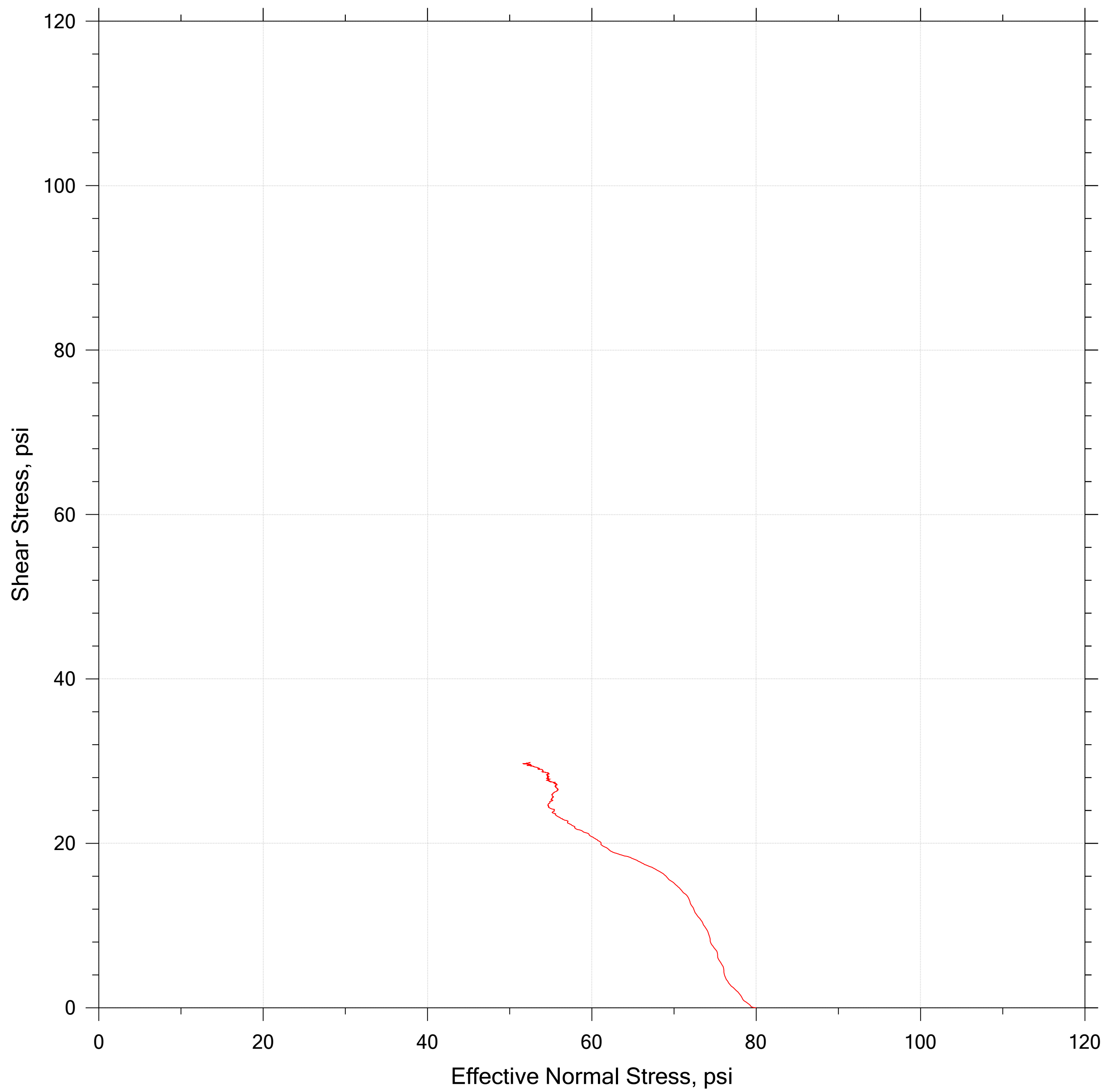
GeoTesting EXPRESS	Project Name: Hermosa	Location: Patagonia, AZ	Project Number: GTX-315266
	Boring Number: ---	Tester: jlw/as	Checker: as
	Sample Number: Composite Ore	Test Date: 10/27/2022	Depth: ---
	Test Number: DSS-1R	Preparation: reconstituted	Elevation: ---
	Description: Moist, gray silty sand		
	Remarks: 4" x 1.5" sample dimensions, Opt MC +3% and 90% of MDD MDD-117.3 pcf OMC-13.9		

Direct Simple Shear Test



GeoTesting EXPRESS	Project Name: Hermosa	Location: Patagonia, AZ	Project Number: GTX-315266
	Boring Number: ---	Tester: jlw/as	Checker: as
	Sample Number: Composite Ore	Test Date: 10/31/2022	Depth: ---
	Test Number: DSS-2RR	Preparation: reconstituted	Elevation: ---
	Description: Moist, gray silty sand		
	Remarks: 4" x 1.5" sample dimensions, Opt MC +3% and 90% of MDD		

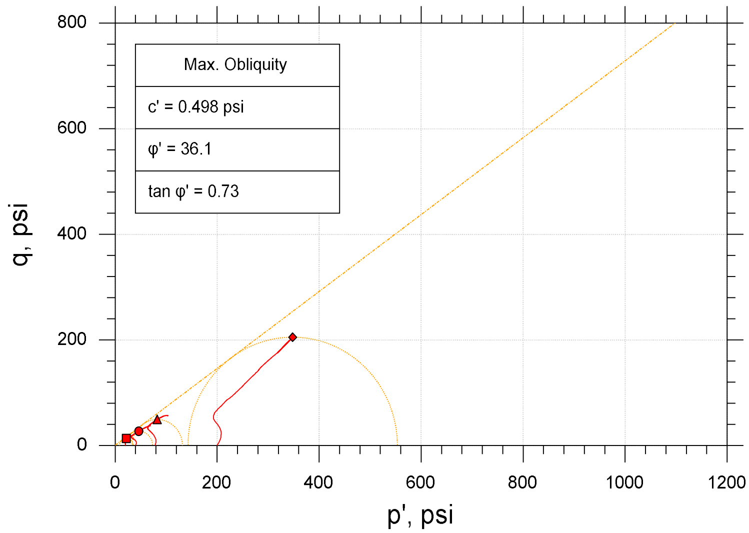
Direct Simple Shear Test

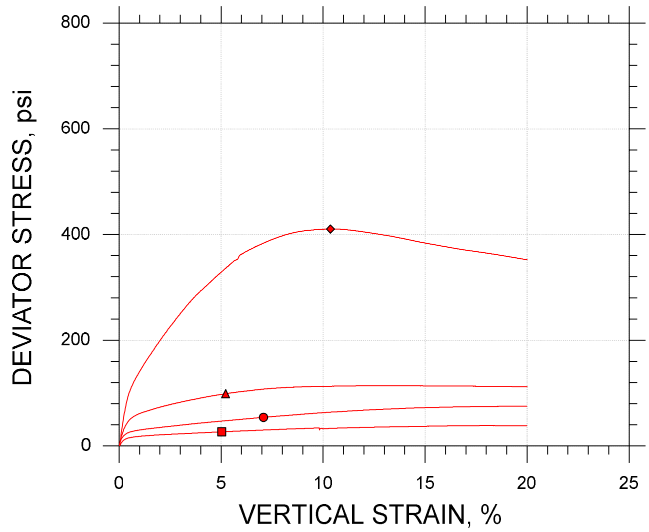


GeoTesting EXPRESS	Project Name: Hermosa	Location: Patagonia, AZ	Project Number: GTX-315266
	Boring Number: ---	Tester: jlw/as	Checker: as
	Sample Number: Composite Ore	Test Date: 10/31/2022	Depth: ---
	Test Number: DSS-2RR	Preparation: reconstituted	Elevation: ---
	Description: Moist, gray silty sand		
	Remarks: 4" x 1.5" sample dimensions, Opt MC +3% and 90% of MDD		

Client: NewFields	
Project Name: Hermosa	
Project Location: Patagonia, AZ	
Project Number: GTX-315266	
Tested By: trm	Checked By: njh
Boring ID: ---	
Preparation: reconstituted	
Description: Moist, gray silty sand	
Classification: Silty SAND	
Group Symbol: SM	
Liquid Limit: NP	Plastic Limit: NP
Plasticity Index: NP	Measured Specific Gravity: 2.83

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767

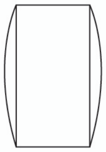


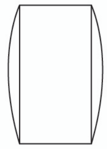


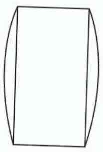
Symbol		■	●	▲	◆
Sample ID		Composite Ore	Composite Ore	Composite Ore	Composite Ore
Depth, ft		---	---	---	---
Test Number		CU-2-1	CU-2-2	CU-2-3	CU-2-4
Initial	Height, in	8.000	8.000	8.000	8.000
	Diameter, in	4.000	4.000	4.000	4.000
	Moisture Content (from Cuttings), %	15.8	15.8	15.8	15.8
	Dry Density, pcf	107.	107.	107.	107.
	Saturation (Wet Method), %	67.9	67.9	67.9	67.9
	Void Ratio	0.657	0.657	0.657	0.657
Before Shear	Moisture Content, %	22.5	21.3	21.5	19.4
	Dry Density, pcf	108.	110.	110.	114.
	Cross-sectional Area (Method A), in²	12.43	12.25	12.28	11.99
	Saturation, %	100.0	100.0	100.0	100.0
	Void Ratio	0.636	0.604	0.608	0.549
	Back Pressure, psi	141.0	160.9	130.9	150.8
Vertical Effective Consolidation Stress, psi		20.00	39.96	79.95	199.9
Horizontal Effective Consolidation Stress, psi		20.01	39.98	79.99	200.0
Vertical Strain after Consolidation, %		0.2774	0.7915	0.7941	1.988
Volumetric Strain after Consolidation, %		1.372	3.351	3.078	6.401
Time to 50% Consolidation, min		---	---	0.3600	---
Shear Strength, psi		13.37	27.10	49.44	205.3
Strain at Failure, %		5.03	7.08	5.22	10.4
Strain Rate, %/min		0.02000	0.02000	0.02000	0.02000
Deviator Stress at Failure, psi		26.73	54.21	98.88	410.5
Effective Minor Principal Stress at Failure, psi		8.400	19.21	33.08	142.8
Effective Major Principal Stress at Failure, psi		35.13	73.42	132.0	553.3
B-Value		0.94	0.93	0.94	0.94

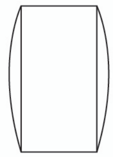
Notes:
- Before Shear Saturation set to 100% for phase calculation.
- Moisture Content determined by ASTM D2216.
- Specific Gravity determined by ASTM D854.
- Atterberg Limits determined by ASTM D4318.
- Deviator Stress includes membrane correction.
- Values for c and φ determined from best-fit straight line for the specific test conditions. Actual strength parameters may vary and should be determined by an engineer for site conditions.

Remarks:

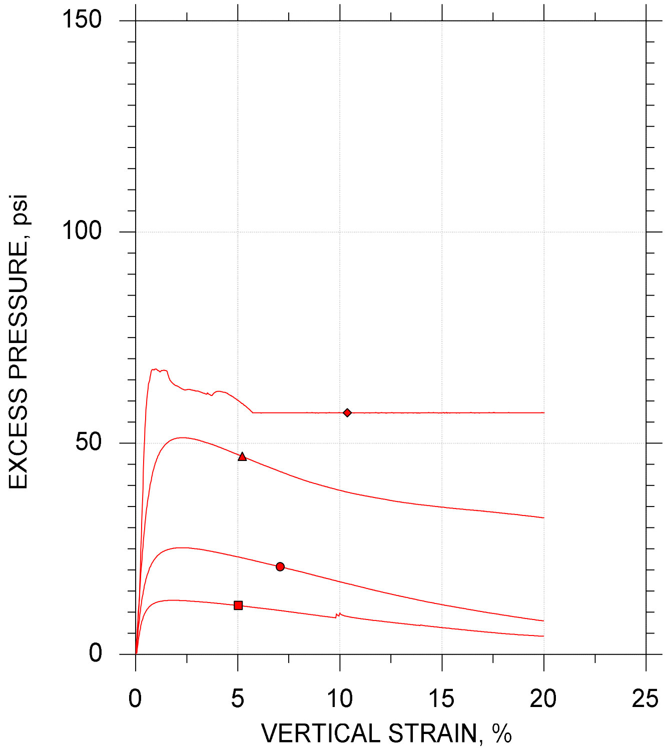


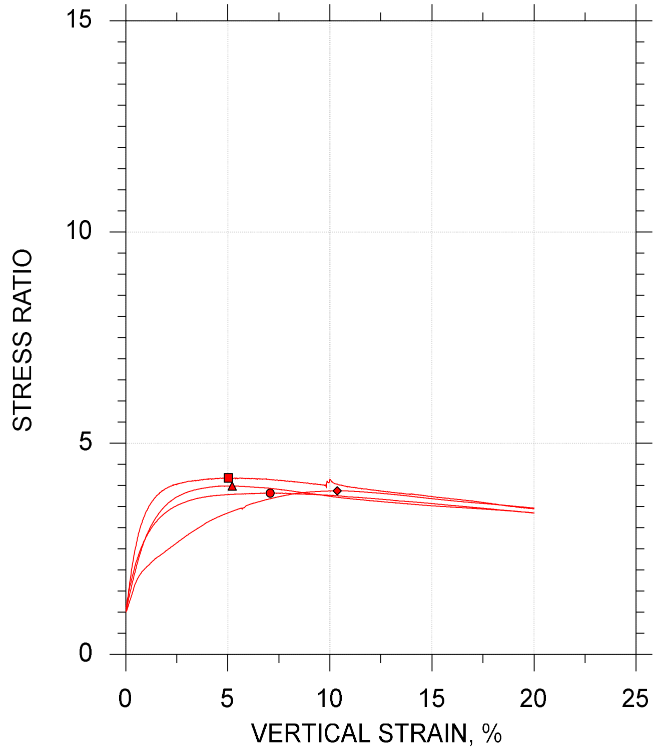


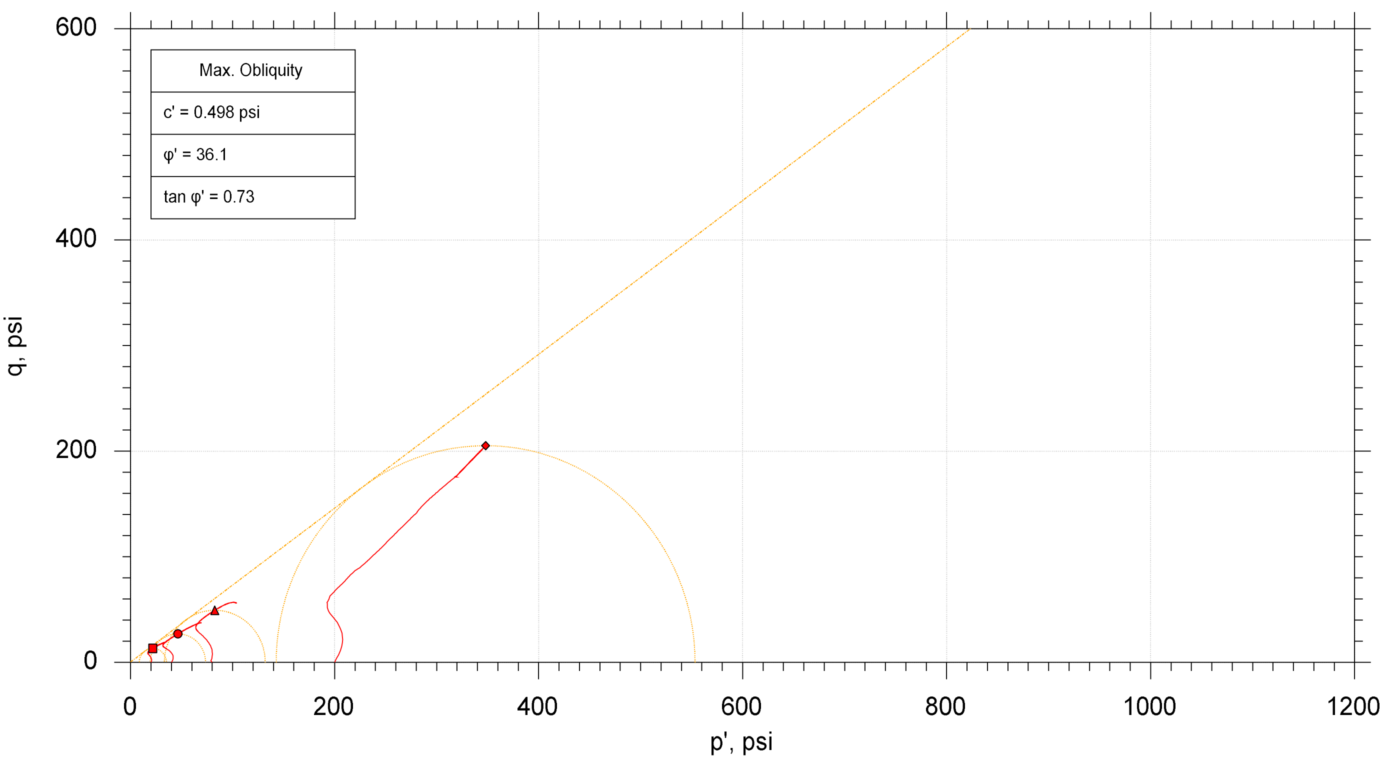




CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767







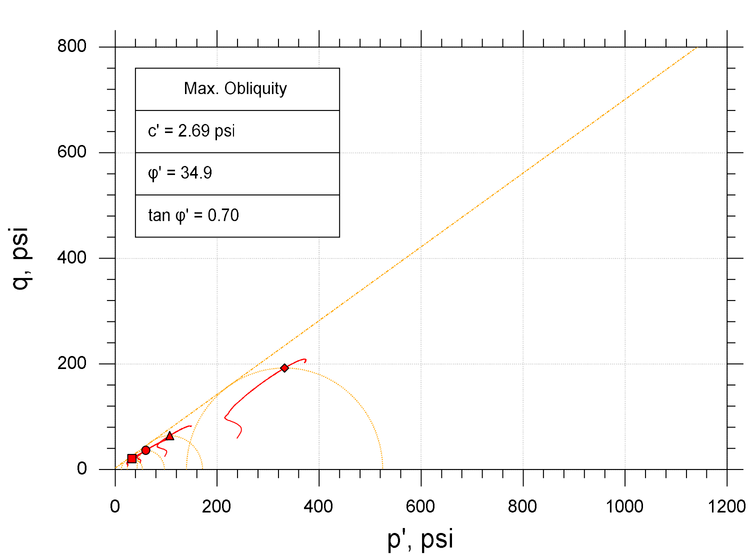
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
■	Composite Ore	CU-2-1	---	trm	10/6/22	njh	10/25/22	315266-CU-2-1n.dat
●	Composite Ore	CU-2-2	---	trm	10/11/22	njh	10/25/22	315266-CU-2-2n.dat
▲	Composite Ore	CU-2-3	---	trm	10/6/22	njh	10/25/22	315266-CU-2-3n.dat
◆	Composite Ore	CU-2-4	---	trm	12/7/22	njh	12/20/22	315266-CU-2-4n.dat

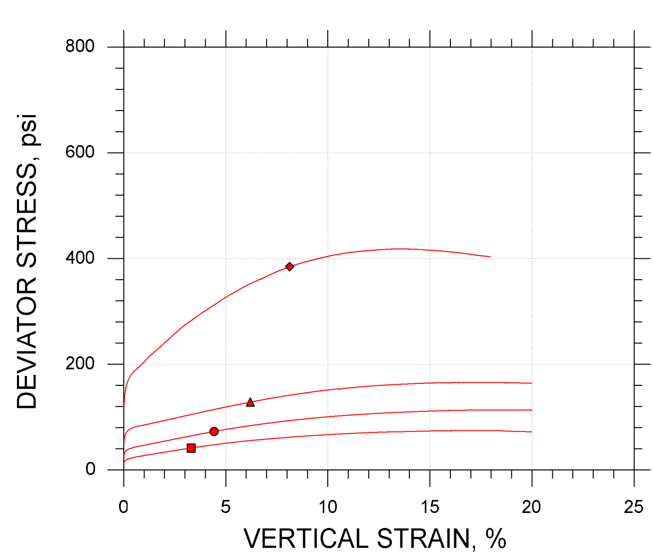
GeoTesting EXPRESS

Project: Hermosa	Location: Patagonia, AZ	Project No.: GTX-315266
Boring No.: ---	Sample Type: reconstituted	
Description: Moist, gray silty sand		
Remarks: TX-030		

Client: NewFIelds	
Project Name: Hermosa	
Project Location: Patagonia, AZ	
Project Number: GTX-315266	
Tested By: trm	Checked By: njh
Boring ID: ---	
Preparation: reconstituted	
Description: Moist, gray silty sand	
Classification: Silty SAND	
Group Symbol: SM	
Liquid Limit: NP	Plastic Limit: NP
Plasticity Index: NP	Measured Specific Gravity: 2.83

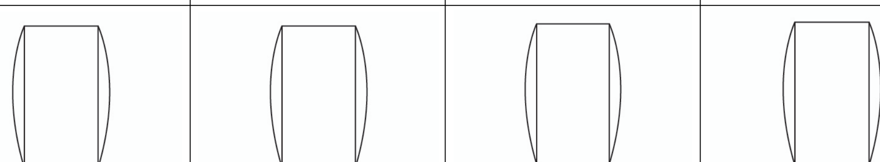
CONSOLIDATED UNDRAINED TRIAXIAL TEST - ANISOTROPIC CONSOLIDATION





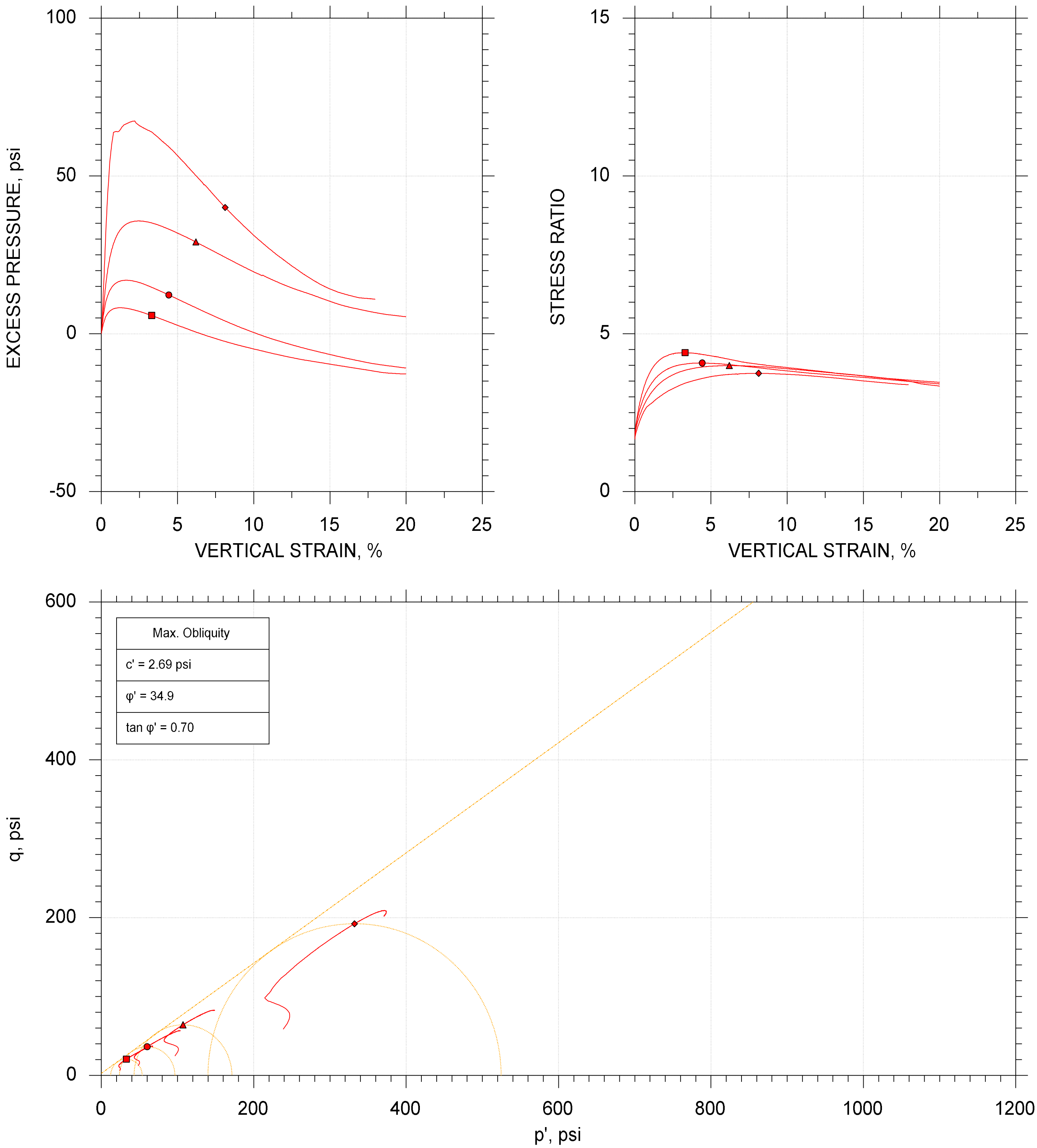
Symbol		■	●	▲	◆
Sample ID		Composite Ore	Composite Ore	Composite Ore	Composite Ore
Depth, ft		---	---	---	---
Test Number		CAU-1-1	CAU-1-2	CAU-1-3	CAU-1-4
Initial	Height, in	8.000	8.000	8.000	8.000
	Diameter, in	4.000	4.000	4.000	4.000
	Moisture Content (from Cuttings), %	15.8	15.8	15.8	15.8
	Dry Density, pcf	107.	107.	107.	107.
	Saturation (Wet Method), %	67.9	67.9	67.9	67.9
	Void Ratio	0.657	0.657	0.657	0.657
Before Shear	Moisture Content, %	22.1	21.2	20.8	22.7
	Dry Density, pcf	109.	110.	111.	108.
	Cross-sectional Area (Method A), in²	12.42	12.28	12.27	12.85
	Saturation, %	100.0	100.0	100.0	100.0
	Void Ratio	0.626	0.601	0.588	0.642
	Back Pressure, psi	140.8	151.0	140.8	131.0
Vertical Effective Consolidation Stress, psi		30.10	60.52	121.1	297.2
Horizontal Effective Consolidation Stress, psi		18.00	36.01	71.99	180.0
Vertical Strain after Consolidation, %		0.7139	1.172	1.853	3.036
Volumetric Strain after Consolidation, %		1.812	3.495	4.163	0.7947
Time to 50% Consolidation, min		---	---	---	---
Shear Strength, psi		20.71	36.44	64.22	192.3
Strain at Failure, %		3.30	4.43	6.20	8.13
Strain Rate, %/min		0.02000	0.02000	0.02000	0.02000
Deviator Stress at Failure, psi		41.43	72.88	128.4	384.7
Effective Minor Principal Stress at Failure, psi		12.17	23.69	42.89	139.9
Effective Major Principal Stress at Failure, psi		53.60	96.57	171.3	524.6
B-Value		0.98	0.95	0.96	0.96

Notes:
- Before Shear Saturation set to 100% for phase calculation.
- Moisture Content determined by ASTM D2216.
- Specific Gravity determined by ASTM D854.
- Atterberg Limits determined by ASTM D4318.
- Deviator Stress includes membrane correction.
- Values for c and φ determined from best-fit straight line for the specific test conditions. Actual strength parameters may vary and should be determined by an engineer for site conditions.



Remarks:

CONSOLIDATED UNDRAINED TRIAXIAL TEST
ANISOTROPIC CONSOLIDATION



	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
■	Composite Ore	CAU-1-1	---	trm	10/13/22	njh	10/25/22	315266-CAU-1-1n.dat
●	Composite Ore	CAU-1-2	---	trm	10/20/22	njh	10/25/22	315266-CAU-1-2n.dat
▲	Composite Ore	CAU-1-3	---	trm	10/17/22	njh	10/25/22	315266-CAU-1-3n.dat
◆	Composite Ore	CAU-1-4	---	trm	12/5/22	njh	12/20/22	315266-CAU-1-4n.dat

GeoTesting EXPRESS

Project: Hermosa	Location: Patagonia, AZ	Project No.: GTX-315266
Boring No.: ---	Sample Type: reconstituted	
Description: Moist, gray silty sand		
Remarks: TX-030		

Client:	NewFields
Project:	Hermosa
Location:	Patagonia, AZ
GTX No.:	315266
Tested By:	jm
Checked By:	
Date:	9/19/2022
Boring No.:	---
Sample No.:	Composite Ore (Taylor Deposite)
Sample Depth:	---
Sample Description:	Moist, grayish brown silty sand

Determination of the Soil Water Characteristic Curve for Desorption Using Hanging Column, Pressure Extractor, Chilled Mirror Hygrometer, or Centrifuge by ASTM D6836

Saturation Liquid:	Distilled Water	Method:	C
Saturation Method:	Tray	Porous Material:	Membrane
Temperature of Soil:	21 °C		

Initial Specimen:	Initial Moisture, %:	17.1	Specific Gravity:	2.83
	Initial Moisture, %/Vol:	28.9	Initial Saturation, %:	98.6
	Dry Unit Weight (pcf):	105.3		

Applied Suction:

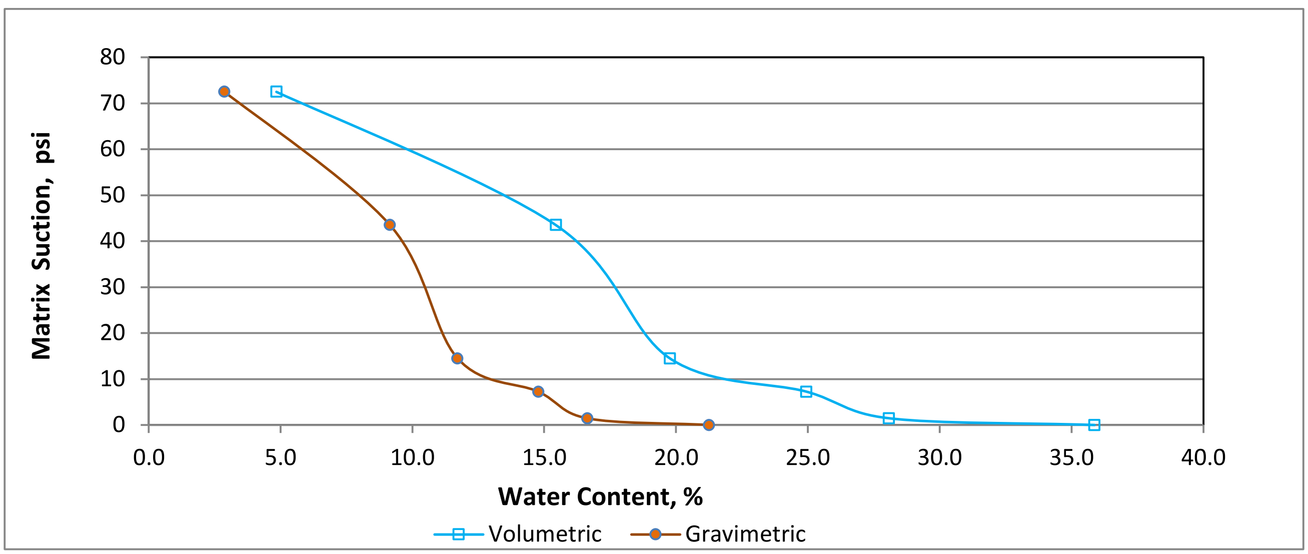
Point	1	2	3	4	5	6
psi	0	1.45	7.25	14.5	43.5	72.5
kPa	0	10	50	100	300	500

Volumetric Water Content:

Point	1	2	3	4	5	6
%	35.9	28.1	24.9	19.8	15.4	4.8

Gravimetric Water Content:

Point	1	2	3	4	5	6
%	21.2	16.6	14.8	11.7	9.1	2.9



Consolidated Undrained Cyclic Direct Simple Shear Test under Constant Volume with Load or Displacement Control by ASTM D8296

Client: NewFields
Project Name: Hermosa
Project Location: Patagonia, AZ

GTX#: 315266
Test Date: 12/22/22

Boring ID: ---
Sample ID: Composite Ore
Depth, ft: ---

Visual Description: Moist, gray silty sand

Test Equipment: Top and bottom box (circular) = 4.0 inch diameter. Load cells and LVDT's connected to data acquisition system for shear force, normal load, horizontal and vertical displacement; surface area = 12.57 in^2, soil height = 1.5 inch. Stacked Ring set-up used, which included porous stones with pins.

Test Condition: Inundated prior to consolidating
Sample Type and Preparation: Target Compaction: 90% relative compaction at + 3% moisture content

Parameter	Point 1	Point 2	Point 3	Point 4	Point 5
Test No.	CDSS-1RR	CDSS-2RR			
Initial Moisture Content, %	16.1	16.1			
Initial Dry Density, pcf	106.3	106.3			
Vertical Consolidation Stress, psi	14.5	14.5			
Initial Horizontal Stress, psi	0	0			
Cyclic Stress Ratio	0.15	0.18			
Number of cycles completed	17	7			
Frequency, Hz	0.2	0.2			
Final Moisture Content, %	18.8	18.5			
Delay before shearing, sec	60	60			
Nominal Rate of Shear Strain, %/hr	5.0	5.0			
Measured Post-Cyclic Peak Shear Stress, psi	5.66	4.37			
Shear Strain at Post-Cyclic Peak Shear Stress, % (20% realative)	14.2	17.5			
Membrane Correction, psi	0.43	0.41			
Corrected Post-Cyclic Peak Shear Stress, psi	5.23	3.96			
S_r/σ'_{vc}	0.36	0.27			

Comments: Actual post cyclic strength parameters should be determined by an engineer familiar with dynamic testing data.

Tested By: jlw

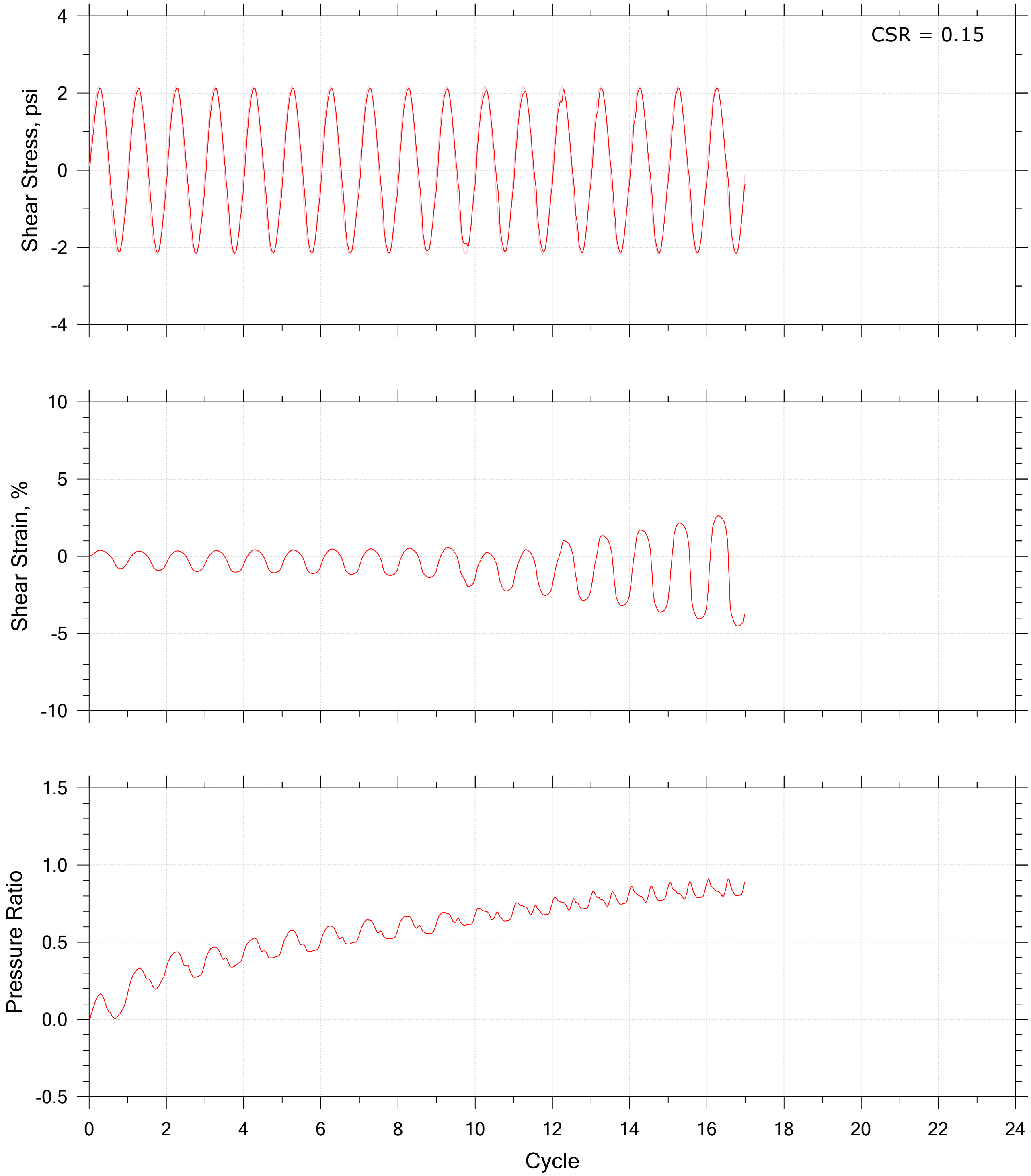
Checked By: as

Notes: These results apply only to the sample tested for the specific test conditions. The test procedures employed follow accepted industry practice and the indicated test method. GeoTesting Express has no specific knowledge as to conditioning, origin, sampling procedure or intended use of the material.

Cyclic Simple Shear Test

Cyclic Data

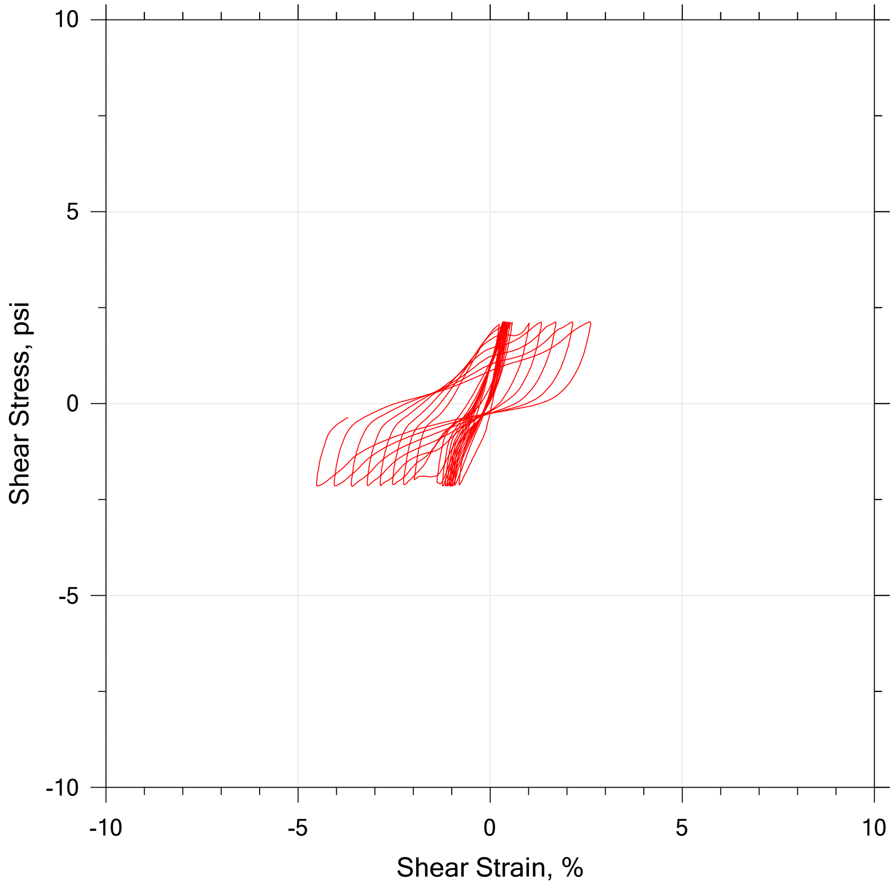
Step 1 of 1

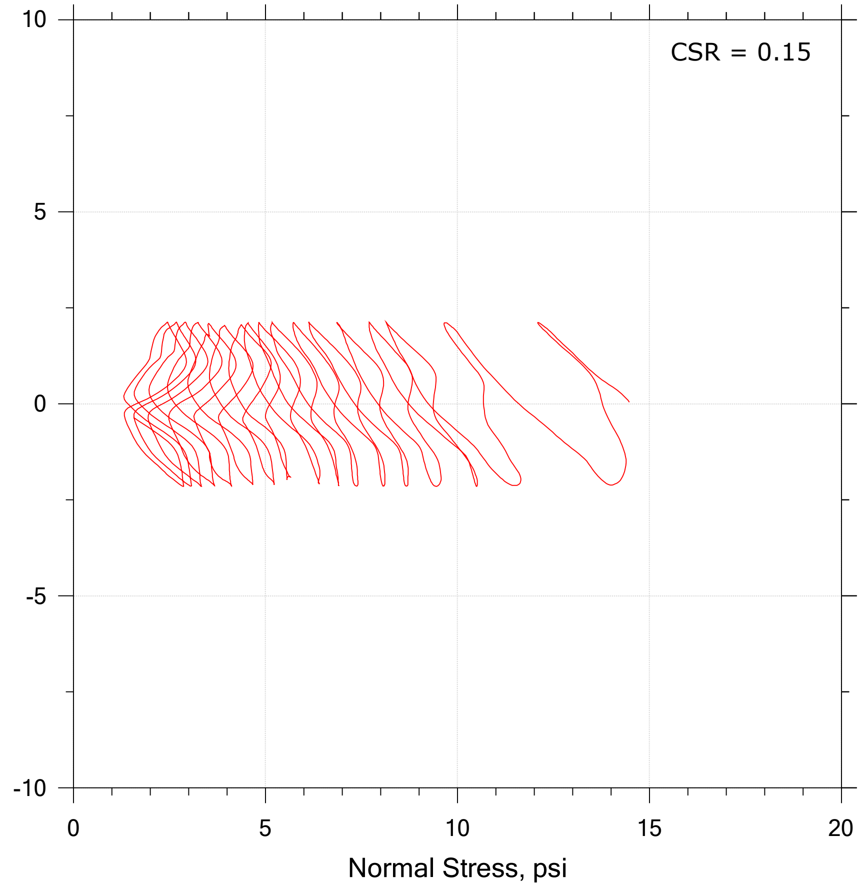


GeoTesting EXPRESS	Project Name: Hermosa	Location: Patagonia, AZ	Project Number: GTX-315266
	Boring Number: ---	Tester: jlw/as	Checker: as
	Sample Number: Composite Ore	Test Date: 11/2/2022	Depth: ---
	Test Number: CDSS-1RR	Preparation: reconstituted	Elevation: ---
	Description: Moist, gray silty sand		
	Remarks: 4" x 1.5" sample dimensions at 90% of relative compaction at +3% mc		

Cyclic Simple Shear Test

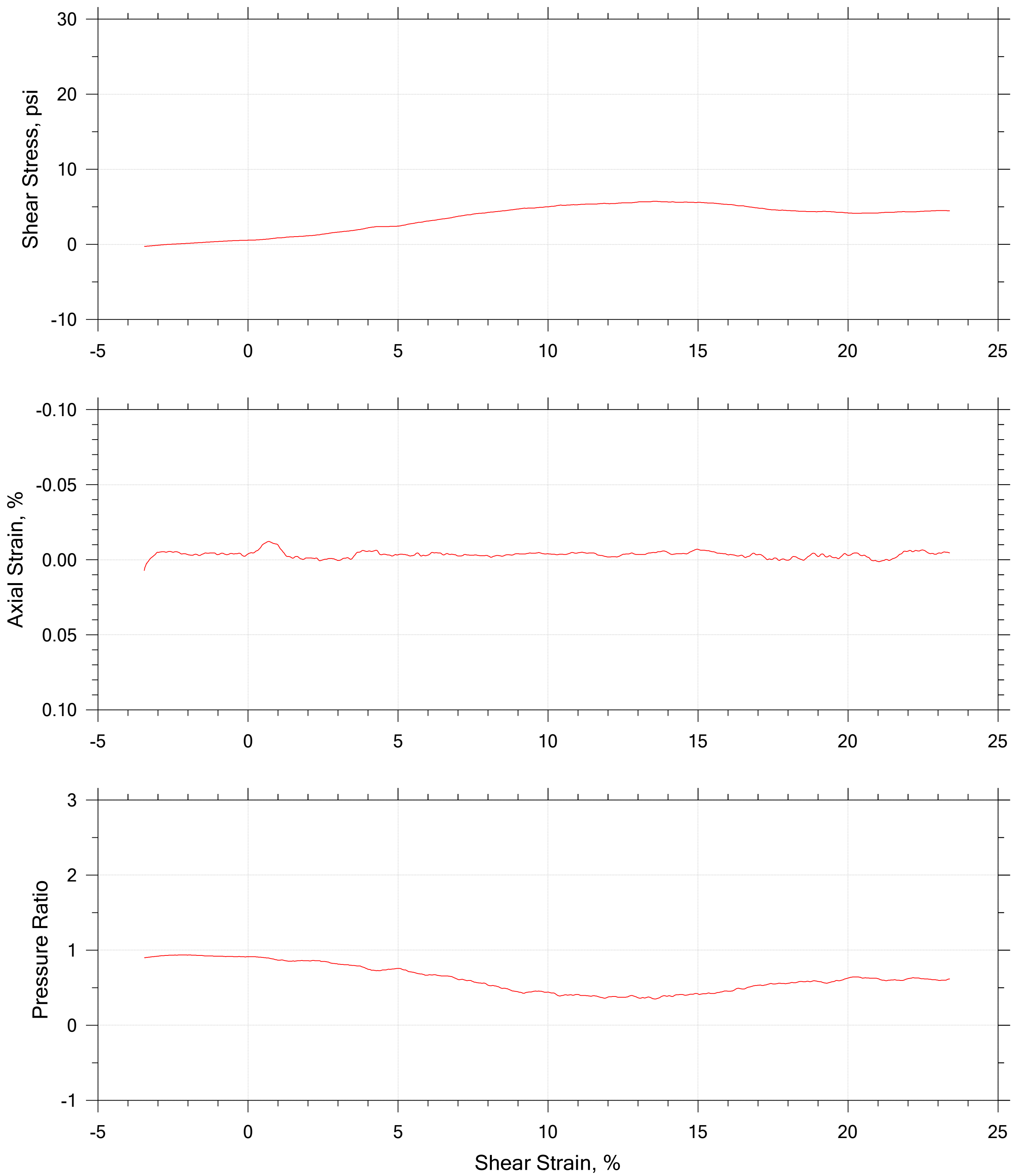
Cyclic Stress Strain Results
Step 1 of 1
Cycle 0.0 to 17.0





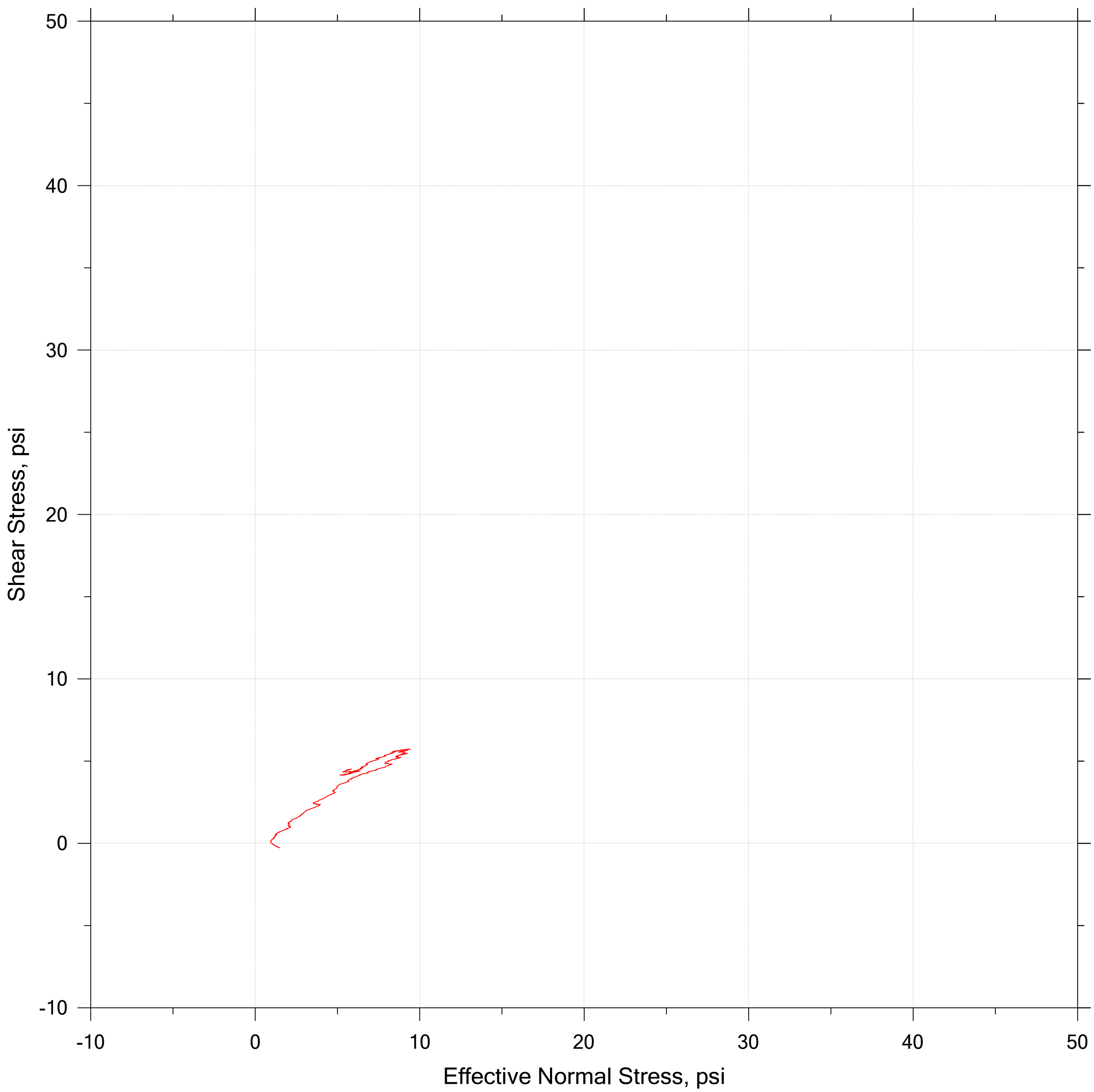
GeoTesting EXPRESS	Project Name: Hermosa	Location: Patagonia, AZ	Project Number: GTX-315266
	Boring Number: ---	Tester: jlw/as	Checker: as
	Sample Number: Composite Ore	Test Date: 11/2/2022	Depth: ---
	Test Number: CDSS-1RR	Preparation: reconstituted	Elevation: ---
	Description: Moist, gray silty sand		
	Remarks: 4" x 1.5" sample dimensions at 90% of relative compaction at +3% mc		

Post Cyclic Simple Shear Test



Project Name: Hermosa	Location: Patagonia, AZ	Project Number: GTX-315266
Boring Number: ---	Tester: jlw/as	Checker: as
Sample Number: Composite Ore	Test Date: 11/2/2022	Depth: ---
Test Number: CDSS-1RR	Preparation: reconstituted	Elevation: ---
Description: Moist, gray silty sand		
Remarks: 4" x 1.5" sample dimensions at 90% of relative compaction at +3% mc		

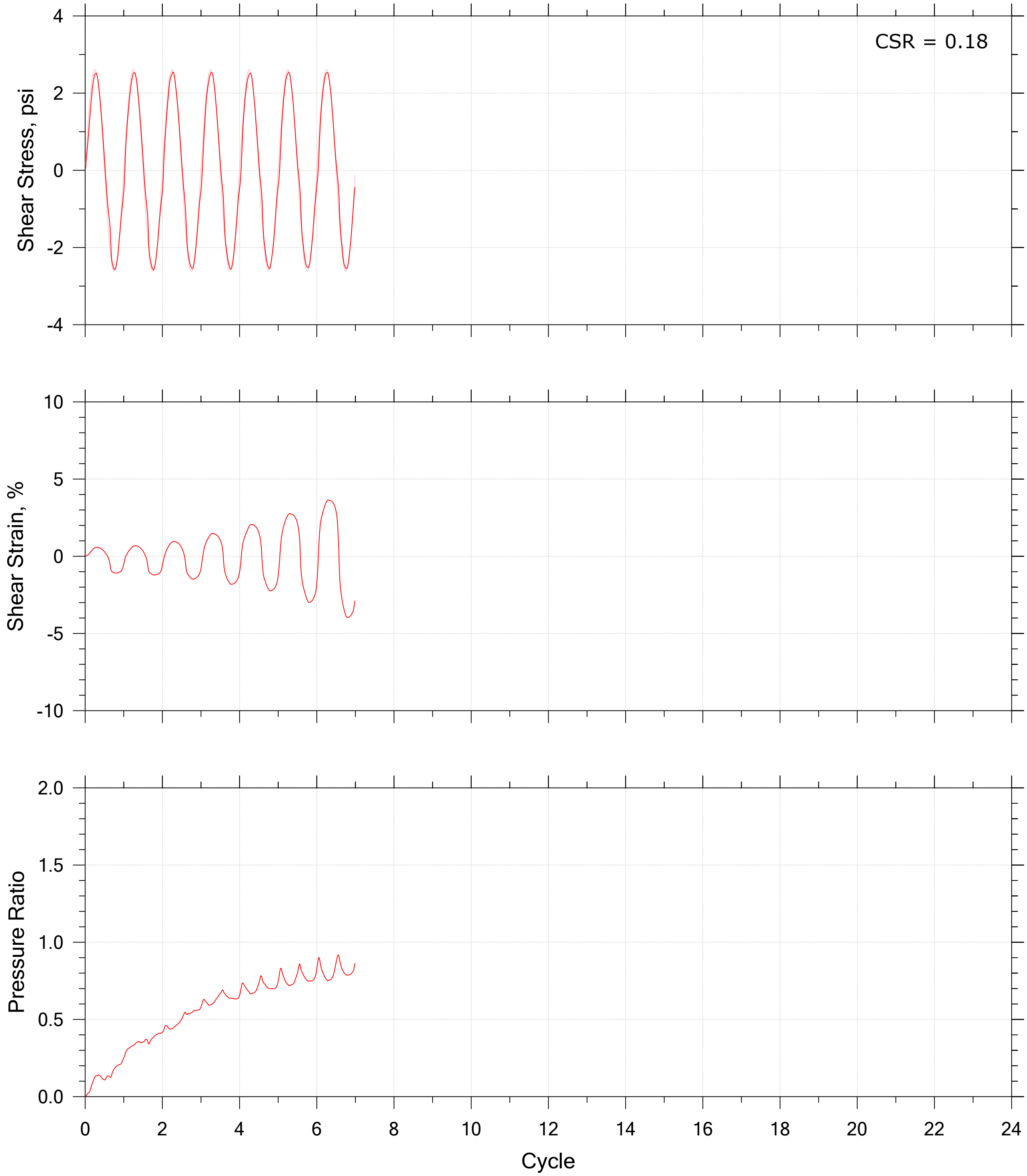
Post Cyclic Simple Shear Test



GeoTesting EXPRESS	Project Name: Hermosa	Location: Patagonia, AZ	Project Number: GTX-315266
	Boring Number: ---	Tester: jlw/as	Checker: as
	Sample Number: Composite Ore	Test Date: 11/2/2022	Depth: ---
	Test Number: CDSS-1RR	Preparation: reconstituted	Elevation: ---
	Description: Moist, gray silty sand		
	Remarks: 4" x 1.5" sample dimensions at 90% of relative compaction at +3% mc		

Cyclic Simple Shear Test

Cyclic Data
Step 1 of 1



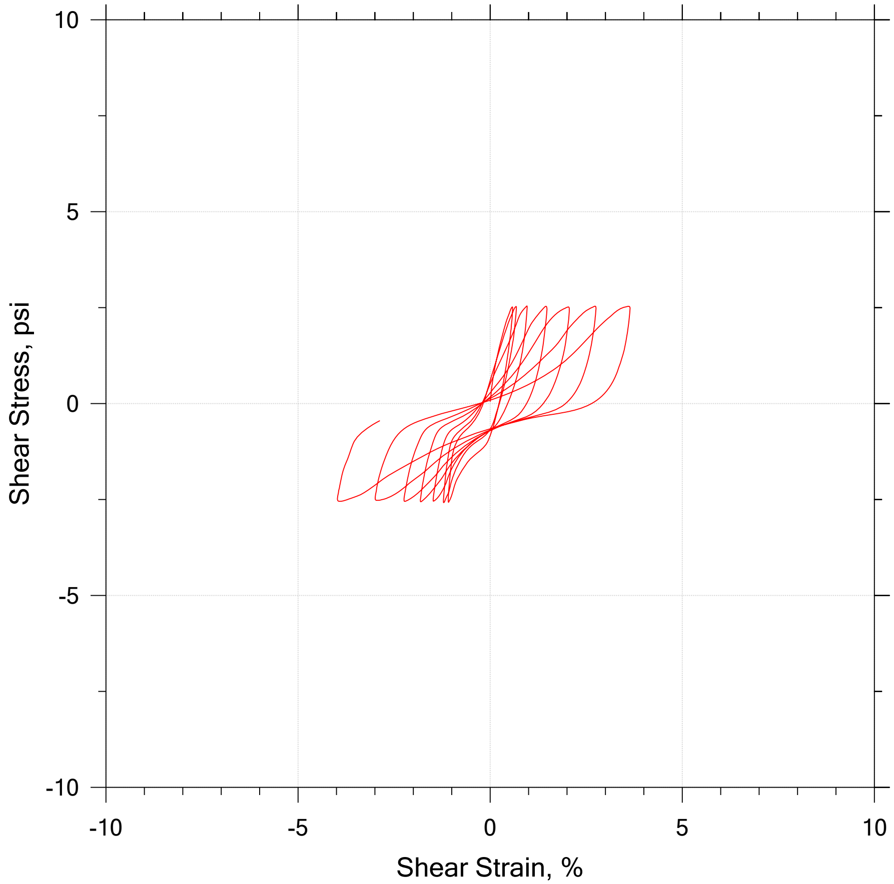
GeoTesting EXPRESS			
	Project Name: Hermosa	Location: Patagonia, AZ	Project Number: GTX-315266
	Boring Number: ---	Tester: jlw	Checker: as
	Sample Number: Composite Ore	Test Date: 12/22/2022	Depth: ---
	Test Number: CDSS- 2R(3)	Preparation: Reconstituted	Elevation: ---
	Description: Moist, gray silt		
	Remarks: 4" x 1.5" sample dimensions, Opt MC +3% and 90% of MDD		

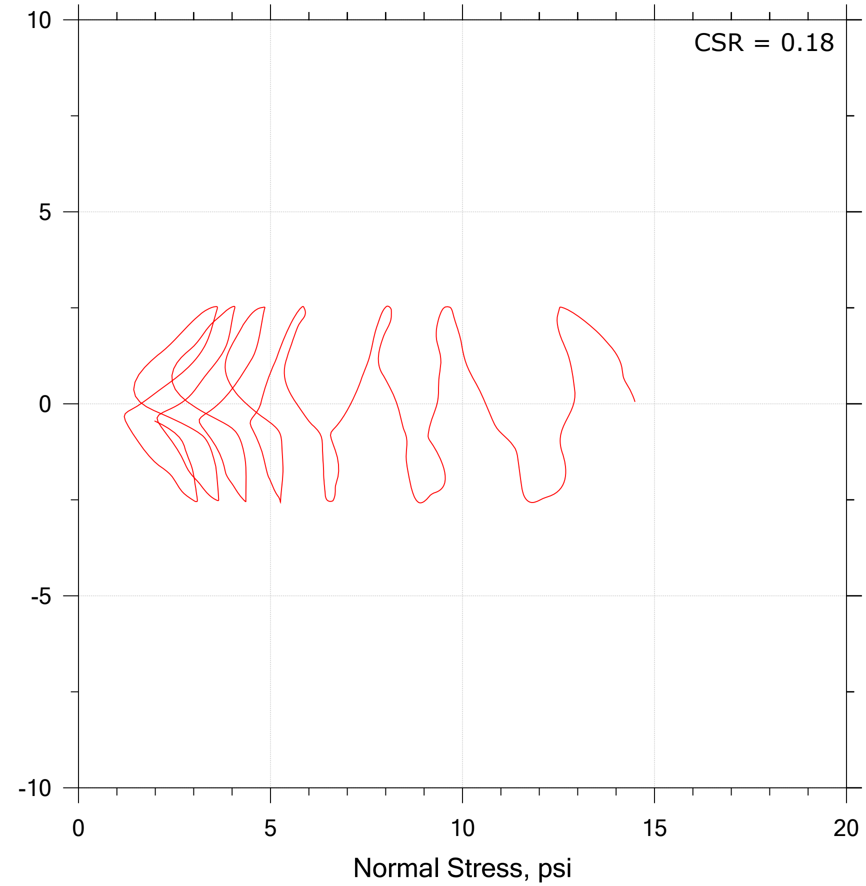
Cyclic Simple Shear Test

Cyclic Stress Strain Results

Step 1 of 1

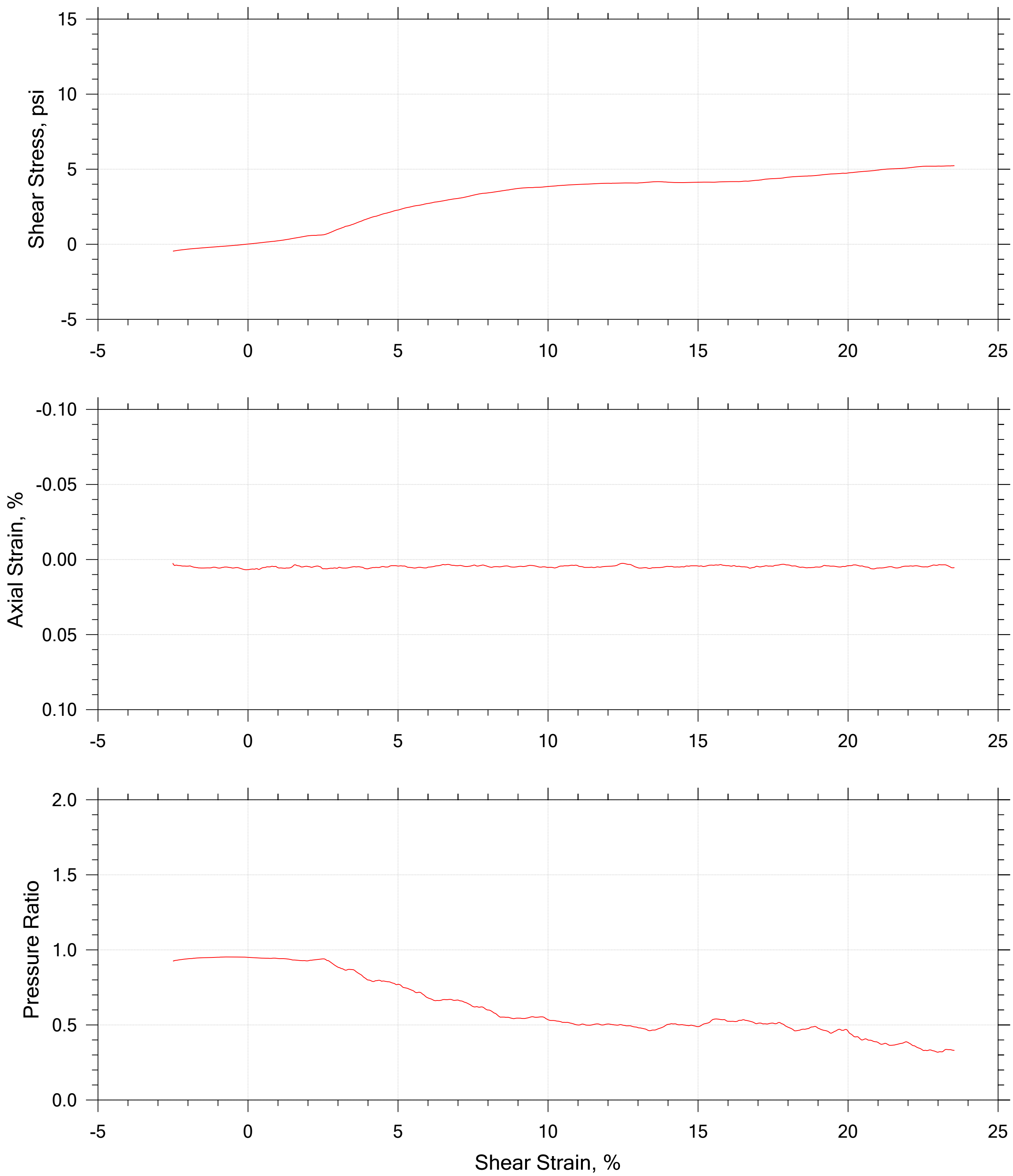
Cycle 0.0 to 24.0





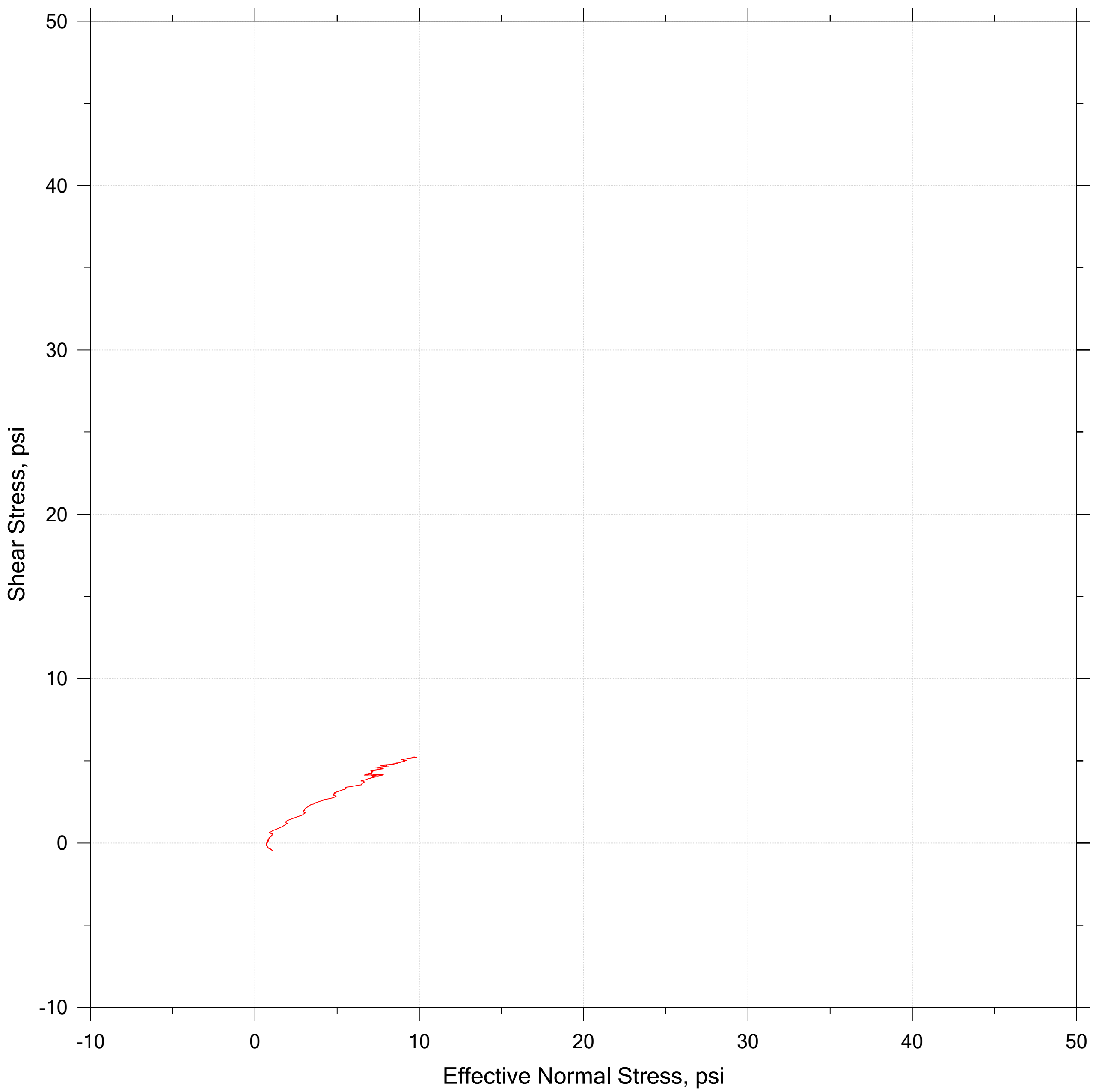
GeoTesting EXPRESS	Project Name: Hermosa	Location: Patagonia, AZ	Project Number: GTX-315266
	Boring Number: ---	Tester: jlw	Checker: as
	Sample Number: Composite Ore	Test Date: 12/22/2022	Depth: ---
	Test Number: CDSS- 2R(3)	Preparation: Reconstituted	Elevation: ---
	Description: Moist, gray silt		
	Remarks: 4" x 1.5" sample dimensions, Opt MC +3% and 90% of MDD		

Post Cyclic Simple Shear Test



GeoTesting EXPRESS			
	Project Name: Hermosa	Location: Patagonia, AZ	Project Number: GTX-315266
	Boring Number: ---	Tester: jlw	Checker: as
	Sample Number: Composite Ore	Test Date: 12/22/2022	Depth: ---
	Test Number: CDSS- 2R(3)	Preparation: Reconstituted	Elevation: ---
	Description: Moist, gray silt		
	Remarks: 4" x 1.5" sample dimensions, Opt MC +3% and 90% of MDD		

Cyclic Simple Shear Test



GeoTesting EXPRESS	Project Name: Hermosa	Location: Patagonia, AZ	Project Number: GTX-315266
	Boring Number: ---	Tester: jlw	Checker: as
	Sample Number: Composite Ore	Test Date: 12/22/2022	Depth: ---
	Test Number: CDSS- 2R(3)	Preparation: Reconstituted	Elevation: ---
	Description: Moist, gray silt		
	Remarks: 4" x 1.5" sample dimensions, Opt MC +3% and 90% of MDD		

Client:	Newfields		
Project Name:	Hermosa		
Project Location:	Patagonia, AZ		
GTX #:	315266		
Start Date:	11/10/2022	Tested By:	sjt
End Date:	11/16/2022	Checked By:	bfs
Boring #:	---		
Sample #:	Composite Ore (Taylor Deposite)		
Depth:	---		
Visual Description:	Moist, gray silty sand		

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter by ASTM D5084
Constant Volume

Sample Type:	Remolded	Permeant Fluid:	De-aired Distilled water
Orientation:	Vertical	Cell #:	5/23

Sample Preparation: Target Compaction: 90% of the maximum dry density (117.3 pcf) at the optimum moisture content (16.9%). Trimmings moisture content =16.9%

Assumed Specific Gravity: 2.83

Parameter	Initial	Final
Height, in	2.00	1.81
Diameter, in	2.86	2.79
Area, in^2	6.42	6.11
Volume, in^3	12.85	11.07
Mass, g	416.2	408.9
Bulk Density, pcf	123.2	140.5
Moisture Content, %	18.4	16.3
Dry Density, pcf	104.0	120.8
Degree of Saturation, %	74	100

B COEFFICIENT DETERMINATION

Cell Pressure, psi:	90.00	Increased Cell Pressure, psi:	95.03	Cell Pressure Increment, psi:	5.03
Sample Pressure, psi:	70.02	Corresponding Sample Pressure, psi:	74.29	Sample Pressure Increment, psi:	4.27
				B Coefficient:	0.85

*B value did not increase with increase in pressure. Final degree of saturation >95%.

FLOW DATA

Date	Trial #	Pressure, psi Cell	Pressure, psi Sample	Manometer Readings Z_1	Z_2	Z_1-Z_2	Elapsed Time, sec	Gradient	Permeability K, cm/sec	Temp, °C	R_t	Permeability K @ 20 °C, cm/sec
11/5	1	90.0	70.0	8.0	4.5	3.5	34	21.9	5.0E-06	19.5	1.013	5.1E-06
11/5	2	90.0	70.0	8.0	4.5	3.5	31	21.9	5.5E-06	19.5	1.013	5.5E-06
11/5	3	90.0	70.0	8.0	4.5	3.5	33	21.9	5.1E-06	19.5	1.013	5.2E-06
11/5	4	90.0	70.0	8.0	4.5	3.5	31	21.9	5.5E-06	19.5	1.013	5.5E-06

PERMEABILITY AT 20° C: 5.3 x 10^{-6} cm/sec (@ 20 psi effective stress)

Client:	Newfields		
Project Name:	Hermosa		
Project Location:	Patagonia, AZ		
GTX #:	315266		
Start Date:	11/10/2022	Tested By:	sjt
End Date:	11/16/2022	Checked By:	bfs
Boring #:	---		
Sample #:	Composite Ore (Taylor Deposite)		
Depth:	---		
Visual Description:	Moist, gray silty sand		

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter by ASTM D5084
Constant Volume

Sample Type: Remolded
Orientation: Vertical
Permeant Fluid: De-aired Distilled water
Cell #: 5/23

Sample Preparation: Target Compaction: 90% of the maximum dry density (117.3 pcf) at the optimum moisture content (16.9%). Trimmings moisture content = 16.9%

Assumed Specific Gravity: 2.83

Parameter	Initial	Final
Height, in	2.00	1.82
Diameter, in	2.86	2.73
Area, in^2	6.42	5.85
Volume, in^3	12.85	10.65
Mass, g	416.2	404.8
Bulk Density, pcf	123.2	144.4
Moisture Content, %	17.1	13.8
Dry Density, pcf	105.2	126.9
Degree of Saturation, %	71	100

B COEFFICIENT DETERMINATION

Cell Pressure, psi:	90.05	Increased Cell Pressure, psi:	94.97	Cell Pressure Increment, psi:	4.92
Sample Pressure, psi:	49.99	Corresponding Sample Pressure, psi:	53.98	Sample Pressure Increment, psi:	3.99
				B Coefficient:	0.81

*B value did not increase with increase in pressure.
Final degree of saturation >95%.

FLOW DATA

Date	Trial #	Pressure, psi		Manometer Readings			Elapsed Time, sec	Gradient	Permeability K, cm/sec	Temp, °C	R_t	Permeability K @ 20 °C, cm/sec
		Cell	Sample	Z_1	Z_2	Z_1-Z_2						
11/15	1	90.1	50.0	8.0	6.0	2.0	40	21.8	2.2E-06	19.5	1.013	2.2E-06
11/15	2	90.1	50.0	8.0	6.0	2.0	37	21.8	2.4E-06	19.5	1.013	2.4E-06
11/15	3	90.1	50.0	8.0	6.0	2.0	37	21.8	2.4E-06	19.5	1.013	2.4E-06
11/15	4	90.1	50.0	8.0	6.0	2.0	35	21.8	2.5E-06	19.5	1.013	2.6E-06

PERMEABILITY AT 20° C: 2.4×10^{-6} cm/sec (@ 40 psi effective stress)

Client:	NewFields		
Project Name:	Hermosa		
Project Location:	Patagonia, AZ		
GTX #:	315266		
Start Date:	11/10/2022	Tested By:	sjt
End Date:	11/22/2022	Checked By:	ank
Boring #:	---		
Sample #:	Composite Ore (Taylor Deposite)		
Depth:	---		
Visual Description:	Moist, gray silty sand		

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter by ASTM D5084

Constant Volume

Sample Type: Remolded
Orientation: Vertical
Permeant Fluid: De-aired Distilled water
Cell #: 5/23

Sample Preparation: Target Compaction: 90% of the maximum dry density (117.3 pcf) at the optimum moisture content (16.9%). Trimmings moisture content = 16.89%

Assumed Specific Gravity: 2.65

Parameter	Initial	Final
Height, in	1.97	1.82
Diameter, in	2.86	2.83
Area, in^2	6.42	6.29
Volume, in^3	12.66	11.45
Mass, g	416.2	408.3
Bulk Density, pcf	125.0	135.6
Moisture Content, %	17.6	15.3
Dry Density, pcf	106.4	117.6
Degree of Saturation, %	84	100

B COEFFICIENT DETERMINATION

Cell Pressure, psi:	90.01	Increased Cell Pressure, psi:	95.01	Cell Pressure Increment, psi:	5.00
Sample Pressure, psi:	30.03	Corresponding Sample Pressure, psi:	34.22	Sample Pressure Increment, psi:	4.19
				B Coefficient:	0.84

*B value did not increase with increase in pressure. Final degree of saturation >95%.

FLOW DATA

Date	Trial #	Pressure, psi Cell	Pressure, psi Sample	Manometer Readings Z_1	Z_2	Z_1-Z_2	Elapsed Time, sec	Gradient	Permeability K, cm/sec	Temp, ^{o}C	R_t	Permeability K @ 20 ^{o}C, cm/sec
11/21	1	90.0	30.0	8.0	5.5	2.5	30	21.8	3.6E-06	19.5	1.013	3.6E-06
11/21	2	90.0	30.0	8.0	5.5	2.5	36	21.8	3.0E-06	19.5	1.013	3.0E-06
11/21	3	90.0	30.0	8.0	5.5	2.5	30	21.8	3.6E-06	19.5	1.013	3.6E-06
11/21	4	90.0	30.0	8.0	5.5	2.5	30	21.8	3.6E-06	19.5	1.013	3.6E-06

PERMEABILITY AT 20^{o} C: 3.4×10^{-6} cm/sec (@ 60 psi effective stress)

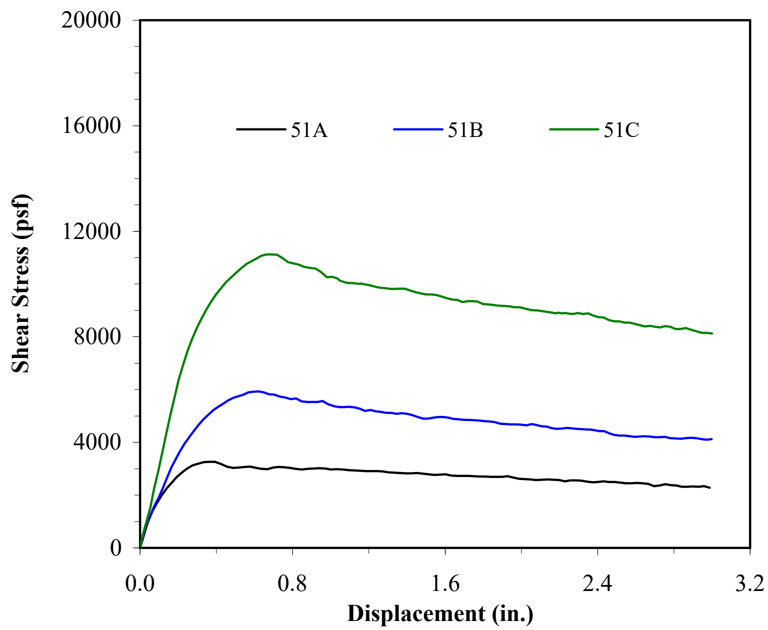
APPENDIX D.5.3

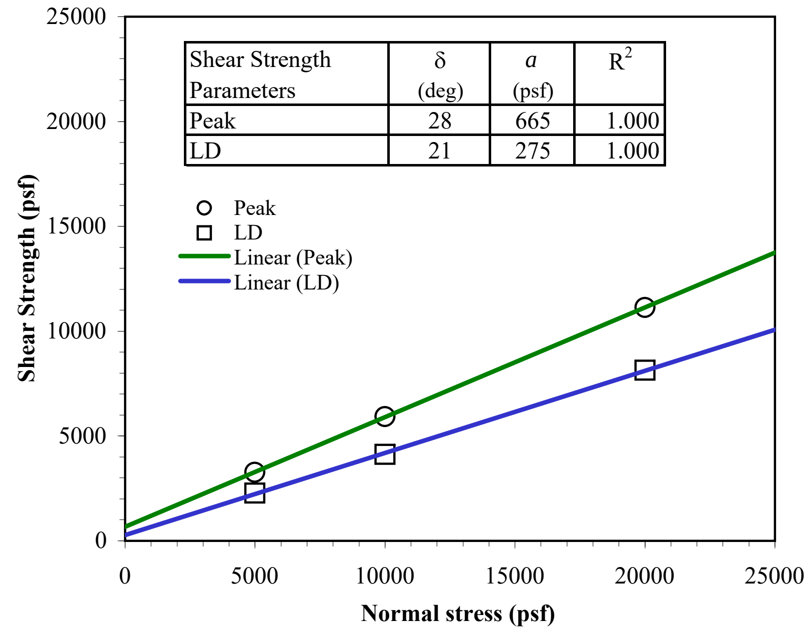
Laboratory Testing Results

Interface Direct Shear

NEWFIELDS COMPANIES, LLC - HERMOAS PROJECT
INTERFACE DIRECT SHEAR TESTING (ASTM D 5321)

Upper Shear Box: Subgrade soil compacted to 95% of max modified Proctor dry unit weight at OMC (γ_{dmax} = 127.8, OMC = 10.4%)/
1/8" to 1/4" thick friction layer (gravel)/
Agru 60-mil Microspike HDPE geomembrane with dull side up /
Lower Shear Box: Concrete sand





Shear Strength Parameters	δ (deg)	a (psf)	R^2
Peak	28	665	1.000
LD	21	275	1.000

Test No.	Shear Box Size (in. x in.)	Normal Stress (psf)	Shear Rate (in./min)	Soaking Stress (psf)	Soaking Time (hour)	Consolidation by Step Loading (psf, hours) 1	2	3	4	5	6	7	8	9	GCL ω_f (%)	Shear Strength τ_P (psf)	Shear Strength τ_{LD} (psf)	Failure Mode
51A	12 x 12	5000	0.01	5000	24	5000, 24										3265	2279	(1)
51B	12 x 12	10000	0.01	10000	24	10000, 24										5925	4123	(1)
51C	12 x 12	20000	0.01	20000	24	20000, 24										11121	8130	(1)

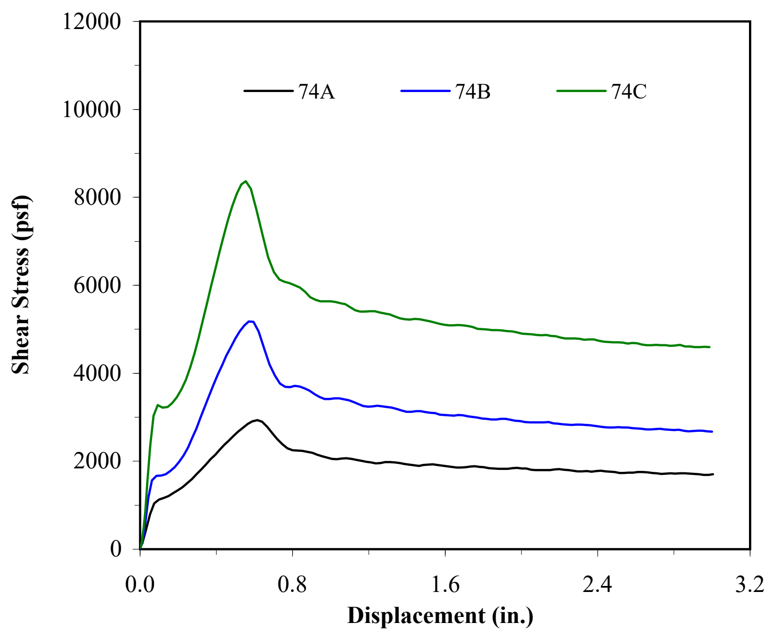
NOTES:
(1) Shear failure at the interface between the thick friction layer soil (gravel) and dull side of Agru 60-mil Microspike HDPE geomembrane.
(2) The reported total-stress parameters of friction angle and adhesion were determined from a best-fit line drawn through the test data. Caution should be exercised in using these strength parameters for applications involving normal stresses outside the range of the stresses covered by the test series. The large-displacement (LD) shear strength was calculated using the shear force measured at the end of the test.

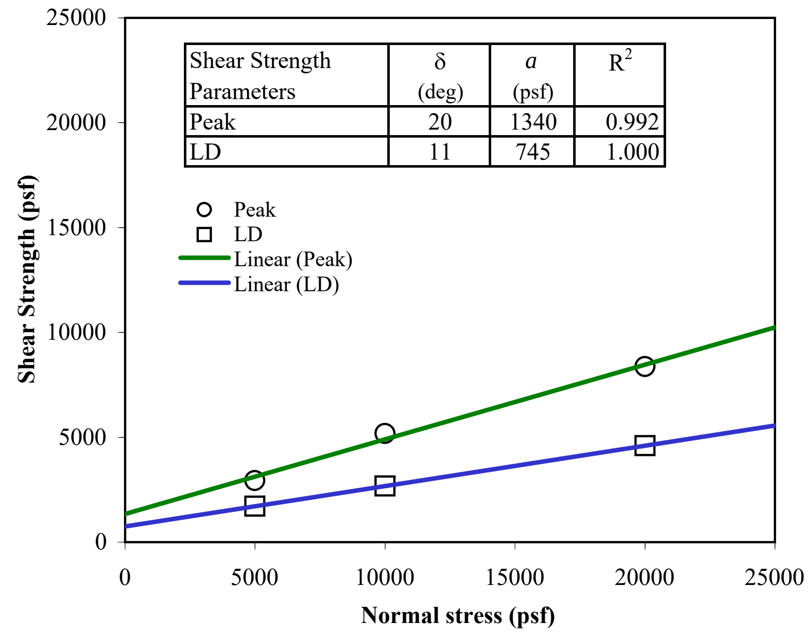
SGI TESTING SERVICES, LLC

DATE OF REPORT:	8/5/2018
FIGURE NO.	1
PROJECT NO.	SGI18024
DOCUMENT NO.	
FILE NO.	

NEWFIELDS COMPANIES, LLC - HERMOAS COMPLEX PROJECT
INTERFACE DIRECT SHEAR TESTING (ASTM D 5321)

Upper Shear Box: Steel grip
Hydrated Bentomat DN9 GCL (No Roll # given) with white NWGT side down against
Agru 60-mil Microspike HDPE geomembrane (Roll #) with shiny side (shiny side asperity: 39 mils) up
Lower Shear Box: Concrete sand





Test No.	Shear Box Size (in. x in.)	Normal Stress (psf)	Shear Rate (in./min)	GCL Soaking Stress (psf)	GCL Soaking Time (hour)	Consolidation by Step Loading 1	2	3	4	5	6	7	8	9	GCL ω_f (%)	Shear Strength τ_P (psf)	Shear Strength τ_{LD} (psf)	Failure Mode
						(psf, hours)												
74A	12 x 12	5000	0.04	200	24	400, 2	800, 2	1600, 2	3200, 2	5000, 24					84.0	2935	1707	(1)
74B	12 x 12	10000	0.04	200	24	400, 2	800, 2	1600, 2	3200, 2	6400, 2	10000, 24				65.0	5177	2669	(1)
74C	12 x 12	20000	0.04	200	24	400, 2	800, 2	1600, 2	3200, 2	6400, 2	12800, 2	20000, 24			58.9	8366	4598	(1)

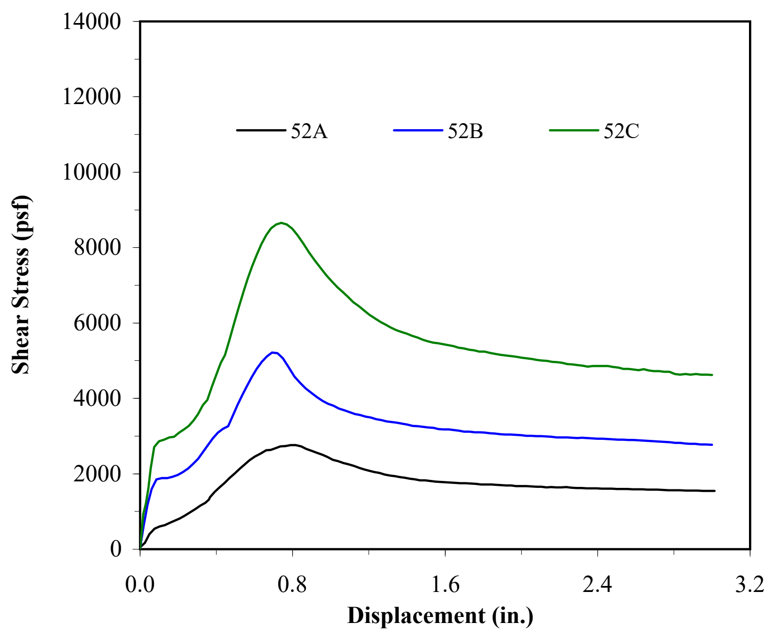
NOTES:
(1) Shear failure at the interface between the white side NWGT of GCL and the shiny side of Agru 60-mil Microspike HDPE geomembrane.
(2) The reported total-stress parameters of friction angle and adhesion were determined from a best-fit line drawn through the test data. Caution should be exercised in using these strength parameters for applications involving normal stresses outside the range of the stresses covered by the test series. The large-displacement (LD) shear strength was calculated using the shear force measured at the end of the test.

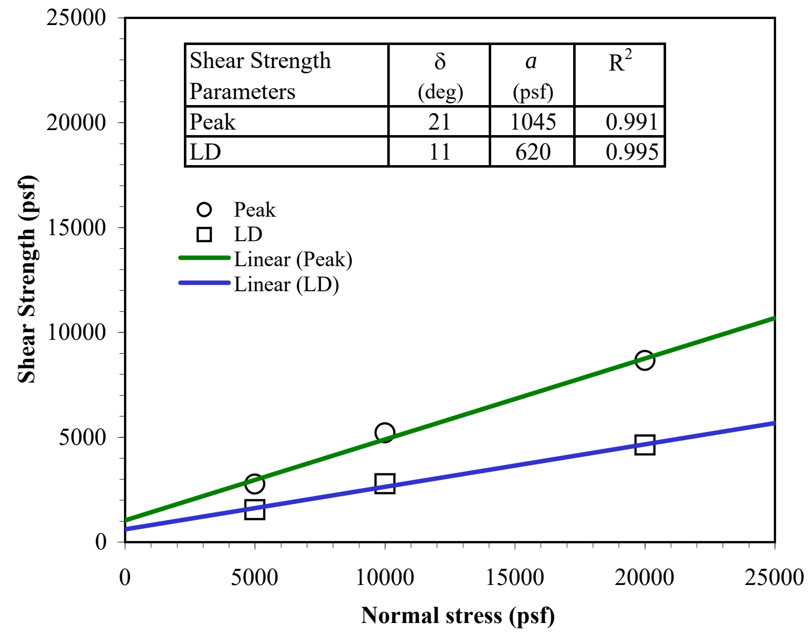
DATE OF REPORT:	10/7/2018
FIGURE NO.	4B
PROJECT NO.	SGI18024
DOCUMENT NO.	
FILE NO.	

SGI TESTING SERVICES, LLC

NEWFIELDS COMPANIES, LLC - HERMOAS PROJECT
INTERFACE DIRECT SHEAR TESTING (ASTM D 5321)

Upper Shear Box: Steel grip
Hydrated Bentomat DN GCL with white nonwoven geotextile side down against
Agru 60-mil Microspike HDPE geomembrane with dull side up
Lower Shear Box: Concrete sand





Test No.	Shear Box Size (in. x in.)	Normal Stress (psf)	Shear Rate (in./min)	Soaking		Consolidation by Step Loading									GCL	Shear Strength		Failure Mode
				Stress (psf)	Time (hour)	1	2	3	4	5	6	7	8	9	ω_f (%)	τ_P (psf)	τ_{LD} (psf)	
						(psf, hours)												
52A	12 x 12	5000	0.01	5000	24	5000, 24	400, 2	800, 2	1600, 2	3200, 2	5000, 24				88.9	2765	1545	(1)
52B	12 x 12	10000	0.01	10000	24	10000, 24	400, 2	800, 2	1600, 2	3200, 2	6400, 2	10000, 24			66.4	5213	2772	(1)
52C	12 x 12	20000	0.01	20000	24	20000, 24	400, 2	800, 2	1600, 2	3200, 2	6400, 2	12800, 2	20000, 24		62.0	8655	4625	(1)

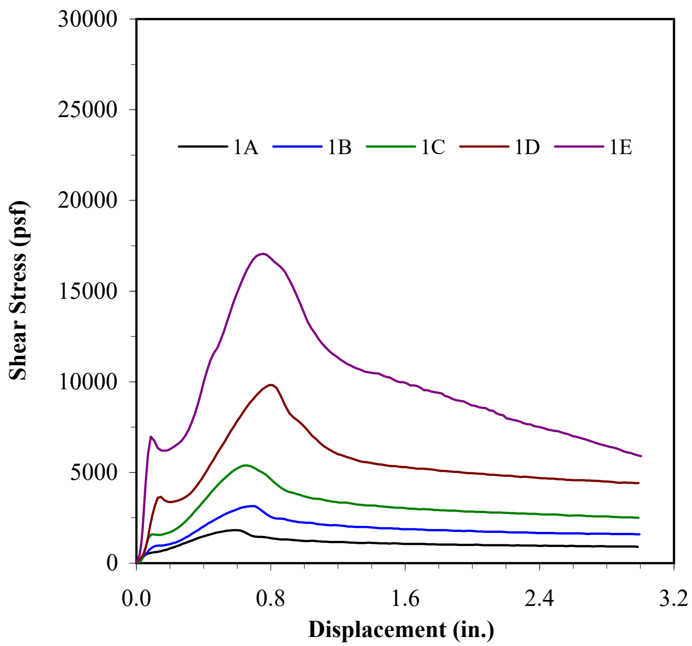
NOTES:
(1) Shear failure at the interface between the white nonwoven geotextile side of the hydrated bentomat GCL and the dull side of Microspike geomembrane.
(2) The reported total-stress parameters of friction angle and adhesion were determined from a best-fit line drawn through the test data. Caution should be exercised in using these strength parameters for applications involving normal stresses outside the range of the stresses covered by the test series. The large-displacement (LD) shear strength was calculated using the shear force measured at the end of the test.

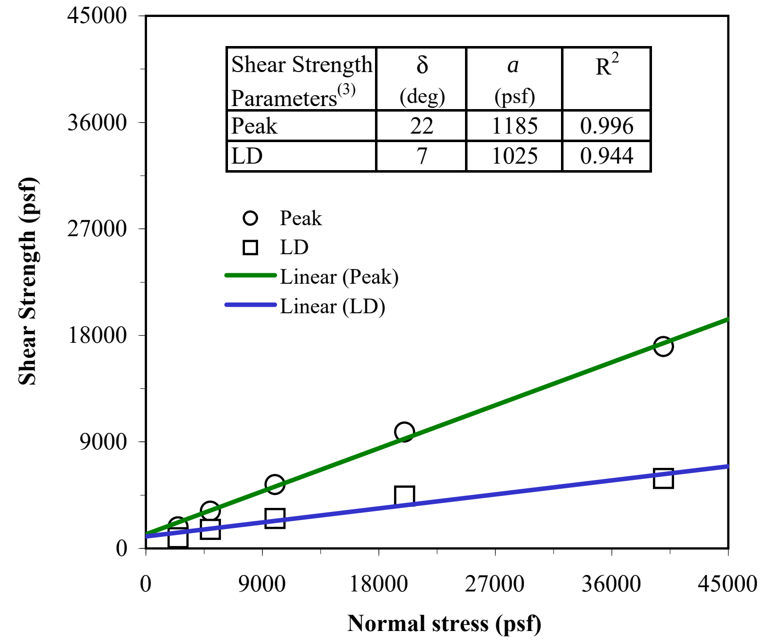
SGI TESTING SERVICES, LLC

DATE OF REPORT:	8/5/2018
FIGURE NO.	2
PROJECT NO.	SGI18024
DOCUMENT NO.	
FILE NO.	

NEWFIELDS LLC - HERMOAS PROJECT 475.0014.035
INTERFACE DIRECT SHEAR TESTING (ASTM D 6243)

Upper Shear Box: Steel grip
Hydrated Bentomat DN9 GCL (Roll #73 and Lot #LL-15-2023) with black side down against
Agru 60-mil Microspike HDPE geomembrane #FNC0108840014 with dull side up
Lower Shear Box: Concrete sand





Test No.	Shear Box Size (in x in)	Normal Stress (psf)	Shear Rate (in/min)	Soaking Stress (psf)	Soaking Time (hour)	Consolidation by Step Loading: 1	2	3	4	5	6	7	8	9	GCL ω_f (%)	Shear Strength τ_P (psf)	τ_{LD} (psf)	Secant Angle δ_P (deg)	δ_{LD} (deg)	Failure Mode
						Normal stress and consolidation time (psf, hours)														
1A	12 x 12	2500	0.01	200	24	400, 2	800, 2	1600, 2	2500, 24						95.4	1817	905	36	20	(1)
1B	12 x 12	5000	0.01	200	24	400, 2	800, 2	1600, 2	3200, 2	5000, 24					78.6	3152	1585	32	18	(1)
1C	12 x 12	10000	0.01	200	24	400, 2	800, 2	1600, 2	3200, 2	6400, 2	10000, 24				59.1	5388	2507	28	14	(1)
1D	12 x 12	20000	0.01	200	24	400, 2	800, 2	1600, 2	3200, 2	6400, 2	12800, 2	20000, 24			52.0	9812	4411	26	12	(1)
1E	6 x 6	40000	0.01	200	24	400, 2	800, 2	1600, 2	3200, 2	6400, 2	12800, 2	25600, 2	40000, 24		50.5	17050	5899	23	8	(2)

NOTES:
(1) Sliding (i.e., shear failure) occurred at the interface between the black side of GCL and the dull side of Microspike HDPE geomembrane.
(2) Partial GCL internal failure
(3) The reported total-stress parameters of friction angle and adhesion were determined from a best-fit line drawn through the test data. Caution should be exercised in using these strength parameters for applications involving normal stresses outside the range of the stresses covered by the test series. The large-displacement (LD) shear strength was calculated using the shear force measured at the end of the test.

SGI TESTING SERVICES, LLC

DATE OF REPORT:	6/2/2023
FIGURE NO.	1
PROJECT NO.	SGI23024
DOCUMENT NO.	
FILE NO.	

APPENDIX D.5.4

Laboratory Testing Results

Liner Integrity

NewFields

LINER INTEGRITY TEST

Project:	Hermosa TSF CQA	Client:	South 3.2 (AMI)
Project No.	475.0014.011	Date:	12/2/2019
Sample ID:	Subgrade	Tested By:	KE
Lab No.	19-413-01	Reviewed By:	KM

Test Parameters

Geosynthetic:	60 Mil Textured Liner
Substrate:	GCL Subgrade
Superstrate:	PL
Normal Load (psf):	16,500

Test Data

	Coupon
Start Date:	12/2/2019
Start Time:	2:00pm
End Date:	12/3/2019
End Time:	2:00pm
Duration (hrs):	24 hrs
No. of Dimples:	7
No. of Punctures:	0
No. of Tears:	0
(Pass/Fail)	**PASS**

General Test Notes: Small visible defects occurred during testing.
Loaded at 110' equivalent height for 24 hours.
Assuming 150 pcf

LINER INTEGRITY TEST

Project:	Hermosa TSF CQA	Client:	South32 (AMI)
Project No.	475.0014.011	Date:	12/2/2019
Sample ID:	LPSL	Tested By:	KE
Lab No.	19-413-02	Reviewed By:	KM

Test Parameters

Geosynthetic:	60 Mil Textured Liner
Substrate:	LPSL
Superstrate:	PL
Normal Load (psf):	16,500

Test Data

	Coupon
Start Date:	12/2/2019
Start Time:	2:00pm
End Date:	12/3/2019
End Time:	2:00pm
Duration (hrs):	24 hrs
No. of Dimples:	3
No. of Punctures:	0
No. of Tears:	0
(Pass/Fail)	**PASS**

General Test Notes: Small visible defects occurred during testing.
Loaded at 110' equivalent height for 24 hours.
Assuming 150 pcf

NewFields

LINER INTEGRITY TEST

Project:	Hermosa TSF1 Design	Client:	South 32
Project No.	475.0014.035/TASK 2	Date:	5/31/2023
Sample ID:	Trial 1 #1	Tested By:	K Engelmeier
Lab No.	23-139-01	Reviewed By:	J Williams

Test Parameters

Geosynthetic:	AGRU 60-mil microspike, 60 HD MS TND91750144		
Substrate:	LPSL USCS Classification: SC		
Superstrate:	Protective Layer (PL)		
Normal Load (psf):	30,000	Applied Load (lbs):	16,380

Test Data

Start Date:	5/30/2023
Start Time:	11:00 AM
End Date:	5/31/2023
End Time:	11:00 AM
Duration (hrs):	24
No. of Dimples:	5
No. of Punctures:	0
No. of Tears:	0
Test (Pass/Fail)	Pass

General Test Notes:

LINER INTEGRITY TEST

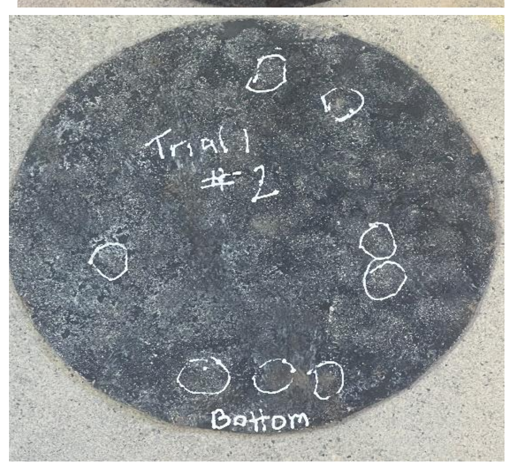
Project:	Hermosa TSF1 Design	Client:	South 32
Project No.	475.0014.035/TASK 2	Date:	5/31/2023
Sample ID:	Trial 1 #2	Tested By:	K Engelmeier
Lab No.	23-139-02	Reviewed By:	J Williams

Test Parameters

Geosynthetic:	AGRU 60-mil microspike, 60 HD MS TND91750144		
Substrate:	LPSL USCS Classification: SC		
Superstrate:	Protective Layer (PL)		
Normal Load (psf):	30,000	Applied Load (lbs):	16,380

Test Data

Start Date:	5/30/2023
Start Time:	11:00 AM
End Date:	5/31/2023
End Time:	11:00 AM
Duration (hrs):	24
No. of Dimples:	8
No. of Punctures:	0
No. of Tears:	0
Test (Pass/Fail)	Pass



General Test Notes:

LINER INTEGRITY TEST

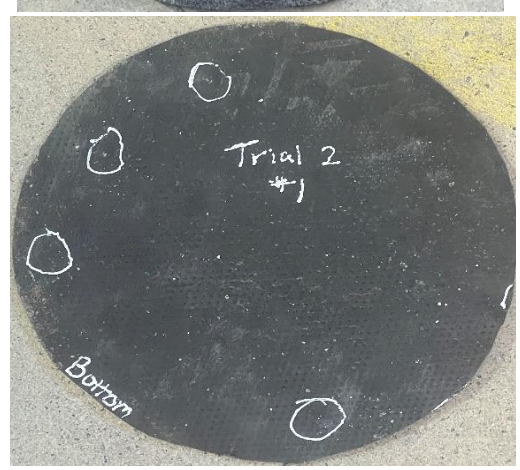
Project:	Hermosa TSF1 Design	Client:	South 32
Project No.	475.0014.035/TASK 2	Date:	5/31/2023
Sample ID:	Trial 2 #1	Tested By:	K Engelmeier
Lab No.	23-139-04	Reviewed By:	J Williams

Test Parameters

Geosynthetic:	AGRU 60-mil microspike, 60 HD MS TND91750144		
Substrate:	LPSL USCS Classification: SC / GCL Bentomat DN9		
Superstrate:	Protective Layer (PL)		
Normal Load (psf):	30,000	Applied Load (lbs):	16,380

Test Data

Start Date:	5/30/2023
Start Time:	11:00 AM
End Date:	5/31/2023
End Time:	11:00 AM
Duration (hrs):	24
No. of Dimples:	4
No. of Punctures:	0
No. of Tears:	0
Test (Pass/Fail)	Pass



General Test Notes:

LINER INTEGRITY TEST

Project:	Hermosa TSF1 Design	Client:	South 32
Project No.	475.0014.035/TASK 2	Date:	6/1/2023
Sample ID:	Trial 5 #1	Tested By:	K Engelmeier
Lab No.	13-139-13	Reviewed By:	J Williams

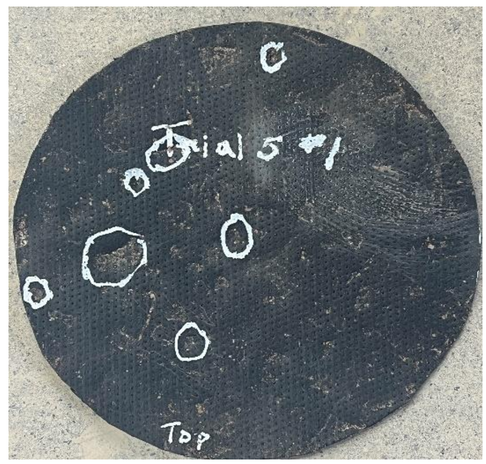
Test Parameters

Geosynthetic:	AGRU 60-mil microspike, 60 HD MS TND91750144		
Substrate:	LPSL USCS Classification: SC		
Superstrate:	Protective Layer (PL)		
Normal Load (psf):	40,000	Applied Load (lbs):	21,838

Test Data

Start Date:	5/31/2023
Start Time:	1:30 PM
End Date:	6/1/2023
End Time:	1:30 PM
Duration (hrs):	24
No. of Dimples:	7
No. of Punctures:	0
No. of Tears:	0
Test (Pass/Fail)	Pass

General Test Notes:



LINER INTEGRITY TEST

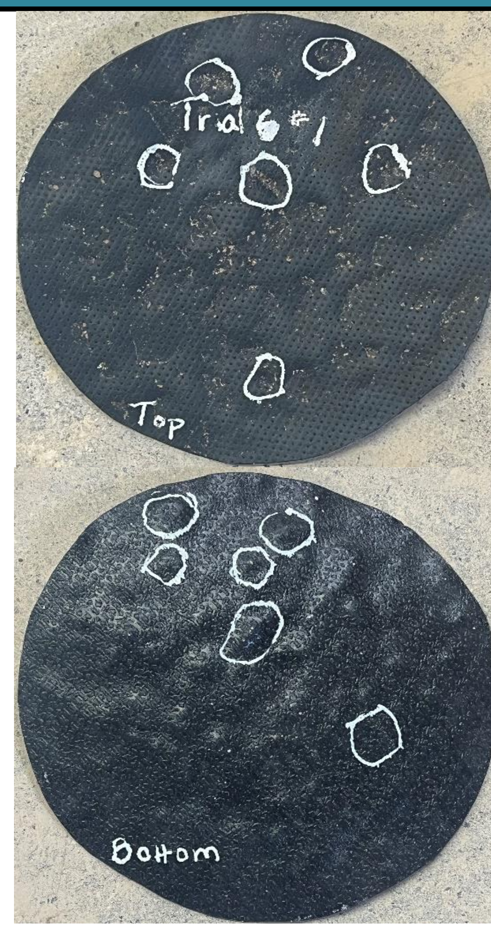
Project:	Hermosa TSF1 Design	Client:	South 32
Project No.	475.0014.035/TASK 2	Date:	6/1/2023
Sample ID:	Trial 6 #1	Tested By:	K Engelmeier
Lab No.	13-139-16	Reviewed By:	J Williams

Test Parameters

Geosynthetic:	AGRU 60-mil microspike, 60 HD MS TND91750144		
Substrate:	LPSL USCS Classification: SC / GCL Bentomat DN9		
Superstrate:	Protective Layer (PL)		
Normal Load (psf):	40,000	Applied Load (lbs):	21,838

Test Data

Start Date:	5/31/2023
Start Time:	1:30 PM
End Date:	6/1/2023
End Time:	1:30 PM
Duration (hrs):	24
No. of Dimples:	6
No. of Punctures:	0
No. of Tears:	0
Test (Pass/Fail)	Pass



General Test Notes:

LINER INTEGRITY TEST

Project:	Hermosa TSF1 Design	Client:	South 32
Project No.	475.0014.035/TASK 2	Date:	6/1/2023
Sample ID:	Trial 6 #2	Tested By:	K Engelmeier
Lab No.	13-139-17	Reviewed By:	J Williams

Test Parameters

Geosynthetic:	AGRU 60-mil microspike, 60 HD MS TND91750144		
Substrate:	LPSL USCS Classification: SC / GCL Bentomat DN9		
Superstrate:	Protective Layer (PL)		
Normal Load (psf):	40,000	Applied Load (lbs):	21,838

Test Data

Start Date:	5/31/2023
Start Time:	1:30 PM
End Date:	6/1/2023
End Time:	1:30 PM
Duration (hrs):	24
No. of Dimples:	7
No. of Punctures:	0
No. of Tears:	0
Test (Pass/Fail)	Pass

General Test Notes:

APPENDIX E

Technical Specifications

APPENDIX E.1

Technical Specifications

TAILINGS STORAGE FACILITY 1 (TSF1)
AQUIFER PROTECTION PERMIT (APP) SIGNIFICANT AMENDMENT
BEST AVAILABLE DEMONSTRATED CONTROL TECHNOLOGY (BADCT) DESIGN

TECHNICAL SPECIFICATIONS

Prepared for:

South32 Hermosa Inc.
1860 East River Road
Tucson, AZ 85718

Prepared by:

NewFields

NewFields Mining Design & Technical Services
9540 Maroon Circle, Suite 300
Englewood, CO 80112

NewFields Job No. 475.0014.035
October 2023

Registered Professional Engineer (Civil)
CERTIFICATE NO.
63431
CRAIG M.
THOMPSON
Date Signed 10/27/23
ARIZONA, U.S.A.
EXPIRES 3/31/26

LIST OF TECHNICAL SPECIFICATIONS FOR
TAILINGS STORAGE FACILITY 1 (TSF1)
AQUIFER PROTECTION PERMIT (APP) SIGNIFICANT AMENDMENT
BEST AVAILABLE DEMONSTRATED CONTROL TECHNOLOGY (BADCT) DESIGN

Specification No.	Rev	Title
0014-SPT-CO	0	Technical Specifications for Concrete Materials and Construction
0014-SPT-CPeP	0	Technical Specifications for Corrugated Polyethylene Pipe Materials and Construction
0014-SPT-EW	0	Technical Specifications for Earthworks Materials and Construction
0014-SPT-GCL	0	Technical Specifications for Geosynthetic Clay Liner Materials and Construction
0014-SPT-GM	0	Technical Specifications for Geomembrane Materials and Construction
0014-SPT-GT	0	Technical Specifications for Geotextile Materials and Construction
0014-SPT-IN	0	Technical Specifications for Geotechnical Instrumentation Materials and Construction
0014-SPT-AB	0	Technical Specifications For Survey And As-Builts

CONCRETE
Technical Specifications

NewFields	CLIENT SOUTH32 HERMOSA INC.	PROJECT NO 475.0014.035
PROJECT	TAILINGS STORAGE FACILITY 1 (TSF1) AQUIFER PROTECTION PERMIT (APP) SIGNIFICANT AMENDMENT BEST AVAILABLE DEMONSTRATED CONTROL TECHNOLOGY (BADCT) DESIGN	
TITLE	TECHNICAL SPECIFICATIONS FOR CONCRETE MATERIALS AND CONSTRUCTION	**SPECIFICATION NO.** 0014-SPT-CO

REV	DATE	PAGES	APPROVALS			REMARKS
			AUTHOR	REVIEW	CLIENT	
0	10/27/2023	16	CMT	RMS		Issued for Tender

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1. GENERAL

1.1. Scope

This specification defines the requirements for concrete materials and methods of construction for cast-in place concrete in the field, installation and quality control associated with the South32 Hermosa Inc. (**Owner**) Tailings Storage Facility 1 (TSF1).

Any alternatives or exceptions to this specification shall be submitted in writing to the **Owner** or its designated representatives and shall be approved by the **Engineer**.

The owner's engineer shall control the quality of construction and shall verify that all construction elements have been completed in accordance with Design Drawings and Technical Specifications.

1.2. Definition of Terms

- "**Owner**" is defined as South32 Hermosa Inc. or any of its authorized representative(s) / agent(s).
- "**Engineer**" is defined as the **Consultant** or **Engineering Company** (NewFields) responsible for the detailed design or any of its authorized representative(s)/ agent(s).
- "**Construction Manager**" is defined as the **Consultant** or **Engineering Company** (to be determined) responsible for the overall project completion.
- "**Construction Quality Assurance (CQA)**" is defined as the **Consultant** or **Engineering Company** (to be determined) hired by the **Owner** to provide independent inspection and testing services for the overall project.
- "**Contractor**" is defined as the party(s) that has executed the contract agreement for the specified Work with the **Owner** or its authorized representative(s)/agent(s).
- "Specifications" are defined as this document, all supplemental addenda, and any modifications furnished by the **Owner**, the **Engineer**, or others that apply to the "Work".
- "Drawings" are defined as the "Hermosa Project Tailings Storage Facility 1 (TSF1)" Drawings furnished by the **Owner**, **Engineer**, or others that apply to the "Work".
- "Site" is defined as the area being developed by the **Owner** and the location where the Work is to be completed as described in these Technical Specifications and detailed on the Drawings.
- "Contract" is defined as the document executed by the **Owner** or its authorized representative(s)/agent(s) with the **Contractor** to complete specified portions of the "Work".
- "Work" is defined as the entire completed construction or the various separately identifiable parts thereof required to be furnished as shown on the Drawings and as described in the Specifications and Contract Documents.

- "Modifications" are defined as changes made to the Specifications or the Drawings that are approved by **Owner** and **Engineer** in writing, after the Specifications and Drawings have been issued for construction. These also refer to changes to design elements in the field to account for unforeseen conditions.
- "Plant" is defined as all equipment, supplies, accommodations, temporary offices, etc., required to complete the "Work".
- "Units" in general, these Specifications and the Drawings will utilize Imperial units, however Metric units will be used when appropriate.
- "The Standard" is ACI 301-20 "Specification for Concrete Construction."

1.3. Reference Standards and Publications

Only the major reference publications are listed below. The complete list shall include all the referenced documents included in the referenced publications below.

The basis of this specification is ACI 301-20, "Specification for Concrete Construction." It is the intent of this specification to conform to the requirements of this document as a minimum standard.

The **Contractor** shall have a copy of the publications highlighted in bold onsite and provide access to the **Engineer** to the publications.

IBC 2021	International Building Code.
ACI 301-20:	**"The Standard" Specifications for Concrete Construction. Methods of Test and Standard Practices for Concrete.**
ACI 318-19(22):	Building Code Requirements for Structural Concrete and Commentary.
ACI-305R-20:	Guide to Hot Weather Concreting.
ACI 306R-16:	Guide to Cold Weather Concreting.
ACI PRC-309-05:	Guide for Consolidation of Concrete.
ACI SP-004 (8^{th}):	Formwork for Concrete.
ACI MNL-66 (20):	ACI Detailing Manual.
ASTM A615-22:	Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement.
ASTM C33-18:	**Standard Specification for Concrete Aggregates.**
ASTM C94-22a:	Standard Specification for Ready-Mixed Concrete
ASTM C150-22:	Standard Specification for Portland Cement.
ASTM C260-10a (2016):	Standard Specification for Air-Entraining Admixtures for Concrete.

ASTM C494-19e1:	Standard Specification for Chemical Admixtures for Concrete.
ASTM D1752-18:	Standard Specification for Preformed Sponge Rubber, Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
ANSI/AWS D1.4:	Structural Welding Code – Reinforcing Steel.

1.4. Submittals

All proposals and submissions by the **Contractor** and all responses by the **Engineer** shall be in writing. Acceptance of the **Contractor's** proposals and submissions by the **Engineer** shall not relieve the **Contractor** of his responsibility for the work as defined by the contract.

Contractor submissions to the **Engineer** shall include qualifying documentation for all materials and products including:

- Proposed concrete mix proportions including supporting trial mix results and certification that the mix proportions will produce concrete of the specified quality and yield, anticipated slumps for each proposed mix before and after addition of superplasticizer.
- Documentation that the plant, equipment, and all materials to be used in the concrete comply with the requirements of ACI 301.
- Mill certificates for reinforcing steel.
- Reinforcing bar detail lists and placing drawings shall be submitted to the **Engineer** for his records.
- Mill certificates for cement and supplementary cementing materials.
- Shop drawings or other documentation for embed or batten strips and anchor bolts or other fittings.
- Description of the proposed concrete batching plant and conveying systems, including capacity, admixture provision batching system, cold weather capabilities, hot weather capabilities, and quality control procedures.
- Note that submissions to the **Engineer** and reviews of submissions by the **Engineer** shall be completed prior to placing any concrete or doing any concrete work. The **Contractor** shall schedule the submissions to allow for at least two weeks for review by the **Engineer**.

The **Contractor** may petition the **Engineer** for the acceptance of:

- **Supplementary Cementing Materials** (fly ash, silica fume and granulated blast furnace slag). The petition shall include:
  - Identification of the source, information on its service record in concrete subjected to similar service, and test data showing conformance with Cementitious Materials Compendium including uniformity requirements.

  - Proposed dosage and timing of addition for each class of concrete as applicable.
- **Water-Reducing Admixture; Water-Reducing High Range Admixture** (Superplasticizer); **Accelerating Admixtures**. The petition shall identify the:
  - Manufacturer.
  - Proposed dosage, and timing of addition for each class of concrete, as applicable.
  - Type of admixture (retarding, accelerating, normal set).

1.5. Reviews

The **Contractor** shall, at the start and during the course of work where appropriate, meet with the **Engineer** and **CQA** for the review of the following:

- Proposed equipment and methods for storing constitutive components, mixing, and conveying concrete. The **Contractor** shall provide documentation that the concrete supplier meets industry certification.
- **Contractor's** Quality Control Program. The concrete supplier shall implement a Quality Control Plan to ensure that the **Owner's** and **Engineer's** performance requirements will be met.
- Inspection and testing of cement, aggregate, water, admixtures, reinforcement, and storage of these materials.
- Proposed form material, form ties, and form release materials. The **Contractor** shall provide calculations for all concrete formwork and shoring, sealed by a Professional **Engineer** licensed to practice in Arizona for all pours in excess of 50 cubic yards.
- Concrete mix designs with regard to strength, performance, shrinkage, porosity, durability, and suitability for project requirements. The concrete supplier shall submit documentation to the satisfaction of the **Owner** demonstrating that the proposed mix design(s) will achieve the required strength, durability, and performance requirements.
- Periodical inspection of the mixing plant.
- Prior to the erection of formwork, or the placement of reinforcement, or concrete:
  - Proposed methods of placing concrete.
  - Proposed methods and materials for supporting and securing reinforcement items to be cast-in and formwork including details of the reinforcement chairs and spacers.
  - Proposed details and positions of construction and crack control joints.
  - Sampling and testing of concrete and inspection of concrete placement procedures.
  - Preparation of existing concrete for bonding to new concrete.
  - Proposed curing methods, stripping times and hot and cold weather protection, and
  - Concreting procedures.
- Immediately prior to concrete placement:

- The inspection by the **Engineer** of the foundation, formwork, reinforcement, cast-in items, and preparation of existing concrete. Inspection by the **Engineer** shall be for conformance with the project documents, but not for structural strength and stability, which is the sole responsibility of the **Contractor**.

1.6. Quality Assurance

Records shall be kept by the **Contractor** for all submissions and for:

- Temperature of the plastic concrete and strength tests in accordance with sections 4.2.2.8 and 4.2.3 of the “The Standard". (See Section 1.2 of this specification for definition of "The Standard.")
- A certificate of accuracy of the scales at the batch plant.
- Air and concrete temperature at the time of concrete placement.
- Delivery tickets: The **Contractor** shall ensure that the records indicate where the delivered concrete was used so that remedial action can be taken if it is subsequently determined that the concrete is unsuitable for use.
- Temperature records, including methods used for the placement and curing of concrete when low temperature as specified in Section 4.2.2.8, or high temperature as specified in Section 5.3.2.1.C of “The Standard" are exceeded.

2. GENERAL

Table 1: Structural Class of Concrete

CLASS #	Structural Class of Concrete:	Max. Size Aggregate (inches)	Total Ent. Air + 1%	28 Day Compressive Strength (psi)	Admixtures Required	Max. Water: Cement	Min-Max. slump (inches)
1.	Slabs, Beams, Columns and Walls	¾	6	4000	AEA	0.45	3-5
2.	Waterproof, Aggressive Exposure Hydraulic Structures	¾	6	4000	AEA &WRA	0.4	3-5

Notes:

1 **Concrete mix designs shall be based on trial mixes prepared by the Contractor and submitted to the Engineer for review. The trials shall use a minimum of three cement factors separated by 50 lbs/yd3 with air content approximating the maximum values in.**
- **Reduce air to 3% for slabs to be steel troweled, except exterior slabs.**
- **All cement shall be Type II**
- **AEA = Air entraining agent. WRA = water reducing agent.**
- **Water: Cement = Water -to- cementitious materials ratio.**
- **Fine and coarse aggregate to be Normal -density aggregate UNO on drawings.**

2 **When concrete is to be placed by pump, properties shall be measured at discharge from the hose. The sand content of the pump mix, as a ratio by weight of total aggregate, shall not be increased more than 3% from the conventionally placed concrete.**

3 **Water reducing high range admixtures (superplasticizers) may be used to obtain higher slumps for workability subject to the Engineer's acceptance.**

2.1. Materials

2.1.1. Cements and Supplementary Cementing

Portland cement shall be Type II unless otherwise shown on the Drawings.

2.1.2. Aggregates

The requirements in ASTM C33 shall be modified as per Table 2 below.

Table 2: Grading Limits for Fine Aggregate (FA)

Total Passing Sieve: Percentage by Mass	US Standard Sieve Size No. /(mm)
100	3/8-in. (9.5mm)
95-100	4 (4.75mm)
80-100	8 (2.36mm)
50-85	16 (1.18mm)
25-60	30 (0.60mm)
5-30	50 (0.30mm)
0-10	100 (0.15mm)
0-3[A,B]	200 (0.075mm)

A For concrete not subject to abrasion, the limit for material finer than the No. 200 sieve (0.075mm) shall be 5.0% maximum.

B For manufactured fine aggregate if the material finer than the No. 200 sieve (0.075mm) consists of dust of fracture, essentially free of clay or shale, this limit shall be 5.0% maximum for concrete subject to abrasion, and 7.0% maximum for concrete not subject to abrasion.

The fineness modulus of the sand shall not be less than 2.3 or more than 3.1.

The grading limits for coarse aggregate vary depending on the maximum nominal particle size used in the mix. The grading requirements for coarse aggregates are shown in ASTM C33.

2.2. Admixtures

Unless otherwise specified herein or directed by the **Engineer**, the following admixtures shall be employed:

- An air-entraining agent, conforming to the requirements of ASTM C260. Air content between four to six percent will be required at the point of placement.
- A water-reducing agent conforming to ASTM C494.

Water-reducing admixtures and water-reducing high range admixtures (superplasticizers) shall meet the requirements of ASTM C494, Standard Specification for Chemical Admixtures for Concrete.

Calcium chloride shall not be used. Admixtures containing chlorides may be used providing the total chloride ion content in the concrete does not exceed 0.1% by weight of cement.

2.3. Concrete Properties

Concrete strengths and maximum aggregate size shall be as per Tables 1 and 2.

Concrete shall be normal density concrete unless noted otherwise on the Drawings.

2.4. Quality Control

The evaluation of concrete quality shall be the responsibility of the **Contractor** and shall be carried out as outlined in Section 1.6 of “The Standard".

The **Contractor** shall provide a coordinator who shall be present at all times during concrete work and who shall be thoroughly trained and experienced in placing the types of concrete specified and who shall direct all the work performed under this Technical Specification. The coordinator shall have the authority to request that mixing trucks return to the batch plant if delivery times are exceeded or to interrupt work if any other quality issues are not being met. Per ASTM C94 Section 12.9: Discharge of the concrete shall be completed within 1.5 hours after the introduction of the mixing water to the cement. This limitation may be waived by the **Engineer**. Refer also to Section 4.1.2.10 of “The Standard”.

The **CQA** may elect to undertake independent testing but this shall not relieve the **Contractor’s** responsibility to perform testing as described below.

Test results shall be submitted to the **Engineer** within 5 working days of the testing.

A strength test shall comprise the testing of four test cylinders. A minimum of four test cylinders shall be taken for each day of placing, and there shall be at least one test for each 100 cubic yards of concrete and for each class of concrete.

One of the cylinders shall be tested at 7 days, two at 28 days and one at 56 days (if the 28-day break does not meet strength). The test results shall be the average of the two 28-day cylinders or if required, the 56-day cylinder.

The concrete shall be considered to have met strength requirements if the average of every set of three consecutive strength tests for each class of concrete exceeds the specified strength and no individual strength test is more than 500 psi below the specified strength. If these strength requirements are not met, the **Engineer** will require adjustments to the mix proportions and additional testing as permitted by Section 1.6 of “The Standard".

Concrete failing to meet the specification’s requirements may be required by the **Engineer** to be removed and replaced with concrete meeting the specification’s requirements. Such removal and replacement shall be at the **Contractor's** expense.

Accelerated strength tests shall not be used as an alternative to the standard cylinder test.

3. PRODUCTION AND DELIVERY

When concrete is mixed in truck mixers, a complete mixing cycle of 70 - 100 revolutions at mixing speed shall be completed before the truck leaves the plant.

Requirements of Section 4.3.2.1 of "The Standard" shall control the **Contractor's** additions of water to concrete (except super plasticized concrete) including:

- The specified water-to-cement ratio shall not be exceeded.
- No more than 90 minutes has elapsed from the time of batching to the start of discharge.
- Addition of water is only at the start of discharge (i.e., not more than 10% of the concrete has been discharged).
- A 30 revolution mixing cycle shall follow water additions.
- Water may not be added more than once to a load.
- The amount of water added and by whose authority shall be recorded on the delivery ticket.

4. FORMWORK, REINFORCEMENT, EMBEDDED METAL AND PRESTRESSING

4.1. Reinforcement

All reinforcement shall conform to ASTM A615.

All steel reinforcement shall be epoxy coated.

Reinforcement shall be provided in accordance with the requirements of ACI 318.

4.2. Hardware and Miscellaneous Materials

Dissimilar metals shall be electrically separated when embedded in concrete.

Aluminum including aluminum conduits shall not be embedded in concrete.

4.3. Storage of Reinforcement

Reinforcement shall be protected from corrosion. Special precautions shall be taken for winter conditions to ensure that reinforcement can be identified.

4.4. Formwork

The **Contractor** who places the concrete (the **Concrete Contractor**) is responsible for the adequacy of all formwork and falsework including metal deck formwork, and satisfying all codes and regulations governing formwork and falsework.

The design, fabrication, erection, and use of concrete formwork shall conform to the requirements of ACI SP-004.

Falsework for suspended concrete elements shall conform to ACI SP-004.

Unless otherwise shown on the drawings, forms shall be constructed to produce the final concrete Surface Class in the following locations:

Surface Class B

Normal Exposed Concrete – All interior and exterior columns, walls, beams, and underside of slabs.

- Form Material: Form ply.
- Resulting Surface: Free from honeycombing, large bug-holes, or voids greater than 1/2" across and/or depth, fins or misalignments greater than 1/8".
- Construction: Maximum deflection 1/270 of span; patching of form panels permitted.
- Patching: Refer to Section 5.3.7 of "The Standard".

Surface Class C

All concrete not exposed to view such as buried foundations and non-exposed faces of retaining walls.

- Form Material: Shiplap or form ply.
- Resulting Surface: No specific requirements other than freedom from major voids or honeycomb. Minimum dimensions and reinforcement cover to be maintained.
- Patching: Not normally required except in areas where reinforcement is exposed. Refer to Section 5.3.7 of "The Standard".

For Surface Class B surfaces, exterior corners and edges exposed to view including horizontal edges of tank pads and curbs shall have 1" x 1" chamfers. Edges of slabs, curbs and pads shall be hand tooled.

All sharp corners for members composed of steel fiber-reinforced concrete shall have 1" x 1" chamfers or be rounded to a radius of 5/8".

4.4.1. Formwork Removal

Unless otherwise shown on the Drawings or advised by the **Engineer**, formwork must not be removed prior to the lapsed time after concrete placement (Minimum Stripping Time) according to the Table 3 below and as otherwise prescribed in the notes following the table.

Minimum stripping times are the lesser of Column A (Minimum Stripping Time) or Column B (Minimum Percentage of Specified 28 Day Strength).

Table 3: Stripping Time

	A Minimum Stripping Time (days):	B Minimum Percentage of Specified 28 Day Strength (%):
Foundation, pile caps, piers, grade walls, pedestals, columns, equipment bases less than 4 ft high	2	30
Foundation, pile caps, piers, grade walls, pedestals, columns, equipment bases greater than 4 ft high	4	60
Walls for liquid containment vessels	5	70
Edges of elevated slabs	2	30
Soffits of slabs without construction loads	7	70
Soffits of slabs with construction loads	14	85
Sides of beams and girders	7	70
Bottom of beams and girders without construction loads	14	85
Bottom of beams and girders with construction loads	21	90

Notes:
1. Minimum stripping time is the lesser of columns A or B, or as extended by Notes 2 through 5, below.
2. If retention of formwork is chosen as a means of curing, extend the stripping time to the required curing time. See Table 4 Minimum Cure Times.
3. If ambient temperatures are less than 50°F extend the stripping time to the satisfaction of the Engineer.
4. Stripping times "with construction loads" are based on superimposed construction loads equal to the load capacity of the member at the time that the loads are imposed, to a maximum equal to the design gravity temporary live load of the member. If the superimposed construction load is greater than this, extend the stripping time to the satisfaction of the Engineer. See Section 6 of this specification.
5. If more than 10% of supplementary cementitious material is incorporated in the mix, extend the stripping time to the satisfaction of the Engineer.

4.5. Fabrication and Placement of Reinforcement

Stirrups and ties of Grade 60 ksi material must meet the bending requirements of Grade 40 ksi steel.

Bar supports and side form spacers shall be non-conductive and shall be the type pre-approved by the **Engineer**.

Top reinforcement in slabs in process buildings subject to wash down (i.e., all floors with slopes) shall have a minimum cover of 2 3/8", unless otherwise shown on the drawings.

Reinforcement shall be securely tied at intersections with wire not less than 16 gage or clips. Slab reinforcement shall be carried on approved concrete pads or approved chairs providing support spacing of not more than 48". Top slab steel shall be carried on support bars of #5 minimum size supported not over 38" apart. Where temperature steel is used to support top slab steel and if temperature steel is 3/8" size, then supports shall not be over 35" apart.

Support bars or spacer bars placed directly on metal deck formwork shall be epoxy-coated or fiberglass or other non-metallic material.

Welding procedure for reinforcing bars is to be done in accordance with ANSI/AWS D1-4. Tack welding of reinforcing bars is not permitted. Reinforcing bars shall only be welded as shown on the drawings or as approved by the **Engineer** in writing.

4.6. Fabrication and Placement of Hardware and Other Embedded Items

Anchor bolts (rods) shall be placed to the tolerances listed in “The Standard". Templates should be used for placing anchor bolts for small equipment and tanks.

All other embedded metal such as door sills, beam support plates and trench angles, shall be set true within ± 1/8" of position shown on drawings.

5. PLACING, FINISHING AND CURING CONCRETE

5.1. Storage of Materials Used for Placing, Finishing, and Curing

Store so that materials are not affected by soil ground moisture.

5.2. Placing of Concrete

The **Contractor** shall notify the **Engineer** and **CQA** before placing any concrete. There shall be adequate notice such that the formwork, reinforcing and embedded metal placement can be reviewed. In no case shall the notice be less than 24 hours. The **Contractor** shall verify all anchor bolts and embedded metal locations before placing concrete.

Concrete shall be deposited as closely as practical to its final position in horizontal or wedge-shaped layers not more than 18 inches deep. Lateral movement of the concrete by means of vibrators will not be permitted.

Concrete shall be dropped vertically, without lateral movement, into formwork without interference. Unconfined free fall shall be limited to 5 feet unless otherwise required or approved by the **Engineer**. If placement methods require free fall of more than 5 feet, the tremie method of placement will be required.

Proposed methods and equipment used for the concrete consolidation shall be in accordance with ACI 309 Guide for Consolidation of Concrete.

5.2.1. Bonding Fresh Concrete to Rock or Hardened Concrete

Surfaces of hardened concrete shall be cleaned with high pressure jets or mechanical means to expose the coarse aggregate to a reveal of 1/4" and remove all laitance and loose material. Unless otherwise shown on drawings, bonding shall be accomplished by:

- Vertical Joints – Surface shall be dampened (but not saturated) immediately prior to placing fresh concrete.
- Horizontal Joints – For those horizontal joints in liquid-retaining structures or those specifically designated on the Drawings or by the **Engineer**, a 6" layer of special bonding mix shall be placed and be well vibrated to achieve maximum bond. The concrete to be used for this special bonding mix shall be the normal mix proportions with one-half the coarse aggregate removed and the slump increased to 5".
- For other horizontal joints, treat same as "Vertical Joints".

Where roughening of the rock or hardened concrete surface is specified, the surface shall be roughened to expose the coarse aggregate to a full amplitude of at least 1/4".

5.3. Joints

Joints shall be constructed and located as described on the Drawings. Whenever PVC waterstop is specified, it shall be wired to the reinforcing steel with all waterstop joints properly fused to provide a continuous seal.

5.4. Joint Filler

The joint filler shall be standard cork joint filler with an insoluble phenolic resin binder, conforming to ASTM D1752, Type 2.

All joints in the filler material shall be made tight so that mortar from fresh concrete will not seep through to the opposite concrete surface.

5.5. Joint Sealant

The **Contractor** shall supply and apply joint sealant complete with bond breakers and backup materials to expansion joints and elsewhere in concrete structures as shown on the Drawings or otherwise required by the **Engineer**.

Except as otherwise specified herein, surface bond breakers and backup materials shall be companion products of the joint sealant used for the work as recommended by the sealant manufacturer and approved by the **Engineer**.

5.6. Curing and Protection

All exposed concrete surfaces shall be cured as given in accordance with the requirements of Section 5.3.6 of "The Standard". Moist curing shall be used. Curing compounds are permitted for this exposure class of concrete if they are not environmentally damaging. In addition, surfaces which are to be water-proofed, painted, coated, will receive a separate topping or grout, or is adjacent to a pour where good bond is required, shall be wet cured only (curing compounds are not permitted).

Curing may consist of formwork retained in place or an approved curing method. Approved methods are a, b, or c of Section 5.3.6.4 of "The Standard".

Unless otherwise shown on the drawings or advised by the **Engineer**, curing must be carried out for the lapsed time (Minimum Cure Times) according to the following table and otherwise prescribed in the notes below the table.

Minimum cure times are the lesser of Column A or Column B in Table 4.

Table 4: Minimum Cure Times

Element	A Cure Time (days):	B Time to Achieve Min. % of Specified Strength of:	C Method of Curing per Section 5.3.6 of "The Standard"
Foundations, pile caps, piers, grade walls, walls, pedestals, columns, equipment bases	7	70	Any
Top surfaces of slabs	7	70	As noted below or (3)

Notes:

1. **The Contractor may establish the Minimum % of Specified Strength by testing field cure cylinders or by other non-destructive testing which is acceptable to the Engineer.**
2. **Cure times shown are based on minimum ambient temperatures of 50°F. For lower temperatures, the Contractor shall extend the cure times to the satisfaction of the Engineer.**
3. **For accelerated strength concrete mixes cure times shall be the minimum defined in Table 4 above.**

5.6.1. Curing of Slab Surfaces

Proper curing of slabs is essential and must be done as follows:

- Begin curing as soon as the plastic curing membrane can be applied without damage to the newly finished surface.
- The concrete surface is to be wetted immediately after final finishing and covered with a 6 mil polyethylene membrane, clear or white, and secured in place with weights to prevent

exposure of the concrete surface during the curing period. The membrane shall cover all exposed surfaces of the concrete.

- Place the membrane flat, without wrinkles, to minimize mottled discoloration.
- Edges shall be lapped 1-foot minimum and tape sealed.
- Provide traffic protection to protect the concrete surface and the polyethylene curing membrane.
- Leave the curing membrane undisturbed for a minimum of 7 days.
- Maintain a film of water under the membrane and add water as required.

5.6.2. Hot Weather Protection

The plastic concrete temperature at time of placement shall not exceed temperatures in Section 5.3.6.5 of "The Standard". When the air temperature is expected to be 80°F or higher, suitable protection shall be provided as described in ACI 305R.

5.6.3. Cold Weather Protection

The minimum plastic concrete temperature at placement shall not be less than temperatures in Section 4.2.2.8 of "The Standard". When the air temperature is or is expected to fall lower than 41°F, suitable protection shall be provided as described in ACI 306R.

5.7. Finishing and Treatment of Slab Surfaces

The final floor finish shall be one of the following types:

- STEEL TROWEL: Dense hard surface obtained by multiple steel trowel passes.
- NON-SLIP SWIRL: Multiple steel trowel passes but with final pass of aluminum float.
- BROOM: Multiple steel trowel passes followed by brooming to the required texture.

Unless designated on the drawings, the following floor finishes shall be used in these areas:

- STEEL TROWEL: Control rooms, electrical rooms, dry process floors, warehouses, under FRP tanks.
- NON-SLIP SWIRL: All process floors that are rarely wetted with water.
- BROOM: Exterior concrete slabs with significant vehicular or people traffic, slabs in process areas that are frequently wetted or flooded or are subject to spillage of process materials, and under steel tanks.

5.8. Finishing of Formed Surfaces

Projecting imperfections shall be removed; depressed imperfections shall be patched by chipping to sharp margin and by filling with mortar. Patches exposed to view shall blend with surrounding surfaces. All patchwork shall be carried out immediately following the stripping of forms and while concrete is still green. Patches shall be properly installed and cured.

The required quality of formed surface shall be as designated in section 4.4 of this specification. The particular patching procedure required for each area shall be reviewed with the **Engineer** prior to starting.

6. CONSTRUCTION LOADS

The **Contractor** shall take precautions to ensure concrete is not damaged from construction loads prior to reaching its specified strength. The **Contractor** shall ensure concrete is not loaded in excess of its design capacity after reaching its specified compressive strength. The **Contractor** shall review plans for placing construction loads with the **Engineer**.

7. HIGH DENSITY POLYETHYLENE (HDPE) EMBEDS

High Density Polyethylene (HDPE) extruded anchoring systems shall be used where identified on the Drawings and where HDPE geomembrane is required to be attached to new cast-in-place or precast concrete. The materials shall be Agru Tri-Lock (manufactured by Agru America) or GSE Polylock (manufactured by GSE Environmental), or approved equivalent. The embed shall have a minimum of three locking fingers, each with a length of at least ⅞ inch.

The embed must be cut and butt-welded together to fit corners and shapes, as needed, although the use of manufacturer supplied corners and “T” connections is preferred. The embed shall be attached to the inside of the concrete form with finishing nails (1-inch or smaller) prior to concrete placement. The nails must be driven flush with the back of the embed to allow for their easy removal when the forms are removed. The embed should be attached sufficient points to ensure a flush fitting with the form.

The concrete surrounding the embed should be vibrated to ensure that there are no void spaces in the concrete adjacent to the embed. After the concrete has set and the forms are removed, the finishing nails can be removed. If concrete gets between the embed and the form, it should be chipped away to reveal the face of the embed. Any sharp edges that are created by the chipping back of the concrete must be beveled to prevent possible cutting or puncturing of the liner.

Prior to welding HDPE liner to the embed, the liner and the embed must be cleaned to remove dirt, water, grease and any other foreign material. Grinding of the liner and embed must also be performed prior to extrusion welding.

Contractor shall adhere to all manufacturer provided installation procedures.

CORRUGATED POLYETHYLENE PIPE
Technical Specifications

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1. GENERAL

This specification defines the requirements for Corrugated Polyethylene Pipe (CPeP) materials, installation, and quality control associated with the South32 Hermosa Inc. (**Owner**) Tailings Storage Facility 1 (TSF1).

Any alternatives or exceptions to this specification shall be submitted in writing to the **Owner** or its designated representatives and shall be approved by the **Engineer**.

The owner's engineer shall control the quality of construction and shall verify that all construction elements have been completed in accordance with Design Drawings and Technical Specifications.

1.1. Definition of Terms

- "**Owner**" is defined as South32 Hermosa Inc. or any of its authorized representative(s) / agent(s).
- "**Engineer**" is defined as the **Consultant** or **Engineering Company** (NewFields) responsible for the detailed design or any of its authorized representative(s)/ agent(s).
- "**Construction Manager**" is defined as the **Consultant** or **Engineering Company** (to be determined) responsible for the overall project completion.
- "**Construction Quality Assurance (CQA)**" is defined as the **Consultant** or **Engineering Company** (to be determined) hired by the **Owner** to provide independent inspection and testing services for the overall project.
- "**Contractor**" is defined as the party(s) that has executed the contract agreement for the specified Work with the **Owner** or its authorized representative(s)/agent(s).
- "Specifications" are defined as this document, all supplemental addenda, and any modifications furnished by the **Owner**, the **Engineer**, or others that apply to the Work.
- "Drawings" are defined as the "Hermosa Project Tailings Storage Facility 1 (TSF1)" Drawings furnished by the **Owner**, **Engineer**, or others that apply to the "Work".
- "Site" is defined as the area being developed by the **Owner** and where the Work is to be completed as described in these Technical Specifications and detailed on the Drawings.
- "Contract" is defined as the document executed by the **Owner** or its authorized representative(s)/agent(s) with the **Contractor** to complete specified portions of the Work.
- "Work" is defined as the entire completed construction or the various separately identifiable parts thereof required to be furnished as shown on the Drawings and as described in the Specifications and Contract Documents.
- "Modifications" are defined as changes made to the Specifications or the Drawings that are approved by **Owner** and **Engineer** in writing, after the Specifications and Drawings have

been issued for construction. These also refer to changes to design elements in the field to account for unforeseen conditions.

- "Plant" is defined as all equipment, supplies, accommodations, temporary offices, etc., required to complete the Work.
- "Units" – In general, these Specifications and the Drawings will utilize Imperial units, however metric units will be used when appropriate.

1.2. Codes and Standards

All pipe work shall be of the best quality available complying with the latest standards for the following:

- ANSI American National Standard Institute
- ASTM American Society of Testing and Materials
- AWWA American Water Works Association
- AASHTO American Association of State Highway and Transportation Officials
- SPI Society of the Plastics Industry, Inc.
- PPI Plastics Pipe Institute

2. CORRUGATED POLYETHYLENE PIPE (CPEP) WITH SMOOTH INTERIOR

2.1. Material Properties

Pipe and fittings shall be made of virgin polyethylene compounds that conform with the applicable current edition of the AASHTO Material Specifications for cell classification as defined and described in ASTM D3350. Resins that have higher cell classifications in one or more properties, with the exception of density, are acceptable provided the product requirements are met.

For slow crack growth resistance, acceptance of resins shall be determined by using the notched constant ligament-stress (NCLS) test in accordance with ASTM F2136 except that the applied stress for the NCLS test shall be 600 psi (Note: The notched depth of 20 percent of the nominal thickness of the specimen is critical to this procedure). The average failure time of the five test specimens must exceed 24 hours with no single test specimen's failure time less than 17 hours.

Pipe and fittings shall be manufactured and comply with the current edition of AASHTO Standard Specifications M252 and M294. All sizes shall conform to the AASHTO classification "Type S" for smooth wall interior solid pipe and "Type SP" for smooth wall interior perforated pipe.

CPeP and couplings for watertight application shall be Advanced Drainage System ADS N12 WT IB or an equivalent product approved by the Engineer. Prefabricated fittings for the watertight application shall have bell ends suitable for connecting to the pipe or alternatively shall have plain ends suitable for using bell-to-bell push-on gasketed couplings.

The pipe shall have a minimum pipe stiffness of 5-percent deflection when tested in accordance with ASTM D2412, as follows:

Nominal Diameter (inches)	Pipe Stiffness (psi)
4, 8 or 12	50
15	42
18	40
24	34
30	28
36	22
42	20
48	18
60	14

The diameters refer to the inside pipe diameter.

Where perforations are specified, they shall conform to the requirements as follows:

- AASHTO M252 “Class 2” for 4-inch to 10-inch diameter CPeP
- AASHTO M294 “Class 2” for 12-inch to 36-inch diameter CPeP

Couplings (non-watertight) shall be corrugated to match the pipe corrugations and shall provide sufficient longitudinal strength to preserve pipe alignment and prevent separation at the joints. Couplings, unless watertight connections are specified, shall be split collar and shall engage at least two full corrugations on each pipe section. Where pipe is joined to other materials or fittings, or joined by other methods, the manufacturer’s recommendations shall be strictly enforced.

CPeP-to-HDPE pipe connections, if specified, shall be made using CPeP-to-HDPE adapters supplied by the CPeP manufacturer. The HDPE pipe end of the adapter shall match the dimensional ratio (DR) of the pipe being connected.

Pipe sizes and types shall be as specified on the Drawings, or as required by the **Engineer**.

2.2. Submittals

The CPeP material supplier shall submit to the **Engineer** a manufacturer's certification that all pipe and fittings they intend to supply comply with the applicable portions of the specifications.

2.3. Pipe Delivery, Handling, and Storage

Pipe, fittings, valves, and other appurtenances shall be loaded and unloaded by lifting with hoists in such a manner as to avoid damage or hazard. Under no circumstances shall pipe or pipe fittings be dropped to the ground or into trenches. Pipe handled on skid ways shall not be skidded or rolled against pipe already on the ground. The interior of all pipe and pipe fittings shall be kept free from dirt and foreign material at all times.

The **Contractor** shall be responsible for any material furnished to him by the **Owner** and shall replace or repair, in a manner approved by the **Engineer** at the **Contractor's** expense, all such material damaged in handling after delivery. This shall include the furnishing of all materials and labor required for the replacement of installed material damaged prior to the final acceptance of the Work.

2.4. Pipe Installation

CPeP shall be installed to the sizes, lines, and grades shown on the Drawings. Pipe sections shall be joined with manufacturer-supplied split couplers with the open seam of the coupler turned to the side of the pipe. End caps shall be installed on the upstream ends of the pipe. Pipes shall be closely monitored during backfilling activities to ensure no damage is done to the pipe.

The pipe shall be installed to the lines and grades and generally in the manner shown on the Drawings. Where specific lines and grades are not indicated on the Drawings, the lines and grades will be determined by the **Engineer** in the field to suit the existing ground conditions. The **Contractor** shall use equipment and methods acceptable to the **Engineer** and in accordance with the pipe manufacturer's recommendations for handling and placement of the pipe and fittings.

The **Contractor** shall provide and install all piping required to complete the piping installation in accordance with good piping practices, regardless of whether such piping is specifically detailed on the Drawings. The general layout as shown on the Drawings shall be maintained. Where interference is encountered during installation or relocation of pipelines is deemed necessary, the **Engineer** shall be consulted before any changes are made.

All pipelines shall be erected to preserve accurate alignment. Care shall be taken in the installation of pipeline runs where drainage is required to ensure that the pipeline has a continuous slope to the point of drainage.

Prior to installation, each segment of pipe and all fittings shall be inspected for defects or damage. All pipe, fittings, and other appurtenances shall be carefully lowered into position, piece by piece. Under no circumstances shall such materials be dropped into position. Extreme care shall be taken to prevent foreign material from entering the pipe while it is being installed. Temporary end caps or other approved means shall cover open ends of the pipe when installation is not in progress.

Pipe bends to form curves either in the horizontal or vertical plane shall not exceed that recommended by the manufacturer or approved by the **Engineer**. The cutting of pipe for inserting fittings or closure pieces shall be done in a neat manner and with good workmanship without damage to the pipe and leaving a smooth end at right angles to the axis of the pipe.

Wherever obstructions not shown on the Drawings are encountered during construction, and where such obstructions interfere with the work to an extent that an alteration in the lines or grades of the pipe is required, the **Engineer** shall approve any deviation or arrange for removal, relocation, or reconstruction of the obstructions.

EARTHWORKS
Technical Specifications

NewFields	CLIENT SOUTH32 HERMOSA INC.	PROJECT NO 475.0014.035
PROJECT TAILINGS STORAGE FACILITY 1 (TSF1) AQUIFER PROTECTION PERMIT (APP) SIGNIFICANT AMENDMENT BEST AVAILABLE DEMONSTRATED CONTROL TECHNOLOGY (BADCT) DESIGN		
TITLE TECHNICAL SPECIFICATIONS FOR EARTHWORKS MATERIALS AND CONSTRUCTION		**SPECIFICATION NO.** 0014-SPT-EW

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1. GENERAL

This specification defines the requirements for the earthwork construction activities associated with the South32 Hermosa Inc. (**Owner**) Tailings Storage Facility 1 (TSF1). The specifications set forth in this document cover the quality of materials and workmanship for earthworks construction.

Any alternatives or exceptions to this Specification shall be submitted in writing to the **Owner** or its designated representatives and shall be approved by the **Engineer**.

The owner's engineer shall control the quality of construction and shall verify that all construction elements have been completed in accordance with Design Drawings and Technical Specifications.

1.1. Definition of Terms

- "**Owner**" is defined as South32 Hermosa Inc. or any of its authorized representative(s) / agent(s).
- "**Engineer**" is defined as the **Consultant** or **Engineering Company** (NewFields) responsible for the detailed design or any of its authorized representative(s)/ agent(s).
- "**Construction Manager**" is defined as the **Consultant** or **Engineering Company** (to be determined) responsible for the overall project completion.
- "**Construction Quality Assurance (CQA)**" is defined as the **Consultant** or **Engineering Company** (to be determined) hired by the **Owner** to provide independent inspection and testing services for the overall project.
- "**Contractor**" is defined as the party(s) that has executed the contract agreement for the specified Work with the **Owner** or its authorized representative(s)/agent(s).
- "Geomembrane Installer" is defined as the party (s) contracted by the **Contractor** or **Owner** to install, inspect, and test the geomembrane portions of the project.
- "Specifications" are defined as this document, all supplemental addenda, and any modifications furnished by the **Owner**, the **Engineer**, or others that apply to the Work.
- "Drawings" are defined as the "Hermosa Project Tailings Storage Facility 1 (TSF1)" Drawings furnished by the **Owner**, **Engineer**, or others that apply to the "Work".
- "Site" is defined as the area being developed by the **Owner** and where the Work is to be completed as described in these Technical Specifications and detailed on the Drawings.
- "Contract" is defined as the document executed by the **Owner** or its authorized representative(s)/agent(s) with the **Contractor** to complete specified portions of the Work.

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- "Modifications" are defined as changes made to the Specifications or the Drawings that are approved by **Owner** and **Engineer** in writing, after the Specifications and Drawings have been issued for construction. These also refer to changes to design elements in the field to account for unforeseen conditions.
- "Plant" is defined as all equipment, supplies, accommodations, temporary offices, etc., required to complete the Work.
- "Units" These Specifications and the Drawings will utilize Imperial units; however metric units will be used when appropriate.

1.2. Codes and Standards

All tests shall be performed in accordance with the current edition of the testing standards as indicated below.

1.2.1. American Association of State Highway and Transportation Officials (AASHTO):

- AASHTO T103: Standard Method of Test for Soundness of Aggregates by Freezing and Thawing
- AASHTO T104: Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate

1.2.2. American Society for Testing and Materials (ASTM):

- ASTM C88-18: Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
- ASTM C117-17: Standard Test Method for Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing
- ASTM C131-20: Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- ASTM C136-19: Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
- ASTM C535-16: Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- ASTM D698(2021): Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort
- ASTM D1556-15e1: Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method

- ASTM D1557-12(2021): Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort
- ASTM D2434-22: Standard Test Methods for Measurement of Hydraulic Conductivity of Coarse-Grained Soils (Constant Head)
- ASTM D4318-17e1: Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- ASTM D4644-16: Standard Test Method for Slake Durability of Shales and Other Similar Weak Rocks
- ASTM D4767-11(2020): Standard Test Method for Consolidated Undrained Triaxial Compression Test for Cohesive Soils
- ASTM D5030-21: Standard Test Method for Density of In-Place Soil and Rock Materials by the Water Replacement Method in a Test Pit
- ASTM D5084-16a: Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
- ASTM D5126-16e1: Standard Guide for Comparison of Field Methods for Determining Hydraulic Conductivity in Vadose Zone
- ASTM D6913-17: Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis
- ASTM D6938-17ae1: Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
- ASTM D7928-21e1: Standard Test Method for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis

1.2.3. United States Environmental Protection Agency (USEPA)

- EPA M600/2-78-054 3.2.3: Field and Laboratory Methods Applicable to Overburdens and Minesoils

1.2.4. United States Army Corps of Engineers (USACE):

- USACE, EM 1110-2-2301 Part 2: Engineering Manual, Engineering and Design, Test Fills

1.2.5. United States Bureau of Reclamation (USBR):

- USBR 5600: Determining Permeability and Settlement of Soils, Fixed Wall Saturated Hydraulic Conductivity
- USBR 5605: Determining Permeability and Settlement of Soils Containing Gravel, Fixed Wall Saturated Hydraulic Conductivity

1.2.6. United States Department of Transportation – Federal Highway Administration (USDOT-FHWA):

- USDOT FLH T 521: Standard Method of Determining Riprap Gradation by Wolman Count

2. LANDSCAPE PRESERVATION

2.1. General

The **Contractor** shall exercise care at all times to preserve the natural landscape and shall conduct operations to prevent unnecessary damage, scarring or defacing of the natural surroundings in the vicinity of the work. Movement of personnel and equipment within the site disturbance area, site access roads, and easements provided for access to the work shall be performed in a manner to prevent damage to the property and the environment.

3. EARTHWORKS

This section presents the technical requirements for the earthworks construction for the Hermosa Project Tailings Storage Facility 1 (TSF1).

All equipment used by the **Contractor** shall meet satisfactory conditions and comply with the Specifications with the approval of the **Engineer**. The **Engineer** reserves the right to request in writing a change in the required equipment or procedure of any work and the **Contractor** shall comply.

During all earthwork operations the **Contractor** will be responsible for dust control. Care shall be taken to minimize and control the generation of dust by means approved by the **Owner** or **Construction Manager**.

3.1. Control of Surface Water and Stormwater Runoff

The **Contractor** shall review the available surface runoff and subsoils data for the project site and evaluate the surface and subsurface conditions at the project site with respect to required diversion and dewatering requirements as conceptually shown on the Drawings. During the construction period, the **Contractor** will be responsible for constructing and maintaining any temporary ditches, channels, and or sediment control ponds required to protect the works and control surface water flows as well as limit sediment transport outside the limits of the work as directed by the **Owner**.

The **Contractor** shall prepare a stormwater management plan in accordance with Best Management Practices (BMP’s). The plan shall detail the materials, equipment, pumps, piping, cofferdams, channels, and other components necessary to complete the construction and erosion and sediment control.

The temporary surface water runoff control including temporary and permanent berms, canals and any other control measures, shall be built according to the line and grade indicated on a plan submitted by the **Contractor** and approved by the **Owner** and **Construction Manager** and maintained throughout the work.

The **Contractor** shall build berms, embankments, and other erosion control measures required to prevent significant transport of sediments from the stockpiles, fill areas, and other areas of the work that may be subject to the effects of stormwater.

The **Contractor** shall provide equipment and perform all necessary work to maintain the areas of surface and groundwater collection to remove sediments from the water before it leaves the site. The **Contractor** shall provide the temporary erosion control measures and make improvements immediately to these control measures as required by the **Owner** or **Engineer**.

The **Contractor** shall prevent all damage to the work areas due to drying, water runoff, and sediment control.

The **Contractor** shall remove all temporary installations of erosion control measures when they are no longer necessary and restore the areas affected by these measures.

The **Contractor** shall be responsible for the damage that results from rainfall runoff and for failed erosion control measures.

3.2. Earthwork Specifications

3.2.1. Clearing, Stripping and Topsoil Removal

The natural ground surface is to be cleared and stripped of all topsoil, organic, and objectionable materials to the limits shown on the Drawings or as required by the **Engineer** to facilitate construction. The limits of stripping shall generally extend approximately 10 feet outside of the Work activity areas as shown on the Drawings. Any clearing and stripping beyond the limits shown on the Drawings, or as required by the **Engineer**, shall be subject to the approval of the **Owner**. The estimated average depth of material to be removed is 12 to 24 inches.

Clearing and Grubbing will be carried out using whatever method is deemed necessary, providing it is consistent with producing an acceptable end result as determined by the **Owner** and the **Engineer**. Care is to be taken to minimize erosion and excessive sediment buildup.

The stripped material shall be hauled to topsoil stockpiles as shown on the Drawings or as directed by the **Owner**. Topsoil stockpiles shall be leveled, trimmed, and shaped to prevent the occurrence of ponding or concentrations of surface runoff and to provide a neat appearance. Finished slopes of the stockpiles shall be graded to 2.5H:1V for interim reclamation. All surface water runoff shall be directed to available natural drainage courses and shall utilize proper sediment control measures approved by the **Owner**.

After clearing, grubbing and topsoil removal is complete, the surface shall be prepared as specified on the Drawings or in the Technical Specifications. A survey shall be taken of the area if necessary, to determine quantities or for verification of lift or layer thickness after stripping is complete.

3.2.2. Grading and Prepared Surfaces

Once the work area has been cleared and stripped to the satisfaction of the **Engineer**, the surface shall be prepared and approved by the **CQA** before any overlying materials are placed. All work areas shall be graded according to the limits shown on the Drawings. Areas of both cut and fill shall be required to bring the grading of the work area to the elevations specified in the Drawings.

Areas that are to be filled and finished subgrade elevation for cut surfaces shall have the exposed surface scarified to a depth of approximately 8–inches, moisture conditioned, and compacted to 95 percent of the maximum dry density, within 3 percent of optimum moisture content as determined by the Modified Proctor Density Test, ASTM D1557. The **Engineer** may waive this requirement if the exposed surface soils without manipulating will provide a firm, non-yielding surface for fill placement, in which case the surface shall be moistened, lightly scarified and the first layer of fill placed.

Cut surfaces on which there is no overlying construction such as a road and channel slopes, in general, do not require scarification, moisture conditioning or compaction.

All boulders and cobbles that are located at the surface or partially exposed in a finish cut or fill area that could be detrimental to the overlying construction shall be removed as directed by the **Engineer**.

Areas of unsuitable material as determined by the **Engineer** or areas of pre-existing fill not compacted to the Technical Specifications shall be excavated to the limits designated by the **Engineer** and replaced with compacted Engineered Fill.

The **Contractor** is responsible for maintaining the surface in a satisfactory condition after approval of the **Engineer**. The **Contractor** shall protect the prepared surface from weather, construction equipment, and other factors.

3.2.3. Excavations and Borrow Areas

Excavation methods, techniques, and procedures shall be developed with consideration to the nature of the materials to be excavated and shall include all precautions that are necessary to preserve, in an undisturbed condition, all areas outside the lines and grades shown on the Drawings or as required by the **Engineer**. Excavation, shaping, etc., shall be carried out by whatever method is considered most suitable, providing it is consistent with producing an acceptable result as determined by the **Engineer**. Excavations shall be graded to provide drainage and prevent ponding. For excavations that cannot be graded to drain, the **Contractor** shall make provisions for the equipment and labor necessary to keep the excavations free of standing water.

No excavation beyond the lines and grades shown on the Drawings or as required by the **Engineer** shall be completed without the prior approval of the **Engineer** and **Owner**. If such additional excavation is done without prior approval and, in the opinion of the **Engineer**, requires backfilling to complete the Work, such backfilling shall be approved by the **Engineer** and shall be completed at the **Contractor's** cost. The **Contractor** shall protect and maintain all excavations until the adjacent placement or overlying placement of material has been completed.

The **Contractor** shall coordinate borrow activities with the **Engineer** and **CQA** to allow the sampling and testing of materials prior to their excavation. The **Contractor** shall allow the **Engineer** and **CQA** adequate time to evaluate potential borrow materials. Materials from excavations within the works or borrow areas that meet the specified requirements for other construction materials shall be stockpiled or placed in fill areas as directed by the **Engineer** and **Owner**. Unsuitable or excess materials shall be hauled to waste or stockpile areas.

The materials obtained from borrow pits or **Owner**-stockpiled material shall be selected to ensure that the gradation requirements for the various construction materials are achieved and that the materials are as homogeneous as possible. Care shall be taken to avoid cross-contaminating different types of materials.

On-site borrow areas shall be developed within the limits shown on the Drawings or as required by the **Owner**. Should the **Contractor** wish to develop additional borrow sources, the **Contractor** shall receive written approval from the **Owner** prior to proceeding. Approval by the **Owner** may require that subsurface investigations be carried out to obtain samples as required by the **Engineer** to make an appropriate assessment of the suitability of the borrow materials in the area for the intended use at the **Contractor's** cost.

Borrow pit operations shall be subject to the approval of the **Owner** and **Engineer** and shall avoid waste of any suitable construction material therein. Clearing and stripping of any borrow area is to be completed with all salvageable growth media stockpiled in areas designated on the Drawings or as directed by the **Owner**. Each borrow area shall be developed with due consideration for drainage and runoff from the excavated surfaces to minimize erosion and ensure sediment control prior to release of any surface water or stormwater. Each borrow area shall be excavated in near horizontal layers and in such a manner that water will not collect and pond except as approved by the **Owner**. Before being abandoned, the sides of any borrow areas outside the Work area shall be brought to stable slopes (not steeper than 2.5H:1V) with slope intersections rounded and contoured to provide a natural, neatly graded appearance.

3.2.4. Fill Materials

Earth fill will not be placed until clearing and stripping and required foundation preparation have been completed, the foundation has been inspected and approved by the **Engineer**, and any required surveys completed.

All material used for fill shall be loaded and hauled to the placement site, dumped, spread, and leveled to the specified layer thickness. Fill shall be moisture conditioned and compacted to form a dense integral fill in accordance with these Technical Specifications and as approved by the **Engineer**. Care shall be taken at all times to avoid segregation of the material being placed and, if required by the **Engineer**, all pockets of segregated or undesirable material shall be removed and replaced with material that matches the surrounding material. All oversize material will be removed from the fill material either prior to it being placed or after it is dumped and spread but prior to compaction. No additional payment will be made to remove oversized materials unless the Work is specifically identified as a payment item on the Schedule of Quantities.

For most construction conditions, the fill is to be constructed in near horizontal layers with each layer being completed over the full length and breadth of the zone before placement of subsequent layers. Each zone shall be constructed with materials meeting the specified requirements and shall be free from lenses, pockets, and layers of materials that are substantially different in gradation from the surrounding material in the same zone, as determined by the **Engineer**.

Except in areas approved by the **Engineer**, where space is limited or as otherwise specified, fill shall be placed by routing the hauling and spreading units approximately parallel to the axis of the fill. The hauling equipment shall be routed in such a manner that they do not follow in the same paths but spread their travel routes evenly over the surface of the fill to aid in compaction.

Moisture conditioning is the operation required to increase or decrease the moisture content of material to within the specified limits. If moisture conditioning is necessary, it may be carried out by whatever method the **Contractor** deems is suitable, provided it produces the moisture content specified in these Technical Specifications or designated by the **Engineer**. The **Contractor** shall take the necessary measures to ensure that moisture is being distributed uniformly throughout each layer of material being placed immediately prior to compaction. Measures shall be adopted as necessary to ensure that the designated moisture content is preserved after compaction until the overlying layer is placed.

All particles having dimensions that interfere with compaction in the fill as determined by the **Engineer** or **CQA** shall be removed from the zone in which they were placed either prior to or during compaction.

The rolling pattern for compaction of all zone boundaries or construction joints shall be such that the full number of roller passes required in one of the adjacent zones, or on one side of the construction joint, extends completely across the boundary or joint.

Minor deviations from the material properties and gradation limitations specified in the Sections below may be acceptable, subject to the review and approval of the **Engineer**. Refer to subsequent Sections 3.2.5 through Sections 3.2.23 for material properties and placement method requirements specific to each fill material type.

3.2.5. Engineered Fill

Material Properties – The Engineered fill will have a wide range of classifications based on the Unified Soil Classification System (USCS) and may contain significant variations in gradation and compaction properties. Engineered fill shall be placed in areas where the material is not required to be of uniform character and engineering properties. Engineered fill shall be free of roots, grass and other organic material and consist of inorganic soil and rock materials from required excavations, overburden materials or borrow material from other sources, as approved by the **Engineer**.

Materials containing rock or cobbles, gravel and clean gap graded sand (minimal fines) from required excavations may be used subject to the **Engineer**'s approval and provided the rock be reasonably graded such that large void spaces do not result and the clean sand is not placed within 10 feet of a permanently exposed slope. Further, the maximum size rock shall be no larger than two-thirds (2/3) of the compacted lift thickness.

Placement Methods – Engineered fill shall be moisture conditioned to within 2 percent below and 3 percent above of the optimum moisture content, placed in 12-inch maximum loose lifts, and compacted to 95 percent of the maximum dry density (ASTM D1557). Slight variations from the specified moisture range may be acceptable subject to acceptance by the **Engineer** and provided the required compacted densities are achieved. The Engineered fill material shall be compacted with appropriate compaction equipment capable of achieving compaction through the full thickness of the lift layer.

If the Engineered fill placement and compaction utilizes 90-ton or larger haul trucks, the lift thickness can be increased subject to the approval of the **Engineer** based on the acceptable test fill performance.

Engineered fill containing more than 30-percent rock (materials above ¾-inch size) shall be spread, placed, and compacted using procedures based on the results of a test fill. The type of compaction equipment, number of passes, maximum rock size and loose lift thickness will be approved by the **Engineer** in writing based on the acceptable test fill performance. The **Contractor** shall outline his proposed procedures for moisture conditioning and fill placement and submit them to the **Engineer** for review and approval. The **Contractor** shall construct a test fill to verify the adequacy of the compaction equipment for achieving the required density. The test fill may be located so that it is incorporated into the fill area. The test fill shall be constructed and monitored in accordance with the U. S. Army Corps of Engineers' (USACE) guidelines for test fill construction (USACE, EM 1110-2-2301 Part 2).

The data to be collected during construction of the test fill shall include the following:

- Lift thickness of 1, 2, and 4-feet (three test fills to determine optimum lift thickness).
  - Note, maximum particle size may not allow for some test fill lift thicknesses.
- Amount of settlement after every two passes of the compactor to a maximum of 25 passes.
- Gradation and moisture content of in-place material.
- In-place fill density at completion of the test by nuclear gauge or other methods approved by the **Engineer**. For some rock fill the water replacement method may be required to assess compaction.

A curve showing change in settlement versus number of passes shall be produced from the data. This curve will be used to determine the required minimum number of passes for acceptable compaction. In general, the minimum number of passes will be that number to achieve 80 percent of the total settlement obtained after ten complete passes of the compaction equipment. Final determination by the **Engineer** of the lift thickness and minimum required passes will be based on review of the test data.

Maximum rock size for all fills shall be two–thirds (2/3) of the compacted lift thickness, unless otherwise approved by the **Engineer**. Oversize materials shall be removed from the fill.

The placement of fill shall be temporarily suspended by the **Contractor** due to weather concerns if the materials and installation cannot comply with the Technical Specifications, with no cost to the **Owner**.

3.2.6. Low Permeability Soil Layer

Material Properties – Low permeability soil layer shall consist of an inorganic fine-grained silt and clay or sandy and gravelly silt and clay material obtained from on-site excavations, near-site borrow areas, or generated and stockpiled by the **Owner**.

The material gradation as determined by ASTM D6913 shall be as follows:

Sieve Size (square openings)	Percent Passing (by dry weight)
2-inch	100
No. 4	55-100
No. 200	25 Min

The low permeability soil layer material shall have a minimum plasticity index of 15 as determined by ASTM D4318. The coefficient of permeability (k) for the low permeability soil layer shall be less than or equal to 1.0×10^{-6} cm/sec.

Laboratory testing (see Table 4) shall be completed on all low permeability soil layer sources prior to placement by the **CQA**. The material shall be classified and compared to the material properties used in the design and approved by the **Engineer** prior to placement.

Removal of the oversize materials may be necessary to meet the requirements of the material gradation and to meet the Technical Specifications for the requirement of the finished surface discussed in Section 3.3.

Placement Methods – Low permeability soil layer materials shall be placed in lifts not to exceed 6 inches in compacted lift thickness. This material shall be compacted to 95 percent of the maximum dry density as determined by ASTM D1557. The moisture content of the material will be maintained at 1 percent below optimum to 4 percent above optimum moisture content. Slight variations from the specified material gradation, moisture range, and compaction requirements may be acceptable subject to the acceptance of the **Engineer**. The low permeability soil layer shall be compacted using a tamping or sheep's foot compactor or approved alternate. Smooth-drum finishing rollers shall be used to smooth the surface to remove the tracks from the tamping or sheep's foot rollers and to embed small stones and rocks into the soil matrix in preparation for geosynthetic placement.

The **Contractor** shall protect the finished surface of the low permeability soil layer from desiccation cracking and weather damage between placement activities and coverage by the Geomembrane Installer. Areas that exhibit desiccation cracks in excess of ¾ inch in depth or are damaged due to weather shall be reworked prior to geosynthetics placement without additional costs to the **Owner**.

The **Contractor** shall remove all rocks larger than 2 inches and construction stakes from the low permeability **materials** and any holes shall be filled to the approval of the **Engineer**.

If any area of the low permeability soil layer does not comply with the requirements of the Technical Specifications and is not approved by the **Engineer,** it shall be considered in nonconformance and the **Contractor** shall be required to rework the area until acceptable at no cost to the **Owner**.

3.2.7. Protective Layer

Material Properties – The protective layer material lies directly above the HDPE geomembrane liner. The purpose of this layer is to provide a protective cover above the HDPE geomembrane and to facilitate drainage of any solutions reporting through the tailings to the geomembrane liner. The protective layer shall consist of acceptable natural silty sands, sandy silts, gravel, silty/sandy gravel or similar. The protective layer material shall be free of large gravel particles (greater 1½ inches in diameter), debris or any other material that has the potential to damage the underlying geomembrane.

The Protective Layer material gradation as determined by ASTM D6913 shall be as follows:

Sieve Size (square openings)	Percent Passing (by dry weight)
1 1/2 inch	100
¾-inch	65-100
No. 4	30-70
No. 40	10-35
No. 200	0-10

The protective layer shall have a maximum plasticity index of 10 as determined by ASTM D4318. The coefficient of permeability (k) for the protective layer shall be greater than or equal to 3.5×10^{-3} cm/sec.

Placement Methods – Before placing the protective layer, the **Contractor** shall verify by a visual inspection that all geomembrane material installed in the area are free from perforations, wrinkles, scratches, and other damage. The **Engineer** shall inspect the geomembrane material to verify that it is ready to receive the protective layer.

Protective layer material shall be placed directly on the geomembrane with extreme care to prevent damage of the geomembrane. This is generally done by hauling and placing the material on the geomembrane in a single lift with haulage units that exert less than 80 pounds per square inch (psi) of ground pressure. The material shall be spread with a low ground pressure crawler-type tractor or equivalent that exerts less than 10 psi of ground pressure. The material shall be placed at a minimum loose thickness such that the final lift thickness is not less than the design thickness shown on the drawings (**Contractor** to determine allowance for settlement). At no time shall equipment operate directly on the surface of the geomembrane.

Special attention shall be taken when protective layer is being placed over the geomembrane. All oversized material that may damage the underlying geomembrane shall be removed by whatever means necessary to ensure there is no damage. Because of the thickness of the protective layer and the potential for damage to the geomembrane, vehicle traffic on the protective layer shall be kept to a minimum and shall be restricted to roadways and other main access ways. Protective layer thickness within roadways shall be maintained at least 4-feet above the geomembrane surface or whatever thickness is deemed necessary by the **Engineer.**

Proposed methods and equipment to be utilized in protective layer construction, shall be submitted to the **Engineer** for review prior to commencement of the Work.

The **Contractor** shall not place fill materials at such times that, in the opinion of the **Engineer**, conditions for such operations are unsatisfactory due to precipitation, low temperatures, or any other reason. As the ambient air temperature increases, wrinkles in the geomembrane will develop due to thermal expansion of the geomembrane. Placement of the protective layer will cease if the wrinkles become large enough to fold over or it causes a crease to form when covered with protective layer material. Protective layer material shall be placed during the cooler times of the day or during the evening when the geomembrane lays relatively flat. To minimize the effect of wrinkles, the protective layer shall be placed in an uphill direction and perpendicular to the contours. At no time, shall conditions result in the movement or slippage of the protective layer materials that could potentially cause liner or pipe damage. Except as necessary for construction and the safety of the Works, geomembrane anchor trenches shall not be filled until several cycles of expansion and contraction have occurred.

The thickness of the protective layer shall be verified by the **CQA** and areas with deficient amounts of material shall be reworked to comply with the Technical Specifications. Any damage done to the geomembrane material during installation shall be exposed by the **Contractor** and repaired by the Geomembrane Installer at no cost to the **Owner**.

Protective layer placement shall be suspended if in the opinion of the **Engineer** the operation creates unsafe conditions due to moisture or ice build-up on the geomembrane, visibility becomes problematic or the quality of work is being compromised. The **Contractor** shall make sure material is not rutting or pumping under the haul traffic due to the excessive moisture.

The **Contractor** shall supply a full-time laborer to visually inspect 100% of the protective layer placement and direct the equipment. The **CQA** will also observe all protective layer placement and will have the authority to require any areas to be removed and inspected if damage to the geomembrane is suspected.

3.2.8. Drainage Aggregate (Select Gravel)

Material Properties – The drainage aggregate material shall consist of clean gravel. The materials shall be composed of hard, durable stone particles reasonably free from thin, flat, and elongated pieces. The material shall consist of native non-plastic materials generated through a crushing and screening operation. The material shall meet the following gradation limits as determined by ASTM D6913 or C136:

Sieve Size (square openings)	Percent Passing (by dry weight)
1 ½ –inch	100
¾-inch	70-100
No. 4	5-50
No. 40	0-35
No. 200	0-5

Material used for drainage aggregate may be approved by the **Engineer** by visual inspection if the rock is determined to be sound and durable. However, if in the **Engineer**'s opinion, the material is questionable or unacceptable, the **Engineer** may require one or more of the following laboratory tests on representative drainage material samples in order to assess the quality of the material.

Drainage Aggregate Material Laboratory Tests

Test Description	Test Method	Specification Requirement
Los Angeles Abrasion	ASTM C535	50% Loss Maximum (after 500 revolutions)
Sodium Sulfate or Magnesium Sulfate Soundness	AASHTO T104 or ASTM C88	10% Maximum Loss (after 5 cycles)
Soundness by Freezing and Thawing	AASHTO T103	10% Maximum Loss (after 12 cycles)
Slake Durability	ASTM D4644	Classification as Type 1

Placement Methods – The drainage aggregate material shall be borrowed, processed if necessary, hauled and placed in a manner that does not contaminate or segregate the material.

3.2.9. Pipe Bedding and Pipe Backfill

Material Properties – Pipe bedding and backfill material for foundations, culverts and pipes shall consist of materials with the following typical characteristics:

Sieve Size (square openings)	Percent Passing (by dry weight)	
	Pipe Backfill	Pipe Bedding
4 –inch (100 mm)	100	
3 –inch (75 mm)	90-100	
1-½-inch (37.5 mm)	--	100
¾-inch (19 mm)	--	90-100
No. 4 (4.75 mm)	--	30-70
No. 40 (0.425 mm)	--	--
No. 200 (0.075 mm)	8-20	8-20
Plasticity Index	10 max	10 max

Pipe bedding and pipe backfill shall be free of organic material.

Placement Methods – Backfilling shall be done as soon as possible after pipe or culvert installation. Suitable backfill and embankment material, free from large lumps, clods, or rocks shall be placed alongside the structure in loose layers not exceeding 8–inches in thickness to provide a berm of compacted earth on each side of the pipe or structure. The fill materials shall be a minimum of 5-feet wide or the width of the pipe diameter or structure but no less than required to operate the appropriate compaction equipment. Each 8-inch layer shall be moisture conditioned, as required to facilitate compaction and compacted to a minimum of 90 percent of the maximum dry density as determined by ASTM D1557 or as directed by the **Engineer**.

If it is necessary to construct a road over the pipe alignment, the **Engineer** shall be consulted prior to the initiation of pipe trench construction for specification modification, as required, to achieve a structure sufficient for such traffic loading. Backfill shall be placed symmetrically on each side of the pipe/structure to prevent undue lateral pressure on buried pipe during the backfill process. The backfill differential on either side of the pipe shall not exceed 8-inches, or one quarter of the diameter of the structure, whichever is less.

Prior to adding each new layer of loose backfill material until a minimum 12-inches of cover is obtained, an inspection shall be made by the **CQA** of the inside of the pipe/structure for local or unequal deformation caused by the backfilling operation. Only hand-operated tamping or vibratory compaction equipment shall be allowed within 3-feet of the sides of any buried pipe or structure. Modification to this Technical Specification as recommended by the culvert or structure manufacturer or designer can be submitted for approval by the **Engineer**. No heavy earthmoving equipment shall be permitted over the structure until a minimum of 150 percent of the largest buried pipe diameter of compacted fill has been placed over the top of the structure, or the minimum cover recommended by the culvert manufacturer or designer. In no case shall the minimum compacted structural cover be less than 24-inches for permanent installations.

Backfill material shall not be placed against any concrete foundation, concrete pipe encasement, concrete abutment, wing wall, or concrete integral culvert installation until the concrete has been in place at least seven days or the compressive strength of the concrete is 75 percent of the required 28-day strength. On structures that are not permanently supported laterally and that cannot tolerate horizontal movement, internal bracing or support should be placed during backfill operations.

3.2.10. Riprap

Material Properties – Riprap shall be hard, durable, angular in shape, reasonably well graded and free of organic and deleterious material and foreign debris. It shall have a specific gravity greater than 2.5. Rounded gravel, cobble and boulders shall not be allowed unless otherwise approved by the **Engineer**. Riprap shall generally conform to the following gradations.

D_{50} = 6 in. (150 mm)

Sieve Size	% Passing	Typical Stone Mass
12 in. (300 mm)	100	85 lbs. (40 kg)
9 in. (225 mm)	50-70	35 lbs. (16 kg)
6 in. (150 mm)	35-55	10 lbs. (4.5 kg)
2 in. (50 mm)	2-10	0.5 lbs. (0.2 kg)

D_{50} = 12 in. (300 mm)

Sieve Size	% Passing	Typical Stone Mass
24 in. (600 mm)	100	650 lbs. (295 kg)
21 in. (525 mm)	70-100	440 lbs. (200 kg)
18 in. (450 mm)	50-70	275 lbs. (125 kg)
12 in. (300 mm)	35-55	85 lbs. (40 kg)
4 in. (100 mm)	2-10	3 lbs. (1.4 kg)

D_{50} = 18 in. (450 mm)

Sieve Size	% Passing	Typical Stone Mass
30 in. (750 mm)	100	1280 lbs. (580 kg)
24 in. (600 mm)	50-70	650 lbs. (295 kg)
18 in. (450 mm)	35-55	275 lbs. (125 kg)
6 in. (150 mm)	2-10	10 lbs. (4.5 kg)

D_{50} = 24 in. (450 mm)

Sieve Size	% Passing	Typical Stone Mass
42 in. (1200 mm)	100	3500 lbs. (1600 kg)
30 in. (750 mm)	50-70	1280 lbs. (580 kg)
24 in. (6000 mm)	35-55	650 lbs. (295 kg)
9 in. (200 mm)	2-10	35 lbs. (16 kg)

Minor deviations to the above gradations may be allowed if approved by the **Engineer**.

When grouted riprap is necessary, the median rock size in the grouted riprap blanket should not exceed 0.67 times the blanket thickness. The largest rock should not exceed the blanket thickness. The finished grout should not leave face stones exposed more than one-third their depth.

The concrete mortar for the grouted riprap shall consist of concrete with a minimum strength of 2,000 psi after 28 days of curing. The maximum aggregate size should be 0.5 inches and have a slump of between 5 to 8 inches. Sand mixes may be used if sufficient cement is included in the mix to give the mortar good strength and workability. The **Engineer** shall approve all mortar mix designs before beginning work.

Weep holes should be installed through the full thickness of the grout or mortar blanket to relief any hydrostatic pressure that may build up beneath the blanket. The weep holes shall be constructed by installing 2-inch diameter PVC pipes at a spacing of 6-feet. The end of the pipe that is buried shall be covered with a wire screen or nonwoven geotextile. If there is no filter layer designed beneath the grout blanket then the bottom end of the weep hole shall be extended at least 6 inches below the grout blanket and encapsulated in a clean drain gravel material that is wrapped with geotextile. The clean gravel shall consist of 1-inch gravel.

Material used for riprap may be approved by the **Engineer** by visual inspection if the rock is determined to be sound and durable. However, if in the **Engineer**’s opinion, the material is questionable, the **Engineer** may require one or more of the following laboratory tests on representative riprap samples in order to evaluate the quality of the material.

Riprap Laboratory Tests

Test Description	Test Method	Specification Requirement
Los Angeles Abrasion	ASTM C535	50% Loss Maximum (after 500 revolutions)
Sodium Sulfate or Magnesium Sulfate Soundness	AASHTO T104 or ASTM C88	10% Maximum Loss (after 5 cycles)
Soundness by Freezing and Thawing	AASHTO T103	10% Maximum Loss (after 12 cycles)
Slake Durability	ASTM D4644	Classification as Type 1

Placement Methods – Surfaces and piping to be protected by riprap shall be dressed to a smooth surface. All soft or objectionable material shall be removed as directed by the **Engineer** and replaced with an approved material. Materials underlying the riprap shall be placed in accordance with each material's specific placement specifications.

The riprap shall be placed as shown on the Drawings or as required by the **Engineer** in a manner that will produce a reasonably well graded mass of stone with the minimum practicable percentage of voids and good stone interlocking and contact. The entire mass of stone shall be placed in reasonable conformance with the lines, grades, and thicknesses shown on the Drawings. Riprap shall be placed to its full thickness during a single operation and in such a manner as to avoid damaging or displacing the underlying bedding material or geotextile.

The larger stones shall be well distributed and the materials shall be placed and distributed so that there will be no large accumulations of either the larger or the smaller size stones. Hand placing or rearranging of individual stones by mechanical equipment may be required to achieve the results specified.

3.2.11. Road Wearing Course

Material Properties – The road wearing course shall generally conform to the following gradation requirements as determined by ASTM D6913 or as approved by the **Engineer**.

Sieve Size (square openings)	Percent Passing (by dry weight)
1.5–inch (38 mm)	100
3/4–inch (19 mm)	80-100
No. 4 (4.75 mm)	45-70
No. 8 (2.36 mm)	25-55
No. 40 (0.425 mm)	10-30
No. 200 (0.075mm)	2-10

The plasticity index for road wearing course materials shall be no greater than 10 as determined by ASTM D4318.

Placement Methods – Road wearing course shall be placed as shown on the Drawings and compacted to 90% of the maximum dry density as determined by ASTM D1557. The moisture content shall be sufficient to obtain adequate density.

3.2.12. Armoring Berms

The armoring berms are intended to decrease the potential for wind and water erosion of the sloped tailings surface.

Material Properties – The armoring material shall consist of approved materials and shall meet the following grading requirements or as approved by the Engineer.

Sieve Size (square openings)	Percent Passing (by dry weight)
8-inch	100
4-inch	80-100
1 ½ –inch	50-90
¾-inch	40-80
No. 4	25-60
No. 40	10-35
No. 200	5-15

Placement Methods – The armoring berms shall be placed at the exterior of the dry stack surface in 5 ft high berms as shown on the Drawings. Every 5 ft in vertical elevation change a new berm shall be established prior to additional material placement thereby protecting the open slopes of the dry stack.

3.2.13. Filtered Tailings Placement

The filtered tailings shall be placed free of organic and other deleterious material, in 12-inch loose lifts. This material shall be moisture conditioned to within 3 percent of the optimum moisture content and compacted to 93 percent of the maximum dry density as determined by ASTM D698. As necessary, the filtered tailings will be moisture conditioned using a tractor and a disc to facilitate drying prior to compaction. If required, lime treatment will occur by spreading quick lime (~1% by dry weight) over the surface of the filtered tailings and discing the lime into the wet tailings lift to expedite drying. Lime addition per layer will be restricted to a maximum of 3% by weight. It is imperative that moisture and compaction specifications are satisfied during operations to ensure first and foremost the stability of the dry stack under both static and seismic loading conditions.

The fill material shall be compacted with a pad foot and/or smooth drum vibratory compactor capable of achieving compaction through the full thickness of the lift layer. The **Contractor** shall make sure that the material placed is not rutting, pumping, or exhibiting excessive deflection during compaction under haul traffic loading. If the surface exhibits excessive deflection, the material in the area of question will require stabilization using a combination of moisture reduction through active drying and recompaction and/or selective placement and mixing of drier material and recompaction.

The fill is to be placed in near horizontal layers with each layer being completed over the full length and breadth of the zone before placement of subsequent layers. Except in areas approved by the **Engineer**, where space is limited or as otherwise specified, filtered tailings shall be placed by routing the hauling and spreading units approximately parallel to the axis of fill. The hauling equipment shall be routed in such a manner that they do not follow in the same paths but spread their travel routes evenly over the surface of the fill to aid in compaction.

The **Contractor** will also be responsible for protecting the work from weather related degradation. Given the risk of weather related degradation is quite high during the Monsoon season, the **Contractor** should plan his work carefully to make sure that all fills are well compacted prior to rain events and that the fills are graded to allow positive drainage away from both active and completed work areas. Any degradation of the work due to weather will be remediated at the **Contractor's** expense. Placement of fill shall be temporarily suspended by the **Contractor** due to weather concerns if the materials and installation cannot comply with the guidance parameters stated above, with no cost to the **Owner**.

3.2.14. Waste Rock from Mine Development

The waste rock from mine development that is considered potentially acid generating (PAG) shall be placed in the TSF for permanent storage on lined containment. For the purposes of this Technical Specification, the nomenclature “waste rock” and “development rock” should be considered equivalent. For example, “PAG waste rock” is equivalent to "PAG development rock.”

Material Properties – Due to the unknown gradation of the waste rock and the potential variation of the gradation that is likely to occur, the placement procedures address a wide range of material. If the waste rock gradation has a maximum particle size of less than 8-inches and contains less than 30-percent rock (materials above ¾-inch size) follow the specification shown in Section 3.2.14.1. If the waste rock has a maximum particle size greater than 8-inches or contains more than 30-percent rock (materials above ¾-inch size) follow the specification for a test fill (U. S. Army Corps of Engineers’) described in Section 3.2.14.2.

3.2.14.1. Waste Rock Placement (Maximum particle size is less than or equal to 8-inches and material is less than 30-percent rock)

Waste rock shall be placed free of organic and other deleterious material in 12-inch loose lifts. This material shall be moisture conditioned to within 3 percent of the optimum moisture content and compacted to 93 percent of the maximum dry density as determined by ASTM D698. Slight variations from the specified moisture range may be acceptable subject to acceptance by the **Engineer** and provided the required compacted densities are achieved. The waste rock shall be compacted with appropriate compaction equipment capable of achieving compaction through the full thickness of the lift layer. Maximum rock size shall be equal to two–thirds (2/3) of the compacted lift thickness, unless otherwise approved by the **Engineer**.

3.2.14.2. Waste Rock Placement (Maximum particle size is greater than 8-inches and/or material is more than 30-percent rock)

If materials greater than 8-inches are encountered during waste rock placement, the lift thickness can be increased subject to the approval of the **Engineer** based on the acceptable test fill performance. Also, waste rock containing more than 30-percent rock (materials above ¾-inch size) shall be spread, placed, and compacted using procedures based on the results of a test fill. The type of compaction equipment, number of passes, maximum rock size and loose lift thickness will be approved by the **Engineer** in writing based on the acceptable test fill performance. The **Contractor** shall outline his proposed procedures for moisture conditioning and fill placement and submit them to the **Engineer** for review and approval. The **Contractor** shall construct a test fill to verify the adequacy of the compaction equipment for achieving the required density. The test fill may be located so that it is incorporated into the fill area. The test fill shall be constructed and monitored in accordance with the USACE guidelines for test fill construction (USACE, EM 1110-2-2301).

The data to be collected during construction of the test fill shall include the following:

- Lift thickness of 1, 2, and 4-feet (three test fills to determine optimum lift thickness).
  - Note, maximum particle size may not allow for some test fill lift thicknesses.
- Amount of settlement after every two passes of the compactor to a maximum of 25 passes.
- Gradation and moisture content of in-place material.
- In-place fill density at completion of the test by nuclear gauge or other methods approved by the **Engineer**. For some rock fill the water replacement method may be required to assess compaction.

A curve showing change in settlement versus number of passes shall be produced from the data. This curve will be used to determine the required minimum number of passes for acceptable compaction. In general, the minimum number of passes will be that number to achieve 80 percent of the total settlement obtained after ten complete passes of the compaction equipment. Final determination by the **Engineer** of the lift thickness and minimum required passes will be based on review of the test data.

3.2.14.3. Waste Rock Placement (Maximum particle size is greater than 32-inches)

For placement of waste rock containing oversize particles (particles in excess of 32-inches), care shall be taken to prevent nesting of the oversize particles during placement. Waste rock placement in close proximity to the oversize particle shall be compacted in accordance with Sections 3.2.14.1 and 3.2.14.2. Particles exceeding 32-inches shall not constitute more than 5% of the fill volume unless otherwise approved by the **Engineer**.

3.2.14.4. Waste Rock Additional Placement Criteria

The **Contractor** shall make sure that the material placed is not rutting, pumping, or exhibiting excessive deflection during compaction under haul traffic loading. If the surface exhibits excessive deflection, the material in the area of question will require stabilization using a combination of moisture reduction through active drying and recompaction and/or selective placement and mixing of drier material and recompaction.

Mine waste rock is to be placed in near horizontal layers with each layer being completed over the full length and breadth of the zone before placement of subsequent layers. Except in areas approved by the **Engineer**, where space is limited or as otherwise specified, waste rock shall be placed by routing the hauling and spreading units approximately parallel to the axis of fill. The hauling equipment shall be routed in such a manner that they do not follow in the same paths but spread their travel routes evenly over the surface of the fill to aid in compaction.

The **Contractor** will also be responsible for protecting the work from weather related degradation. Given the risk of weather related degradation is quite high during the Monsoon season, the **Contractor** should plan his work carefully to make sure that the surface is graded to allow positive drainage away from both active and completed work areas. Any degradation of the work due to weather will be remediated at the **Contractor's** expense. Placement of waste rock shall be temporarily suspended by the **Contractor** due to weather concerns if the materials and installation cannot comply with the guidance parameters stated above, with no cost to the **Owner**.

3.2.15. Construction Cut

The Construction Cut from various onsite projects that is considered PAG shall be placed in the TSF for permanent storage on lined containment.

Material Properties – The construction cut will have a wide range of USCS classification and may contain significant variations in gradation and compaction properties. Due to the unknown gradation of the Construction Cut and the potential variation of the gradation that is likely to occur throughout the construction, the placement procedures address a wide range of material.

Placement Methods – Construction cut material placement criteria is the same as the Waste Rock from Mine Development placement criteria. Reference Section 3.2.14.1 through Section 3.2.14.4 for placement criteria.

3.2.16. Water Treatment Plant (WTP) Filter Cake

Material Properties – The anticipated material properties are as follows (the material properties are based on WTP1 and WTP2 filter cake control samples). Particle Size Distribution (by dry weight)

Sieve Size (square openings)	Percent Passing (by dry weight)
No.4	100
No.10	--
No. 16	--
No. 40	--
No. 50	--
No. 100	--
No. 200	20-100

- Non-plastic soil.
- Moisture content will range between ~360% and ~390% (based on dry weight of solids) upon arrival to the TSF.

Placement Methods – Upon placement in the TSF, the WTP filter cake shall be spread and dried to reduce the material moisture content. The filter cake shall then be mixed with tailings, on-site native borrow material and/or waste rock at a minimum ratio of 3 (tailings/on-site native borrow/ waste rock) to 1 (filter cake). After mixing, the material shall be moisture conditioned to within 2 percent below and 3 percent above the optimum moisture content. The material shall be placed in 12-inch maximum loose lifts and compacted to 93 percent of the maximum dry density as determined by ASTM D698. The WTP filter cake material shall be compacted with appropriate compaction equipment capable of achieving compaction through the full thickness of the lift.

Care shall be taken to ensure that the mixed material is not rutting, pumping, or exhibiting excessive deflection during compaction under haul traffic loading. If the surface exhibits excessive deflection, the material in the area of question will require stabilization using a combination of moisture reduction through active drying and recompaction and/or selective placement and mixing of drier material and recompaction.

To the greatest extent possible, filter cake material placement shall not be in one continuous area or layer. Placement of filter cake material shall be temporarily suspended due to weather concerns if the materials and installation cannot comply with the Technical Specifications.

The specified requirements listed above are based on laboratory testing results from WTP filter cake samples. If the WTP filter cake material properties change or the estimated quantity of filter cake placed in the TSF increases, the **Engineer** shall be notified.

3.2.17. Core Cutting

The core cutting material that is generated from trimming rock core samples for metallurgical testing will be hauled and placed in the TSF.

Material Properties – The anticipated material properties are as follows (based on a control sample obtained January 2nd, 2019):

- Particle Size Distribution (by dry weight)

Sieve Size (square openings)	Percent Passing (by dry weight)
1 inch	100
No.4	76
No. 10	72
No. 40	69
No. 200	64

- Material will be saturated upon arrival to the TSF.

The specified requirements listed above are based on index testing results from a composite core cutting sample obtained on January 2nd, 2019. If the core cutting material properties change or the estimated quantity of core cutting placed in the TSF increases, the **Engineer** shall be notified.

Placement Methods – Placement criteria is the same as WTP Filter Cake (Section 3.2.16). Please note, independent core cutting material quality assurance tests are not required due to the nominal quantity of core cutting material to be placed in the TSF.

3.2.18. Drill Cutting Material

The drill cutting material that is generated from exploration activities will be hauled and placed in the TSF.

Placement Methods – Placement criteria is the same as WTP Filter Cake (Section 3.2.16). Independent drill cutting material quality assurance tests are not required due to the nominal quantity of drill cutting material to be placed in the TSF.

3.2.19. Sediments from Stormwater BMPs

The sediments generated from site stormwater BMPs will be hauled and placed in the TSF.

Material Properties – The anticipated material properties are as follows (based on three control sample obtained in July 2020):

- Particle Size Distribution (by dry weight)

Sample	3.0"	1.5"	0.75"	0.375"	#4	#10	#16	#40	#50	#100	#200
Sample #1	100.0	98.4	95.8	92.0	86.7	77.3	67.8	41.5	31.7	16.2	8.7
Sample #2	100.0	100.0	100.0	100.0	97.8	92.0	87.9	78.3	73.7	63.2	48.7
Sample #3	100.0	97.4	92.4	84.2	72.8	54.9	44.6	27.9	22.4	12.8	7.6
Average	**100**	**99**	**96**	**92**	**86**	**75**	**67**	**49**	**43**	**31**	**22**

- Material will be non-plastic to low plasticity index (less than 10).
- Material will have an average moisture content of 12.4 percent upon arrival to the TSF.

Placement Methods – Placement criteria is the same as WTP Filter Cake (Section 3.2.16). If the estimated sediment material quantity increases, the **Engineer** shall be notified.

3.2.20. Assay Rejects

Assay rejects generated as part of the exploration process are anticipated to be hauled and placed in the TSF.

Placement Methods – Placement criteria is the same as WTP Filter Cake (Section 3.2.16). If the estimated material quantity increases, the **Engineer** shall be notified.

3.2.21. Sediments from Vehicle and Equipment Wash Sumps

Sediments generated from vehicle and equipment wash sumps are anticipated to be hauled and placed in the TSF.

Material Properties – The anticipated material properties (gradation and Atterberg limits) of the sediments from the vehicle and equipment wash sumps is unknown at this time but it is assumed the material will be similar to the sediments from stormwater BMPs.

Placement Methods – Placement criteria is the same as WTP Filter Cake (Section 3.2.16). If the estimated sediment material quantity increases, the **Engineer** shall be notified.

3.2.22. Growth Media

Growth media will consist of organic soils placed during closure to provide a medium for plant growth. Growth media sources shall be designated by the **Owner** and approved by the **Engineer** prior to placement.

Placement Methods – Growth media shall be hauled and spread to the lines, grades, and in areas shown on the Drawings. Materials shall be placed in a non-compacted lift. The finished surface of the growth media material shall be scarified or harrowed to allow for proper seed placement and plant growth.

3.2.23. Friction Layer

The friction layer is intended to increase the resistance to sliding of the geomembrane liner on the underlying low permeability soil layer. The friction layer shall be placed on top of the low permeability soil layer, and be seated into the surface of the low permeability soil layer in a manner that generates a continuous soil layer.

Material Properties – The material used to produce the friction layer shall consist of approved materials and shall meet the following grading requirements or as approved by the Engineer.

Sieve Size (square openings)	Percent Passing (by dry weight)
1/2-inch	100
3/8-inch	85-100
No. 8	5-30
No. 16	0-10

Placement Methods – The friction layer and the underlying low permeability soil layer shall be considered a continuous soil layer. The material shall be proof rolled and demonstrate good mechanical bonding with the underlying low permeability soil layer and, upon completion, exhibit a firm surface with visible signs of sand and gravel embedment. Although the surface is intended to provide friction resistance, care must be taken to ensure any materials that may damage the overlying geomembrane are removed. Loose material that is not embedded in the surface will be removed using an air lance of other similar method.

3.2.24. Anchor Trench

The anchor trenches shall be excavated to the lines and grade shown on the Drawings prior to geosynthetics placement. Slightly rounded corners shall be constructed in the trench where the geomembrane adjoins the trench to avoid sharp bends in the geomembrane.

Material Properties – The anchor trench material shall consist of non-deleterious or consolidating materials that are 2-inch minus or an alternative material approved by the Engineer.

Placement Methods – The anchor trench material shall be placed in 12-inch thick loose lifts and compacted to 90% of the maximum dry density as determined by ASTM D1557. The moisture content shall be sufficient to obtain adequate density. Care shall be taken when backfilling and compacting the anchor trenches to prevent any damage to the geomembrane. At no time shall construction equipment come into direct contact with the geomembrane. If damage occurs, it shall be repaired by the **Contractor** prior to the completion of backfilling, at no cost to the **Owner**.

3.2.25. Deleterious Material

Material other than satisfactory soil, sand, gravel, as described herein, should be considered unsatisfactory unless the Engineer states otherwise after visual inspection of the material. These materials should not be used as fill and backfills, regardless of whether it is from an on-site source or delivered to the site. Unsatisfactory soils include those classified by the Unified Soil Classification System as elastic silt, clay of high plasticity, or organic soil. Deleterious material also includes any organic matter, wood, metal, piping, and could include concrete or asphalt waste or soil containing excessive cobbles and boulders.

3.3. Finished Surface Preparation of Areas to Receive Geosynthetics

Areas to receive geosynthetics shall be approved subgrade free of angular particles over ¾-inch diameter and hard objects that may damage the geosynthetic. Where excessive coarse material is exposed at the surface, rock removal by appropriate methods or other surface finishing as directed by the **Engineer** will be required. Rough areas with depressions or loose material shall be covered with a cushion of fine-grained materials or for large depressions, with screened, low permeability soil layer material (passed over ½-inch mesh screen) or equivalent.

Once the **Contractor** believes that the surface preparation is complete, an inspection will be completed by the Geomembrane Installer, **Engineer**, and **Owner** with the **Contractor** present. Any areas requiring repairs shall be fixed by the **Contractor** at no cost to the **Owner**.

3.4. Compaction Equipment

Sufficient compaction equipment of the types and sizes required to complete the work shall be provided for compaction of the various fill materials. The use of alternative equipment will be dependent upon completion of suitable test fills to the satisfaction of the **Engineer** to confirm that the alternative equipment will compact the fill materials to the specified density.

Compaction equipment shall be maintained in good working condition at all times to ensure that the amount of compaction obtained is a maximum for the equipment. The **Contractor** shall provide the **Owner** and **Engineer** a list of proposed compaction equipment to be used before commencing Work.

3.4.1. Smooth Drum Vibratory Roller

Smooth drum vibratory rollers shall be equipped with a suitable cleaning device to prevent the accumulation of material on the drum during rolling. Each roller shall have a total static weight of not less than 20,000 pounds at the drum when the roller is standing on level ground. The drum shall be not less than 60-inches in diameter and 78-inches in width. The vibration frequency of the roller drum during operation shall be between 1,100 and 1,500 vibrations per minute, and the centrifugal force developed by the roller, at 1,250 vibrations per minute, shall not be less than 38,000 pounds.

For compaction by the vibratory roller, a single coverage shall be defined as one pass of the roller. A minimum overlap of 12-inches shall be maintained between the surfaces traversed by adjacent passes of the roller drum. During compaction, the roller shall be propelled at 2 miles per hour (mph) or lesser speed as approved by the **Engineer**. The power of the motor driving the vibrator shall be sufficient to maintain the specified frequency and centrifugal force under the most adverse conditions that may be encountered during the compaction of the fill. Propulsion equipment for the roller shall be adequate to propel the roller at speeds up to 4 mph.

3.4.2. Tamping-Foot or Sheep's-foot Roller

The tamping-foot or sheep's-foot roller shall be self-propelled and fully ballasted with a standard tamping-foot design developing 5,000 pounds in force per linear foot of width at rest on level ground or equivalent as approved by the **Engineer**.

3.4.3. Special Compactors

Special compactors shall be used to compact materials that, in the opinion of the **Engineer**, cannot be compacted properly by the specified larger vibratory roller because of location or accessibility.

Special compaction measures shall be adopted such as hand-held or small walk behind compactors or other methods approved by the **Engineer** to compact fill in trenches, around structures, and in other confined areas that are not accessible to the larger vibratory roller or tamping-foot roller. Such compaction shall be to the specified density for the particular material.

4. CONSTRUCTION TOLERANCES

The **Contractor** shall construct the various aspects of the project to the lines and grades shown on the Drawings, or as required by the **Engineer**, within the following tolerances:

- Finish grades and slopes for the TSF shall be in general conformance with the Drawings. Deviations from finished grades and slopes are subject to approval by the **Engineer** and shall not result in low spots, pockets, non-uniform slopes or result in slopes, which deviate by more than 4 inches from the design. The overall slope needs to be the same as shown on the Drawings.
- Finish grades and slopes for diversion channels shall be in general conformance with the Drawings. Deviations from finished grades and slopes are subject to approval by the **Engineer** and shall not result in flat or low spots, pockets, non-uniform slopes, or channel grades, which deviate by more than 2 inches from the design. The overall slope needs to be the same as shown on the Drawings.
- The maximum permissible combined horizontal and vertical deviation of the perimeter boundaries of the TSF and channels from the lines and grades shown on the Drawings or as required by the **Engineer** shall be 12-inches.
- The finished surface of the TSF shall not deviate vertically by more than 4-inches from the lines and grades shown on the drawings.
- All pipes shall be constructed to the following tolerances: alignment and grade shall not deviate from manufacturer recommendations and more than 5 percent of the nominal diameter of the pipe from a straight line between control points.

5. QUALITY ASSURANCE

The **CQA** will take samples of fill materials and perform gradation, moisture content, Atterberg limits and Proctor moisture density tests on the materials to establish engineering parameters for each material type. During material placement, field density tests on the compacted fill and any other tests that the **Engineer** considers necessary to ensure that the fill being placed meets the specified requirements. The results of the tests carried out by the **CQA** will be final and conclusive in determining compliance with the Technical Specifications. Test Methods are listed in Table 1 of Section 6.

Each lift of fill will be approved by the **CQA** prior to placement of additional fill materials. Sufficient time shall be allowed by the **Contractor** for the **CQA** to carry out the required test work and interpret the test results in order to determine the acceptability of each lift. Cooperation shall be given by the **Contractor**, to the **Owner** and the **Engineer** and the **CQA**, for taking samples or making tests, and such assistance shall be rendered as is necessary to enable sampling and testing to be carried out expeditiously.

Tests carried out by the **CQA** will be performed in accordance with the latest test methods prescribed by ASTM and other such recognized industry standards. The tests shall include Control (borrow source samples and samples taken on the fill prior to placement/compaction) and Record Tests (samples taken on the fill after placement/compaction).

5.1. Control Tests

Tests for gradation, moisture content, moisture density relationship (Proctor compaction test) and other tests where applicable will be made by the **CQA** on samples of fill materials taken from borrow areas and on the fill material after spreading but prior to compaction. Samples will be tested at the minimum frequencies listed in Section 6 in order to ensure that the fill material is in full compliance with the Technical Specifications. Materials not meeting specified material properties shall be reworked or rejected until passing results are achieved.

5.2. Record Tests

The **CQA** will conduct field density, moisture content, and other tests on the compacted in-place fill and will obtain samples of the compacted fill for related laboratory testing at such frequency as the **Engineer** considers necessary to determine that the compacted fill is in full compliance with the Technical Specifications. Areas with failing field tests shall be reworked until passing tests are achieved. Holes created from field-testing of low permeability soil layer material shall be backfilled with a mixture of soil and bentonite at a 5:1 ratio, respectively or alternatively by bentonite powder.

6. TESTING FREQUENCIES

The **CQA** will carry out frequent quality control and quality assurance tests to determine compliance of the Work with the Technical Specifications.

The latest edition of standard procedures shall be used for all activities, and in general, these will be adopted from recognized organizations such as ASTM. The following tables outline the test methods and the minimum testing requirements for the project:

Table 1: Test Methods

Test	Type of Test	Test Method (ASTM)
C1, R1	Atterberg Limits	D4318
C2, R2	Moisture Content	D6938
C3, R3	Particle Size Distribution	D6913 [a]
C4, R4	Laboratory Compaction-Mod. Proctor	D1557
R5a	Nuclear Density	D6938
R5b	Sand Cone	D1556
R5c	Water Replacement	D5030
C6, R6a	Laboratory Permeability	D5084/ USBR 5600/ USBR 5605
R6b	Air Entry Permeameter	D5126
C7	Acid Generating Potential	EPA M600/2-78-054 3.2.3
C8, R8	Rigid Wall Falling Permeability	USBR 5600 /USBR 5605
R9	Wolman Count	USDOT FLH T521
R10	Consolidated Undrained Triaxial Compression	D4767
Notes: **C = Control Tests; R = Record Tests** [a] **Hydrometer tests down to the 2-micron size will be carried out in accordance with ASTM D7928 as directed by the QA Engineer but will generally not be required; all samples to be washed over a No.200 sieve.**		

Table 2: Test Frequency – Prepared Surfaces

Test	Type of Test	Minimum Frequency (one per)
C1, R1	Atterberg Limits	Soil Type/ 500,000 ft^2
C2, R2	Moisture Content	100,000 ft^2
C3, R3	Particle Size Distribution	Soil Type / 500,000 ft^2
C4, R4	Laboratory Compaction	Soil type
R5a	Nuclear Density	100,000 ft^2
R5b/R5c	Sand Cone or Water Replacement Density	1/30 Nuclear Density Tests
Note: Required number of tests shall be determined by whichever method of determining the frequency requires the most tests.		

Table 3: Test Frequency – Engineered Fill

Test	Type of Test	Minimum Frequency (one per)
C1, R1	Atterberg Limits	15,000 yd^3
C2, R2	Moisture Content	5,000 yd^3
C3, R3	Particle Size Distribution	15,000 yd^3
C4, R4	Laboratory Compaction	Soil type or every 100,000 yd^3
R5a	Nuclear Density	5,000 yd^3
R5b/R5c	Sand Cone or Water Replacement Density	50,000 yd^3
Note: Required number of tests shall be determined by whichever method of determining the frequency requires the most tests. If material is too coarse for testing per ASTM, then use test fill method per USACE EM 1110-2-2301.		

Table 4: Test Frequency – Low Permeability Soil Layer

Test	Type of Test	Minimum Frequency (one per)
C1, R1	Atterberg Limits	Lesser of Soil type or every 10,000 yd^3
C2, R2	Moisture Content	2,000 yd^3
C3, R3	Particle Size Distribution	10,000 yd^3
C4, R4	Laboratory Compaction	Lesser of Soil type or every 100,000 yd^3
R5a	Nuclear Density	2,000 yd^3
R5b	Sand Cone Density	20,000 yd^3
R6	Laboratory Permeability	200,000 yd^3
Note: Required number of tests shall be determined by whichever method of determining the frequency requires the most tests.		

Table 5: Test Frequency – Protective Layer

Test	Type of Test	Minimum Frequency (one per)
C1, R1	Atterberg Limits	7,500 yd^3
C3, R3	Particle Size Distribution	7,500 yd^3
C8, R8	Rigid Wall Falling Permeability	20,000 yd^3
Note: Sample sizes to be sampled in accordance with ASTM standards.		

Table 6: Test Frequency – Drainage Aggregate

Test	Type of Test	Minimum Frequency (one per)
C3, R3	Particle Size Distribution	7,500 yd^3
C6, R6	Laboratory Permeability	37,500 yd^3
C9	Acid Generating Potential	1 per source or as requested by **Engineer**
Note: Sample sizes to be sampled in accordance with ASTM standards.		

Table 7: Test Frequency – Pipe Backfill and Pipe Bedding

Test	Type of Test	Minimum Frequency (one per)
C1, R1	Atterberg Limits	Soil type/5,000 yd^3 or 1 per structure
C2, R2	Moisture Content	per nuclear density requirements
C3, R3	Particle Size Distribution	5,000 yd^3 or 1 per structure
C4, R4	Laboratory Compaction	Soil type/25,000 yd^3
R5a	Nuclear Density	Greater of 2 per major foundation / 500 yd^3 *
R5b	Sand Cone Density	every 20 nuclear density tests
***Frequency of testing for backfill for minor foundations shall be determined by the Project Field Engineer**		

Table 8: Test Frequency – Riprap

Test	Type of Test	Frequency (one per)
Visual Inspection and Documentation		Continuous during placement
R9	Wolman Count	One per size and every 5,000 yd^3
Note: Required number of tests shall be determined by whichever method of determining the frequency requires the most tests.		

Table 9: Test Frequency – Road Wearing Course

Test	Type of Test	Minimum Frequency (one per)
R1	Atterberg Limits	2,000 yd^3
R3	Particle Size Distribution	2,000 yd^3
R5a	Nuclear Density	1 per 500 ft of roadway

Table 10: Test Frequency – Armoring Berms

Test	Type of Test	Minimum Frequency (one per)
C3, R3	Particle Size Distribution	5,000 yd^3

Table 11: Test Frequency – Filtered Tailings

Test	Type of Test	Minimum Frequency (one per)
C1, R1	Atterberg Limits	5,000 yd^3
C2, R2	Moisture Content	2,500 yd^3
C3, R3	Particle Size Distribution	5,000 yd^3
C4, R4	Laboratory Compaction	Soil type or every 20,000 yd^3
R5a	Nuclear Density	2,500 yd^3
R5b/R5c	Sand Cone or Water Replacement Density	20,000 yd^3
Notes: Required number of tests shall be determined by whichever method of determining the frequency requires the most tests.		

Table 12: Test Frequency – Waste Rock

Test	Type of Test	Minimum Frequency (one per)
C1, R1	Atterberg Limits	15,000 yd^3
C2, R2	Moisture Content	5,000 yd^3
C3, R3	Particle Size Distribution	15,000 yd^3
C4, R4	Laboratory Compaction	Soil type or every 100,000 yd^3
R5a	Nuclear Density	5,000 yd^3
R5b/R5c	Sand Cone or Water Replacement Density	50,000 yd^3
Notes: Required number of tests shall be determined by whichever method of determining the frequency requires the most tests. If material is too coarse for testing per ASTM, then use test fill method per USACE EM 1110-2-2301.		

Table 13: Test Frequency – Construction Cut

Test	Type of Test	Minimum Frequency (one per)
C1, R1	Atterberg Limits	15,000 yd^3
C2, R2	Moisture Content	5,000 yd^3
C3, R3	Particle Size Distribution	15,000 yd^3
C4, R4	Laboratory Compaction	Soil type or every 100,000 yd^3
R5a	Nuclear Density	5,000 yd^3
R5b/R5c	Sand Cone or Water Replacement Density	50,000 yd^3
Notes: Required number of tests shall be determined by whichever method of determining the frequency requires the most tests. If material is too coarse for testing per ASTM, then use test fill method per USACE EM 1110-2-2301.		

Table 14: Test Frequency – WTP Filter Cake (WTP1 and WTP2)

Test	Type of Test	Minimum Frequency (one per)
C1, R1	Atterberg Limits	2,000 yd^3
C2, R2	Moisture Content	1,000 yd^3
C3, R3	Particle Size Distribution	2,000 yd^3
C4, R4	Laboratory Compaction	Soil type or every 15,000 yd^3
R5a	Nuclear Density	1,000 yd^3
R5b/R5c	Sand Cone or Water Replacement Density	15,000 yd^3
R10	CU Triaxial Compression	Annually or 3,500 yd^3
Notes: Required number of tests shall be determined by whichever method of determining the frequency requires the most tests. If material is too coarse for testing per ASTM, then use test fill method per USACE EM 1110-2-2301.Testing frequencies shall only apply when WTP filter cake material is placed as a mixture with tailings and/or on-site native borrow material that is less than 30% rock by weight (materials above ¾-inch size). When WTP filter cake is mixed with waste rock or any material containing more than 30% rock, the placement method shall adhere to the technical specifications developed for placement of waste rock in the TSF.		

Table 15: Test Frequency – Sediment from Stormwater BMPs

Test	Type of Test	Minimum Frequency (one per)
C1, R1	Atterberg Limits	2,000 yd^3
C2, R2	Moisture Content	1,000 yd^3
C3, R3	Particle Size Distribution	2,000 yd^3
C4, R4	Laboratory Compaction	Soil type or every 15,000 yd^3
R5a	Nuclear Density	1,000 yd^3
R5b/R5c	Sand Cone or Water Replacement Density	15,000 yd^3
R10	CU Triaxial Compression	Annually or 2,000 yd^3
Notes: Required number of tests shall be determined by whichever method of determining the frequency requires the most tests. If material is too coarse for testing per ASTM, then use test fill method per USACE EM 1110-2-2301.Testing frequencies shall only apply when sediment material is placed as a mixture with tailings and/or on-site native borrow material that is less than 30% rock by weight (materials above ¾-inch size). When sediment material is mixed with waste rock or any material containing more than 30% rock, the placement method shall adhere to the technical specifications developed for placement of waste rock in the TSF.		

GEOSYNTHETIC CLAY LINER
Technical Specifications

NewFields	CLIENT SOUTH32 HERMOSA INC.				PROJECT NO 475.0014.035
PROJECT TAILINGS STORAGE FACILITY 1 (TSF1) AQUIFER PROTECTION PERMIT (APP) SIGNIFICANT AMENDMENT BEST AVAILABLE DEMONSTRATED CONTROL TECHNOLOGY (BADCT) DESIGN					
TITLE TECHNICAL SPECIFICATIONS FOR GEOSYNTHETIC CLAY LINER MATERIALS AND CONSTRUCTION					**SPECIFICATION NO.** 0014-SPT-GCL

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1. GENERAL

This specification defines the requirements for geosynthetic clay liner (GCL) materials, installation, and quality control associated with the South32 Hermosa Inc. (**Owner**) Tailings Storage Facility 1 (TSF1).

Any alternatives or exceptions to this specification shall be submitted in writing to the **Owner** or its designated representatives and shall be approved by the **Engineer**.

The owner's engineer shall control the quality of construction and shall verify that all construction elements have been completed in accordance with Design Drawings and Technical Specifications.

1.1. Definition of Terms

- "**Owner**" is defined as South32 Hermosa Inc. or any of its authorized representative(s) / agent(s).
- "**Engineer**" is defined as the **Consultant** or **Engineering Company** (NewFields) responsible for the detailed design or any of its authorized representative(s)/ agent(s).
- "**Construction Manager**" is defined as the **Consultant** or **Engineering Company** (to be determined) responsible for the overall project completion.
- "**Construction Quality Assurance (CQA)**" is defined as the **Consultant** or **Engineering Company** (to be determined) hired by the **Owner** to provide independent inspection and testing services for the overall project.
- "**Contractor**" is defined as the party(s) that has executed the contract agreement for the specified Work with the **Owner** or its authorized representative(s)/agent(s).
- "**Installer**" and **"Installer Construction Quality Control (CQC)"** is defined as the qualified Contractor that has been hired to install the GCL and complete CQC activities for the specified Work.
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- “Plant” is defined as all equipment, supplies, accommodations, temporary offices, etc., required to complete the Work.
- “Units” - In general, these Specifications and the Drawings will utilize Imperial units, however Metric units will be used when appropriate.

1.2. References

All tests shall be performed in accordance with the current edition of the ASTM, GRI or other Testing Standards as indicated below.

1.2.1. American Society for Testing and Materials (ASTM) Standards

- ASTM D638-22: Test Method for Tensile Properties of Plastics
- ASTM D792-20: Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
- ASTM D882-18: Test Method for Tensile Properties of Thin Plastic Sheeting
- ASTM D1141-98(2021): Practice for Preparation of Substitute Ocean Water
- ASTM D1505-18: Test Method for Density of Plastics by the Density-Gradient Technique
- ASTM D2216-19: Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
- ASTM D4354-12(2020): Practice for Sampling of Geosynthetics for Testing
- ASTM D4439-20: Terminology for Geosynthetics
- ASTM D4632-15a: Test Method for Grab Breaking Load and Elongation of Geotextiles
- ASTM D4759-11(2018)e1: Practice for Determining the Specification Conformance of Geosynthetics
- ASTM 5035 – 11(2019): Test Method for Breaking Force and Elongation of Textile Fabrics (Strip Method)
- ASTM D5199-12(2019): Test Method for Measuring the Nominal Thickness of Geosynthetics
- ASTM D5261-10(2018): Test Method for Measuring Mass per Unit Area of Geotextiles
- ASTM D5321-21: Test Method for Determining the Shear Strength of Soil-Geosynthetic and Geosynthetic-Geosynthetic Interfaces by Direct Shear
- ASTM D5721-22: Practice for Air-Oven Aging of Polyolefin Geomembranes
- ASTM D5887-22a: Test Method for Measurement of Index Flux Through Saturated Geosynthetic Clay Liner Specimens Using a Flexible Wall Permeameter

- ASTM D5888-19: Guide for Storage and Handling of Geosynthetic Clay Liners
- ASTM D5889-18(2022): Practice for Quality Control of Geosynthetic Clay Liners
- ASTM D5890-19: Test Method for Swell Index of Clay Mineral Component of Geosynthetic Clay Liners
- ASTM D5891-19: Test Method for Fluid Loss of Clay Component of Geosynthetic Clay Liners
- ASTM D5993-18(2022): Test Method for Measuring the Mass Per Unit Area of Geosynthetic Clay Liners
- ASTM D5994-10(2021): Test Method for Measuring the Core Thickness of Textured Geomembrane
- ASTM D6102-20: Guide for Installation of Geosynthetic Clay Liners
- ASTM D6141-18 (2022): Guide for Screening Clay Portion and Index Flux of Geosynthetic Clay Liner for Chemical Compatibility to Liquids
- ASTM D6243-20: Test Method for Determining the Internal and Interface Shear Strength of Geosynthetic Clay Liner by the Direct Shear Method
- ASTM D6495-18(2022): Guide for Acceptance Testing Requirements for Geosynthetic Clay Liners
- ASTM D6496-20: Test Method for Determining Average Bonding Peel Strength Between Top and Bottom Layers of Needle-Punched Geosynthetic Clay Liners
- ASTM D6693-20: Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes
- ASTM D6766-20a: Test Method for Evaluation of Hydraulic Properties of Geosynthetic Clay Liners Permeated with Potentially Incompatible Aqueous Solutions
- ASTM D6768-20: Test Method for Tensile Strength of Geosynthetic Clay Liners

1.2.2. Geosynthetic Research Institute (GRI) Standards

- GM13 Revision 16 dated March 17, 2021: Test Methods, Test Properties, and Testing Frequency for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes
- GM17 Revision 14 dated March 17, 2021: Test Methods, Test Properties, and Testing Frequency for Linear Low Density Polyethylene (LLDPE) Smooth and Textured Geomembranes
- GM18 Revision 8 dated September 10, 2015: Test Methods, Test Properties and Testing Frequency for Flexible Polypropylene (fPP and fPP-R) Nonreinforced and Reinforced Geomembranes

2. GEOSYNTHETIC CLAY LINER

The GCL shall consist of a reinforced product consisting of sodium bentonite encapsulated between two nonwoven geotextiles needle-punched together such as Bentomat DN, manufactured by CETCO, or an equivalent product reviewed and approved by the **Engineer**. It is anticipated that a minimum internal peel strength of at least 15 pounds will be required to resist the shear forces without failing internally. Interface shear testing (described in Section 2.3.3) will be required to confirm that the GCL meets the design requirements.

2.1. Manufacturer's Quality Control

GCL roll goods shall meet or exceed the minimum requirements stated herein. Finished roll goods shall also meet or exceed the **Manufacturer**'s published typical or average lot **Specifications** and these **Specifications**.

2.2. Warranty

The **Manufacturer** shall submit the proposed materials and installation warranty with the bid proposal. Terms and conditions of the warranty are to be agreed upon between the **Owner** and the **Manufacturer**.

2.3. Submittals Post-Award

2.3.1. General

The **Manufacturer** shall submit a complete description of their quality control program, as applicable, for manufacturing, handling, installing, testing, repairing, and providing a completed lining in accordance with the requirements of these **Specifications.**

The **Manufacturer** shall provide technical supervision and assistance as requested during installation of the lining system.

The **Manufacturer** shall submit for approval samples of the GCL materials proposed for use.

2.3.2. Certificates

Prior to delivery, **Contractor** shall submit **Manufacturer**'s Quality Control Certificate for each roll of material to the **Engineer** for approval. These certificates shall clearly indicate the roll or rolls that the results represent. Roll goods shipped to the project **site** that do not meet or exceed the **Manufacturer**'s published typical or average lot specifications and the **Specifications** stated herein shall be rejected. The **Manufacturer** must satisfy by affidavit to the **Engineer** and the **Project Manager** that the material he offers to furnish will meet, in every respect, the requirements set forth in these **Specifications**. The Quality Control Certificate shall include the following information:

- Roll number and identification
- Results of quality control tests

Tests to be performed and minimum **Specifications** shall include, but not be limited to, the items presented in Table 2-1.

Table 2-1: Geosynthetic Clay Liner

Property	Test Method	Specification
Bentonite Moisture Content	ASTM D2216	12% max
Bentonite Swell Index	ASTM D5890	24 ml/2g min
Bentonite Fluid Loss	ASTM D5891	18 ml max
Bentonite Mass/Area	ASTM D5993	0.75 lb/ft^2 min
Total Mass/Area	ASTM D5993	0.85 lb/ft^2 min
GCL Moisture Content	ASTM D5993	35% max
GCL Grab Strength	ASTM D6768	50 lbs/in
GCL Peel Strength	ASTM D6496	15 lbs/in min
GCL Index Flux	ASTM D5887	1 x 10^{-8} m^3/m^2/sec max
GCL Hydraulic Conductivity	ASTM D5887	5 x 10^{-11} cm/sec max
GCL Hydrated Internal Shear Strength	ASTM D6243	500 psf typ. @ 200 psf

Materials failing to meet the prescribed requirements of Table 2-1 shall not be considered for a material substitution.

2.3.3. Interface Shear Test

GCL proposed for the project will require interface shear testing in contact with 60 mil double sided textured HDPE as described in this section. The HDPE and GCL materials for testing shall be provided to the testing laboratory by the **Manufacturers**. The **Manufacturer** shall be responsible for conducting interface shear tests through a third party laboratory.

Interface testing shall be performed in accordance with ASTM D5321. Shearing shall take place under normal stresses of 5,000, 10,000, 20,000 and 40,000 psf. Testing at each of the normal stresses shall be undertaken on individual samples, i.e., multi-stage testing of an individual sample of HDPE or GCL is not permitted. The testing shall be completed with sufficient displacement so that residual interface strength values can be determined. The shearing failure mode shall be between the HDPE geomembrane and the GCL. If internal shearing occurs then a higher peel strength GCL will be required.

3. GCL INSTALLATION

3.1. General

The GCL shall be installed within the areas shown on the **Drawings** or as directed by the **Engineer**.

The GCL rolls shall be stored so they are protected from ultraviolet light, puncture, dust, grease, moisture, mechanical abrasion, excessive heat, or other damage. The rolls shall not be stacked more than two rolls high and care shall be taken to maintain identification and **Manufacturer** data on the roll.

Each GCL roll shall be wrapped with a material that will protect the GCL, including the ends of the roll, from damage due to shipment, water, sunlight, and contaminants. The protective wrapping shall be maintained during periods of shipment and storage.

During storage, GCL rolls shall be elevated off the ground and adequately covered to protect them from the following: site construction damage, precipitation, extended ultraviolet radiation including sunlight, chemicals that are strong acids or strong bases, flames including welding sparks, temperatures in excess of 160^{o}F (71^{o}C), and any other environmental condition that may damage the property values of the GCL.

Prior to deployment of GCL, the **Installer** shall inspect and accept, with the **Engineer**, **CQA** and the **Project Manager**, all surfaces on which the GCL is to be placed. The surface on which the GCL is to be installed shall be free of sharp particles, rocks, or other objectionable material or debris to the satisfaction of the **Engineer**, **CQA**, the **Project Manager**, and the **Installer**. Sharp and/or objectionable objects shall be removed by raking, sweeping, or hand picking, as necessary.

Installation of the GCL shall be performed under the direction of a supervisor who has installed a minimum of 10,000,000 square feet of the specified type of GCL or similar. Installation shall be performed under the direction of an installer (who may also be the field installation supervisor or crew foreman) with installation experience of a minimum of 3,000,000 square feet of the GCL type specified or similar product, using the same type of equipment to be used in the current project. During the installation, the field installation supervisor or master installer shall be present. Qualified technicians employed by the **Installer** shall complete all patching and other operations.

The GCL shall be placed over the prepared surfaces using methods and procedures that ensure a minimum of handling. Adequate temporary and permanent anchoring devices and ballasting shall be provided to prevent uplift and damage due to wind. The **Installer** is solely responsible for the safety of his operations including decisions regarding deployment in adverse weather conditions and the amount of temporary anchoring and ballasting required. The **Contractor** shall take necessary precautions to protect the GCL from any damage, including prohibiting workers from smoking on or near the GCL and wearing foot apparel that would damage the geosynthetic.

To the extent possible, seams shall be oriented parallel to the fall line, slope, or grade of the ground. The panels shall be secured temporarily with sandbags or other approved ballasting method to hold them in place until the field seams have been completed and the GCL has been permanently anchored. Sandbags/ballast shall be removed from the GCL when they are no longer required to secure the GCL.

The **Installer** shall take into account that high winds occur at the project **site** and may result in liner damage and delays. The **Installer** shall take all necessary measures to ensure that each panel is sufficiently ballasted to prevent damage or movement by wind.

The GCL direction of unrolling shall be installed according to the manufacturers guidelines. If CETCO Bentomat GCL is used, the product shall be installed so that the black side is in contact with the geomembrane. The GCL shall be laid out and installed by trained technicians in accordance with the **Drawings**; the layout and details as presented in the approved shop drawings; and in accordance with the **Manufacturer**'s requirements.

Care must be taken to minimize the extent to which the GCL is dragged across the subgrade in order to avoid damage to the surface of the GCL. A temporary covering commonly known as a slip sheet or rub sheet may be used to reduce friction damage during placement. Sheet goods damaged from improper installation methods shall be removed and replaced at the **Installer's** expense.

The GCL seams shall be constructed by overlapping adjacent panel edges and ends. Seams shall be flat and without wrinkles. The **Installer** shall ensure that the overlap zone is not contaminated with loose soil or other debris. Seams shall be shingled in the direction of flow and overlapped in accordance with the **Manufacturer**'s specifications, or as follows (whichever is greater):

Longitudinal seams and seams at the end of panels shall be overlapped a minimum of 24 inches. The GCL termination along the low permeability soil layer interface shall be constructed with a minimum overlap of 24 inches or as shown on the Drawings (whichever is greater). Longitudinal seams (as applicable) and seams at the ends of the panels shall be constructed so they are shingled in the direction of the grade. All overlapped seams in the GCL shall be heat-tacked using a quick pass of a flame torch or hot-air gun (or equivalent) followed by a quick application of appropriate pressure provided by a roller, foot pressure or other means. Assessment of adequate seam tacking shall be made in the field by **CQA** based on visual observations.

During installation, the **Installer** shall give each field panel an “identification” code number consistent with the approved layout plan. The **CQA** and the **Engineer** shall agree upon the numbering system. The **Installer** shall update the layout plan as each panel is installed to show the location of each panel. A field panel is defined as the area of GCL that is to be seamed in the field (roll or portion of a roll cut in the field).

Bentonite-enhanced seams are required between overlapping end-of-roll panels and at the GCL termination along the low permeability soil layer interface. The underlying edge of the overlap shall be exposed and a continuous bead of granular sodium bentonite shall be applied 12 inches from the edge of the underlying panel or low permeability soil layer material. Granular bentonite shall be placed continuously and evenly along the overlaps at a minimum rate of ¼-pound per linear foot. Supplemental bentonite shall be of the same type and quality as the material within the GCL.

The **Installer** shall only work on an area that can be completed in one working day. Completion is defined as the full installation of the GCL and placement of the HDPE geomembrane materials or protective waterproof tarps or plastic. GCL shall be covered immediately to protect it from precipitation that may occur during construction. Installation shall not take place during high humidity, rain, or other types of precipitation. Any GCL that becomes hydrated prior to coverage shall be removed and replaced at no additional cost to the **Owner**.

The GCL shall be installed such that vehicle traffic is minimized and damage to the material does not occur. Equipment which could damage the GCL should not be allowed to travel directly on it. Acceptable installation, therefore, shall ideally be accomplished such that the GCL is unrolled in front of backwards-moving equipment. If the installation equipment causes rutting of the subgrade, the subgrade must be restored to its originally accepted condition before GCL placement continues.

Rips or tears in the GCL shall be repaired completely by exposing the affected area, removing all foreign objects or soil, and then placing a patch over the defect with a minimum overlap of three (3) feet on all edges. Granular bentonite shall be placed between the patch and the repaired material at a minimum rate of ¼ pound per linear foot of edge.

An adequate amount of handling equipment, welding apparatuses, and test equipment shall be maintained on **Site** by the **Installer** to avoid delays due to problems with equipment failures.

3.2. HDPE Deployment over GCL

To the extent that is practical, direct vehicular contact with the GCL during HDPE deployment should be avoided or minimized. HDPE deployment equipment that must travel on the GCL shall consist of lightweight, low ground pressure vehicles. Any rutting or damage to the GCL due to vehicular traffic shall be removed, replaced, or repaired to the satisfaction of the **Engineer** at the **Installer's** expense. The **Manufacturer** should be contacted with specific recommendations regarding appropriate equipment and procedures relative to HDPE deployment over the GCL.

Prior to HDPE deployment, the **Installer** shall notify the **Engineer** of the HDPE deployment equipment proposed to travel on the exposed GCL.

3.3. GCL Installation Construction Quality Control

A **Project Manager** appointed by the **Owner** will perform all of the construction management functions and ensure that the project is built in accordance with the project documents. Any questions with regard to the **Drawings** or **Specifications** associated with the **Work** shall be addressed to the **Engineer** for clarifications in accordance with the established project protocol. All proposed changes to the **Drawings** or **Specifications** shall be approved by the **Project Manager** and the **Engineer** prior to implementing the change.

CQC is the responsibility of the **Installer** and the **Installer** is responsible for the quality of the work. A formalized, third party **CQC** program is required for the GCL scope of work. The **Owner** will have a third party **CQA** program in place as described herein. Testing of the **Work** by **CQA** does not relieve the **Installer** of liability for substandard materials or end product work. All **CQC** test results and observation reports shall be provided to the **Project Manager** on Monday for the preceding week. A final **CQC** report shall be submitted to the **Project Manager** and the **Engineer** within 15 calendar days after the installation work has been completed.

3.4. GCL Installer Warranty

The **Installer** shall warrant the installation against workmanship defects a minimum of five (5) years from the date of installation or as mutually agreed prior to award of the **Contract**. This warranty shall cover the cost of material, freight and duties, handling, labor, and equipment to replace or repair defective workmanship.

4. CONSTRUCTION QUALITY ASSURANCE (CQA) REQUIREMENTS

4.1. General

The **CQA** activities shall be performed under the direction of a Senior Technician or Field **Engineer** who has monitored the installation of a minimum of 5,000,000 square feet of the specified type of GCL or similar.

4.2. CQA Inspection and Review Requirements

The **Engineer** shall be the interpreter of the **Specifications** and shall make observations as considered necessary to assess and accept the quality of the work. Continuous observations of construction operations shall be made by **CQA** under the direction of the **Engineer**.

The **Project Manager** shall be responsible for verification of lines and grades prior to acceptance of the completed work. The **Installer** shall be responsible for any surveying required during GCL placement. The **Installer** shall also be responsible for the preparation of record (as-built) **drawings** for all GCL covered areas. If the as-built **drawings** for the project will be prepared by the **Contractor** or a subcontractor to the **Contractor**, the name of the preparer of the **Drawings** shall be submitted to the **Project Manager** in writing for approval prior to deployment of any GCL.

4.3. Construction Quality Assurance Reports

The **Engineer** shall submit reports of observations and tests made by **CQA** to the **Project Manager**. The reports shall be submitted to the **Project Manager** within two (2) to three (3) days. Items of non-conformance will be brought to the attention of the **Project Manager** as soon as possible, after identification.

A copy of all **CQA** reports will be maintained at the construction **Site**, and shall include the following:

- Date issued.
- Project title and number.
- Designation of material inspected.
- Observations regarding compliance or noncompliance with the **Drawings** and **Specifications**.

GEOMEMBRANE
Technical Specifications

NewFields	CLIENT SOUTH32 HERMOSA INC.	PROJECT NO 475.0014.035

PROJECT TAILINGS STORAGE FACILITY 1 (TSF1)
AQUIFER PROTECTION PERMIT (APP) SIGNIFICANT AMENDMENT
BEST AVAILABLE DEMONSTRATED CONTROL TECHNOLOGY (BADCT) DESIGN

TITLE	TECHNICAL SPECIFICATIONS FOR GEOMEMBRANE MATERIALS AND CONSTRUCTION	SPECIFICATION NO. 0014-SPT-GM

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- "**Installer**" and **"Installer Construction Quality Control (CQC)"** is defined as the qualified Contractor that has been hired to install the geomembrane and complete CQC activities for the specified Work.
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- "Modifications" are defined as changes made to the Specifications or the Drawings that are approved by **Owner** and **Engineer** in writing, after the Specifications and Drawings have been issued for construction. These also refer to changes to design elements in the field to account for unforeseen conditions.
- "Plant" is defined as all equipment, supplies, accommodations, temporary offices, etc., required to complete the Work.
- "Units" - In general, these Specifications and the Drawings will utilize Imperial units, however metric units will be used when appropriate.

1.2. References

All tests shall be performed in accordance with the current edition of the American Society for Testing and Materials (ASTM), Geosynthetic Research Institute (GRI), or other Testing Standards as indicated below.

1.2.1. ASTM Standards:

- ASTM D792-20: Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
- ASTM D1004-21: Standard Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting
- ASTM D1238-20: Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer
- ASTM D1505-18: Standard Test Method for Density of Plastics by the Density-Gradient Technique
- ASTM D1603-20: Standard Test Method for Carbon Black Content in Olefin Plastics
- ASTM D4218-20: Standard Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique
- ASTM D4437-16 (2018): Standard Practice for Nondestructive Testing (NDT) for Determining the Integrity of Seams Used in Joining Flexible Polymeric Sheet Geomembranes
- ASTM D4833-07 (2020): Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products
- ASTM D5199-12 (2019): Standard Test Method for Measuring the Nominal Thickness of Geosynthetics
- ASTM D5321M-21: Standard Test Method for Determining the Shear Strength of Soil-Geosynthetic and Geosynthetic-Geosynthetic Interfaces by Direct Shear
- ASTM D5397-20: Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test

- ASTM D5596-03 (2021): Standard Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics
- ASTM D5641-16: Standard Practice for Geomembrane Seam Evaluation by Vacuum Chamber
- ASTM D5721-22: Standard Practice for Air-Oven Aging of Polyolefin Geomembranes
- ASTM D5820-95 (2018): Standard Practice for Pressurized Air Channel Evaluation of Dual Seamed Geomembranes
- ASTM D5885-20: Standard Test Method for Oxidative Induction Time of Polyolefin Geosynthetics by High-Pressure Differential Scanning Calorimetry
- ASTM D5994-10 (2021): Standard Test Method for Measuring Core Thickness of Textured Geomembrane
- ASTM D6365-99 (2019): Standard Practice for the Nondestructive Testing of Geomembrane Seams using the Spark Test
- ASTM D6370-99 (2019): Standard Test Method for Rubber-Compositional Analysis of Thermogravimetry (TGA)
- ASTM D6392-12 (2018): Standard Test Method for Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods
- ASTM D6693-20: Standard Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes
- ASTM D6747-21: Standard Guide for Selection of Techniques for Electrical Detection of Potential Leak Paths in Geomembranes
- ASTM D7007-16: Standard Practices for Electrical Methods for Locating Leaks in Geomembranes Covered with Water or Earthen Materials
- ASTM D7238-20: Standard Test Method for Effect of Exposure of Unreinforced Polyolefin Geomembrane Using Fluorescent UV Condensation Apparatus
- ASTM D7240-18: Standard Practice for Leak Location using Geomembranes with an Insulating Layer in Intimate Contact with a Conductive Layer via Electrical Capacitance Technique (Conductive Geomembrane Spark Test)
- ASTM D7466-10 (2015)e1: Standard Test Method for Measuring Asperity Height of Textured Geomembranes
- ASTM D8117-21: Standard Test Method for Oxidative Induction Time of Polyolefin Geosynthetics by Differential Scanning Calorimetry

1.2.2. Geosynthetic Research Institute (GRI):

- GRI GM 9 Revision 1 dated January 10, 2013: Cold Weather Seaming of Geomembranes
- GRI GM 10 Revision 5 dated March 24, 2021: The Stress Crack Resistance of HDPE Geomembrane Sheet

- GRI GM 13 Revision 16 dated March 17, 2021: Test Methods, Test Properties and Testing Frequency for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes
- GRI GM 14 Revision 1 dated January 9, 2013: Selecting Variable Intervals for Taking Geomembrane Destructive Seam Samples Using the Method of Attributes
- GRI GM 19a Revision 10 dated March 18, 2021: Seam Strength and Related Properties of Thermally Bonded Homogeneous Polyolefin Geomembranes/Barriers

2. GEOMEMBRANE

The geomembrane shall be 60 mil (1.5 mm) double textured High Density Polyethylene (HDPE) unless otherwise indicated on the Drawings. Where referred to as 60 mil HDPE geomembrane on the drawings will mean double textured HDPE.

2.1. Manufacturer's Quality Control

The HDPE geomembrane shall be a high quality formulation containing approximately 97 percent polymer and 3 percent carbon black with antioxidants and heat stabilizers. It shall be resistant to ultraviolet (UV) rays. All resin shall be hexene-based, consist of all virgin material from the same manufacturer, shall not be intermixed, and no reclaimed polymer may be added to the resin. The manufacturing process shall not use more than 10 percent regrind. If regrind is used, it must be similar HDPE to the parent material.

The geomembrane material shall comprise HDPE material manufactured of new, first-quality products designed and manufactured specifically for the purpose of liquid containment in hydraulic structures as applied to the mining industry. The material shall be produced to be free of holes, blisters, undispersed raw materials, or any sign of contamination by foreign matter. The geomembrane shall be supplied in roll form. Each roll shall be identified with labels indicating roll number, thickness, length, width, and manufacturer's name and date of manufacture.

The geomembrane manufacturer shall be ISO 9000/2015 certified. The manufacturer's laboratory must be certified by Geosynthetic Accreditation Institute (GAI)/Laboratory Accreditation Program (LAP) for the tests being performed and shall have a third-party independent quality assurance program. The third party shall perform the required tests at the required frequency as stated in this **Specification** or at such frequency as mutually agreed by the **Owner**, the **Engineer**, and the manufacturer at the time of award. All test results shall be provided to the **Engineer** and the rolls of material shall be clearly identified and correlate to the test results.

Extrudate rod or bead material shall be made from the same type of resin as the geomembrane and be from the same resin supplier as the resin used for manufacture of the geomembrane.

2.2. Manufacturer's Warranty

The material shall be warranted against manufacturer's defects as well as degradation due to UV light for exposed areas for a minimum of 20 years from the date of installation or as mutually agreed prior to award of the contract for supply between the **Owner** and the geomembrane manufacturer. This warranty shall cover the cost of material, freight and duties, handling, labor, and equipment to replace the defective or failed material.

2.3. Submittals Post-Award

2.3.1. Manufacturer Submittals

The manufacturer shall furnish the following product data, in writing, to the **Owner** and the **Engineer** prior to shipment of the geomembrane material:

Resin data including the following:

- Certification stating that the resin meets the specification requirements and that it is all from the same manufacturer (see Table 4).
- Statement certifying no reclaimed polymer and no more than 10% rework of the same type of material is added to the resin (product run may be recycled).
- Copy of quality assurance and quality control certificates issued by resin supplier.

Geomembrane roll, extrudate rod and bead material:

- All rolls shall be delivered with labels affixed to or markings on the selvage edge clearly stating the manufacturer's name, product identification, material thickness, roll number, roll type, roll dimensions, and roll weight.
- Copy of quality assurance and quality control certificates issued by the geomembrane manufacturer and the third-party independent quality assurance tester.
- Certification that the geomembrane material delivered to the project complies with these specifications.
- Certification that extrudate rod or bead is from one manufacturer, is the same resin type, and was obtained from the same resin supplier as used to manufacture the geomembrane rolls.

It is the Manufacturer's responsibility to submit timely proposals and submittals allowing a minimum of two (2) weeks for review and approval.

2.3.2. Lining Contractor Submittals

It is the **Installer's** responsibility to submit timely proposals (allowing a minimum of two weeks for approval). The **Installer** shall supply the **Owner** and **Engineer** with the following prior to commencement of work:

- Panel layouts of the geomembrane that must be approved by the **Engineer** prior to commencing the Work. The submittal shall include a proposed field panel "identification" code numbering system.
- Resumes for the Master Welder and other welders with a description of their qualifications and experience for approval prior to arrival on site.
- The **Installer** shall submit a copy of their Quality Control Manual prior to the start of installation of any geomembrane. If there are discrepancies between this Specification and the **Installer's** Quality Control Manual, the more stringent requirements will apply unless determined otherwise by the **Engineer**. The **Engineer** shall review and approve the **Installer's** Quality Control Manual including logs, inspection and testing methods and forms prior to the Installer commencing the Work.

2.4. Third Party Conformance Testing (Manufacturing)

During manufacturing of the geomembrane, samples shall be obtained and forwarded to a third party geomembrane quality assurance testing Laboratory (to be determined by the **Engineer** and **Owner**) by a representative of the **Engineer** for testing to ensure conformance with the Specifications.

Unless otherwise stated, samples shall be 3 feet long by the width of the roll and shall be taken at a frequency of no less than one per 1,000,000 square feet or one per resin lot, whichever requires more samples.

The conformance tests shall be performed to verify conformance to the design Specifications as listed on Table 1 for Smooth Geomembrane and Table 2 for Textured Geomembrane. The following conformance tests shall be performed on each conformance sample.

- Thickness (ASTM D5199)
- Density (ASTM D1505)
- Tensile Properties (ASTM D6693)
- Tear Resistance (ASTM D1004)
- Puncture Resistance (ASTM D4833)
- Carbon Black Dispersion (ASTM D5596)
- OIT (ASTM D8117)

3. GEOMEMBRANE INSTALLATION

3.1. General

The HDPE geomembrane shall be installed on the areas shown on the Drawings or as directed by the **Engineer**. The Installer shall be an approved installer by the Manufacturer.

The geomembrane rolls shall be stored so they are protected from puncture, dust, grease, moisture, mechanical abrasion, excessive heat, or other damage. The rolls shall be stored on a flat smooth surface (minus 1-inch well graded gravel rolled with a smooth drum or equivalent) and not stacked more than two rolls high. Care shall be taken to maintain identification and manufacturer data on the roll.

Prior to deployment of geomembrane, the **Installer** shall inspect and accept, with the **Engineer**, **CQA** and the **Owner**, all surfaces on which the geomembrane is to be placed. The surface on which the geomembrane is to be installed shall be free of sharp particles, rocks, or other debris to the satisfaction of the **Engineer**, **CQA**, the **Owner**, and the **Installer**. Sharp and/or objectionable objects shall be removed by raking, sweeping, or handpicking, as necessary.

Installation of the geomembrane shall be performed under the direction of a supervisor who has installed a minimum of 10,000,000 square feet of the specified type of geomembrane or similar. Seaming shall be performed under the direction of a master seamer (who may also be the field installation supervisor or crew foreman) with seaming experience of a minimum of 3,000,000 square feet of the geomembrane type specified or similar product, using the same type of seaming apparatus to be used in the current project. During the seaming, the field installation supervisor or master seamer shall be present. Qualified technicians employed by the **Installer** shall complete all seaming, patching, testing, and other welding operations.

The geomembrane shall be placed over the prepared surfaces using methods and procedures that ensure a minimum of handling. Adequate temporary and permanent anchoring devices and ballasting shall be provided to prevent uplift and damage due to winds. The **Installer** is solely responsible for the safety of his operations including decisions regarding deployment in adverse weather conditions and the amount of temporary anchoring and ballasting required. The **Contractor** shall take necessary precautions to protect the geomembrane from any damage, including prohibiting workers from smoking on or near the geomembrane and wearing foot apparel that would damage the geomembrane.

To the extent possible, seams shall be oriented parallel to the fall line, slope, or grade of the ground. The panels shall be secured temporarily with sandbags or other approved ballasting method to hold them in place until the field seams have been completed and the geomembrane has been permanently anchored. Ballast material shall conform to the specified requirements for protective layer.

The **Installer** shall take into account that high winds occur at the project site and may result in liner damage and delays. The **Installer** shall take all necessary measures to ensure that each panel is sufficiently ballasted to prevent damage or movement by wind. Fusion of panels and repairs will only be permitted under weather conditions allowing such work, and within the warranty limits of the geomembrane manufacturer, as approved by the **Owner** and the **Engineer**.

Horizontal field seams on slopes shall be kept to a minimum and require the approval of the **Engineer**. Horizontal seams on steep slopes shall be avoided where possible by cutting the liner at a 45-degree angle. Generally, horizontal seams are to be no closer than 10-feet from the toe of the slope. Horizontal seams shall be made by lapping the uphill material over the downhill material. Panels shall be shingled in a manner that prevents water from running beneath the liner.

The geomembrane shall be installed in a relaxed condition and shall be free of tension or stress upon completion of the installation. The installed geomembrane shall contain sufficient slack material to allow for thermal expansion and contraction for the annual temperature range expected at the site. Individual wrinkles should take the form of undulations in the liner but should not be large enough for the material to fold over on itself.

During installation, the **Installer** shall give each field panel an “identification” code number consistent with the approved layout plan. The **CQA** shall agree upon the numbering system. The **Installer** shall update the layout plan as each panel is installed to show the location of each panel. A field panel is defined as the area of geomembrane that is to be seamed in the field (roll or portion of a roll cut in the field).

Individual panels of geomembrane material shall be laid out in a pattern that will produce the least number of seams. The material shall be overlapped prior to welding. Extreme care shall be taken by the **Installer** in the preparation of the areas to be welded. The joint interface shall be cleaned and prepared according to industry standard procedures, those specified by the material manufacturer, and those approved by the **Engineer**. Seaming shall not take place unless the panels are dry and clean. All sheeting shall be welded together by thermal methods. When placing panels together where one panel has been deployed previously, the adjacent panels will need to be allowed to equilibrate in temperature and slack before welding.

Any area showing damage due to excessive scuffing, puncture, or distress from any cause shall be replaced or repaired with an additional piece of geomembrane. The cost of replacing or repairing the geomembrane shall be borne solely by the **Installer**. Patching of panels to repair defects shall be limited. If excessive physical damage occurs to the geomembrane during or after installation (i.e., wind blowout, rock, or equipment damage) the **Engineer** may require the damaged area to be replaced.

No "fish mouths" will be allowed within the seam area. Where "fish mouths" occur, the material shall be cut, overlapped, and the area shall be patched.

Geomembrane panels must have a finished overlap of 4 to 6-inches for double-wedge welding seams and minimum 6-inches for extrusion welding seams. Notwithstanding this provision, sufficient overlap shall be provided to allow shear and peel tests to be performed on any seam.

Handling and storage of the geomembrane material shall be in accordance with the manufacturer's printed instructions. Persons walking or working on the geomembrane shall not engage in activities or wear foot apparel that could damage the geomembrane.

An adequate amount of handling equipment, welding apparatuses, and test equipment shall be maintained on site to avoid delays due to problems with equipment failures.

3.2. Geomembrane Installation Quality Control

3.2.1. General

The **Installer** shall be fully responsible for carrying out all quality control inspection and tests on the geomembrane and shall do so to the satisfaction of the **Engineer** and in accordance with this Specification and the **Installer's** Quality Control Manual. On-site physical nondestructive and destructive testing shall be completed on all joints to ensure that watertight uniform seams are achieved on a continuous basis as installation proceeds. The **CQA** shall randomly witness destructive tests completed by the **Installer's CQC**. At the time of bid submission, details shall be provided by the Installer that set forth the method proposed for both destructive and nondestructive testing of seams. The **Engineer** shall approve these methods prior to the **Installer** commencing the Work.

Fusion of panels and repairs will only be permitted under weather conditions allowing work that is in conformance to the Specifications and within the warranty limits imposed by the manufacturer and to the approval of the **Engineer**.

The **Installer** shall not have more than 500,000 square feet of geomembrane deployed at any time without final CQA/CQC and acceptance by the **CQA**. At the beginning of each day's work, the **Installer** shall provide the **CQA** with copies of all the previous days' reports (electronic format) as well as an update of the quantity and location of geomembrane placed.

3.2.2. Trial Welds

Trial welds shall be completed to verify the performance of the welding equipment and operator prior to performing production welds or if significant changes in temperature or weather conditions occur. No welding equipment or operator shall perform production welds until equipment and operator have successfully completed a trial weld and are approved by the **CQA**. The following procedures shall be followed for trial welds:

- Make trial welds under the same surface and environmental conditions as the production welds, i.e., in contact with subgrade and similar ambient temperature.
- Minimum of two trial welds per day per welding apparatus – one made prior to the start of work, one completed at mid-shift, and after work stoppages longer than 30 minutes or for every 5 hours of seaming operations.
- Cut 10 each (5 for peel test, 5 for shear test) 1-inch-wide-by-6-inch long test strips from the trial weld.
- Quantitatively test specimens for peel adhesion and for bonded seam strength (shear).
- Trial weld specimens shall pass when the results shown in Table 3 are achieved in both peel and shear tests and:
  - The break, when peel testing, occurs by Separation in the plane of the sheet (SIP), not through adhesion failure separation (AD). When the seam separation is equal to or greater than 25% of the track width, it is a failed test.
  - The break is ductile.
- Repeat the trial weld, in its entirety, when the trial weld samples fail in either peel or shear as defined on Table 3 and above.

3.2.3. Field Seaming

The **Installer** shall have at least one Master Welder who shall provide direct supervision to other welders. Field seaming procedures and requirements shall include:

- The welding equipment shall be capable of continuously monitoring and controlling the temperatures in the zone of contact where the machine is actually fusing the material to ensure changes in environmental conditions will not affect the integrity of the weld.
- The seam area shall be cleaned of dust, mud, moisture, and debris immediately ahead of the welding apparatus.
- The seam overlaps shall be aligned consistent with the requirements of the welding equipment being used. A 4-inch to 6-inch overlap shall be used for double-wedge welded seams and 6-inches for extrusion welded seams unless approved otherwise by the **Engineer**.
- Seaming shall not proceed when the ambient air temperature or adverse weather conditions jeopardize the integrity of the geomembrane installation. If adverse weather

prevents work from being completed, the **Installer** shall make-up the work during a scheduled day off.

- Extrusion welding apparatuses shall be purged of heat-degraded extrudate before welding.
- The double-wedge fusion welding process shall be used unless alternate methods are approved by the **Engineer**. Extrusion welding shall be permitted to weld short seams to repair small areas where double-wedge welding is not feasible, and for caps and patches.

3.2.4. Field Seam and Panel Inspection and Testing

3.2.4.1. Nondestructive Testing and Inspection

The **Installer CQC** and **CQA** shall perform visual inspections of deployed and welded HDPE panels to identify defects, damage, or protrusion of sharp objects that may affect the integrity of the geomembrane. Defective or damaged areas shall be marked and repaired according to the Technical Specifications and the guidelines in the **Installer's** Quality Control Manual.

The **Installer's CQC** and **CQA** shall inspect each seam, marking their initials and date inspected at the end of each panel. Any area showing a defect shall be marked and repaired in accordance with the applicable repair procedures.

3.2.4.2. Continuity Testing

A maximum effort shall be made by the **Installer** to install a perfect geomembrane liner. This implies that all seams completed in the field, patches, and extrusions shall be tested and recorded. All failures shall be isolated and repaired as directed by the **Engineer** and **CQA**. A general testing procedure for the **Installer CQC** is as follows:

- Test all field seams and patches with interseam pressure, vacuum box, spark tester, or other approved methods. Non-destructive testing methods are discussed in the following subsections.
- Isolate and repair all areas indicating any defects. Retest the repair.

3.2.4.3. Interseam Pressure Testing

Test procedure shall be in accordance with ASTM D5820 for interseam pressure for seams (for double-wedge welding only):

- Seal both ends of the seam to be tested by applying heat to the end of the seam via a heat gun until flow temperature is achieved. Clamp off the ends and let cool.
- Insert a pressure gauge with needle assembly into the end of the seam and seal.

- Pressurize the air channel between the two seams to between 30 psi and 35 psi. Following pressure stabilization, take the initial pressure reading, hold the pressure a minimum of 3 minutes and take a second reading.
- The allowable leak-down for the seam is 3 psi maximum.
- If the pressure does not drop below the maximum allowable 3 psi, open the air channel at the end away from the pressure gauge. Air should rush out and the pressure gauge should register an immediate drop in pressure, indicating that the entire length of seam has been tested. If this does not happen, either the air channel is blocked or the equipment is faulty, and the test is not valid.
- Enter the results of the leak test on the appropriate documentation, indicating either a passed or a failed seam. If the seam fails, the repair work and subsequent testing should be recorded on the same document.
- Repair the area where the pressure gauge/needle assembly was installed and where the air was released.

3.2.4.4. Vacuum Box Testing

Where possible, the **Installer CQC** shall test all extrusion seams in accordance with ASTM D5641:

- Mix a solution of liquid detergent and clean water and apply an ample amount to the area to be tested. If a seam contains excess overlap or loose edges, it must be trimmed before testing.
- Place a rigid transparent vacuum box over the area and apply a slight amount of downward pressure to the box to seat the seal strip to the liner.
- Apply a vacuum of 4 psi to 8 psi for a minimum of 10 seconds to the area. The **Installer CQC** shall examine the geomembrane through the viewing window for the presence of soap bubbles indicating a leak. If no bubbles appear after 10 seconds, consider the area leak free. Once the area is leak free, depressurize the box, and move it over the next adjoining area with an appropriate overlap and repeat the process.
- Enter the results of the leak test on the appropriate documentation, indicating either a passed or a failed seam. If the seam fails, the repair work and subsequent testing should be recorded on the same document.

3.2.4.5. Spark Testing

Extrusion welded patches, caps, pipe boots, etc., in lieu of vacuum-box testing, shall be spark tested in accordance with ASTM D6365 and the following procedures:

- The seam shall be prepared for extrusion welding in accordance with the **Installer**’s procedures.

- Just prior to applying the extrusion bead, a small-gauge copper wire (18-gauge bare copper wire or equivalent) shall be placed into the seam. The wire should be grounded at one end and placed at the edge of the top sheet of the overlap seam. Tucking the wire under the edge of the top sheet will help hold the wire in place during welding, but this should be done prior to grinding to avoid the risk of contamination of the weld area. Electrically conductive tape placed along the edge of the overlying patch can also be used instead of copper wire.
- Apply the extrudate bead as normal and allow the weld to cool.
- Complete a calibration test on a trial seam containing a non-welded segment ensuring the identification of such a defect (non-welded segment) under the planned spark tester settings and procedures.
- Energize the spark tester and move the electrode wand near the trial seam to determine the maximum length of spark that can be generated. Adjust the output voltage setting until the spark length exceeds the greatest potential leak path distance. This is typically the diagonal distance from the embedded wire to the edge of the weld bead at a "T" joint.
- Once the output voltage has been set, testing can be started. Testing is performed by passing the electrode over the seams with the electrode in contact with the membrane or the extruded weld bead. The audible and visual indication of a spark provides the determination of a potential leak path.
- If a potential leak is detected the area can be repaired with a patch. Applying additional weld beads adjacent to the leaking weld is not an acceptable repair technique. This will only lengthen the leak path to the extent that the spark tester may not be capable of generating a spark of sufficient length to breach the lengthened gap.
- After patching, the seam must be retested until no defects are indicated.
- Enter the results of the spark test on the appropriate documentation, indicating either a passed or a failed seam. If the seam fails, the repair work and subsequent testing should be recorded on the same document.
- When flammable gasses are present, use special care and precautions in the area to be tested.

3.2.4.6. Destructive Testing

Peel and shear seam strength testing shall be carried out on samples of seams removed from the installed panels. For these tests, the following procedures shall be followed:

- Coupon sampling of all field seams, including patches and repair areas, shall be taken by cutting perpendicular to the seams a sample approximately 36-inch long by a 6-inch wide (minimum) centered over the seam. This sample shall be cut into three 12-inch long samples and labeled with the sample number, date, time, location, seam number, individually marked "**Owner** (Archive) Sample," "**CQA** Sample," and "**Installer CQC** Sample." The frequency and location shall be determined by the **CQA** but shall not be less than one sample per 500-feet of field seams. These coupons shall be tested by the **Installer** on-site for peel (5 coupons), shear seam strength (5 coupons), and thickness in accordance with ASTM D6392. The **CQA** shall also test the samples for conformance. If there is any discrepancy in the results, the **CQA** results will override the **Installer's**.

- Heat-welded seams shall be allowed to cool or warm to about 70°F prior to testing. Solvent seams, when used, shall be allowed to cure according to the manufacturer's recommendations. Additionally, at the **Engineer's** option, approximately 10 percent of the coupons (size 1-inch by 6-inches) shall be sent to an independent laboratory for confirmation testing. Should the lab and field tests conflict, installation shall halt until the conflict is resolved to the satisfaction of the **Engineer**.

Weld specimens shall pass the requirements for shear and peel presented in Table 3 and as follows:

- During testing, the break shall occur by SIP not through AD. When the seam separation is equal to or greater than 25% of the track width, it is a failed test.
- The break is ductile.

In the event of a failing test result, the following procedures shall be used:

- The **Installer** shall trace the weld path to an intermediate location (at a minimum of ten (10) feet from the location of the failed test in both directions), at the discretion of the **Engineer**, and take an additional sample for testing. If this test passes, then the seam shall be capped between the two passing locations. If the test fails, in either direction, the tracking process shall continue until a passing area is found.
- Over the length of seam failure, the **Installer** shall either cut out the old seam, reposition the panel and re-seam, or cap the failing area, as required by the **Engineer**.
- Samples taken as the result of failed tests do not count toward the total number of destructive tests required.

3.2.5. Repair Procedures

Damaged or defective geomembrane or seam areas failing a destructive or non-destructive test shall be repaired. Each repair requires a non-destructive test using either a vacuum box or spark testing methods. The **Installer** shall be responsible for repair of damaged or defective areas. The repair method shall be decided by the **Installer** but must be agreed upon by the **Engineer**. Procedures available include the following:

- <u>Replacement</u>: Remove damaged geomembrane or unacceptable seam and replace with acceptable geomembrane materials if the damage cannot be satisfactorily repaired.
- <u>Patching</u>: Used to repair large holes, tears, undispersed raw materials, and contamination by foreign matter.
- <u>Capping</u>: Used to repair large lengths of failed seams.

Abrading and rewelding of small seam areas and welding the flap on fusion-welded seams are not acceptable repair procedures and shall not be accepted.

In addition, the following procedures shall be observed:

- Surfaces of the polyethylene that are to be repaired by extrusion welds shall be lightly abraded to ensure cleanliness.
- All geomembrane shall be clean and dry at the time of repair.
- Extend patches or caps at least 6-inches for extrusion welds and 4-inches for fusion welds beyond the edge of the defect, and round the corners of the patch material. The edges of all patches are to be beveled.

Furthermore, repair verification shall be performed as follows:

- Number, date, location, repair technician, CQC and test outcome of each patch.
- Non-destructively test each repair using methods specified in this Technical Specification.
- Enter the results of the repair procedures on the appropriate documentation, indicating the repair verification. If the repair fails, the repair work and subsequent testing should be recorded on the same document.

3.2.6. Installer's CQC Reporting and As-built

Installer's CQC will be responsible for recording and reporting the following information on a daily basis:

- Panel deployment log
- Seaming log
- Trial weld test results
- Non-destructive and destructive testing results
- Documentation of all seam and major patch repairs
- As-built information (in AutoCAD compatible format) showing the surveyed geomembrane panel layout, seams, location of destructive test samples, and the location of major repairs including repaired seams, major patches, and capped areas

The reports shall be provided in hard copy and electronic format (Word and Excel) unless agreed otherwise with the **Owner** and **Engineer**.

The log formats shall be included in the **Installer's** Quality Control Manual and the format and information to be included on the logs is subject to approval by the **CQA**.

At the completion of the installation and prior to final payment, the **Installer** shall provide the **CQA** or **Engineer** and **Owner** the following information no later than 15 calendar days after the installation work has been completed:

- Completed as-built drawings (AutoCAD compatible format) showing the surveyed geomembrane panel layout, seams, location of destructive test samples, and the location of major repairs including repaired seams, major patches, and capped areas.
- A certification that the geomembrane was installed and tested in accordance with the Specifications together with a report of the completed QC documents. The completed QC documents shall include the Panel Deployment Log, Seaming Log, Trial Weld Test Results, Destructive Testing Results, and Repair Log which shall also summarize non-destructive testing results.

3.3. Installer Warranty

The **Installer** shall warrant the installation against workmanship defects a minimum of 5 years from the date of installation or as mutually agreed prior to award of the contract. This warranty shall cover the cost of material, freight and duties, handling, labor, and equipment to replace or repair defective workmanship.

4. CONSTRUCTION QUALITY ASSURANCE (CQA) REQUIREMENTS

4.1. General

The **CQA** activities shall be performed under the direction of a Senior Technician or Field Engineer who has installed a minimum of 5,000,000 square feet of the specified type of geomembrane or similar.

4.2. CQA Inspection and Review Requirements

The **CQA** shall be responsible for inspecting the geomembrane installation to ensure that the work is completed in accordance with the specifications. Inspections and review will include, but not be limited to the following:

- Random visual verification of trial welding results
- Random visual verification of production seaming operations
- Random visual verification of seam testing (air tests) results
- Random visual verification of vacuum box and spark testing
- Random verification of the **Installer CQC** destructive seam strength testing
- Final inspection and approval of completed geomembrane
- Review of the Installer CQC documentation

4.3. CQA Testing Requirements

The **CQA** shall be responsible for the following testing:

- Trial weld verification (10% minimum, randomly selected). Frequency to be increased at the discretion of the **CQA** if conflicting results occur.
- Destructive Test verification (100%). Additional test samples may be collected and tested at the discretion of the **CQA**.

4.4. CQA Reporting and Review of Installer CQC Information

CQA and the **Engineer** will be responsible for reviewing the information submitted by the **Installer's CQC**. This will include the panel deployment log, seaming log, trial weld, destructive testing results, and repair log including non-destructive testing results as well as the as-built information.

The **CQA** shall also produce a daily report (weekly reports may also be required) and a summary for testing completed (Trial Weld and Destructive Test Results) to document activities associated with installation of the geomembrane.

Table 1: HDPE Geomembrane - Smooth
(per GRI Test Method GM13 revision 16 dated March 17, 2021)

Properties	Test Method	Test Value 60 mil (1.5 mm)	Test Value 80 mil (2 mm)	Testing Frequency (minimum)
Thickness (min. avg.)	ASTM D5199	Nominal	Nominal	Each roll
▪ Lowest individual of 10 values		-10%	-10%	
Density g/cc (min.)	ASTM D1505/D792	0.940 g/cc	0.940 g/cc	200,000 lbs
Tensile Properties [1] (min. avg.)	ASTM D6693 Type IV			20,000 lbs
▪ Yield strength		126 lbs/in	168 lbs/in	
▪ Break strength		228 lbs/in	304 lbs/in	
▪ Yield elongation		12%	12%	
▪ Break elongation		700%	700%	
Tear Resistance (min. avg.)	ASTM D1004	42 lbs	56 lbs	45,000 lbs
Puncture Resistance (min. avg.)	ASTM D4833	108 lbs	144 lbs	45,000 lbs
Stress Crack Resistance [2]	ASTM D5397 (Appendix)	500 hrs	500 hrs	Per GRI-GM10
Carbon Black Content (range)	ASTM D4218 [3]	2.0-3.0%	2.0-3.0%	20,000 lbs
Carbon Black Dispersion	ASTM D5596	Note 4	Note 4	45,000 lbs
Oxidative Induction Time (OIT) (min. avg.) [5]				200,000 lbs
a) Standard OIT	ASTM D8117	100 min.	100 min.	
--OR--				
b) High Pressure OIT	ASTM D5885	400 min.	400 min.	
Oven Aging at 85°C [5, 6]	ASTM D5721			Each formulation
a) Standard OIT (min. avg.) – % retained after 90 days	ASTM D8117	55%	55%	
--OR--				
b) High Pressure OIT (min. avg.) – % retained after 90 days	ASTM D5885	80%	80%	
UV Resistance [7]	ASTM D7238			Each formulation
Standard OIT (min. avg.)	ASTM D8117	N.R. [8]	N.R. [8]	
--OR--				
High Pressure OIT (min. avg.) - % retained after 1,600 hrs [9]	ASTM D5885	50%	50%	

1 Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.
Yield elongation is calculated using a gage length of 1.3 inches
Break elongation is calculated using a gage length of 2.0 inches.
2 The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing.
3 Other methods such as D1603 (Tube furnace) or D6370 (TGA) are acceptable if an appropriate correlation to D4218 (muffle furnace) can be established.
4 Carbon black dispersion (only near spherical agglomerates) for 10 different views: 9 in Categories 1 or 2 and 1 in Category 3.
5 The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.
6 It is also recommended to evaluate samples at 30 and 60 days to compare with the 90-day response.
7 The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.
8 Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.
9 UV resistance is based on percent-retained value regardless of the original HP-OIT value.

Table 2: HDPE Geomembrane - Textured

(per GRI Test Method GM13 revision *GM13 revision 16 dated March 17, 2021*)

Properties	Test Method	Test Value		Testing Frequency (minimum)
		60 mils (1.5 mm)	80 mils (2.0 mm)	
Thickness (min. avg.)	ASTM D5994	Nominal (-5%)	Nominal (-5%)	Per roll
▪ Lowest individual for 8 out of 10 values		-10%	-10%	
▪ Lowest individual for any of the 10 values		-15%	-15%	
Asperity Height mils (min. avg.)	ASTM D7466	16 mil	16 mil	Every 2nd roll[1]
Density mg/L (min. avg.)	ASTM D1505/D792	0.940 g/cc	0.940 g/cc	200,000 lbs
Tensile Properties [2] (min. avg.)	ASTM D6693 Type IV			20,000 lbs
▪ Yield strength		126 lbs/in	168 lbs/in	
▪ Break strength		90 lbs/in	120 lbs/in	
▪ Yield elongation		12%	12%	
▪ Break elongation		100%	100%	
Tear Resistance (min. avg.)	ASTM D1004	42 lbs	56 lbs	45,000 lbs
Puncture Resistance (min. avg.)	ASTM D4833	90 lbs	120 lbs	45,000 lbs
Stress Crack Resistance [3]	ASTM D5397 (App.)	500 hrs	500 hrs	Per GRI-GM10
Carbon Black Content (range)	ASTM D4218 [4]	2.0-3.0%	2.0-3.0%	20,000 lbs
Carbon Black Dispersion	ASTM D5596	Note 5	Note 5	45,000 lbs
Oxidative Induction Time (OIT) (min. avg.) [6]				200,000 lbs
a) Standard OIT	ASTM D8117	100 min.	100 min.	
--OR--				
b) High Pressure OIT	ASTM D5885	400 min.	400 min.	
Oven Aging at 85°C [6, 7]	ASTM D5721			Each formulation
a) Standard OIT (min. avg.) - % retained after 90 days	ASTM D8117	55%	55%	
--OR--				
b) High Pressure OIT (min. avg.) - % retained after 90 days	ASTM D5885	80%	80%	
UV Resistance[8]	ASTM D7238			Each formulation
a) Standard OIT (min. avg.)	ASTM D8117	N.R.[9]	N.R.[9]	
--OR--				
b) High Pressure OIT (min. avg.) - % retained after 1,600 hrs [10]	ASTM D5885	50%	50%	

[1] Alternate the measurement side for double-sided textured sheet.
[2] Machine direction (MD) and cross-machine direction (XMD) average values should be on the basis of five (5) test specimens each direction.
Yield elongation is calculated using a gauge length of 1.3 inches.
Break elongation is calculated using a gauge length of 2.0 inches.
[3] SP-NCTL test is not appropriate for testing geomembranes with textured or irregular rough surfaces. Test should be conducted on smooth edges of textured rolls or on smooth sheets made from the same formulation as being used for the textured sheet materials. The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing.
[4] Other methods, such as D1603 (tube furnace) orD6370 (TGA) are acceptable if an appropriate correlation to D4218 (muffle furnace) can be established.
[5] Carbon black dispersion (only near spherical agglomerates) for ten (10) different views: Nine (9) in Categories 1 or 2 and one (1) in Category 3.
[6] The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.
[7] It is also recommended to evaluate samples at 30 and 60 days to compare with the 90-day response.
[8] The condition of the test should be 20-hour UV cycle at 75°C followed by 4-hour condensation at 60°C.
[9] Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV-exposed samples.
[10] UV resistance is based on percent-retained value regardless of the original HP-OIT value.

Table 3: Seam Strength and Related Properties of Thermally Bonded Smooth and Textured HDPE Geomembranes (per GRI Test Method GM19a Revision 10 dated March 18, 2021)

Geomembrane Nominal Thickness	60 mil (1.5 mm)	80 mil (2.0 mm)
Hot Wedge Seams [1]		
Shear strength (lbs/in.)	120	160
Shear elongation at break [2] (%)	50	50
Peel strength (lbs/in.)	91	121
Peel separation (%)	25	25
Extrusion Fillet Seams		
Shear strength (lbs/in.)	120	160
Shear elongation at break [2] (%)	50	50
Peel strength (lbs/in.)	78	104
Peel separation (%)	25	25

[1] **Also for hot air and ultrasonic seaming methods.**

[2] **Elongation measurements should be omitted for field testing.**

Table 4: Raw Material Properties

Property	Test Method	HDPE
Density (g/cm^3)	ASTM D1505	$\geq$0.932
Melt Flow Index (g/10 min)	ASTM D1238 (190/2.16)	$\leq$1.0
OIT (minutes)	ASTM D8117 (1atm/200°C)	$\geq$100

GEOTEXTILE

Technical Specifications

NewFields	**CLIENT** SOUTH32 HERMOSA INC.			**PROJECT NO** 475.0014.035
PROJECT	TAILINGS STORAGE FACILITY 1 (TSF1) AQUIFER PROTECTION PERMIT (APP) SIGNIFICANT AMENDMENT BEST AVAILABLE DEMONSTRATED CONTROL TECHNOLOGY (BADCT) DESIGN			
TITLE	TECHNICAL SPECIFICATIONS FOR GEOTEXTILE MATERIALS AND CONSTRUCTION			**SPECIFICATION NO.** 0014-SPT-GT

REV	**DATE**	**PAGES**	**APPROVALS**			**REMARKS**
			AUTHOR	**REVIEW**	**CLIENT**	
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1. GENERAL

1.1. Scope

This specification defines the requirements for geotextile materials, installation, and quality control for use as a protection (cushioning) material and as a separation material associated with the South32 Hermosa Inc. (**Owner**) Tailings Storage Facility 1 (TSF1).

Any alternatives or exceptions to this specification shall be submitted in writing to the **Owner** or its designated representatives and shall be approved by the **Engineer**.

The owner's engineer shall control the quality of construction and shall verify that all construction elements have been completed in accordance with Design Drawings and Technical Specifications.

1.2. Definition of Terms

- "**Owner**" is defined as South32 Hermosa Inc. or any of its authorized representative(s) / agent(s).
- "**Engineer**" is defined as the **Consultant** or **Engineering Company** (NewFields) responsible for the detailed design or any of its authorized representative(s)/ agent(s).
- **"Construction Manager"** is defined as the **Consultant** or **Engineering Company** (to be determined) responsible for the overall project completion.
- "**Construction Quality Assurance (CQA)**" is defined as the **Consultant** or **Engineering Company** (to be determined) hired by the **Owner** to provide independent inspection and testing services for the overall project.
- "**Contractor**" is defined as the party(s) that has executed the contract agreement for the specified Work with the **Owner** or its authorized representative(s)/agent(s).
- "Specifications" are defined as this document, all supplemental addenda, and any modifications furnished by the **Owner**, the **Engineer**, or others that apply to the Work.
- "Drawings" are defined as the "Hermosa Project Tailings Storage Facility 1 (TSF1)" Drawings furnished by the **Owner**, **Engineer**, or others that apply to the "Work".
- "Site" is defined as the area being developed by the **Owner** and where the Work is to be completed as described in these Technical Specifications and detailed on the Drawings.
- "Contract" is defined as the document executed by the **Owner** or its authorized representative(s)/agent(s) with the **Contractor** to complete specified portions of the Work.
- "Work" is defined as the entire completed construction or the various separately identifiable parts thereof required to be furnished as shown on the Drawings and as described in the Specifications and Contract Documents.

- "Modifications" are defined as changes made to the Specifications or the Drawings that are approved by **Owner** and **Engineer** in writing, after the Specifications and Drawings have been issued for construction. These also refer to changes to design elements in the field to account for unforeseen conditions.
- "Plant" is defined as all equipment, supplies, accommodations, temporary offices, etc., required to complete the Work.
- "Units" – In general, these Specifications and the Drawings will utilize Imperial units, however Metric units will be used when appropriate.

1.3. References

All tests shall be performed in accordance with the current edition of the American Society for Testing and Materials (ASTM), Geosynthetic Research Institute (GRI), American Association of State Highway and Transportation Officials (AASHTO) or other Testing Standards as indicated below.

1.3.1. American Society for Testing and Materials (ASTM):

- ASTM D1883-21: Standard Test Method for California Bearing Ratio (CBR) of Laboratory-Compacted Soils
- ASTM D4354-12(2020): Standard Practice for Sampling of Geosynthetics and Rolled Erosion Control Products (RECP's) for Testing
- ASTM D4491-22: Standard Test Methods for Water Permeability of Geotextiles by Permittivity
- ASTM D4533-15: Standard Test Method for Trapezoid Tearing Strength of Geotextiles
- ASTM D4632-15a: Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
- ASTM D4751-21a: Standard Test Methods for Determining Apparent Opening Size of a Geotextile
- ASTM D4759-11(2018)e1: Standard Practice for Determining the Specification Conformance of Geosynthetics
- ASTM D4873-17(2021): Standard Guide for Identification, Storage and Handling of Geosynthetic Rolls and Samples
- ASTM D5035-11(2019): Standard Test Method for Breaking Force and Elongation of Textile Fabrics (Strip Method)
- ASTM D5261-10(2018): Standard Test Method for Measuring Mass per Unit Area of Geotextiles
- ASTM D6241-22a: Standard Test Method for Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe

- ASTM D7238-20: Standard Test Method for Effect of Exposure of Unreinforced Polyolefin Geomembrane Using Fluorescent UV Condensation Apparatus

1.3.2. American Association of State Highway and Transportation Officials (AASHTO):

- M288: Standard Specification for Geosynthetic Specification for Highway Applications

1.3.3. Geosynthetic Research Institute (GRI):

- GRI GT12(a) Revision 2 dated March 3, 2016: Test Methods and Properties for Nonwoven Geotextiles Used as Protection (or Cushioning) Materials
- GRI GT13(a) Revision 4 dated June 20, 2017: Test Methods and Properties for Geotextiles Used as Separation between Subgrade Soil and Aggregate

2. SUBMITTALS

2.1. Submittals Post-Award

- Prior to material delivery to the project site, the **Contractor** shall provide the **Engineer** with a written certification or manufacturers quality control data which displays that the geotextile meets or exceeds the values specified herein.
- The **Contractor** shall submit, if required by the **Engineer**, the manufacturer's quality control manual for the geotextile to be delivered to the site.

2.2. Manufacturer's Quality Control

- Manufacturer quality control certificates stating the name of the manufacturer, product name, style number, chemical composition of the filaments or yarns, and other pertinent information to fully describe the geotextile.
- The manufacturer is responsible for establishing and maintaining a quality control program to assure compliance with the requirements of the Specification. Documentation describing the quality control program shall be made available upon request.
- The manufacturer's certificate shall state that the finished geotextile meets the minimum average roll value (MARV) requirements of the Specification as evaluated under the manufacturer's quality control program. A person having legal authority to bind the manufacturer shall attest to the certificate.
- Mislabeling or misrepresentation of materials shall be reason to reject those geotextile products.

3. SHIPMENT, STORAGE AND HANDLING

Geotextile labelling, shipment and storage shall follow ASTM D4873. Product labels shall clearly show the manufacturer or supplier name, style, and roll number. Each shipping document shall include a notation certifying that the material is in accordance with the manufacturer's certificate.

Each geotextile roll shall be wrapped with a material that will protect the geotextile, including the ends of the roll, from damage due to shipment, water, sunlight, and contaminants. The protective wrapping shall be maintained during periods of shipment and storage.

During storage, geotextile rolls shall be elevated off the ground and adequately covered to protect them from the following: site construction damage, precipitation, extended ultraviolet radiation including sunlight, chemicals that are strong acids or strong bases, flames including welding sparks, temperatures in excess of 160°F (71°C), and any other environmental condition that may damage the property values of the geotextile.

4. GEOTEXTILE MATERIAL

- The nonwoven needle punched geotextile specified herein shall be made from staple fiber.
- The geotextile shall be of new prime quality virgin polymer of 100-percent polyethylene (97-percent polypropylene and 3-percent carbon black with antioxidants and heat stabilizers), or polyester/polypropylene blend designed and manufactured specifically for the purpose of separation, tensile reinforcement, planar flow, filtration, and protection and shall be used as designated on the Drawings.
- The geotextile shall be able to withstand direct exposure to ultraviolet radiation from the Sun for up to 15 days without any noticeable effect on index or performance properties.
- Rolls shall be free of holes, contamination, and foreign debris.
- Geotextile shall meet or exceed all material properties listed herein based on the specific purpose and expected conditions.

Table 1 – Required Properties, Test Methods and Values for Geotextiles Used as Geomembrane Protection (or Cushioning) Materials

Property[1]	Test Method ASTM	Unit	Mass/Unit Area (oz/yd^2)					
Mass per unit area	D5261	oz/yd^2	10	12	16	24	32	60
Grab Tensile strength	D4632	lb	230	300	370	450	500	630
Grab tensile elongation	D4632	%	50	50	50	50	50	50
Trap. Tear strength	D4533	lb	95	115	145	200	215	290
Puncture (CBR) strength	D6241	lb	700	800	900	1100	1700	2400
UV resistance[2]	D7238	%	70	70	70	70	70	70

Notes: 1) All values are MARV except UV resistance which is a minimum value. For geosynthetics, MARV is a manufacturing quality control tool used to establish published values such that the purchaser will have a 97.7% confidence that the property in question will meet published values. For normally distributed data, "MARV" is calculated as the typical value minus two (2) standard deviations from documented quality control test results for a defined population from one specific test method associated with one specific property.

2) Evaluation to be on 50mm strip tensile specimens per ASTM D5035 after 500 lt. hours exposure.

- For the purposes of separation, the geotextile shall meet the minimum required values as defined in the Tables 2, 3 and 4 below with the exception of AOS which is maximum average roll value (MaxARV) and UV stability which is a minimum average value:

Table 2 – Geotextile Properties Class 1 (High Survivability)

Property[1]	ASTM Test	Unit	Elongation < 50%	Elongation $\geq$ 50%
Grab Tensile Strength	D4632	lb	315	203
Trapezoid Tear Strength	D4533	lb	112	79
CBR Puncture Strength	D6241	lb	630	440
Permittivity	D4491	sec^{-1}	0.02	0.02
Apparent Opening Size	D4751	in	0.024	0.024
UV Stability[2]	D7238	% Str. Ret. @ 500 lt. hours	80	80

Notes: 1) All values are minimum average roll values (MARV) except AOX which is a maximum average roll value (MaxARV) and UV stability which is a minimum average value.
2) Evaluation to be on 2.0-inch strip tensile specimens after 500 hours exposure.

Table 3 – Geotextile Properties Class 2 (Moderate Survivability)

Property[1]	ASTM Test	Unit	Elongation < 50%	Elongation $\geq$ 50%
Grab Tensile Strength	D4632	lb	248	158
Trapezoid Tear Strength	D4533	lb	90	56
CBR Puncture Strength	D6241	lb	500	320
Permittivity	D4491	sec^{-1}	0.02	0.02
Apparent Opening Size	D4751	in	0.024	0.024
UV Stability[2]	D7238	% Str. Ret. @ 500 lt. hours	70	70

Notes: 1) All values are minimum average roll values (MARV) except AOX which is a maximum average roll value (MaxARV) and UV stability which is a minimum average value.
2) Evaluation to be on 2.0-inch strip tensile specimens after 500 hours exposure.

Table 4 – Geotextile Properties Class 3 (Low Survivability)

Property[1]	ASTM Test	Unit	Elongation < 50%	Elongation $\geq$ 50%
Grab Tensile Strength	D4632	lb	180	113
Trapezoid Tear Strength	D4533	lb	68	41
CBR Puncture Strength	D6241	lb	380	230
Permittivity	D4491	sec^{-1}	0.02	0.02
Apparent Opening Size	D4751	in	0.024	0.024
UV Stability[2]	D7238	% Str. Ret. @ 500 lt. hours	60	60

Notes: 1) All values are minimum average roll values (MARV) except AOX which is a maximum average roll value (MaxARV) and UV stability which is a minimum average value.
2) Evaluation to be on 2.0-inch strip tensile specimens after 500 hours exposure.

Table 5 – Required Degree of Survivability as a Function of Subgrade Conditions, Construction Equipment and Lift Thickness (Class 1, 2 and 3 Properties are Given in Table 3, 4 and 5; Class 1+ Properties are Higher than Class 1 but Not Defined at this Time)

	Low ground-pressure equipment ≤ 25 kPa (3.6 psi)	**Medium ground-pressure equipment > 25 to ≤ 50 kPa (> 3.6 to ≤ 7.3 psi)**	**High ground-pressure equipment > 50 kPa (> 7.3psi)**
Subgrade has been cleared of all obstacles except grass, weeds, leaves and fine wood debris. Surface is smooth and level so that any shallow depressions and humps do not exceed 450 mm (18 in.) in depth or height. All larger depressions are filled. Alternatively, a smooth working table may be placed.	Low (Class 3)	Moderate (Class 2)	High (Class 1)
Subgrade has been cleared of obstacles larger than small to moderate-sized tree limbs and rocks. Tree trunks and stumps should be removed or covered with a partial working table. Depressions and humps should not exceed 450mm (18 in.) in depth or height. Larger depressions should be filled.	Moderate (Class 2)	High (Class 1)	Very High (Class 1+)
Minimal site preparation is required. Trees may be felled, delimbed, and left in place. Stumps should be cut to project not more than ± 150mm (6 in.) above subgrade. Fabric may be draped directly over the tree trunks, stumps, large depressions and humps, holes, stream channels, and large boulders. Items should be removed only if placing the fabric and cover material over them will distort the finished road surface.	High (Class 1)	Very High (Class 1+)	Not Recommended

***Recommendations are for 150 to 300 mm (6 to 12 in.) initial lift thickness. For other initial lift thicknesses:**
300 to 450mm (12 to 18 in.): reduce survivability requirement one level.
450 to 600mm (18 to 24 in.): reduce survivability requirement two levels.
>600mm (24 in.): reduce survivability requirement three levels.
Note 1: While separation occurs in every geotextile application, this pavement-related specification focuses on subgrade soils being "firm" as indicated by CBR values higher then 3.0 (soaked) or 8.0 (un-soaked).
Source: Modified after Christopher, Holtz, and DiMaggio

5. EXECUTION

5.1. Quality Assurance

- The **Engineer** or **CQA** shall examine the geotextile rolls upon delivery to the site and report any deviations from project Specifications to the **Contractor**.
- The **Engineer** may decide to arrange conformance testing of the rolls delivered to the job site. For this purpose, the **Engineer** shall take a sample three feet (along roll length) by roll width according to ASTM D4354. The sample shall be properly marked, wrapped, and sent to an independent laboratory for conformance testing.
- The pass or fail of the conformance test results shall be determined according to ASTM D4759.

5.2. Installation

- The geotextile shall be handled in such a manner as to ensure that it is not damaged in any way. Should the **Contractor** damage the geotextile to the extent that it is no longer usable as determined by these Specifications or by the **Engineer** or **CQA**, the **Contractor** shall replace the geotextile at their own cost.
- The geotextile shall be installed to the lines and grades as shown on the Drawings and as described herein.
- The geotextile shall be rolled down the slope in such a manner as to continuously keep the geotextile in tension by self-weight. The geotextile shall be securely anchored in an anchor trench where applicable, or by other approved or specified methods.
- In the presence of wind, all geotextiles shall be weighted by sandbags or approved equivalent. Such anchors shall be installed during placement and shall remain in place until replaced with cover material.
- The **Contractor** shall take necessary precautions to prevent damage to adjacent or underlying materials during placement of the geotextile. Should damage to such material occur due to the fault of the **Contractor**, the **Contractor** shall repair the damaged materials at their own cost and to the satisfaction of the **Engineer**.
- During placement of the geotextile, care shall be taken not to entrap soil, stones or excessive moisture that could hamper subsequent seaming of the geotextile as judged by the **Engineer** or **CQA**.
- The geotextile shall not be exposed to precipitation prior to being installed and shall not be exposed to direct sun light for more than 15 days after installation.
- The geotextile shall be seamed using heat seaming or stitching methods as recommended by the manufacturer and approved by the **Engineer**. Sewn seams shall be made using polymeric thread with chemical resistance equal to or exceeding that of the geotextile. All sewn seams shall be continuous. Seams shall be oriented down slopes perpendicular to grading contours unless otherwise specified. For heat seaming, fusion welding techniques recommended by the manufacturer shall be used.
- The **Contractor** shall not use heavy equipment to traffic above the geotextile without approved protection.
- The geotextile shall be covered as soon as possible after installation and approval. Installed geotextile shall not be left exposed for more than 15 days.
- Material overlying the geotextile shall be carefully placed to avoid wrinkling or damage to the geotextile.
- Holes in the geotextile material shall be repaired using a patch of identical material extending a minimum 6 inches on all sides of the hole and heat bonded. If heat bonding is not possible, the patch shall extend a minimum of 18 inches on all sides of the hole.

- In areas where the non-woven geotextile is used as separation or filtration, care shall be taken to install the layer without producing holes or gaps where the migration of fines could occur. This is accomplished by ensuring sufficient overlap of seams of 18-inches minimum and properly wrapping the edges of the geotextile under the gravel areas being protected or by over running the edges of the geotextile beyond the area requiring separation or filtration.

6. CERTIFICATION

At the completion of the geotextile installation, the **Contractor** shall provide the **CQA** and **Owner** with a certification stating that the geotextile was installed and tested in accordance with the Specifications together with a report of the test results. The certification shall be provided to the **CQA** and **Owner** prior to the demobilization of the installation personnel from the site unless agreed otherwise by the **Owner**. The report of the test results shall be provided to the **Owner** and the **Engineer** no later than 30 days after the installation work has been completed.

GEOTECHNICAL INSTRUMENTATION
Technical Specifications

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1. GENERAL

This specification defines the requirements for the geotechnical instrumentation materials and installation associated with the South32 Hermosa Inc. (**Owner**) Tailings Storage Facility 1 (TSF1).

Any alternatives or exceptions to this specification shall be submitted in writing to the **Owner** or its designated representative and shall be approved by the **Engineer.**

All piezometers and associated installation elements shall be placed by a specialty contractor with experience in placement of instruments, proper routing and bedding of cable and connection to a terminal readout box. The owner's engineer shall control the quality of construction and shall verify that all construction elements have been completed in accordance with Design Drawings and Technical Specifications.

1.1. Definition of Terms

- "**Owner**" is defined as South32 Hermosa Inc. or any of its authorized representative(s) / agent(s).
- "**Engineer**" is defined as the **Consultant** or **Engineering Company** (NewFields) responsible for the detailed design or any of its authorized representative(s)/ agent(s).
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been issued for construction. These also refer to changes to design elements in the field to account for unforeseen conditions.

- “Plant” is defined as all equipment, supplies, accommodations, temporary offices, etc., required to complete the Work.
- “Units” – In general, these Specifications and the Drawings will utilize Imperial units, however Metric units will be used when appropriate.

2. PIEZOMETERS

Vibrating wire piezometers will be placed as shown on the Drawings. The vibrating wire piezometer consists of a transducer that uses a pressure sensitive diaphragm with a vibrating wire element attached to it. The diaphragm is welded to a capsule that is evacuated and hermetically sealed. Fluid pressures acting upon the outer face of the diaphragm cause deflections of the diaphragm and changes in tension and frequency of the vibrating wire. The changing frequency is sensed and transmitted to the readout device by electrical coil acting through the wall of the capsule. Piezometers incorporate a porous filter stone ahead of the diaphragm, which allows the fluid to pass through but prevents soil particles from impinging directly on the diaphragm.

2.1. Piezometer and Pressure Transducer

The piezometer shall have an average accuracy of 0.1 percent over its entire pressure range of 0 to 350 kPa (0 to 50 psi). Calibration data must be provided with each instrument. The transducer shall be capable of operation in temperatures from -20°C to 80°C. The transducer shall have an over-pressurization capability of two times (2x) the rated pressure. Each piezometer shall be provided with a 50-micron sintered stainless steel filter. All materials shall be stainless steel except the vibrating wire. The interior shall be hermetically sealed to provide a stable, inert atmosphere around the wire to ensure long life of the gauge. Each piezometer shall be equipped with a thermistor with a range of -50°C to 60°C with an accuracy of ±1°C. Vibrating wire piezometers shall be as manufactured by Geokon, Inc., 48 Spencer Street, Lebanon, New Hampshire 03766, Model No. 4500HD Heavy Duty (350 kPa/50 psi) or approved equal.

2.2. Piezometer Cable

Each vibrating wire piezometer will be furnished with sufficient electrical cable for its required length, an additional 5 percent for slack, and an additional 10 feet per instrument connection to readout box. The cables shall be waterproof with good electrical properties. Each cable shall be four-conductor wires of commercially pure annealed copper or tinned copper. The conductors shall be installed with colored insulating-grade, 10-mil high-density polypropylene. All conductors in any single length of wire shall be insulated with the same type of material. The piezometer conductor insulation colors shall be red, white, black, and green. The four conductor wires shall be jacketed with extruded PVC temperature rated from -20°C to +80°C or other approved equivalent.

Each cable shall be attached to the appropriate piezometer and permanently marked with the number of the instrument to which it is attached. This marking shall be every 10 feet over the length of the cable and shall be placed on the cable by the instrument manufacturer prior to shipment to the construction site. Each cable shall be mounted on a reel and protected to prevent damage during shipping. Each reel shall be stenciled or labeled with the name of the instrument, and all wire ends shall be capped on the open end of the wire on the reel. The electrical cables shall be Geokon Model No. 02-500PE1 or approved equal.

2.3. Piezometer Readout Equipment

A Model GK-405 readout box will be used for collecting data from the piezometers and supplied by the **Contractor** to the **Owner** at the end of the Project.

All piezometer leads shall terminate at a common location as shown on the Drawings. All leads shall be clearly marked with each instrument number on the terminal panels. A lockable, waterproof, and dust-resistant steel Geokon Model 4999 Terminal Box is required to house the terminal ends of the cables at each location. The box shall be mounted on a reading platform as shown on the Drawings.

2.4. Piezometer Initial Readings

Upon receipt of the piezometers, their zero readings shall be checked and noted. Connections from the GK-405 readout are normally black-to-black and red-to-red, etc. The thermistor, included inside the body of each piezometer, is read on the green-and-white connectors.

Calibration data is supplied with each piezometer. This includes a zero reading at a specific temperature and barometric pressure. Zero readings at the site should coincide with the factory readings within a few digits after barometric and temperature corrections are made. According to Geokon, the factory elevation is approximately 580 feet. Barometric pressure changes with elevation at a rate of approximately 0.16 psi per 3,280 feet.

For accurate results, total saturation of the filter is necessary prior to installation. For the low air entry filter normally supplied, this saturation occurs as the tip is lowered into water. Water is forced into the filter, compressing the air in the space between the filter stone and the pressure sensitive diaphragm. After a period, this air will dissolve into the water until the space and the filter are entirely filled with water. (To maintain saturation, the unit should be kept under water until installation.) Refer to the vendor's instruction manual for the proper procedure for saturating (de-airing) the filter tip.

It is important that the temperature of the piezometer be uniform and held constant. Otherwise, variations in temperature across the body of the piezometer will give rise to temperature transients and spurious readings. These are particularly noticeable if the piezometer is gripped momentarily in the hand.

When measuring the in situ zero pressure reading, the piezometer must be maintained in a constant temperature environment for a period of about 30 minutes.

2.5. Piezometer Installation

The piezometers will be installed as shown on the Drawings. Installation procedures will be as follows:

- Piezometers with adequate cable length will be fabricated in the factory. Actual field measurements will determine the specific lengths based on installation near the locations shown on the Drawings.
- Piezometers will be placed at each location and laid within a sand wrap as shown on the Drawings.
- Piezometer cables are to be placed in a protective HDPE pipe.
- The piezometer cable and protective HDPE pipe located outside the geomembrane limits will be constructed in accordance with the Drawings. Piezometer cables are to be hand backfilled with fine grained materials to provide at least 6 inches of bedding and 12 inches of cover below/above the cables.
- Piezometer cable and protective HDPE pipe placed within the geomembrane limits to be constructed within the protective layer.
- The **Contractor** will perform an as-built survey of all piezometer locations and elevations before covering it with fill material.

SURVEY AND AS-BUILTS
Technical Specifications

NewFields	CLIENT SOUTH32 HERMOSA INC.	PROJECT NO 475.0014.035

PROJECT TAILINGS STORAGE FACILITY 1 (TSF1)
AQUIFER PROTECTION PERMIT (APP) SIGNIFICANT AMENDMENT
BEST AVAILABLE DEMONSTRATED CONTROL TECHNOLOGY (BADCT) DESIGN

TITLE TECHNICAL SPECIFICATIONS FOR SURVEY AND AS-BUILTS	**SPECIFICATION NO.** 0014 SPT AB.DOCX

REV	DATE	PAGES	APPROVALS			REMARKS
			AUTHOR	REVIEW	CLIENT	
0	10/27/2023	4	CMT	RMS		Issued for Tender

TABLE OF CONTENTS

1. GENERAL

This Specification defines the requirements for the survey, as-built drawings and record drawings associated with the South32 Hermosa Inc. (**Owner**) Tailings Storage Facility 1 (TSF1).

Any alternatives or exceptions to this Specification shall be submitted in writing to the **Owner** or its designated representative with the bid.

The **Owner** will perform basic construction surveying to establish horizontal and vertical control. The **Contractor** will perform surveys of completed works for payment/quantity tracking and as-built records and may be required to perform progress surveys as requested by the **Owner**. The **Owner** reserves the right to perform duplicate surveys of the completed works to verify payment/quantity tracking.

1.1. Definition of Terms

- "**Owner**" is defined as South32 Hermosa Inc. or any of its authorized representative(s) / agent(s).
- "**Engineer**" is defined as the **Consultant** or **Engineering Company** (NewFields) responsible for the detailed design or any of its authorized representative(s)/ agent(s).
- "**Construction Manager**" is defined as the **Consultant** or **Engineering Company** (to be determined) responsible for the overall project completion.
- "**Construction Quality Assurance (CQA)**" is defined as the **Consultant** or **Engineering Company** (to be determined) hired by the **Owner** to provide independent inspection and testing services for the overall project.
- "**Contractor**" is defined as the party(s) that has executed the contract agreement for the specified Work with the **Owner** or its authorized representative(s)/agent(s).
- "Specifications" are defined as this document, all supplemental addenda, and any modifications furnished by the **Owner**, the **Engineer**, or others that apply to the Work.
- "Drawings" are defined as the "Hermosa Project Tailings Storage Facility 1 (TSF1)" Drawings furnished by the **Owner**, **Engineer**, or others that apply to the "Work".
- "Site" is defined as the area being developed by the **Owner** and where the Work is to be completed as described in these Technical Specifications and detailed on the Drawings.
- "Contract" is defined as the document executed by the **Owner** or its authorized representative(s)/agent(s) with the **Contractor** to complete specified portions of the Work.
- "Work" is defined as the entire completed construction or the various separately identifiable parts thereof required to be furnished as shown on the Drawings and as described in the Specifications and Contract Documents.
- "Modifications" are defined as changes made to the Specifications or the Drawings that are approved by **Owner** and **Engineer** in writing, after the Specifications and Drawings have been

"Issued for Construction". These also refer to changes to design elements in the field to account for unforeseen conditions.

- "Units" - In general, these Specifications and the Drawings will utilize Imperial units, however Metric units will be used when appropriate.

2. EARTHWORK SURVEY REQUIREMENTS

Mapping accuracy may require adjustments to the plan elevations due to actual field conditions. Any proposed changes shall be submitted in writing and are subject to review and approval by the **Engineer**.

The construction tolerances are defined in **Specification No. 0014-SPT-EW**.

2.1. Owner

The **Owner** will perform basic construction surveying to establish horizontal and vertical control for the project. The **Owner** will provide a pre-construction survey to the **Engineer** and **Contractor**, to be used in determining earthworks quantities. The **Owner** may use their own surveyor to verify the **Contractor** surveys. The **Owner** will be responsible for the as-built surveys performed on the project. At a minimum, as-built surveys and drawings are required for the following work-related elements:

- The surface after growth media removal or existing grade surface in areas of improvements where growth media removal is not required.
- Finished subgrade in the TSF area. This survey must be provided electronically (AutoCAD V. 2021 or compatible) to the **Construction Manager** and **Engineer** at least three (3) working days prior to LPSL or GCL placement.
- Top of LPSL and GCL. This survey must be provided electronically (AutoCAD v. 2021 or compatible) to the **Construction Manager** and **Engineer** at least three (3) working days prior to geomembrane lining activities.
- Locations of all geomembrane limits and anchor trenches.
- Locations of all GCL limits and anchor trenches.
- Finished grade of all construction areas.
- Top of protective layer in the TSF area.
- All piping, including instrumentation, valves, and flow measurement devices.

The as-built drawings shall consist of topographic maps of the finished grade surfaces and shall provide sufficient detail to allow for verification of the various project elements, including (but not limited to) elevation, grades and location of access roads, stormwater diversion channel and toes of perimeter cuts and fills. No areas within the scope of the project shall be covered with geomembrane liner without written approval of the **Engineer**, the **Owner**, and the **Construction Manager**.

Any areas found to be deficient shall be rectified by the Earthwork **Contractor** at no additional cost to the **Owner**. Additional electronic as-built drawings shall be provided to the **Construction Manager** and the **Engineer** for review and approval for any rectified areas prior to geomembrane liner placement.

Final as-built drawings shall require sealing by a Professional Land Surveyor registered in the State of Arizona. Each drawing shall be submitted to the **Construction Manager**. Drawings shall be provided in 11x17-inch size and 24x36-inch (or 24x34-inch) size (if requested by the **Owner**) and shall be in color. The **Construction Manager** will indicate the number and size of drawings required for **Owner** records and for inclusion in the Record of Construction (ROC) Report.

2.2. Contractor

Interim construction surveys and slope staking required to perform the work and assure completion to the specified lines and grades will be the **Contractor's** responsibility. This may require surveying buried components (subgrade, underliner, pipes, etc.) to verify compliance with the design drawings, bid documents and Technical Specifications before they are covered. Quantities presented on **Contractor** payment applications shall be supported by survey data as required by the bid documents. **Contractor** shall make this survey data available at the request of the **Owner**.

3. GEOMEMBRANE LINER AS-BUILT DRAWINGS

As-built surveyed drawings documenting the layout and numbering of panels, roll numbers, and destructive sample locations for each element of the project shall be required. Panel seam locations, destructive sample locations and repairs shall be surveyed and included with the as-built drawings. As-built drawings based on the required survey shall be submitted to the **Construction Manager** and the **Engineer** within five (5) business days of the completion of the liner installation. As-built drawings shall be prepared and submitted in paper and electronic format. The Liner **Contractor** shall provide draft as-built drawings to the **Engineer** for review prior to finalization. As-built drawings shall be prepared and submitted in paper and electronic format (AutoCAD v. 2021 or compatible). Full color as-built drawings on company title block, in 11x17-inch size and 24x36-inch (or 24x34-inch) size (if requested by the **Owner**) shall be submitted to the **Construction Manager** for inclusion in the final ROC Report. The **Construction Manager** will indicate the number and size of drawings required for **Owner** records and for inclusion in the ROC Report.

4. RECORD DRAWINGS

The **Engineer** shall provide record drawings documenting all revisions to the Drawings approved during construction. Any proposed Modifications require approval by the **Owner** and the **Engineer** and may be subject to permit restrictions or modifications and therefore require thorough consideration before the Modification can be approved. The **Engineer** shall provide draft record drawings to the **Owner** for review prior to finalization. Record drawings shall be prepared and submitted in paper and electronic format (AutoCAD v. 2021 or compatible). Full color as-built drawings on company title block, in 11x17-inch and 24x36-inch (or 22x34-inch) size (if requested by the **Owner**) shall be submitted to the **Construction Manager**. The final record drawings shall be sealed by a Professional Engineer registered in the State of Arizona.

APPENDIX E.2

Technical Data Sheets

BENTOMAT® DN-9

GEOSYNTHETIC CLAY LINER

DESCRIPTION

BENTOMAT DN GCL is a reinforced geosynthetic clay liner (GCL) consisting of a layer of sodium bentonite between two nonwoven geotextiles, which are needlepunched together.

TESTING DATA

PHYSICAL PROPERTIES			
MATERIAL PROPERTY	TEST METHOD	TEST FREQUENCY	REQUIRED VALUES
Bentonite Swell Index[1]	ASTM D5890	1 per 50 tonnes	24 mL/2g min.
Bentonite Fluid Loss[1]	ASTM D5891	1 per 50 tonnes	18 mL max.
Cap Nonwoven Geotextile Mass Per Area	ASTM D5621	200,000 ft^2 (20,000 m^2)	9 oz/yd2 (300 gsm) MARV
Base Nonwoven Geotextile Mass Per Area	ASTM D5621	200,000 ft^2 (20,000 m^2)	6 oz/yd2 (200 gsm) MARV
Bentonite Mass/Area[2]	ASTM D5993	40,000 ft^2 (4,000 m^2)	0.75 lb/ft^2 (3.6 kg/m^2) min.
GCL Grab Strength[3]	ASTM D6768	200,000 ft^2 (20,000 m^2)	50 lbs/in (87.5 N/cm) MARV
GCL Peel Strength[3]	ASTM D6496	40,000 ft^2 (4,000 m^2)	12 lbs/in (21 N/cm) min.
GCL Index Flux[4]	ASTM D5887	Weekly	1×10^{-8} $m^3/m^2/s$ max.
GCL Hydraulic Conductivity[4]	ASTM D5887	Weekly	5×10^{-9} cm/s max.
GCL Hydrated Internal Shear Strength[5]	ASTM D5321 ASTM D6243	Periodic	500 psf (24 kPa) typical @ 200 psf

Notes:

[1] Bentonite property tests performed at a bentonite processing facility before shipment to CETCO's GCL production facilities.

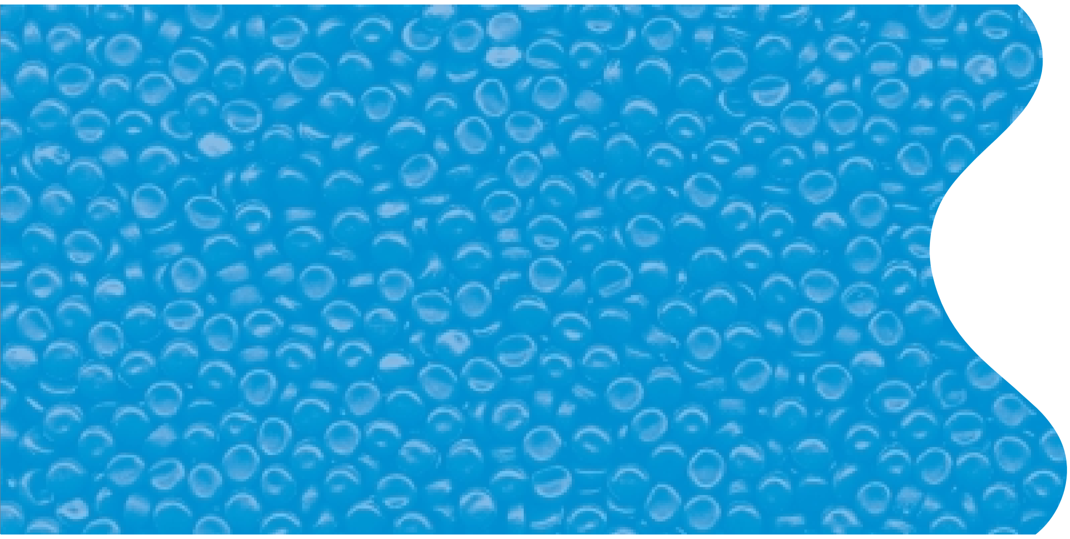
[2] Bentonite mass/area reported at 0% moisture content.

[3] All tensile strength testing is performed in the machine direction using ASTM D6768. All peel strength testing is performed using ASTM D6496. Upon request, tensile and peel results can be reported per modified ASTM D4632 using 4 inch grips.

[4] Index flux and permeability testing with deaired distilled/deionized water at 80 psi (551kPa) cell pressure, 77 psi (531 kPa) headwater pressure and 75 psi (517 kPa) tailwater pressure. Reported value is equivalent to 925 gal/acre/day. This flux value is equivalent to a permeability of 5x10-9 cm/sec for typical GCL thickness. Actual flux values vary with field condition pressures. The last 20 weekly values prior the end of the production date of the supplied GCL may be provided.

[5] Peak values measured at 200 psf (10 kPa) normal stress for a specimen hydrated for 48 hours. Site-specific materials, GCL products, and test conditions must be used to verify internal and interface strength of the proposed design.

English



Polyethylene

Resistance to chemicals and other media

Lupolen (LDPE, HDPE)

Hostalen (HDPE)

Lupolex (LLDPE)

Luflexen (mLLDPE)

basell
Polyolefins

Formed in October 2000, Basell is owned equally by BASF and Shell. Basell and its joint ventures serve customers in more than 120 countries with materials produced in 18 countries. The company's network of joint ventures expands Basell's technology and market base and enables the company to follow key customers as they expand and globalize their operations.

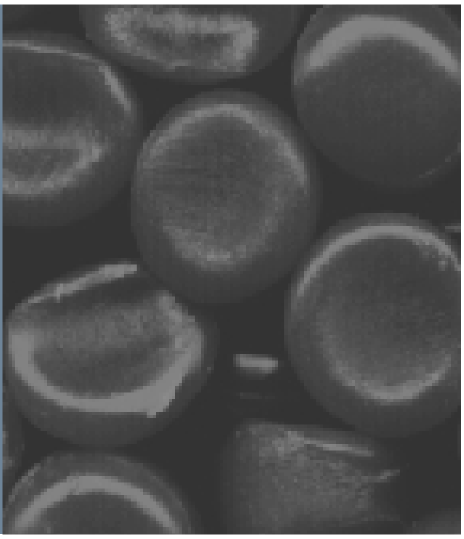
With research and development centers in Europe, North America and the Asia-Pacific region, Basell is continuing and expanding a technological heritage that dates back to the start of the polyolefins industry. The company is committed to continuously extending the property profile of its polyolefins portfolio and to developing with its customers a shared agenda for bringing new products to market as quickly as possible.

Basell is committed to strong Health, Safety and Environmental (HSE) performance. The company's products are used in countless consumer and industrial goods from food and drink packaging to car components, and from household products to underground piping.

Basell's corporate center is located in Hoofddorp, The Netherlands, near Amsterdam. The company has regional offices in Brussels, Belgium; Mainz, Germany; Elkton, Maryland, USA; São Paulo, Brazil; and Hong Kong, as well as sales offices in the major markets around the world.

About Basell

Basell develops, produces and markets polypropylene, polyethylene, advanced polyolefin materials and polyolefin catalysts and also develops and licenses polyolefin processes.



The Resistance to Chemicals

Lupolen, Lupolex, Luflexen and *Hostalen* resins are highly resistant to chemicals due to their hydrocarbon character and degree of crystallinity.

The proportion of crystalline matter in a linear, high-density polyethylene is about 70 to 80 %; in branched polyethylene of low to medium density, 40 to 45 %. The resistance to chemicals is thus reduced in this sequence. The adverse action of chemicals may consist of diffusion through the polyethylene articles, swelling or dissolving, or direct attack, e. g. by oxidation.

Polyethylene is not absolutely impermeable to gases. In fact some liquids, particularly aromatic, aliphatic, and low-boiling chlorinated hydrocarbons, e. g. benzene and carbon tetrachloride, may diffuse through polyethylene even at low temperatures. The higher the temperature and the lower the degree of crystallinity, the greater the diffusion rate.

Lupolen, Lupolex, Luflexen and *Hostalen* resins are completely resistant at room temperature to water, alkalis, solutions of salts, and inorganic acids[1)] (with the exception of those acids that are oxidizing agents). At low temperatures polar liquids, such as alcohols, organic acids, esters, ketones, etc. will generate a very slight swelling of the resins. In contrast aliphatic and aromatic hydrocarbons and their halogen derivatives are taken up more readily and cause considerable swelling.

Swelling is associated with a decrease in strength, but the original properties are restored upon evaporation of the liquid concerned. This is not the case with low-volatile substances, e. g., greases, oils, waxes, etc. Swelling and the related impairment of properties decreases with decreasing temperatures and with increases in crystallinity of the polyethylene.

At elevated temperatures, *Lupolen, Lupolex, Luflexen* and *Hostalen* resins are soluble in aliphatic, aromatic and chlorinated hydrocarbons to an extent depending on their density. The temperature at which these materials are dissolved increases with the degree of crystallinity. For instance, *Lupolen* resins with a density of 0.960 g/cm³ swell only slightly in benzene at the boiling point, whereas *Lupolen* resins with a density of 0.918 g/cm³ dissolve completely.

Despite their good resistance to chemicals, polyethylene mouldings are sometimes subject to environmental stress cracking if they are exposed to the simultaneous action of certain polar liquids and mechanical stresses, particularly tension or bending.

Notorious initiators of environmental stress cracking are silicone and essential oils, alcohols, organic acid, and aqueous solutions of surfactants, e. g., modern detergents, soaps, emulsifying agents etc. aqueous solutions of alkalis, e. g., caustic soda, soda or waterglass, may also give rise to environmental stress cracking, but not to a great extent.

Even if no external load is applied, high moulded-in stresses could favour environmental stress cracking if a moulded part gets in contact with any of the reagents mentioned above. Polyethylene with a low melt index is more resistant to environmental stress cracking.
The resistance to chemicals of *Lupolen, Lupolex, Luflexen* and *Hostalen* resins is included in the attached tables. For the sake of convenience, all the products have been classified into two groups, viz.,

LDPE, LLDPE, mLLDPE
($\rho = 0.918 - 0.935$ g/cm³)

MDPE, HDPE
($\rho = 0.935 - 0.960$ g/cm³)

The results of such chemical resistance tests are often subject to external influences that are difficult to define. For instance, a polyethylene may be listed as resistant to some substances, but may be damaged if it is immersed in each one of them, one after the other. In addition, the temperature, mechanical load, duration of exposure and permissible tolerances can vary considerably in practice. In such cases, Basell should be contacted or practical tests should be conducted.

The purpose of the resistance tables is to give a preliminary idea on the performance of a given moulding or to facilitate selection of suitable grades.

This does not preclude the need to check the chemical resistance of the particular finished article under the specific service conditions as part of overall design testing, e. g. of drums for the transport of dangerous goods. The information listed is not necessarily valid for all applications.

Table

Plastic test specimens were immersed for 60 days in the test substance without mechanical stress and then tested for swelling, weight loss and tensile properties.

Test specimen:
50 mm x 25 mm x 1 mm and test specimen 1B according to ISO 527-2, with dimensions in the ratio 1:4, both taken from compression moulded sheet.

Explanation of symbols:

✚ = **resistant**
tensile strength at yield and elongation at break unchanged

○ = **limited resistance**
tensile strength at yield and elongation at break slightly reduced

▭ = **not resistant**
tensile strength at yield and elongation at break greatly reduced

▽ = **discolouration possible**

★ = **and at boiling point**

★★ = **not applicable to welded joints**
(including joints produced by thermal bending); information available from us or the semifinished product manufacturer

1) Strong acids can cause shade changes, particularly in coloured material
Lupolen, Lupolex, Luflexen and *Hostalen* are trademarks owned or used by Basell

The resistance of *Lupolen, Lupolex, Luflexen* and *Hostalen* resins to chemicals

Substance	Concentration	Behaviour of MDPE/HDPE at 20 °C	60 °C	Behaviour of LDPE/LLDPE/ mLLDPE at 20 °C	60 °C
Acetaldehyde	techn. grade	+	○	+	–
Acetaldehyde, aqueous	any	+	○	+	
Acetaldehyde + acetic acid	90:10	+		+	
Acetamide		+	+	+	
Acetic acid	100 %	+	○▽	+	○▽
Acetic acid, aqueous	70 %	+	+	+	+
Acetic anhydride	techn. grade	+	○▽	+	
Acetoacetic acid		+		+	
Acetone	techn. grade	+	+*	○	
Acetophenone		+		○	
Acetylene		+			
Acids, aromatic		+	+	+	
Acronal® dispersions	as supplied commerc.	+	○	+	
Acrylonitrile	techn. grade	+	+	+	○
Adipic acid, aqueous	saturated	+	+	+	+
Adipic ester		+	○		
Air	techn. grade	+	+	+	+
Aktivin® (chloramine, aqueous 1 %)		+	+	+	+
Allyl acetate		+	+ to ○	+	○
Allyl alcohol (2-propenol-1)	96 %	+	+	○	○
Allyl chloride		○	–	–	–
Aluminium chloride, aqueous	any	+	+	+	+
Aluminium chloride, solid		+	+	+	+
Aluminium fluoride	conc.	+	+	+	+
Aluminium hyroxide		+	+	+	+
Aluminium metaphosphate		+	+	+	+
Aluminium sulphate, aqueous	saturated	+	+	+	+
Aluminium sulphate, solid		+	+	+	+
Alum, aqueous	any	+	+	+	+
Amino acids		+	+	+	+
2-aminoethanol (ethanolamine)	techn. grade	+		+	
Ammonia, gaseous		+	+	+	
Ammonia, liquid		+		+	
Ammonia water	any	+	+	+	
Ammonium acetate, aqueous	any	+	+	+	+
Ammonium bicarbonate, aqueous	saturated	+	+	+	+
Ammonium carbonate, aqueous	any	+	+	+	+
Ammonium chloride, aqueous	any	+	+	+	+
Ammonium fluoride, aqueous	saturated	+	+	+	+
Ammonium hydrosulphide, aqueous	any	+	+	+	+
Ammonium metaphosphate		+	+	+	+
Ammonium nitrate, aqueous	any	+	+	+	+
Ammonium phosphate, aqueous	any	+	+	+	+
Ammonium sulphate, aqueous	any	+	+	+	+

Substance	Concentration	Behaviour of MDPE/HDPE at 20 °C	Behaviour of MDPE/HDPE at 60 °C	Behaviour of LDPE/LLDPE/mLLDPE at 20 °C	Behaviour of LDPE/LLDPE/mLLDPE at 60 °C
Ammonium sulphide, aqueous	any	+	+	+	+
Ammonium thiocyanate		+	+	+	+
Amyl acetate	techn. grade	+	+	+	○
Amyl alcohol (C5 alcohols)	techn. grade	+	+	+	○
Amyl chloride	100 %	○	–	–	–
Amyl phthalate		+	○	○	○
Aniline	any	+	+	+	○
Aniline hydrochloride, aqueous	any	+	+	+	+
Animal oils		+	○	+	○
Aniseed		○	○ to –	–	–
Aniseed oil		○	–	–	–
Anisole		+	–	○	–
Anone (cyclohexanone)		+	○	○	–
Anthraquinone sulphonic acid, aqueous (susp.)		+	+	+	+
Antifreeze (automotive)	as supplied commerc.	+	+	+	+
Antimony chloride, anhydrous		+	+	+	+
Antimony pentachloride		+	+	+	+
Antimony trichloride		+	+	+	+
Aqua regia (HCl + HNO3)		–		–	
Aromatic oils		○	–	○	–
Arsenic acid, aqueous	any	+	+	+	+
Arsenic anhydride		+	+	+	+
Ascorbic acid		+	+	+	+
Asphalt		+	○▽	+	○▽
Aspirin®		+		+	
Barium hydroxide, aqueous	any	+	+	+	+
Barium salts, aqueous	any	+	+	+	+
Battery acid		+	+	+	+
Beater glue (animal glue)	as supplied commerc.	+	+		
Beef tallow		+	+ to ○	+	○
Beer		+	+	+	+
Beer sugar colouring	as supplied commerc.	+	+	+	+
Beeswax		+	○ to –	+	–
Benzaldehyde, aqueous	any	+	+ to ○	○	○
Benzaldehyde in isopropyl alcohol	1 %	+	+	+	○
Benzene	techn. grade	○	–	○	–
Benzene sulphonic acid		+	+	+	+
Benzoic acid, aqueous	any	+	+	+	+
Benzoyl chloride		○	○	–	
Benzyl alcohol		+	+	+	○
Benzyl chloride		○	–	–	
Bichromate – sulphuric acid	conc.	–		–	
Bismuth salts		+	+	+	+

The resistance of *Lupolen, Lupolex, Luflexen* and *Hostalen* resins to chemicals

Substance	Concentration	Behaviour of MDPE/HDPE at		Behaviour of LDPE/LLDPE/ mLLDPE at	
		20 °C	60 °C	20 °C	60 °C
Bisulphite liquor		+	+		
Bitumen		+	○▽	+	○▽
Bleaching solution with 12.5 % active chlorine**		○	−	○	−
Bone oil		+	+	+	+
Borax (sodium tetraborate), aqueous	saturated	+	+	+	+
Boric acid, aqueous	any	+	+	+	+
Boric acid methyl ester		+	○ to −	+	−
Boron trifluoride		+	+ to ○	+	○
Brake fluid		+	+	+	○
Brandy		+	+	+	+
Bromic acid	conc.	−		−	
Bromine, liquid	100 %	−		−	
Bromine vapours		−		−	
Bromine water	cold saturated	+		+	
Bromochloromethane		−		−	
1,3-butadiene, gaseous	techn. grade	○	−		
Butanediol, aqueous	any	+	+	+	+
Butanetriol, aqueous	any	+	+	+	+
Butane, gaseous		+			
Butanol, aqueous	any	+	+	+	○
Butanone		+	○ to −	+	−
2-Butenediol-1,4	techn. grade	+		+	
2-Butinediol-1,4	techn. grade	+		+	
Butoxyl® (methoxybutylacetate)		+	○		
Butter		+		+	
Butylene glycol	techn. grade	+	+	+	+
Butyl acetate (acetic acid butyl ester)	techn. grade	+	○	+	○
Butyl acrylate		+	○	+	○
Butyl alcohol		+	+	+	○
Butyl benzyl phthalate		+	+	○	○
Butyl glycol (ethylene glycol monobutylether)	techn. grade	+		+	
Butyl phenol	techn. grade	+	+	○	
Butyl phenone	techn. grade	−		−	
Butyl phthalate (dibutyl phthalate)	techn. grade	+	○	○	○
Butyric acid, aqueous	any	+	○	+	○
Calcium carbide		+	+	+	+
Calcium carbonate		+	+	+	+
Calcium chlorate, aqueous	saturated	+	+	+	+
Calcium chloride, aqueous	saturated	+	+	+	+
Calcium hydroxide		+	+	+	+
Calcium hypochlorite, aqueous (suspension)	any	+	+	+	+
Calcium nitrate, aqueous	50 %	+	+	+	+
Calcium oxide (powder)		+	+	+	+

Substance	Concentration	Behaviour of MDPE/HDPE at		Behaviour of LDPE/LLDPE/ mLLDPE at	
		20 °C	60 °C	20 °C	60 °C
Calcium phosphate		✚	✚	✚	✚
Calcium sulphate		✚	✚	✚	✚
Calcium sulphide, aqueous	≤ 10 %	○	○		
Camphor		○	▭	○	▭
Camphor oil		▭		▭	
Cane sugar, aqueous	any	✚	✚	✚	✚
Carbazole		✚	✚		
Carbolic acid (phenol)		✚	✚▽	○	○▽
Carbolineum	as supplied commerc.	✚		○	
Carbolineum, aqueous (for fruit trees)		✚▽	○▽	○▽	○▽
Carbonic acid, aqueous	any	✚	✚	✚	✚
Carbonic acid, dry	100 %	✚	✚		
Carbon dioxide	100 %	✚	✚		
Carbon disulphide		○	▭	○	▭
Carbon monoxide, gaseous	techn. grade	✚	✚		
Carbon tetrachloride		○	▭	▭	▭
Castor oil		✚	✚	✚	○
Caustic soda solution	any	✚	✚	✚	✚
Cetyl alcohol (hexadecanol)		✚	✚	✚	
Chloral hydrate, aqueous	any	✚	✚▽	✚	✚▽
Chloral (trichloroacetaldehyde)	techn. grade	✚	✚		
Chloramine, aqueous	saturated	✚		✚	
Chloric acid, aqueous	1 %	✚	✚	✚	✚
Chloric acid, aqueous	10 %	✚	✚	✚	✚
Chlorinated lime		✚	✚	✚	✚
Chlorine, aqueous solution (chlorine water)	saturated	✚	○	✚	○
Chlorine, gaseous, dry		○	▭	○	▭
Chlorine, gaseous, moist		○	▭	○	▭
Chlorine, liquid		▭		▭	
Chlorine bleaching solution with 12.5 % active chlorine		○	▭	○	▭
Chloroacetic acid, aqueous	≤ 85 %	✚	✚	✚	✚
Chloroacetic acid (mono), aqueous	any	✚	✚	✚	○
Chlorobenzene		○	▭	○	▭
Chloroformic acid ester		✚	○		
Chloroform	techn. grade	○ to ▭	▭	▭	▭
Chloropicrin		✚ to ○	▭		
Chlorosulphonic acid	techn. grade	▭	▭	▭	▭
Chrome alum (potassium chromic sulphate), aqueous	saturated	✚	✚	✚	✚
Chrome anode slime		✚	✚	✚	✚
Chrome salts, aqueous	any	✚	✚	✚	✚
Chromic acid, aqueous**	50 %	○	▭▽	○	▭▽
Chromium trioxide, aqueous**	50 %	○	▭▽	○	▭▽
Chromosulphuric acid		▭		▭	
Cider		✚	✚	✚	✚

The resistance of *Lupolen, Lupolex, Luflexen* and *Hostalen* resins to chemicals

Substance	Concentration	Behaviour of MDPE/HDPE at 20 °C	60 °C	Behaviour of LDPE/LLDPE/mLLDPE at 20 °C	60 °C
Citric acid, aqueous	saturated	✚	✚	✚	✚
Citrus fruit juices		✚	✚	✚	✚
Clophen® A 50 and A 60®		✚	○ to ▭		
Coal tar oil		✚▽	○▽	✚▽	○▽
Coconut oil		✚	○	✚	○
Coconut oil alcohol	techn. grade	✚	○	✚	○
Cod liver oil		✚	○	✚	○
Coffee extract		✚	✚	✚	✚
Cognac		✚		✚	
Cola concentrates		✚	✚	✚	✚
Common salt, aqueous	any	✚	✚	✚	✚
Coolants and lubricants for metalworking		○	○		
Copper chloride, aqueous	saturated	✚	✚	✚	✚
Copper cyanide, aqueous	saturated	✚		✚	
Copper fluoride, aqueous	saturated	✚	✚	✚	✚
Copper nitrate, aqueous	30%	✚	✚	✚	✚
Copper salts, aqueous	cold saturated	✚	✚	✚	✚
Copper sulphate, aqueous	any	✚	✚	✚	✚
Corn oil		✚	○	✚	○
Cottonseed oil	techn. grade	✚	✚	✚	○
Coumarone resins		✚	✚		
Creosote		✚	✚▽		
Cresol	100%	✚	○▽	○	▭
Cresol, aqueous	dilute	✚	✚▽	✚	
Crop protection agents, aqueous	as supplied commerc.	✚	✚	✚	✚
Crotonaldehyde	techn. grade	✚	○	○	
Crude oil		✚	○	✚	○
Cyclanone (fatty alcohol sulphonate)	as supplied commerc.	✚	✚	✚	
Cyclohexane		✚	✚	✚	▭
Cyclohexanol		✚	✚	✚	✚
Cyclohexanone (anone)		✚	○	○	▭
Decahydronaphthalene (Dekalin®)	techn. grade	✚	○	○	▭
Defoamers		✚	✚ to ○	✚	○
Detergents		✚	✚	✚	✚
Detergents, synthetic	end use concentration	✚	✚	✚	✚
Developer solutions (photographic)		✚▽	✚▽	✚▽	✚▽
Dextrin (starch gum), aqueous	18%	✚	✚	✚	✚
Dextrose, aqueous	any	✚	✚	✚	✚
1,2-Diaminoethane (ethylenediamine)	techn. grade	✚	✚	✚	○
1,2-Dibromoethane		○	▭	▭	▭
Dibutyl ether		✚ to ○	▭	○	▭
Dibutyl phthalate (butyl phthalate)	techn. grade	✚	○	○	○
Dibutyl sebacate		✚	○	○	○

Substance	Concentration	Behaviour of MDPE/HDPE at		Behaviour of LDPE/LLDPE/ mLLDPE at	
		20 °C	60 °C	20 °C	60 °C
Dichloroacetic acid	techn. grade	✚	○▽	✚	▭
Dichloroacetic acid	50%	✚	✚	✚	✚
Dichloroacetic acid methyl ester		✚	✚	○	▭
Dichlorobenzene		○	▭	▭	▭
Dichlorodiphenyltrichloroethane (DDT, powder)		✚	✚	✚	✚
Dichloroethane		○	○	▭	▭
1,1-Dichloroethylene (vinylidene chloride)	techn. grade	▭	▭	▭	▭
Dichloromethane**		○	○*	▭	▭*
Dichloropropane		○	▭	▭	▭
Dichloropropene		○	▭	▭	▭
Diesel fuel		✚	○	✚	▭
Diethanolamine	techn. grade	✚		✚	
Diethylene glyol		✚	✚	✚	✚
2-Diethylhexylphthalate (DOP)		✚	○	✚	
Diethylketone		✚	○	○	▭
Diethyl ether		✚ to ○	○*	○	
Diglycolic acid, aqueous	30%	✚	✚	✚	✚
Diisobutylketone	techn. grade	✚	○ to ▭	○	▭
Diisoctyl phthalate	techn. grade	✚	○	○	
Diisopropyl ether		✚ to ○	▭	○	▭
Dimethylamine		✚	○	○	▭
Dimethyl formamide	techn. grade	✚	✚ to ○	✚	○
Dimethyl sulphoxide		✚	✚	✚	
Dinonyl phthalate (DNP)	techn. grade	✚	○	○	
Dioctyl phthalate		✚	○	○	
Dioxane		✚	✚	✚	○
Diphenylamine		✚	○	✚	○
Diphenyl oxide		✚	○	✚	○
Disodium phosphate		✚	✚	✚	✚
Disodium sulphate		✚	✚	✚	✚
Dodecylbenzenesulphonic acid		✚	○	✚	○
Drinking water, also chlorinated		✚	✚	✚	✚
Dyes		✚▽	✚▽	✚▽	✚▽
Eau de Javelle (potassium hypochlorite bleaching solution)		✚ to ○	▭	✚ to ○	▭
Eau de Labarraque (sodium hypochlorite bleaching solution)		✚ to ○	▭	✚ to ○	▭
Electrolytic baths for electroplating		✚ to ○	○	✚ to ○	○
Emulsifiers		✚	✚	✚	
Emulsions (photographic)		✚	✚	✚	✚
Ephetin®, aqueous	10%	✚	✚	✚	✚
Epichlorohydrin		✚	✚	✚	✚
Essential oils		✚	✚	✚	○
Esters, aliphatic	techn. grade	✚	✚ to ○	✚ to ○	○ to ▭
Ethane		✚	✚		

The resistance of *Lupolen, Lupolex, Luflexen* and *Hostalen* resins to chemicals

Substance	Concentration	Behaviour of MDPE/HDPE at 20 °C	Behaviour of MDPE/HDPE at 60 °C	Behaviour of LDPE/LLDPE/ mLLDPE at 20 °C	Behaviour of LDPE/LLDPE/ mLLDPE at 60 °C
Ethanolamine (2-aminoethanol)	techn. grade	+		+	
Ethanol	96 %	+	+	+	+
Ethanol denatured with toluene	96 % (v/v)	+		+	
Ethereal oils		○	−	○	−
Ether		+ to ○	○*	○	
Ethylenediamine tetraacetic acid		+	+	+	+
Ethylene		+	+		
Ethylene chloride		○	−	○	−
Ethylene chlorohydrin (chloroethanol)	techn. grade	+	+▽	+	+▽
Ethylene diamine (1,2-diaminoethane)	techn. grade	+	+	+	○
Ethylene dibromide		○	−	○	−
Ethylene dichloride (dichloroethane)		○	−	○	−
Ethylene glycol		+	+	+	+
Ethylene glycol monobutyl ether (butyl glycol)	techn. grade	+		+	
Ethylene oxide, gaseous		+	+		
Ethyl acetate (acetic acid ethyl ester)	techn. grade	+	○	○	−
Ethyl alcohol	96 %	+	+	+	+
Ethyl alcohol + acetic acid (fermentation mixture)	as used in production	+	+	+	+
Ethyl benzene	techn. grade	○		○	
Ethyl chloride (chloroethane)	techn. grade	○*		○*	
Ethyl ether (diethyl ether)	techn. grade	+ to ○	○*	○	
2-Ethyl hexanol		+	○	+	○
Euron® B		○	○		
Euron® G		+	+		
Fatty acids (>C6)		+	+ to ○	+	○
Fatty acid amides		+	○	+	○
Fatty alcohols		+	○	+	○
Fatty oils		+	○	+	○
Ferric alum (ferric ammonium sulphate), aqueous	saturated	+	+	+	+
Ferric chloride, aqueous	any	+	+	+	+
Ferric nitrate, aqueous	saturated	+	+	+	+
Ferric sulphate, aqueous	saturated	+	+	+	+
Ferrous chloride, aqueous	saturated	+	+	+	+
Ferrous sulphate, aqueous	saturated	+	+	+	+
Fertilizer salts, aqueous	any	+	+	+	+
Fixing salt, aqueous	any	+	+	+	+
Fixing salt, solid		+	+	+	+
Fluorine, gaseous		−		−	
Fluoroboric acid, aqueous		+	○	+	○
Fluorosilicic acid	any	+	+	+	+
Fluorosilicic acid, aqueous	any	+	+	+	+
Formaldehyde, aqueous	up to 40 %	+	+	+	+
Formamide		+	+	+	+

Substance	Concentration	Behaviour of MDPE/HDPE at 20 °C	Behaviour of MDPE/HDPE at 60 °C	Behaviour of LDPE/LLDPE/mLLDPE at 20 °C	Behaviour of LDPE/LLDPE/mLLDPE at 60 °C
Formic acid, aqueous	10 %	✚	✚	✚	✚
Formic acid, aqueous	85 %	✚	✚	✚	✚
Frigen® 12 (Freon® 12)	100 %	○	▭	○	▭
Fructose (fruit sugar), aqueous	any	✚	✚	✚	✚
Fruit juices, fermented		✚	✚	✚	✚
Fruit juices, unfermented	any	✚	✚	✚	✚
Fruit pulp		✚	✚	✚	✚
Fuel oil		✚	○	○	▭
Fuming sulphuric acid ($H_2SO_4 + SO_3$)	any	▭		▭	
Furfurol		✚	○	○	▭
Furfuryl alcohol		✚	✚▽	✚	✚▽
Gas, manufactured	as supplied commerc.	✚		✚	
Gas, natural	techn. grade	✚		✚	
Gas, liquor		✚	✚	✚	✚
Gasoline, regular-grade (DIN 51635)		✚	○	○	▭
Gelatin		✚	✚	✚	✚
Genantin®		✚	✚		
Gin		✚		✚	
Glacial acetic acid (100 % acetic acid)	techn. grade	✚	○▽	✚	○▽
Glauber's salt, aqueous	any	✚	✚	✚	✚
Glucose, aqueous	any	✚	✚	✚	✚
Glue		✚	✚	✚	✚
Glycerin, aqueous	any	✚	✚	✚	✚
Glycerin chlorohydrin		✚	✚	✚	✚
Glycerol		✚	✚	✚	✚
Glycine		✚	✚	✚	✚
Glycolic acid, aqueous	up to 70 %	✚	✚	✚	✚
Glycolic acid butyl ester		✚	✚	✚	
Glycol, aqueous	as supplied commerc.	✚	✚	✚	✚
Glysantin®		✚	✚	✚	✚
Grisiron® 8302		○	○		
Grisiron® 8702		✚	✚		
Halothan®		○	○ to ▭		
Heptane		✚	○	✚	▭
Hexafluorosilicic acid, aqueous	40 %	✚	✚	✚	✚
Hexane		✚	○	✚	▭
Hexanetriol		✚	✚	✚	✚
Honey		✚	✚	✚	✚
Hydraulic fluid		✚	○	✚	
Hydrazine hydrate		✚	✚	✚	✚
Hydrobromic acid, aqueous	50 %	✚	✚	✚	✚
Hydrochloric acid, aqueous	any	✚	✚	✚	✚

The resistance of *Lupolen, Lupolex, Luflexen* and *Hostalen* resins to chemicals

Substance	Concentration	Behaviour of MDPE/HDPE at 20 °C	60 °C	Behaviour of LDPE/LLDPE/ mLLDPE at 20 °C	60 °C
Hydrocyanic acid		✙	✙	✙	✙
Hydrofluoric acid, aqueous	40-85 %	✙	○	✙	○
Hydrogen		✙	✙		
Hydrogen bromide, gaseous	techn. grade	✙	✙	✙	
Hydrogen chloride gas, dry and moist		✙	✙	✙	
Hydrogen peroxide, aqueous	10 %	○	▭	○	▭
Hydrogen peroxide, aqueous	30 %	○	▭	○	▭
Hydrogen peroxide	100 %	○	○	○	▭
Hydrogen sulphide, aqueous	saturated	✙	✙	✙	✙
Hydrogen sulphide, gaseous		✙	✙	✙	✙
Hydroquinone		✙▽	✙▽	✙▽	✙▽
Hydrosulphite, aqueous	up to 10 %	✙	✙	✙	✙
Hydroxylamine sulphate, aqueous	12 %	✙	✙	✙	✙
Hypochlorous acid		✙ to ○	○	○	
Ink		✙	✙	✙	✙
Iodine in potassium iodide solution	3 % iodine	✙	✙	✙	✙
Iodine tincture, DAB 6	as supplied commerc.	✙	○▽	✙	○▽
Isoamyl alcohol	techn. grade	✙	○	✙	○
Isobutyl alcohol (isobutanol)		✙	✙	✙	○
Isobutyric acid	techn. grade	✙	○	✙	○
Isooctane		✙	○	✙	▭
Isopropanol (isopropyl alcohol)	techn. grade	✙	✙	✙	✙
Isopropyl acetate	100 %	✙	○	✙	○
Isopropyl ether	techn. grade	✙ to ○	▭	○	▭
Jam		✙	✙	✙	✙
Kerosene		✙	○	○	▭
Ketones		✙ to ○	○ to ▭	✙ to ○	○ to ▭
Lactic acid, aqueous	any	✙	✙	✙	✙
Lactose (milk sugar)		✙	✙	✙	✙
Lanolin (wool fat)		✙	✙	✙	✙
Latex		✙	✙	✙	✙
Lead acetate, aqueous	any	✙	✙	✙	✙
Lead tetraethyl		✙		✙	
Lime		✙	✙	✙	✙
Lime water		✙	✙	✙	✙
Linseed oil	techn. grade	✙	✙	✙	○
Liqueur		✙	✙		
Liquid manure		✙	✙		
Liquid soaps		✙	✙	✙	✙
Lithium bromide		✙	✙	✙	✙

Substance	Concentration	Behaviour of MDPE/HDPE at 20 °C	60 °C	Behaviour of LDPE/LLDPE/ mLLDPE at 20 °C	60 °C
Lubricating oils	techn. grade	✚	✚ to ○	✚	○
Lysol®		✚	○		
Machine oil		✚	○	✚	○
Magnesium carbonate		✚	✚	✚	✚
Magnesium chloride, aqueous	any	✚	✚	✚	✚
Magnesium fluorosilicate		✚	✚	✚	✚
Magnesium hydroxide		✚	✚	✚	✚
Magnesium iodide		✚	✚	✚	✚
Magnesium salts, aqueous	any	✚	✚	✚	✚
Magnesium sulphate, aqueous	any	✚	✚	✚	✚
Maleic acid, aqueous	up to 100 %	✚	✚	✚	✚
Malic acid, aqueous	50 %	✚	✚	✚	✚
Manganese sulphate		✚	✚	✚	✚
Margarine		✚	✚	✚	✚
Mash		✚	✚	✚	✚
Mayonnaise		✚		✚	
Menthol		✚	○	○	▭
Mercury		✚	✚	✚	✚
Mercury chloride		✚	✚	✚	✚
Mercury salts		✚	✚	✚	✚
Metal soaps		✚	✚	✚	✚
Methacrylic acid		✚	✚	✚	○
Methanol	techn. grade	✚	✚	✚	✚
Methoxybutanol		✚	○	✚	○
Methoxybutyl acetate (Butoxyl®)		✚	✚	✚	○
Methylamine, aqueous	32 %	✚		✚	
2-Methylbutanol-2	techn. grade	✚	○	✚	○
Methylene chloride** (dichloromethane)		○	○*	▭	▭*
Methylisobutyl ketone		✚	○ to ▭	✚	▭
Methyl acetate (acetic acid methyl ester)	techn. grade	✚		✚	
Methyl acrylate		✚	✚	✚	○
Methyl alcohol		✚	✚	✚	✚
Methyl benzene		○	▭	○	▭
Methyl benzoic acids (toluic acids)	saturated	○		○	
Methyl bromide, gaseous	techn. grade	▭		▭	
Methyl bromide (bromomethane), gaseous	techn. grade	▭		▭	
Methyl chloride (chloromethane), gaseous	techn. grade	○		▭	
Methyl cyclohexane		○	○ to ▭	○	▭
Methyl ethyl ketone	techn. grade	✚	○	○	▭
Methyl glycol		✚	✚	✚	✚
Methyl methacrylate		✚	✚	✚	○
4-Methyl pentanol-2		✚	✚ to ○▽	✚	○▽
Methyl propyl ketone		✚	○	○	▭

The resistance of *Lupolen, Lupolex, Luflexen* and *Hostalen* resins to chemicals

Substance	Concentration	Behaviour of MDPE/HDPE at 20 °C	60 °C	Behaviour of LDPE/LLDPE/ mLLDPE at 20 °C	60 °C
N-Methyl pyrrolidone		+	+	+	
Methyl salicylate (salicylic acid methyl ester)		+	○	+	○
Methyl sulphuric acid	50 %	+	+	+	+
Milk		+	+	+	+
Mineral oil	without additives	+	+ to ○	+	○
Mineral water		+	+	+	+
Molasses		+	+	+	+
Molasses wort		+	+	+	+
Monochloroacetic acid		+	○	+	○
Monochloroacetic acid ethyl ester		+	+	+	○
Monochloroacetic acid methyl ester		+	+	+	○
Monochlorobenzene		○	–	○	–
Mordants, metallic		+		+	
Morpholine		+	+	+	
Motor oil (heavy duty oil)		+	+ to ○	+	○
Mowilith® emulsions		+	+	+	+
Mustard		+	+	+	+
Nail polish remover		+	○	+	○
Naphthalene		+	–	+	–
Naphtha	techn. grade	+	○	+	○
Naphtha		+	○	+	○
Naphtha/benzene mixture	80/20	+	○	+	○
Nickel chloride		+	+	+	+
Nickel nitrate		+	+	+	+
Nickel salts, aqueous		+	+	+	+
Nickel sulphate, aqueous	any	+	+	+	+
Nicotine		+	+	+	+
Nicotinic acid	≤ 10 %	+		+	
Nitric acid**	25 %	+	+	+	+
Nitric acid**	50 %	○	–	○	–
Nitric acid	95 %	–	–	–	–
2,2',2"-Nitrilotriethanol (triethanolamine), aqueous	any	+	○	+	○
Nitrobenzene		+	○	○	–
Nitrocellulose		+		+	
o-Nitrotoluene		+	○	○	–
Nonyl alcohol (nonanol)		+	+	+	○
Nut oil		+		+	
Octyl cresol	techn. grade	○	–	○	–
Oils, ethereal		○	–	○	–
Oils, vegetable and animal		+	+ to ○	+	○
Oleic acid		+	○	+	○
Oleum		–	–	–	–

Substance	Concentration	Behaviour of MDPE/HDPE at 20 °C	60 °C	Behaviour of LDPE/LLDPE/ mLLDPE at 20 °C	60 °C
Olive oil		+	+	+	○
Optical brighteners		+	+	+	+
Orange juice		+	+	+	+
Oxalic acid, aqueous	any	+	+	+	+
Oxygen		+	+	+	+
Ozone	50 ppm	○	−	○	−
Palmitic acid		+	+	+	+
Palmityl alcohol		+	+	+	+
Palm nut oil		+		+	
Paraffin, liquid		+	+	+	○
Paraffin wax emulsions	as supplied commerc.	+	○	+	○
Paraformaldehyde		+	+	+	+
Peanut oil	techn. grade	+		+	
Pentanol		+		+	
Peppermint oil		+		+	
Perchloric acid, aqueous	20 %	+	+	+	+
Perchloric acid, aqueous	50 %	+	○	+	○
Perchloric acid, aqueous	70 %	+	−	+	−
Perchloroethylene		○	−	−	−
Petrol, regular-grade (DIN 51 635)		+	○	○	−
Petroleum		+	○	○	−
Petroleum ether		+	○	+	
Phenolic resin moulding compounds		+	+	+	+
Phenol		+	+▽	○	○▽
Phenyl ethyl alcohol		+	+	+	○
Phenyl hydrazine	techn. grade	○	○ to −	○	−
Phenyl hydrazine hydrochloride		+	−	+	−
Phenyl sulphonate (sodium dodecyl benzene sulphonate)		+	+	+	+
Phosgene, gaseous		○			
Phosgene, liquid	100 %	−			
Phosphates, aqueous	any	+	+	+	+
Phosphoric acid, aqueous	50 %	+	+	+	+
Phosphoric acid, aqueous	80 % ... 95 %	+	○▽	+	○▽
Phosphorus oxychloride		+	○	+	○
Phosphorus pentoxide	100 %	+	+	+	+
Phosphorus trichloride		−	−	−	−
Photographic developers		+▽	+▽	+▽	+▽
Photographic emulsions	as supplied commerc.	+	+	+	+
Photographic fixing baths	as supplied commerc.	+	+	+	+
Phthalic acid, aqueous	50 %	+	+	+	+
Phthalic acid dibutyl ester (dibutyl phthalate)	techn. grade	+	○	○	○
Phthalic ester		+	+ to ○	+	○
Picric acid, aqueous	1 %	+		+	

The resistance of *Lupolen, Lupolex, Luflexen* and *Hostalen* resins to chemicals

Substance	Concentration	Behaviour of MDPE/HDPE at 20 °C	Behaviour of MDPE/HDPE at 60 °C	Behaviour of LDPE/LLDPE/ mLLDPE at 20 °C	Behaviour of LDPE/LLDPE/ mLLDPE at 60 °C
Pineapple juice		✚	✚	✚	✚
Pine needle oil		✚		✚	
Plasticisers		✚	○	○	○
Polyacrylic acid emulsions		✚	✚	✚	✚
Polyester plasticisers		✚	✚ to ○	○	○
Polyester resins		○	▭	○	▭
Polyglycols		✚	✚	✚	✚
Polysolvan® O (glycolic acid butyl ester)		✚	✚	✚	○
Potassium aluminium sulphate, aqueous	any	✚	✚	✚	✚
Potassium bicarbonate, aqueous	saturated	✚	✚	✚	✚
Potassium bisulphate, aqueous	saturated	✚	✚	✚	✚
Potassium bisulphite, aqueous	saturated	✚	✚	✚	✚
Potassium borate, aqueous	1 %	✚	✚	✚	✚
Potassium bromate, aqueous	up to 10 %	✚	✚	✚	✚
Potassium bromide, aqueous	any	✚	✚	✚	✚
Potassium carbonate, aqueous	any	✚	✚	✚	✚
Potassium chlorate, aqueous	any	✚	✚	✚	✚
Potassium chloride, aqueous	any	✚	✚	✚	✚
Potassium chromate, aqueous	40 %	✚	✚	✚	✚
Potassium chromic sulphate (chrome alum), aqueous	saturated	✚	✚	✚	✚
Potassium cyanide, aqueous	any	✚	✚	✚	✚
Potassium dichromate, aqueous	any	✚	✚	✚	✚
Potassium ferrocyanide and ferricyanide, aqueous	any	✚	✚	✚	✚
Potassium fluoride, aqueous	any	✚	✚	✚	✚
Potassium hexacyanoferrate, aqueous	any	✚	✚	✚	✚
Potassium hydroxide		✚	✚	✚	✚
Potassium hydroxide, aqueous	any	✚	✚	✚	✚
Potassium hydroxide solution	50 %	✚	✚	✚	✚
Potassium hypochlorite, aqueous	saturated	○	▭	○	▭
Potassium iodide, aqueous	any	✚	✚	✚	✚
Potassium nitrate, aqueous	any	✚	✚	✚	✚
Potassium perborate		✚	✚	✚	✚
Potassium perchlorate, aqueous	up to 10 %	✚	○	✚	○
Potassium perchlorate, aqueous	1 %	✚		✚	
Potassium permanganate	20 %	✚	✚▽	✚	✚▽
Potassium permanganate, aqueous	up to 6 %	✚	✚▽	✚	✚▽
Potassium persulphate, aqueous	any	✚	✚	✚	✚
Potassium phosphate, aqueous	saturated	✚	✚	✚	✚
Potassium sulphate, aqueous	any	✚	✚	✚	✚
Potassium sulphide, aqueous	saturated	✚	✚	✚	✚
Potassium sulphite, aqueous	saturated	✚	✚	✚	✚
Potassium tetracyanocuprate, aqueous	saturated	✚	✚	✚	✚
Potassium thiosulphate, aqueous	saturated	✚	✚	✚	✚
Propane, gaseous	techn. grade	✚			

Substance	Concentration	Behaviour of MDPE/HDPE at		Behaviour of LDPE/LLDPE/ mLLDPE at	
		20 °C	60 °C	20 °C	60 °C
Propanol-(2) (isopropyl alcohol)		+	+	+	+
n-Propanol (n-propyl alcohol)		+	+	+	+
Propanol (propyl alcohol)		+	+	+	+
Propargyl alcohol, aqueous	7%	+	+	+	+
Propionic acid, aqueous	any	+	+	+	+
Propylene dichloride	100%	−		−	
Propylene glycol		+	+	+	+
Propylene oxide		+	+		
Pseudocumene		○	○		
Pyridine		+	○	+	○
Quinine		+	+	+	+
Release agents		+	+		
Roasting gases, dry	any	+	+		
Rubber dispersions (latex)		+	+	+	+
Sagrotan®		+	○	+	○
Salicylic acid		+	+	+	+
Salt brines	saturated	+	+	+	+
Saturated steam condensate		+	+	+	+
Sauerkraut (pickled cabbage)		+	+	+	+
Sea water		+	+	+	+
Silicic acid, aqueous	any	+	+	+	+
Silicone emulsion	as supplied commerc.	+	+	+	+
Silicone oil	techn. grade	+	+	+	+
Silver nitrate		+	+	+	+
Silver nitrate, aqueous	any	+	+	+	+
Silver salts, aqueous	cold saturated	+	+	+	+
Soap solution, aqueous	any	+	+	+	+
Soda (sodium carbonate), aqueous	any	+	+	+	+
Sodium acetate, aqueous	any	+	+	+	+
Sodium aluminium sulphate		+	+	+	+
Sodium benzoate, aqueous	any	+	+	+	+
Sodium bicarbonate, aqueous	saturated	+	+	+	+
Sodium bisulphate, aqueous	saturated	+	+	+	+
Sodium bisulphite, aqueous	saturated	+	+	+	+
Sodium borate		+	+	+	+
Sodium bromide		+	+	+	+
Sodium carbonate, aqueous	any	+	+	+	+
Sodium chlorate, aqueous	saturated	+	+	+	+
Sodium chloride, aqueous	any	+	+	+	+
Sodium chlorite, aqueous	50%	+		+	
Sodium chromate		+	+	+	+

The resistance of *Lupolen, Lupolex, Luflexen* and *Hostalen* resins to chemicals

Substance	Concentration	Behaviour of MDPE/HDPE at 20 °C	Behaviour of MDPE/HDPE at 60 °C	Behaviour of LDPE/LLDPE/mLLDPE at 20 °C	Behaviour of LDPE/LLDPE/mLLDPE at 60 °C
Sodium cyanide		+	+	+	+
Sodium dichromate		+	+	+	+
Sodium dodecylbenzenesulphonate		+	+	+	+
Sodium ferricyanide, aqueous	saturated	+	+	+	+
Sodium ferrocyanide		+	+	+	+
Sodium fluoride		+	+	+	+
Sodium hexametaphosphate, aqueous	saturated	+	+	+	+
Sodium hydroxide, aqueous	any	+	+	+	+
Sodium hydroxide, solid		+	+	+	+
Sodium hypochlorite, aqueous with 12.5 % active chlorine**		○	–	○	–
Sodium iron cyanide		+	+	+	+
Sodium nitrate, aqueous	any	+	+	+	+
Sodium nitrite, aqueous	any	+	+	+	+
Sodium perborate, aqueous	any	+	○	+	○
Sodium perchlorate, aqueous	any	+	+	+	+
Sodium peroxide, aqueous	saturated	○		○	
Sodium peroxide, aqueous	10 %	+	+	+	+
Sodium phosphate, aqueous	saturated	+	+	+	+
Sodium silicate		+	+	+	+
Sodium silicate, aqueous	any	+	+	+	+
Sodium sulphate, aqueous	cold saturated	+	+	+	+
Sodium sulphide, aqueous	any	+	+	+	+
Sodium tetraborate (borax), aqueous	saturated	+	+	+	+
Sodium thiosulphate, aqueous	saturated	+	+	+	+
Soft soap		+	+	+	+
Soya bean oil		+	+	+	○
Spermaceti		+		○	
Spindle oil		+ to ○	○	○	
Spirits		+		+	
Stain remover		+ to ○	○	○	
Starch, aqueous	any	+	+	+	+
Starch gum (dextrin), aqueous	18 %	+	+	+	+
Starch syrup		+	+	+	+
Stearic acid		+	○	+	○
Styrene		○	–	○	–
Succinic acid, aqueous	50 %	+	+	+	+
Sugar beet juice		+	+	+	+
Sugar syrup		+	+	+	+
Sulphates, aqueous solutions	any	+	+	+	+
Sulphur		+	+	+	+
Sulphuric acid, aqueous	up to 50 %	+	+	+	+
Sulphuric acid, aqueous	70 %	+	○	+	○
Sulphuric acid, aqueous	80 %	+	○	+	○
Sulphuric acid, aqueous	98 %	○ 1)	–	○	–

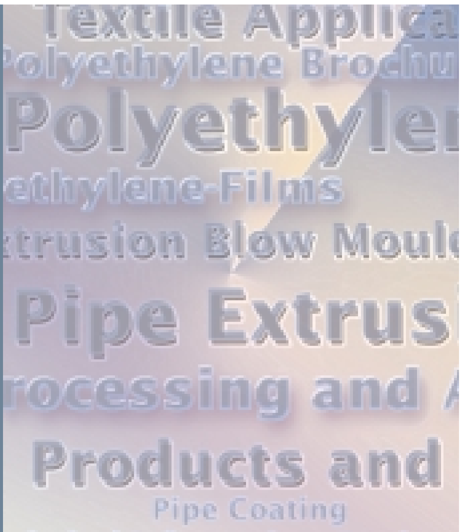
1) *Lupolen* and *Hostalen* blow mouldings that have been approved for use with dangerous filling substances are suitable for contact with e. g. 98 % Sulphuric acid

Substance	Concentration	Behaviour of MDPE/HDPE at		Behaviour of LDPE/LLDPE/ mLLDPE at	
		20 °C	60 °C	20 °C	60 °C
Sulphurous acid		✚	✚	✚	✚
Sulphuryl chloride (sulphonyl chloride)		▭		▭	
Sulphur dioxide, aqueous	any	✚	✚	✚	✚
Sulphur dioxide, gaseous		✚	✚		
Sulphur trioxide		▭		▭	
Tallow	techn. grade	✚	✚	✚	✚
Tannic acid (tannin), aqueous	10%	✚	✚	✚	✚
Tanning extracts, vegetable	as supplied	✚		✚	
Tartaric acid, aqueous	any	✚	✚	✚	✚
Tetrabromomethane		○ to ▭	▭	▭	▭
Tetrachloroethane		○ to ▭	▭	▭	▭
Tetrachloroethylene		○ to ▭	▭	▭	▭
Tetrachloromethane (carbon tetrachloride)	techn. grade	○	▭	▭	▭
Tetrahydrofuran	techn. grade	○ to ▭	▭	▭	▭
Tetrahydronaphthalene (Tetralin®)	techn. grade	✚	▭	○	▭
Thioglycolic acid		✚	✚	✚	✚
Thionyl chloride		▭		▭	
Thiophene		○	▭	○	▭
Tin (II) chloride, aqueous	any	✚	✚	✚	✚
Tin (IV) chloride, aqueous	saturated	✚	✚	✚	✚
Toluene	techn. grade	○	▭	○	▭
Toluic acids (methyl benzoic acids)	saturated	○		○	
Tomato juice		✚	✚	✚	✚
Transformer oil (insulating oil)	techn. grade	✚	○	✚	○
Tributyl phosphate		✚	✚	✚	
Trichloroacetaldehyde (chloral)	techn. grade	✚	✚	○	▭
Trichloroacetic acid	techn. grade	✚	○ to ▭	○	▭
Trichloroacetic acid, aqueous	50%	✚	✚	✚	✚
Trichlorobenzene		▭	▭	▭	▭
Trichloroethylene	techn. grade	○ to ▭	▭	▭	▭
Tri-ß-chloroethylphosphate		✚	✚	✚	
Tricresyl phosphate		✚	✚	✚	
Triethanolamine		✚	✚▽	✚	○▽
Triethanolamine (2,2‘2“-nitrilotriethanol), aqueous	any	✚	○	✚	○
Triethylene glycol		✚	✚	✚	✚
Trilon®		✚	✚		
Trimethylol propane, aqueous		✚	✚	✚	✚
Trimethyl borate		✚	○ to ▭	✚	▭
Trioctyl phosphate		✚	○	✚	
Trisodium phosphate		✚	✚	✚	✚
Turpentine oil	techn. grade	✚ to ○	▭	○	▭
Tutogen® U		✚	✚		
Tween® 20 and 80		✚	▭		
Two-stroke oil		✚	○		

The resistance of *Lupolen, Lupolex, Luflexen* and *Hostalen* resins to chemicals

Substance	Concentration	Behaviour of MDPE/HDPE at 20 °C	Behaviour of MDPE/HDPE at 60 °C	Behaviour of LDPE/LLDPE/mLLDPE at 20 °C	Behaviour of LDPE/LLDPE/mLLDPE at 60 °C
Urea, aqueous	up to 33 %	+	+	+	+
Uric acid		+	+	+	+
Urine		+	+	+	+
Vaseline	techn. grade	+ to ○	○	○	○
Vaseline oil	techn. grade	+ to ○	○	○	○
Vinegar (wine vinegar)	as supplied commerc.	+	+	+	+
Vinylidene chloride (1,1-dichloroethylene)	techn. grade	−		−	
Vinyl acetate		+	+	+	○
Viscose spinning solutions		+	+	+	+
Vitamin C		+		+	
Vitamin preparations, dry (powder)		+		+	
Walnut oil		+	○	+	○
Washing up liquids	usual	+	+	+	+
Waste gases containing carbonic acid	any	+	+		
Waste gases containing carbon dioxide	any	+	+		
Waste gases containing carbon monoxide	any	+	+		
Waste gases containing hydrochloric acid	any	+	+		
Waste gases containing hydrogen fluoride	trace	+	+		
Waste gases containing nitrogen oxides	trace	+	+		
Waste gases containing sulphur dioxide	low	+	+		
Waste gases containing sulphuric acid (moist)	any	p	p		
Waste gases containing sulphur trioxide (fuming sulphuric acid)	trace	−		−	
Water, distilled		+	+	+	+
Waxes		+	+ to ○	+	○
Wax alcohols	techn. grade	○	○		
Whey		+	+	+	+
Whisky		+		+	
White spirit	techn. grade	+		○	
Wine		+		+	
Wine vinegar (table vinegar)	as supplied commerc.	+	+	+	+
Wood stains	end use concentration	+	+ to ○		
Xylene		○	−	○	−
Yeast		+	+	+	+
Zinc carbonate		+	+	+	+
Zinc chloride, aqueous	any	+	+	+	+
Zinc oxide		+	+	+	+
Zinc salts, aqueous	any	+	+	+	+
Zinc sludge		+	+	+	+

Substance	Concentration	Behaviour of MDPE/HDPE at		Behaviour of LDPE/LLDPE/ mLLDPE at	
		20 °C	60 °C	20 °C	60 °C
Zinc stearate		✣	✣	✣	✣
Zinc sulphate, aqueous	any	✣	✣	✣	✣



Literature

Resistance factor for pressure pipes

A special assessment is required when mechanical, chemical and, in some cases, thermal stresses occur together in applications such as pressure pipes or large tanks. Here the resistance factor (f_{CR}) gives vital information. It characterises the long-term behaviour of pipes in contact with a certain substance under pressure in relation to their long-term behaviour in contact with water under pressure. Resistance factors have been determined for polyethylene pipes in contact with a whole range of substances [1] [2] [3].

Note
The information submitted in this publication is based on our current knowledge and experience. In view of the many factors that may affect processing and application these data do not relieve processors from the responsibility of carrying out their own tests and experiments; neither do they imply any legally binding assurrance of certain properties or of suitability for a specific purpose. It is the responsibility of those to whom we supply our products to ensure that any proprietary rights and existing laws and legislation are observed.

Literature

[1] E. Gaube, W. Müller, G. Diedrich: "Zeitstandfestigkeit von Rohren aus Hartpolyethylen und Polypropylen unter Einfluß von Chemikalien" (Creep strength of high-density polyethylene and polypropylene pipes in contact with chemical substances) Kunststoffe 56 (1996), pp 673 – 679

[2] G. Diedrich, B. Kempe, K. Graf: "Zeitstandfestigkeit von Rohren aus Polyethylen (HDPE) und Polypropylen (PP) unter Chemikalieneinwirkung" (Creep strength of polyethylene (HDPE) and polypropylene (PP) in contact with chemical substances) Kunststoffe 69 (1979), pp 470 – 476

[3] B. Kempe: "Prüfmethoden zur Ermittlung des Verhaltens von Polyolefinen bei der Einwirkung von Chemikalien" (Test methods to determine the behaviour of polyolefins in contact with chemical substances) Werkstofftechnik 15 (1984), pp. 157 – 172

APPENDIX F

Liquefaction Assessment

NewFields
Perspective. Vision. Solutions.

TECHNICAL MEMORANDUM

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Reviewed By: **Mike Smith, P.E. – Project Principal (NewFields)**
Craig Thompson, P.E. – Senior Engineer (NewFields)

Project: **Hermosa Project, Tailings Storage Facility 1 (TSF1)**

Project No: **475.0014.035**

Subject: **Production Filtered Tailings Cyclic Liquefaction Analysis**

Date: **31 May 2023**

1.0 INTRODUCTION

This Technical Memorandum summarizes the dynamic laboratory testing of unit element tailings samples and subsequent liquefaction triggering analysis for the Hermosa Project. The laboratory testing, performed in 2020 and 2022, included composite samples of synthetic tailings (tailings synthesized by grinding and processing ore in a lab). The synthetic tailings were provided by South32. It is our understanding that these materials are representative of filtered tailings that will be produced during operations. The testing program considered placement criteria for dry stacked filtered tailings as defined in the Technical Specifications as well as the results presented in the site-wide Seismic Hazard Assessment (NewFields, 2021).

This Technical Memorandum is an update to the previously issued seismic liquefaction triggering analysis (NewFields, 2022). This update incorporates new test results and analysis from the 2022 combined bulk synthetic tailings samples.

2.0 LABORATORY TESTING

NewFields completed laboratory testing programs (2020 and 2022) to evaluate the dynamic properties of the dry stacked filtered production tailings. In both programs, testing was completed on composite samples of the various ore streams, including *Concha*, *Deeps*, *Epitaph*, and *Scherler* ores. In 2020, background index testing of the samples was completed by Knight Piésold and can be referenced in the Tailings Storage Facility 1 (TSF1) Design Report

(NewFields, 2023) and dynamic testing was completed at the TerraSense laboratory under the direction of NewFields. In 2022, background index testing of the samples was completed by NewFields and can be referenced in the TSF1 Design Report (NewFields, 2023) and dynamic testing was completed at the Geocomp laboratory under the direction of NewFields. For ease of reference, the index testing results are included in Attachment A.

2.1 Cyclic Direct Simple Shear Tests

Cyclic direct simple shear (cDSS) and post cyclic monotonic direct simple shear (DSS) tests were completed. The undrained tests were conducted with an NGI type simple shear device that uses a steel-wire reinforced rubber membrane to enclose the sample.

Samples were remolded considering the placement criteria outlined in the Technical Specifications for dry stacked filtered tailings placement at that time. Six specimens were remolded to 90 percent of the maximum dry density (MDD) at approximately 3 percent over optimum moisture content (OMC). Two other specimens were remolded to approximately 85 and 95 percent of the MDD at approximately 3 percent over OMC to assess the influence of compactive effort on cyclic resistance.

Each specimen was incrementally consolidated to an assigned vertical effective stress and vertical deformations were recorded. The majority of samples were consolidated to 675 psf, which is representative of a one bench height or 5-feet of tailings depth, two samples were consolidated to 2,088 psf (3 bench heights), and one sample was consolidated to 3,750 psf which is representative of five bench heights or 25-feet of tailings depth.

After consolidation was complete, each sample was subjected to stress-controlled cyclic shear loadings. The sinusoidal cyclic shear stress was applied at a frequency of between 0.2 to 0.5 Hz. Constant volume conditions were imposed by restricting vertical displacement.

Termination of cyclic loadings was based on the excess pore pressure ratio. In general, tests were terminated when the ratio exceeded 0.9 to 0.95, near the on-set of liquefaction but prior to total liquefaction, so that the specimens were not completely deformed for the subsequent monotonic DSS.

After completion of cyclic loading, each specimen was subjected to a post-cyclic, monotonic, strain controlled undrained DSS using the same apparatus. In general, a horizontal shear strain rate of approximately 4 to 5 percent per hour was applied to the specimens, with the exception that specimen 1047 was sheared at a higher rate approaching 10 percent per hour.

A summary of the cDSS and DSS test results is presented in Table 1 and laboratory data sheets are included as Attachment B.

TABLE 1 – SUMMARY OF CDSS AND DSS TEST RESULTS

Test ID (Remold Criteria)	Remolded		Consolidated			Cyclic		Post-Cyclic
	ω_0 (%)	γ_{d0} (pcf)	σ'_{vc} (psf)	ω_c (%)	γ_{dc} (pcf)	τ_{cy} / σ'_{vc}	N [1]	S_r / σ'_{vc}
Combined Bulk Synthetic Tailings Sample from 2020								
1047 (90% MDD, +3% OMC)	13.7	113.3	675	18.9	114.6	0.165	>95 [2]	0.72
1048 (90% MDD, +3% OMC)	13.7	112.5	675	17.6	113.1	0.188	17	0.47
1049 (90% MDD, +3% OMC)	13.4	112.9	675	17.7	113.9	0.210	7	0.46
1050[3] (90% MDD, +3% OMC)	13.5	111.1	3375	17.5	115.0	0.192	7	0.24
1051[3] (85% MDD, +3% OMC)	14.7	108.2	675	19.4	110.0	0.170	9	0.13
1052[3] (95% MDD, +3% OMC)	13.9	119.3	675	15.5	119.5	0.200	11	1.08
Combined Bulk Synthetic Tailings Sample from 2022								
CDSS-1RR (90% MDD, +3% OMC)	16.1	106.3	2088	**	117.6	0.15	17	0.36
CDSS-2R(3) (90% MDD, +3% OMC)	16.1	106.3	2088	**	113.8	0.18	7	0.27

Notes: [1] Number of cycles to achieve liquefaction based on an excess pore water pressure ratio exceeding 0.95.
[2] Cyclic loadings terminated after a 0.91 excess pore water pressure ratio was achieved.
[3] Performed as a sensitivity analysis by varying consolidation pressure and density.

3.0 CYCLIC LIQUEFACTION ASSESSMENT

A cyclic liquefaction assessment was completed for the production tailings using the available laboratory data. The liquefaction susceptibility was assessed by comparing the cyclic demand on the facility for the design seismic event(s) to the cyclic resistance of the filtered tailings. The filtered tailings would generally be considered liquefiable if the cyclic demand exceeded the cyclic resistance. The following subsections document the liquefaction assessment.

3.1 Methodology

Cyclic resistance of the dry stacked filtered tailings is quantified using the cyclic resistance ratio (CRR) and the cyclic demand is quantified using the cyclic stress ratio (CSR). The factor of safety (FoS) associated with the on-set of liquefaction is estimated by:

$$FoS = \frac{CRR}{CSR} \tag{1}$$

The evaluation was completed in consideration of the seismic design criteria for the TSF summarized in Table 2 and documented in the site-wide Seismic Hazard Assessment (NewFields, 2021). The seismic design criteria are derived from the following TSF design standards, regulations, and/or guidelines:

- Arizona Department of Environmental Quality (ADEQ) Best Available Demonstrated Control Technology (BADCT) Guidance Manual.
- Australian National Committee on Large Dams (ANCOLD) Guidelines on Tailings Dams.
- Global Industry Standard on Tailings Management (GISTM).

TABLE 2 – SEISMIC DESIGN CRITERIA

Guidance Document	Return Period	PGA (g)	Magnitude [1]	Comment
Operational or Active Closure				
BADCT	450-year	0.03	5.1	
GISTM (“Significant”)	1,000-year	0.06	5.1	
ANCOLD (“High C”)	2,000-year	0.10	5.1	Used 2,500-year from SHA
Passive Closure				
ANCOLD (“High C”) / GISTM (“Significant”)	10,000-year	0.22	5.5	
Note: [1] Modal magnitude				

The 2,000-year return period is the minimum seismic design criteria for active care (operations and initial closure) and the 10,000-year is the design criteria for passive care (long-term closure).

Data from the Seismic Hazard Assessment (SHA) for the 2,500-year return period was conservatively utilized for active care.

3.2 Cyclic Resistance Ratio

The CRR of the dry stacked filtered tailings was estimated using the cDSS test results. The cyclic resistance data, as inferred from plots of the cyclic stress ratio versus numbers of cycles to liquefaction, are presented in Figure 1. The data is traditionally combined into a non-linear cyclic resistance curve that is often a function of the material type, density, and confinement, as follows:

$$CRR = a * N^{-b} \qquad (2)$$

Where *a* and *b* are fitting parameters. Research has shown that laboratory measured CRR based on one-directional loading are somewhat different than in-situ conditions where multi-directional loadings occur, and as such laboratory values are typically reduced by 10 percent. The trendlines in Figure 1 represent the cyclic resistance curves based on the actual lab data and a reduced curve based on the 10 percent reduction to the measured values.

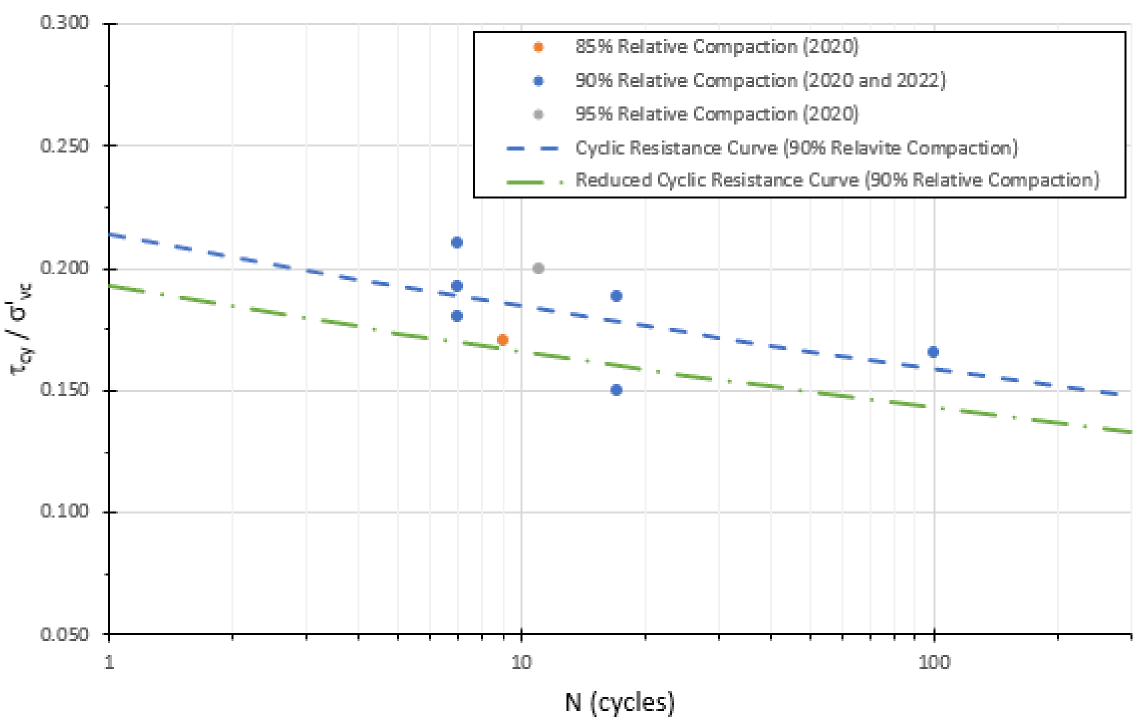


FIGURE 1 – CYCLIC RESISTANCE FOR FILTERED TAILINGS SAMPLES

The number of equivalent uniform cycles is related to the earthquake magnitude. Idriss and Boulanger (2008) related magnitude to equivalent cycles for a reference stress level of 65 percent using a power relationship, and this value is presented in Table 3. The design earthquake magnitude was determined for both the 2,500-year (active closure) and 10,000-year (passive closure) return period seismic events in the site-wide seismic hazard assessment (NewFields, 2021).

TABLE 3 – CYCLIC RESISTANCE RATIO

	2,500-Year	10,000-Year
N_{eq}[1]	3	5
CRR	0.20	0.19
Notes: [1] Number of equivalent cycles		

3.3 Cyclic Stress Ratio

The cyclic stress ratio is a function of seismic design parameters and in-situ stress conditions, and was calculated using the following relationship (Seed and Idriss, 1971):

$$CSR = \frac{\tau_{avg}}{\sigma'_v} = 0.65\left(\frac{a_{max}}{g}\right)\left(\frac{\sigma_v}{\sigma'_v}\right)r_d \tag{3}$$

Where a_{max} is the peak ground acceleration at the ground surface for the design earthquake, g is the acceleration of gravity, and r_d is a stress reduction coefficient. The stress reduction coefficient is a function of both the design earthquake magnitude as well as the depth and was estimated using equations presented by Idriss (1999).

3.4 Results

The CSR values in combination with the reduced CRR values, were utilized to calculate the factor of safety against liquefaction. The calculated factors of safety for each return period seismic event are presented in Figure 2. Because the CSR values are a function of depth, the factor of safety against liquefaction is also a function of depth.

The factor of safety against cyclic liquefaction (reduced CRR divided by CSR) was calculated considering pore water pressure (PWP) conditions equal to zero in the compacted filtered tailings stack assuming saturation may be high enough to generate excess pore pressure during cyclic loadings, but not high enough that in-situ stress conditions are affected prior to the earthquake.

Future phreatic conditions within the filtered tailings stack are unknown and as such vibrating wire piezometers (VWPs) will be used to monitor phreatic conditions.

The results clearly indicate that filtered tailings compacted to a minimum of 90% relative compaction at 3% over OMC are highly resistant to liquefaction for the 2,500-year return event (active care). The calculated factor of safety reduces significantly for the 10,000-year return event (passive care) but remains above unity for PWP soil conditions equal to zero.

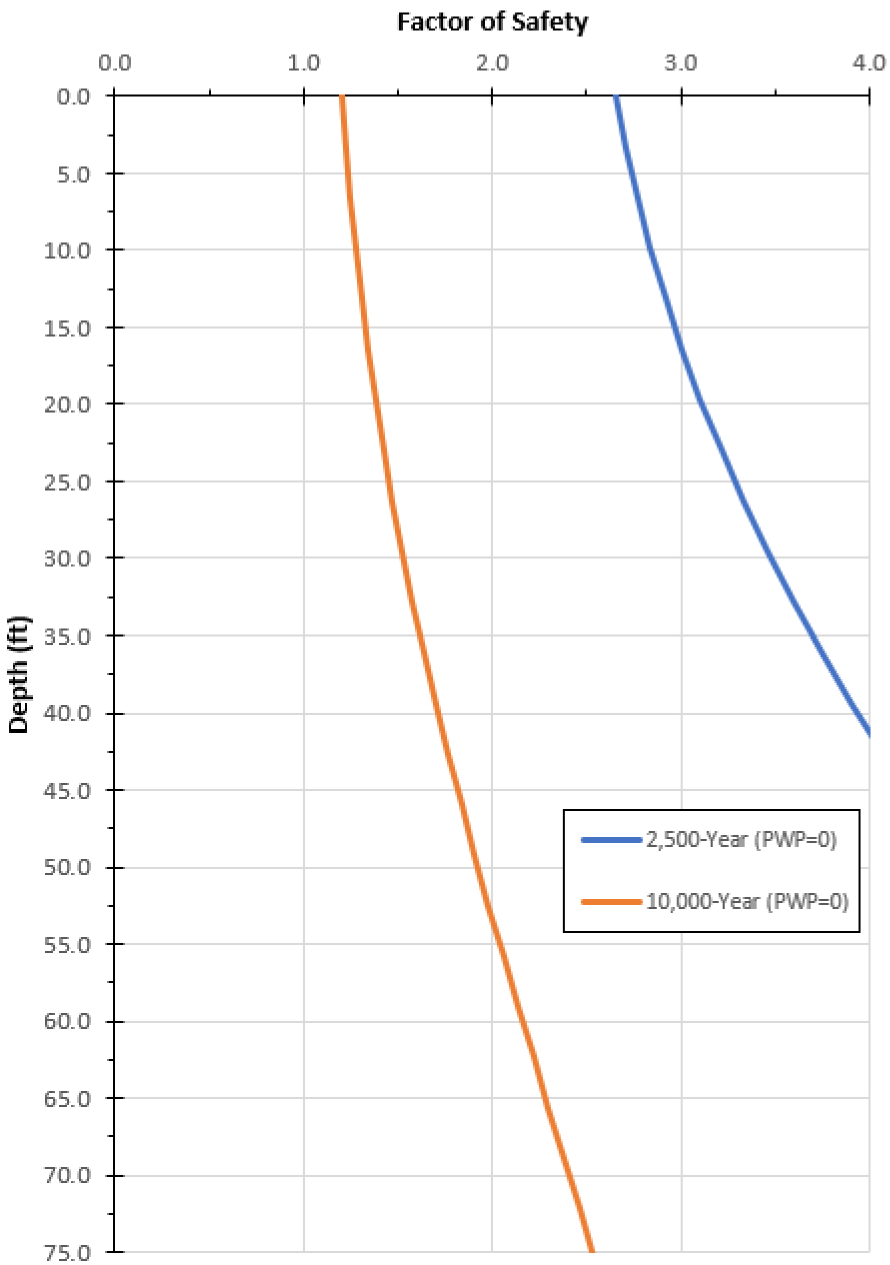


FIGURE 2 – FACTOR OF SAFETY AGAINST CYCLIC LIQUEFACTION

4.0 CONCLUSIONS

The cyclic laboratory test data for the future production filtered tailings are presented herein and a cyclic liquefaction assessment was completed. Results of the cyclic liquefaction assessment indicate:

- Filtered tailings placed to a minimum of 90 percent relative compaction are highly resistant to cyclic liquefaction considering the earthquake return periods of 2,500-year (active care) and 10,000-year (passive care) determined by the seismic hazard assessment. Please note, the minimum design seismic criteria for active care is a 2,000-year return period (see Section 3.1). Since the seismic hazard assessment defined the 2,500-year, it was conservatively selected for the liquefaction assessment in lieu of the 2,000-year return period.
- Only one cyclic test was completed on a specimen compacted to a lower relative compaction; approximately 85 percent, with the available data indicating filtered tailings at lower compacted densities are more likely to liquify under cyclic loading. In the case of the lower degree of compaction assessed, the presumptive factor of safety against cyclic liquefaction would be less than unity for near surface filtered tailings.
- Similarly, only one cyclic test was completed on a specimen compacted to a higher relative compaction; approximately 95 percent. As expected, results of laboratory testing on this sample indicate that higher degrees of compaction would improve liquefaction resistance.
- The Technical Specification for filtered tailings placement was conservatively modified to require a higher degree of compaction (increased from 90 to 93 percent relative compaction). Liquefaction resistance was one reason facilitating this change.
- Phreatic conditions within the filtered tailings influence the liquefaction resistance. Unsaturated materials are generally non-liquefiable but as the materials approach saturation the possibility of liquefaction is present given the necessary loading conditions and material state. If materials are sufficiently saturated to liquefy, the evaluation indicates that increasing phreatic head increases the risk of liquefaction. Hydrostatic loading conditions are not expected to develop since the facility does not retain water, the filtered tailings are required to meet compaction and moisture placement criteria outlined in the Technical Specifications (minimum 93% relative compaction and within 3% of OMC), and the in place filtered tailings are graded to drain to promote stormwater runoff during precipitation events.
- Although the filtered tailings were shown to not be susceptible to liquefaction for the design seismic events, the DSS tests completed at the end of cDSS testing provide an indication of residual undrained shear strength. During testing, cyclic loadings were halted prior to extensive liquefaction of the specimens to minimize disturbance prior to the DSS.

Nonetheless, a wide range of undrained shear strengths were measured with some samples exhibiting very low post-liquefaction shear strength and others exhibiting significant strength.

Based on the assessment presented herein, NewFields recommends the following:

- Installation of piezometers within the filtered tailings stack is necessary to provide monitoring of pore water pressures throughout operations. Actual pore water pressure measurements should be checked against Trigger Action Response Plan (TARP) values developed for the TSF. The TARP values should consider the cyclic liquefaction analysis results presented in this Technical Memorandum.
- Filtered tailings produced from the future mining operation could be different than the synthetic tailings provided by South32 for laboratory testing purposes. If index properties are different, additional laboratory characterization, as well as cone penetrometer field programs, should be considered to ensure the design intent is met.

5.0 REFERENCES

Idriss, I.M., (1999), An Update to the Seed-Idriss Simplified Procedure for Evaluating Liquefaction Potential. Proceedings of TRB Workshop on New Approaches to Liquefaction, Federal Highway Administration, Washington DC, January 10, 1999.

Idriss, I.M. and Boulanger, R.W., (2008), Soil Liquefaction during Earthquake. EERI Publication, Monograph MNO-12, Earthquake Engineering Research Institute, Oakland.

NewFields Mining Design & Technical Services, (2021), Hermosa Project, Seismic Hazard Assessment, Santa Cruz County, Arizona, dated April 23, 2021.

NewFields Mining Design & Technical Services, (2022), Synthetic Tailings Liquefaction Analysis, dated January 6, 2022.

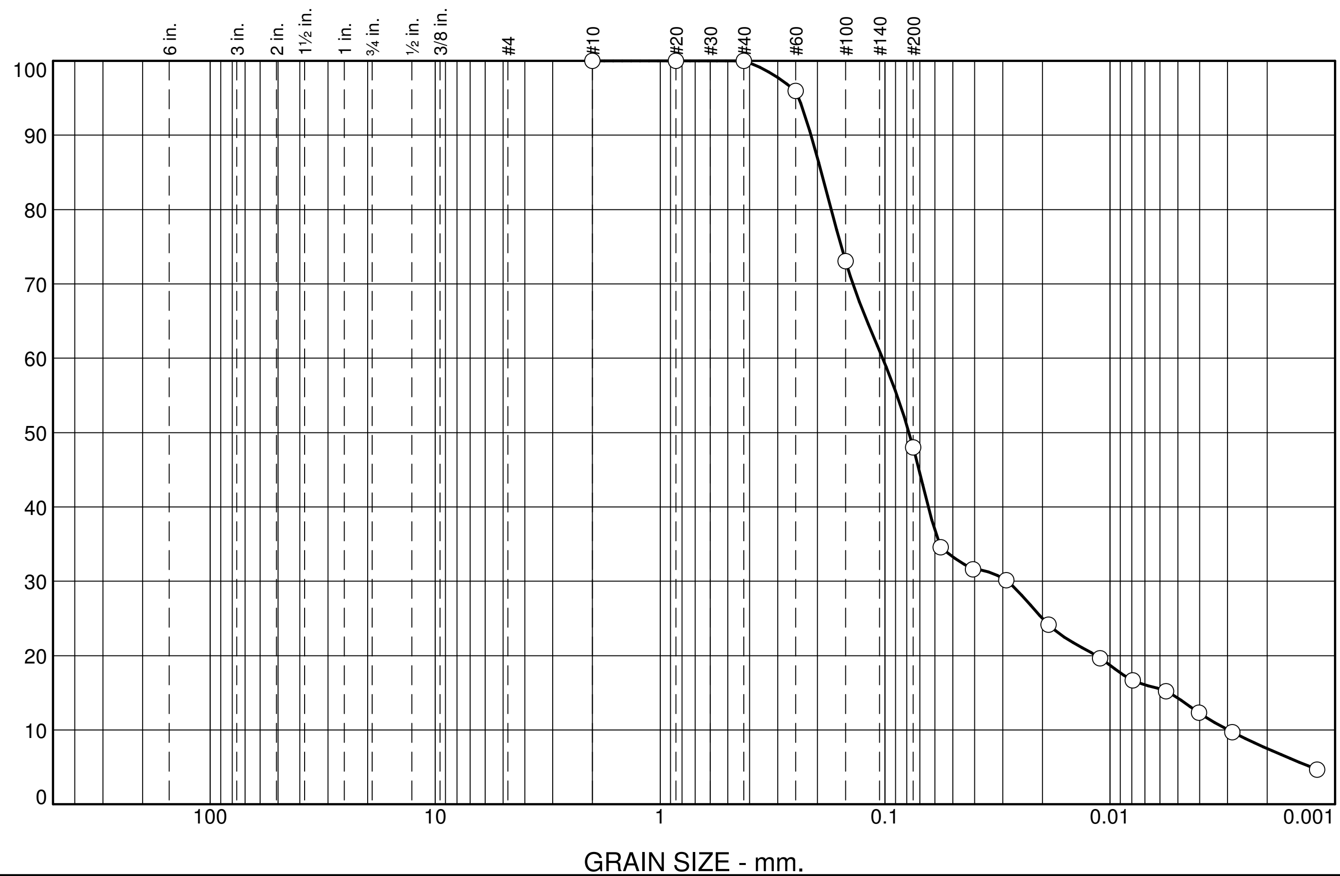
NewFields Mining Design & Technical Services, (2023), Hermosa Project, Tailings Storage Facility 1 (TSF1), Aquifer Protection Permit (APP) Significant Amendment, Best Available Demonstrated Control Technology (BADCT) Design, dated TBD.

Seed, H.B. and Idriss, I.M., (1971), Simplified Procedure for Evaluating Soil Liquefaction Potential. Journal of the Soil Mechanics and Foundations Division.

ATTACHMENT A

COMBINED BULK SYNTHETIC TAILINGS SAMPLE FROM 2020

Particle Size Distribution Report ASTM D6913



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.0	52.0	40.5	7.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	100.0		
#40	100.0		
#60	96.0		
#100	73.1		
#200	48.0		
0.0567 mm.	34.6		
0.0406 mm.	31.6		
0.0289 mm.	30.1		
0.0188 mm.	24.2		
0.0111 mm.	19.7		
0.0079 mm.	16.7		
0.0056 mm.	15.2		
0.0040 mm.	12.3		
0.0029 mm.	9.7		
0.0012 mm.	4.7		

* (no specification provided)

Soil Description

silty sand

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 0.2136 D_{85}= 0.1922 D_{60}= 0.1025
D_{50}= 0.0783 D_{30}= 0.0286 D_{15}= 0.0055
D_{10}= 0.0030 C_u= 34.40 C_c= 2.68

Classification

USCS= SM AASHTO= A-4(0)

Remarks

Sample No.: **Source of Sample:** **Date:** 6/2/20
Location: Concha **Elev./Depth:**

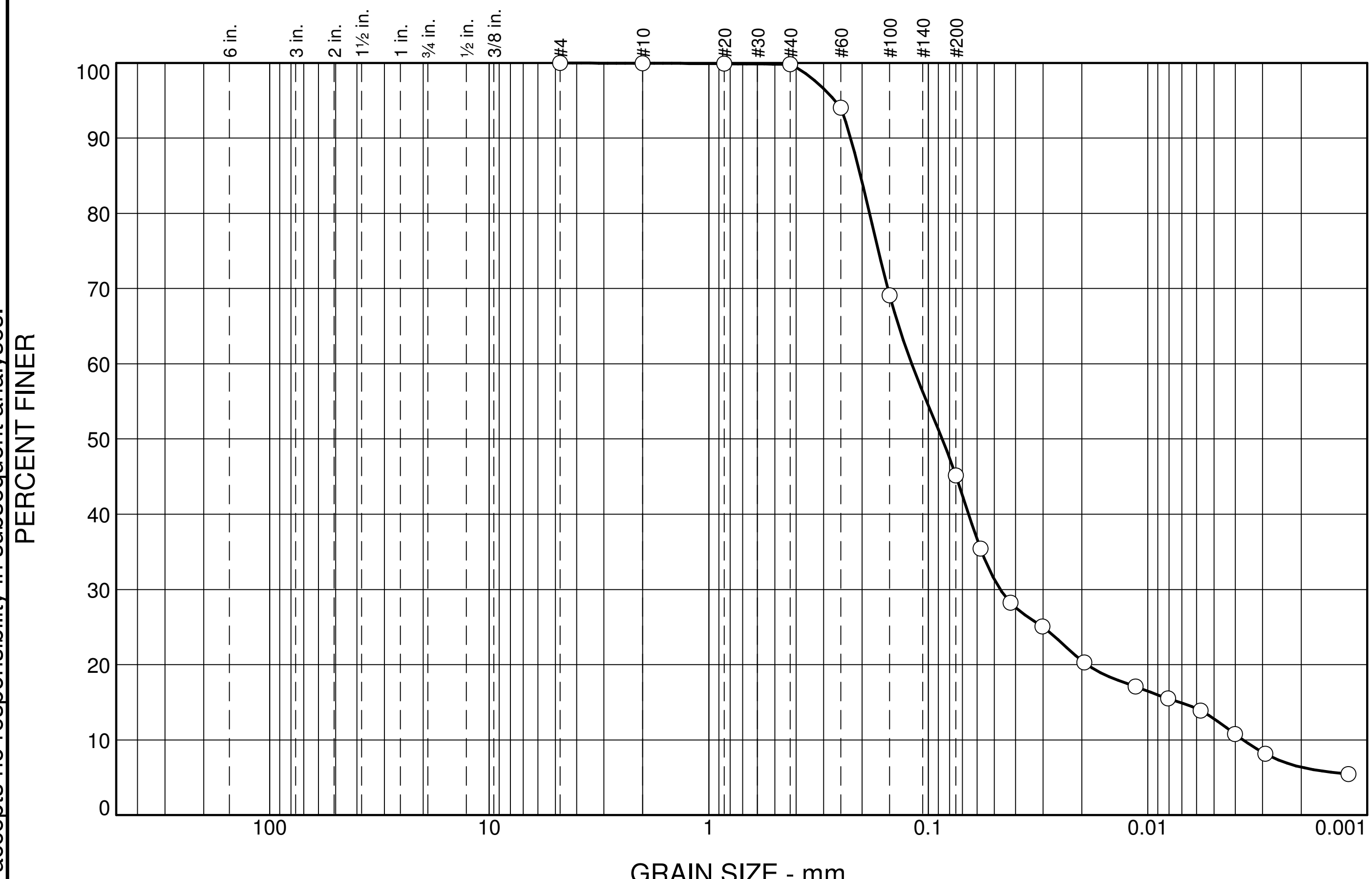
Knight Piésold CONSULTING

Client: South 32 - Hermosa Project
Project: Hermosa
Project No: 101-00777.03 **Figure**

Tested By: ICloud **Checked By:** JBruce

Cursory interpretations require review by a professional engineer. Knight Piesold accepts no responsibility in subsequent analyses.

Particle Size Distribution Report ASTM D6913



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	0.1	54.6	38.8	6.4

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.9		
#20	99.9		
#40	99.8		
#60	94.1		
#100	69.1		
#200	45.2		
0.0578 mm.	35.4		
0.0422 mm.	28.2		
0.0302 mm.	25.1		
0.0195 mm.	20.3		
0.0114 mm.	17.1		
0.0081 mm.	15.5		
0.0058 mm.	13.9		
0.0040 mm.	10.8		
0.0029 mm.	8.1		
0.0012 mm.	5.4		

* (no specification provided)

Soil Description

silty sand

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 0.2255 D_{85}= 0.2034 D_{60}= 0.1191
D_{50}= 0.0865 D_{30}= 0.0469 D_{15}= 0.0072
D_{10}= 0.0037 C_u= 32.34 C_c= 5.02

Classification

USCS= SM AASHTO= A-4(0)

Remarks

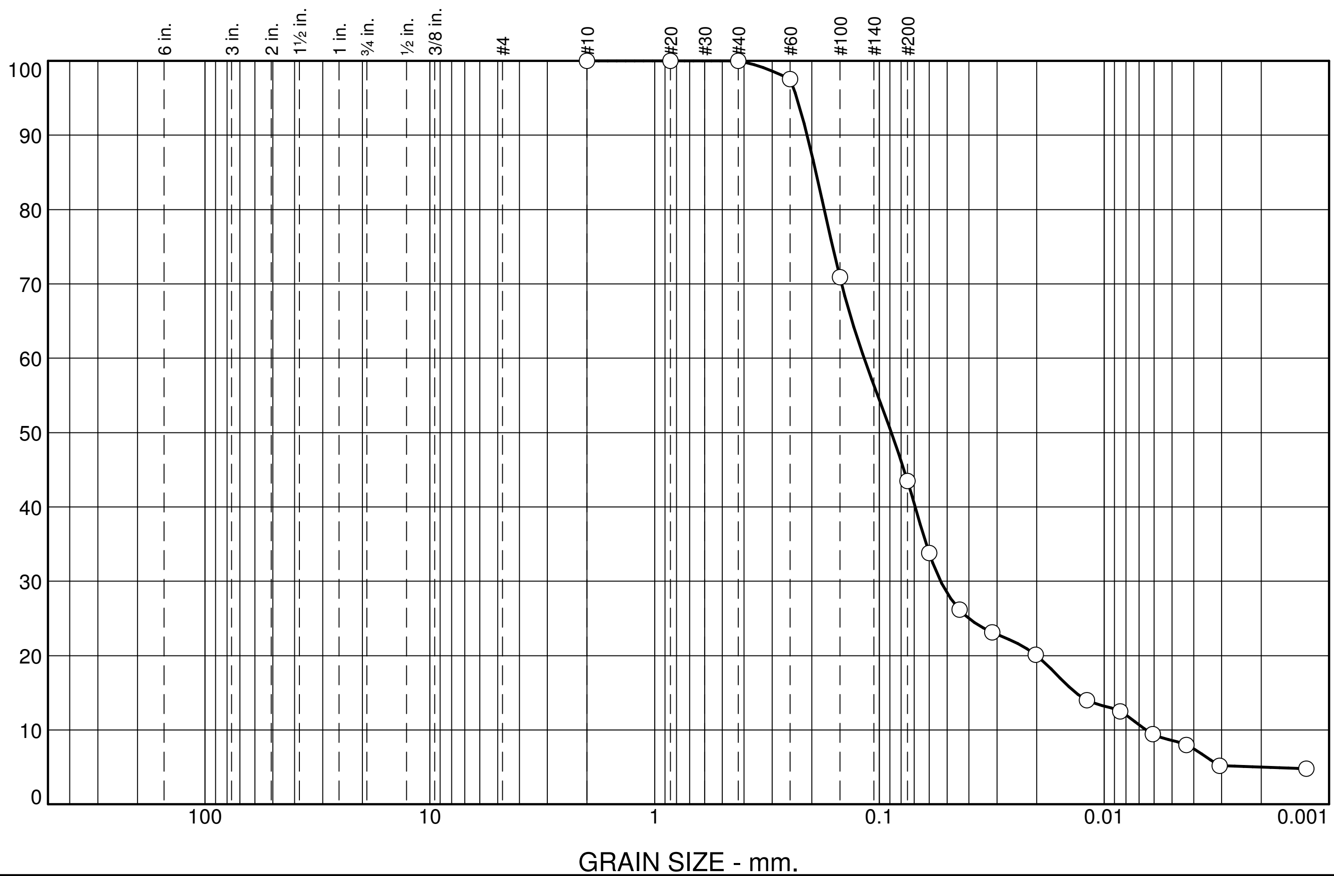
Sample No.: CU **Source of Sample:** **Date:** 6/16/20
Location: Combined Bulk Sample **Elev./Depth:**

Knight Piésold CONSULTING

Client: South 32 - Hermosa Project
Project: Hermosa

Project No: 101-00777.03 **Figure**

Particle Size Distribution Report ASTM D6913



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.0	56.5	38.5	5.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	100.0		
#40	100.0		
#60	97.5		
#100	70.9		
#200	43.5		
0.0601 mm.	33.8		
0.0440 mm.	26.2		
0.0315 mm.	23.1		
0.0202 mm.	20.1		
0.0119 mm.	14.0		
0.0085 mm.	12.5		
0.0061 mm.	9.4		
0.0043 mm.	8.0		
0.0031 mm.	5.2		
0.0013 mm.	4.8		

* (no specification provided)

Soil Description

silty sand

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 0.2099 D_{85}= 0.1918 D_{60}= 0.1169
D_{50}= 0.0884 D_{30}= 0.0534 D_{15}= 0.0133
D_{10}= 0.0065 C_u= 17.98 C_c= 3.75

Classification

USCS= SM AASHTO= A-4(0)

Remarks

Sample No.: **Source of Sample:** **Date:** 6/2/20
Location: Deeps **Elev./Depth:**

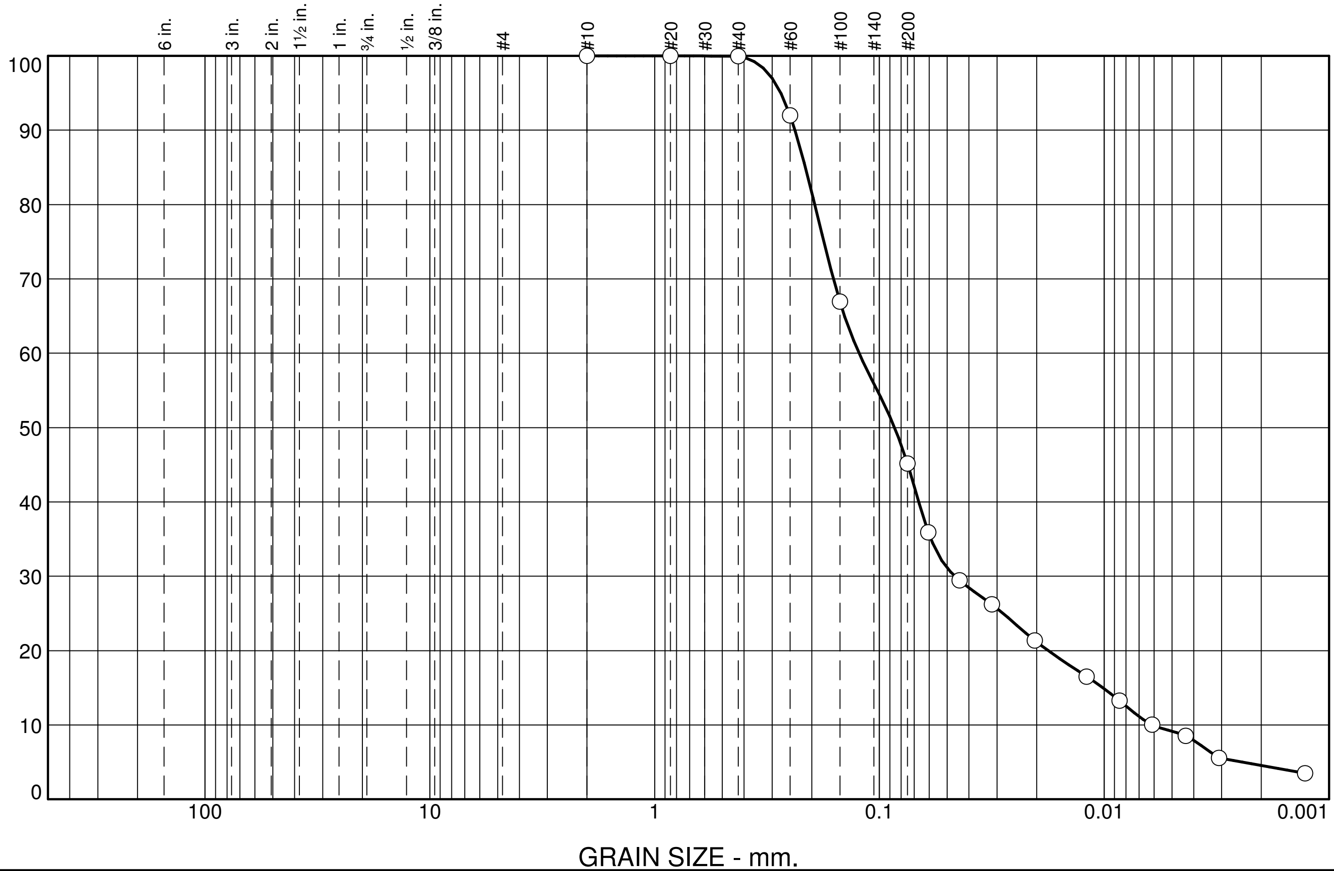
Knight Piésold CONSULTING

Client: South 32 - Hermosa Project
Project: Hermosa
Project No: 101-00777.03 **Figure**

Cursory interpretations require review by a professional engineer. Knight Piesold accepts no responsibility in subsequent analyses.

Tested By: ICloud **Checked By:** JBruce

Particle Size Distribution Report ASTM D6913



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.0	54.8	40.6	4.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	100.0		
#40	100.0		
#60	92.0		
#100	67.0		
#200	45.2		
0.0606 mm.	35.9		
0.0440 mm.	29.5		
0.0316 mm.	26.2		
0.0203 mm.	21.4		
0.0120 mm.	16.5		
0.0086 mm.	13.3		
0.0061 mm.	10.0		
0.0043 mm.	8.5		
0.0031 mm.	5.6		
0.0013 mm.	3.5		

* (no specification provided)

Soil Description

silty sand

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 0.2378 D_{85}= 0.2137 D_{60}= 0.1230
D_{50}= 0.0856 D_{30}= 0.0462 D_{15}= 0.0101
D_{10}= 0.0061 C_u= 20.24 C_c= 2.85

Classification

USCS= SM AASHTO= A-4(0)

Remarks

Sample No.: **Source of Sample:** **Date:** 6/2/20
Location: Epitaph **Elev./Depth:**

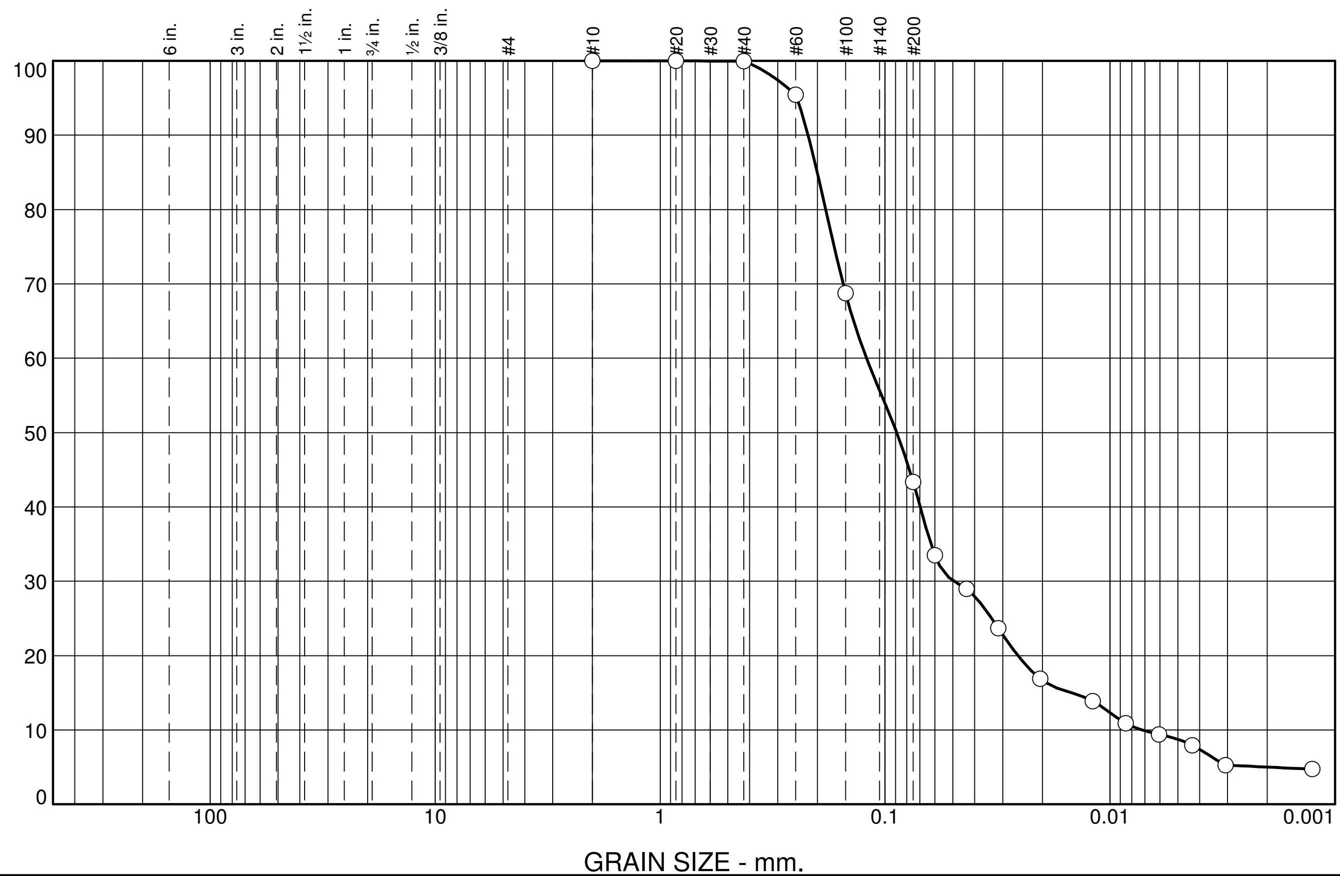
Knight Piésold CONSULTING

Client: South 32 - Hermosa Project
Project: Hermosa
Project No: 101-00777.03 **Figure**

Cursory interpretations require review by a professional engineer. Knight Piesold accepts no responsibility in subsequent analyses.

Tested By: ICloud **Checked By:** JBruce

Particle Size Distribution Report ASTM D6913



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.1	56.6	38.3	5.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	100.0		
#40	99.9		
#60	95.4		
#100	68.7		
#200	43.3		
0.0601 mm.	33.5		
0.0434 mm.	29.0		
0.0314 mm.	23.7		
0.0204 mm.	16.9		
0.0119 mm.	13.9		
0.0085 mm.	10.9		
0.0061 mm.	9.4		
0.0043 mm.	8.0		
0.0031 mm.	5.3		
0.0013 mm.	4.7		

* (no specification provided)

Soil Description

silty sand

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 0.2202 D_{85}= 0.2005 D_{60}= 0.1209
D_{50}= 0.0887 D_{30}= 0.0494 D_{15}= 0.0148
D_{10}= 0.0072 C_u= 16.73 C_c= 2.80

Classification

USCS= SM AASHTO= A-4(0)

Remarks

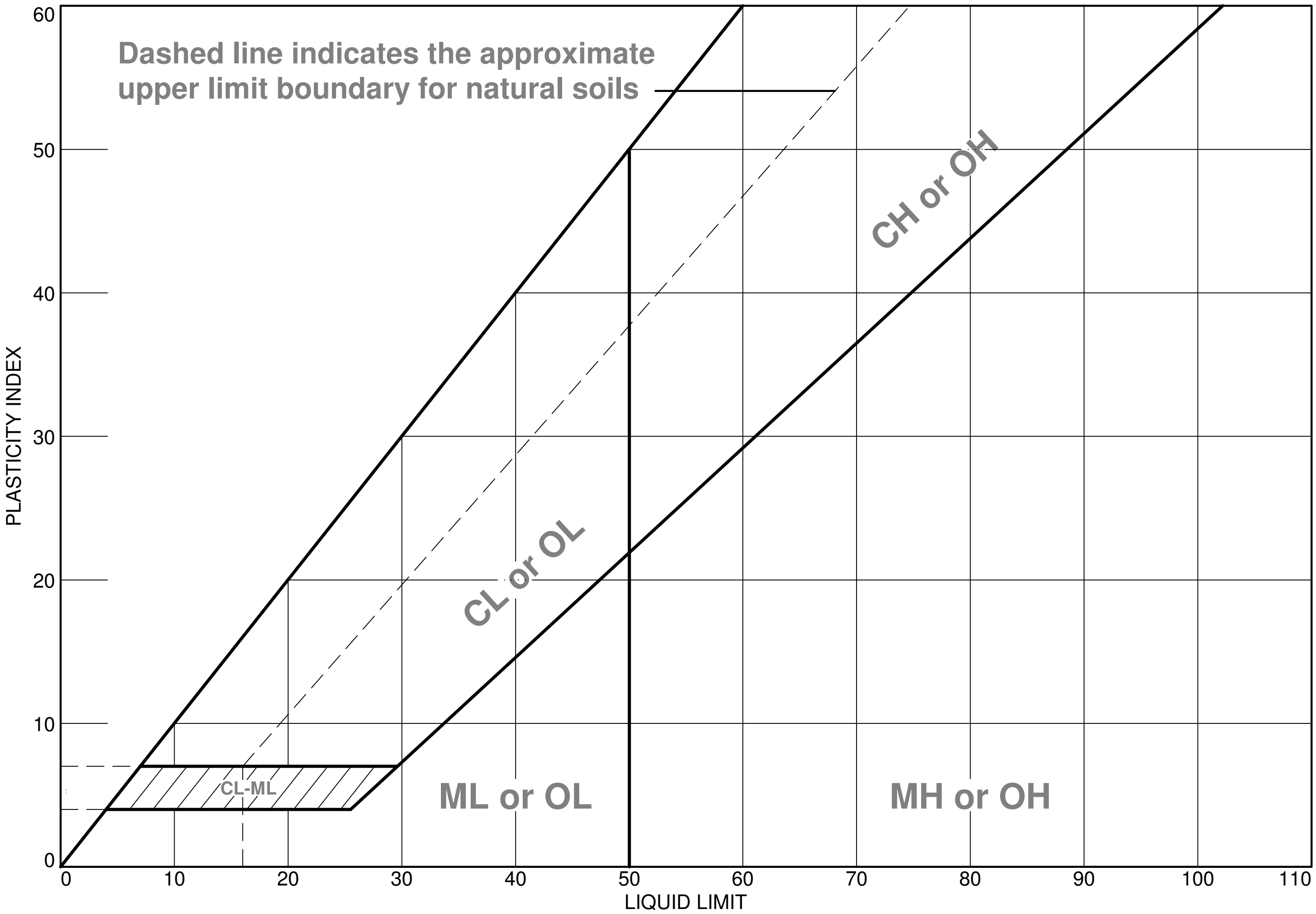
Sample No.: **Source of Sample:** **Date:** 6/2/20
Location: Scherler **Elev./Depth:**

Knight Piésold CONSULTING

Client: South 32 - Hermosa Project
Project: Hermosa
Project No: 101-00777.03 **Figure**

Tested By: ICloud **Checked By:** JBruce

LIQUID AND PLASTIC LIMITS TEST REPORT ASTM D4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	silty sand	NP	NP	NP	100.0	48.0	SM
■	silty sand	NP	NP	NP	100.0	43.5	SM
▲	silty sand	NP	NP	NP	100.0	45.2	SM
◆	silty sand	NP	NP	NP	99.9	43.3	SM
▼	silty sand	NP	NP	NP	99.8	45.2	SM

Project No. 101- **Client:** South 32 - Hermosa Project

Project: Hermosa

● **Location:** Concha
■ **Location:** Deeps
▲ **Location:** Epitaph
◆ **Location:** Scherler
▼ **Location:** Combined Bulk Sample **Sample Number:** CU

Knight Piésold CONSULTING

Remarks:

Figure

Tested By: MFreund **Checked By:** JBruce

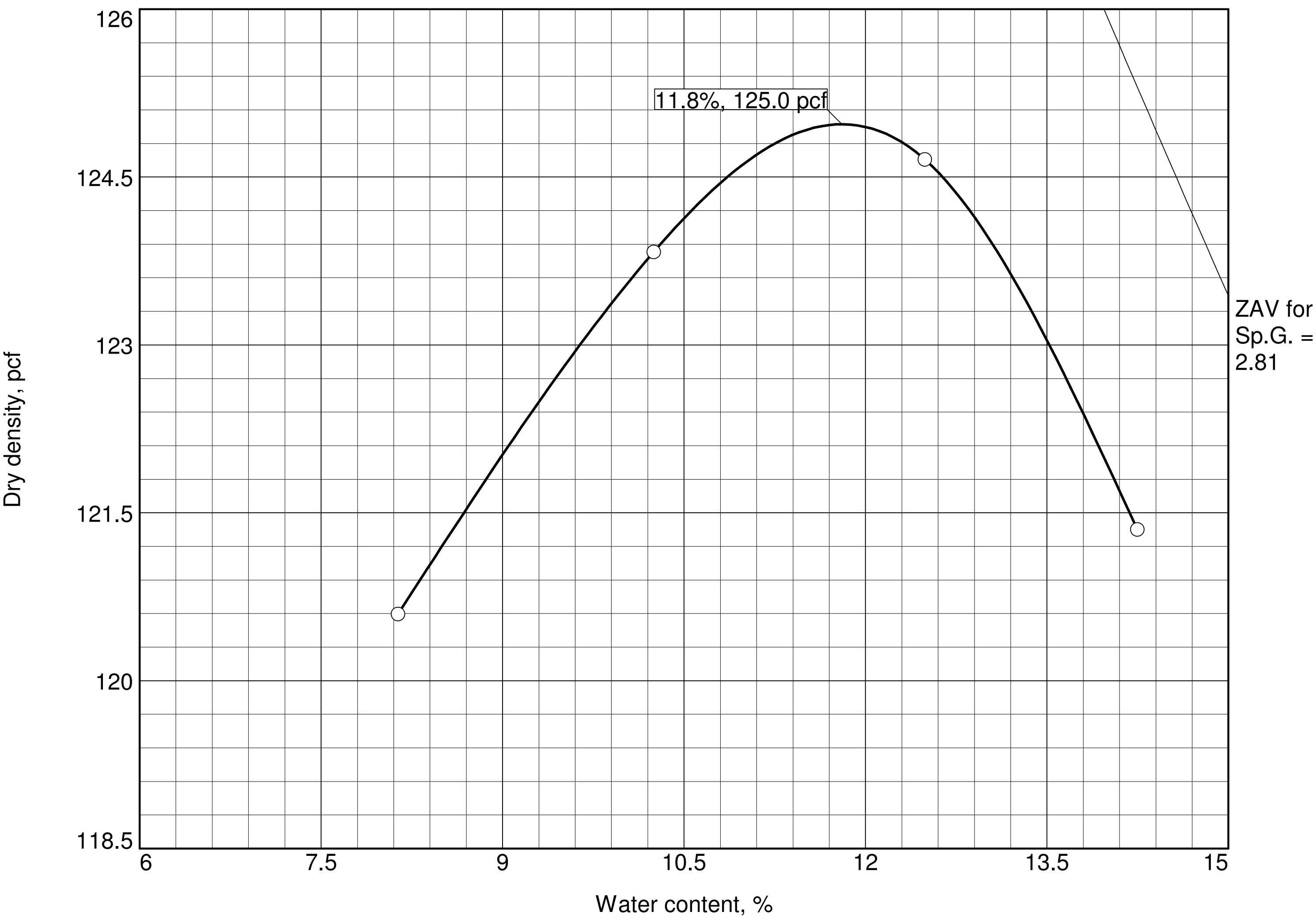
Knight Piésold CONSULTING

Specific Gravity - Soil
ASTM D 854

Project	Hermosa	**Project No.**	TU101-000777/03
Date Staged	3/3/2020		
Date Completed	6/5/2020	**Lab No.**	L2020-035
Tested By	Icloud	**Checked By**	Jbruce

Sample No.	Concha		Deeps		Epitaph		Scherler		Bulk Sample	
Sample Prep. (Wet or Dry)	wet		wet		wet					
Flask No.										
1) Wt. of Flask + Soil										
2) Wt. of Flask										
3) Wt. of Soil (1-2)	31.02	31.03	31.13	31.12	31.04	31.02	31.11	31.06	28.98	29.04
4) Calibrated Wt. of Flask + Water	335.66	338.86	337.73	338.71	337.40	365.91	338.53	338.18	338.02	337.57
5) #3 + #4	366.68	369.89	368.86	369.83	368.44	396.93	369.64	369.24	367.00	366.61
6) Wt. of Flask + Water + Soil	356.16	359.47	357.48	358.76	357.23	385.53	358.43	358.04	356.83	356.57
7) Volume of Soil (5 - 6)	10.52	10.42	11.38	11.07	11.21	11.40	11.21	11.20	10.17	10.04
8) Test Temperature, deg. C	24	24	24.7	24.6	23	23.1	24.5	24.6	27.1	27.1
9) Temperature Correction, k	0.999088	0.999088	0.998916	0.998942	0.999339	0.999315	0.998968	0.998942	0.998279	0.998279
10) Specific Gravity ((3 / 7) * k)	2.946	2.975	2.733	2.808	2.767	2.719	2.772	2.770	2.845	2.887
Reported Average, G_s @ 20 deg.C	2.961		2.770		2.743		2.771		2.866	
Tare	3	17	10	13	6	2	20	1	10	13
Dry Soil + tare, g	433.46	426.08	433.96	433.97	406.84	423.91	426.26	425.44	431.82	431.92
Tare, g	402.44	395.05	402.83	402.85	375.8	392.89	395.15	394.38	402.84	402.88

General Notes: Line 9, k, is determined by dividing the density of water at test temperature recorded, by the density of water at 20 deg. C.



Test specification: ASTM D 698-12 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
				2.811	NP	NP	0	

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 125.0 pcf Optimum moisture = 11.8 %	

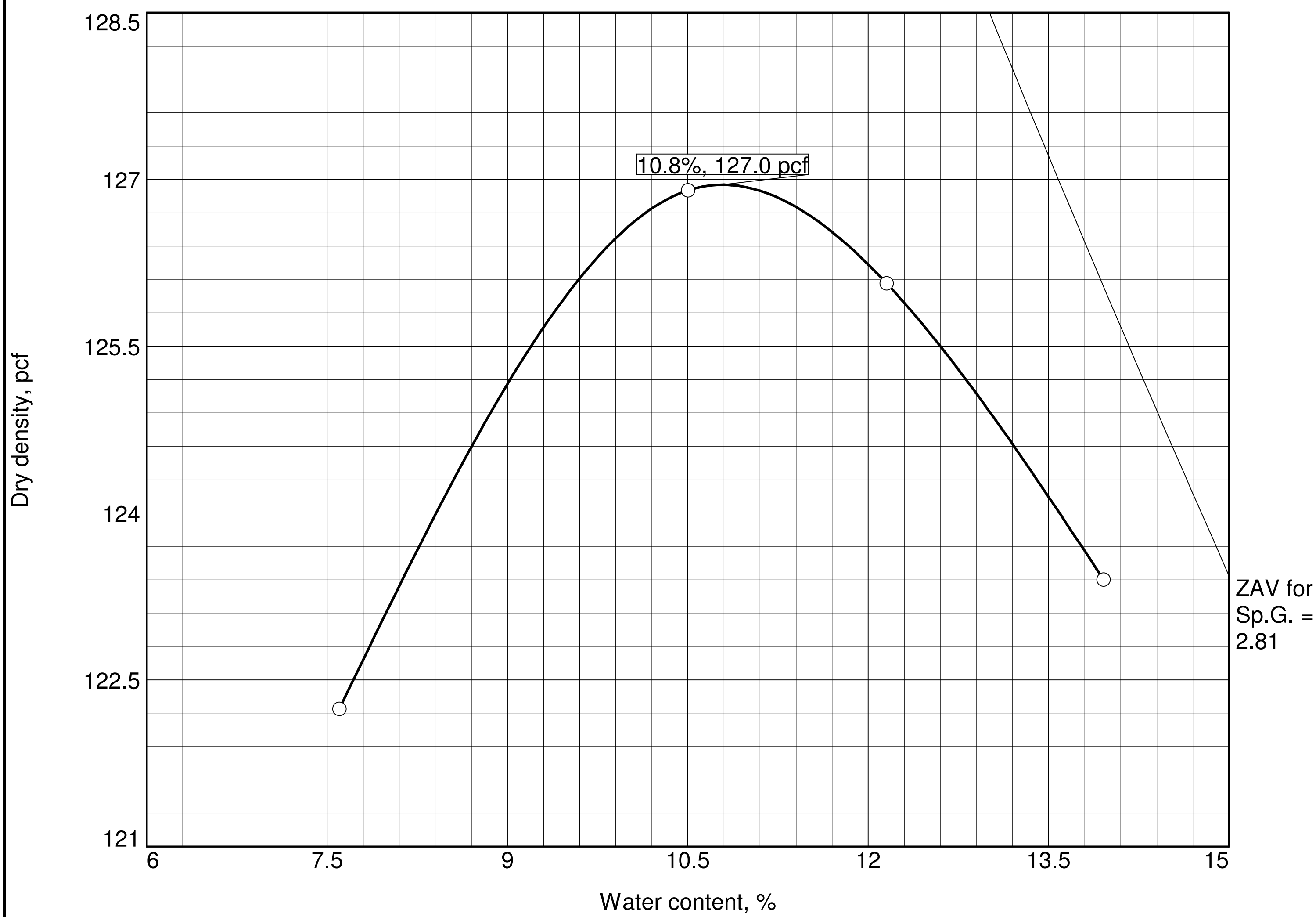
Project No. 101-00777.03 **Client:** South 32 - Hermosa Project
Project: Hermosa
Date: 6/11/20
○ **Location:** Combined Bulk Sample **Sample Number:** D698-1

Knight Piésold CONSULTING

Remarks:

Figure

Tested By: ICloud **Checked By:** JBruce



Test specification: ASTM D 698-12 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
				2.811	NP		0	45.2

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 127.0 pcf Optimum moisture = 10.8 %	silty sand

Project No. 101-00777.03 **Client:** South 32 - Hermosa Project
Project: Hermosa
Date: 6/11/20
○ **Location:** Combined Bulk Sample **Sample Number:** D698-2

Knight Piésold CONSULTING

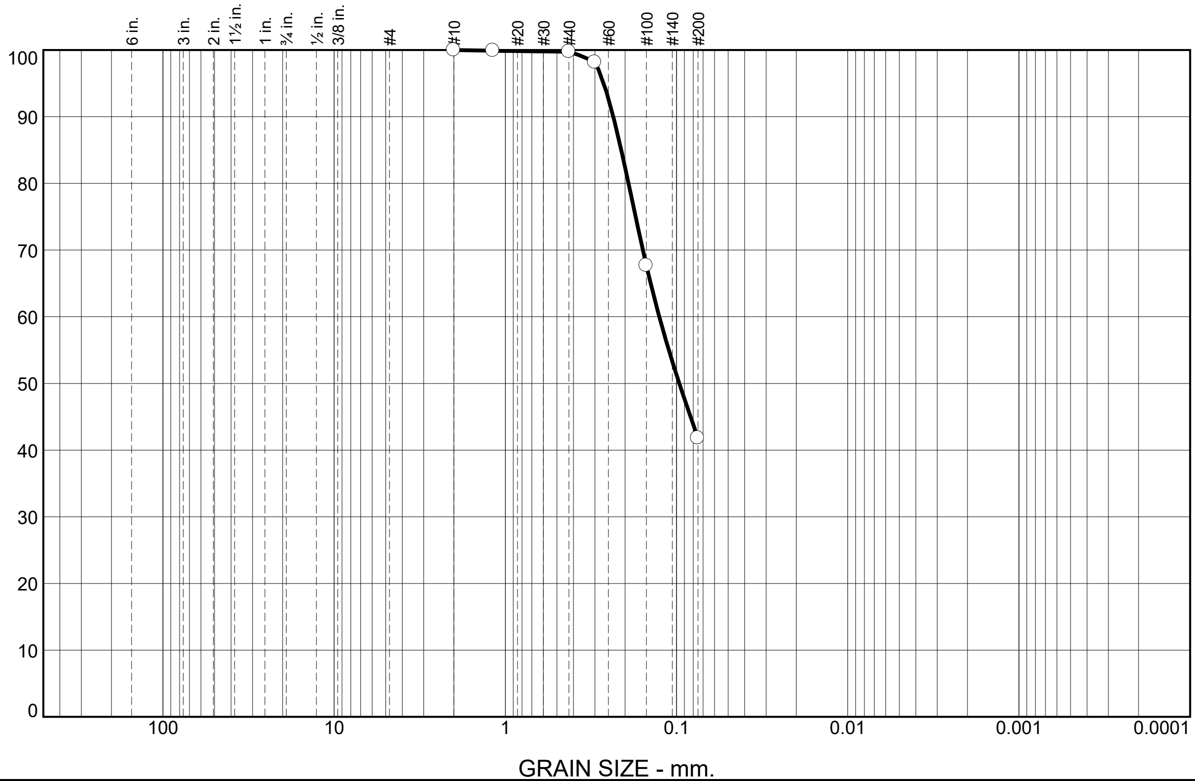
Remarks:

Figure

Tested By: MFreund **Checked By:** JBruce

COMBINED BULK SYNTHETIC TAILINGS SAMPLE FROM 2022

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.2	58.0	41.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#16	99.9		
#40	99.8		
#50	98.2		
#100	67.7		
#200	41.8		

* (no specification provided)

Soil Description

Gray silty sand

Atterberg Limits

PL= NP   LL= NP   PI= NP

Coefficients

D_{90}= 0.2340 D_{85}= 0.2103 D_{60}= 0.1263
D_{50}= 0.0965 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM   AASHTO= A-4(0)

Remarks

Location: Tailings Comp 1
Sample Number: 22-034-01

Date: 2/24/2022

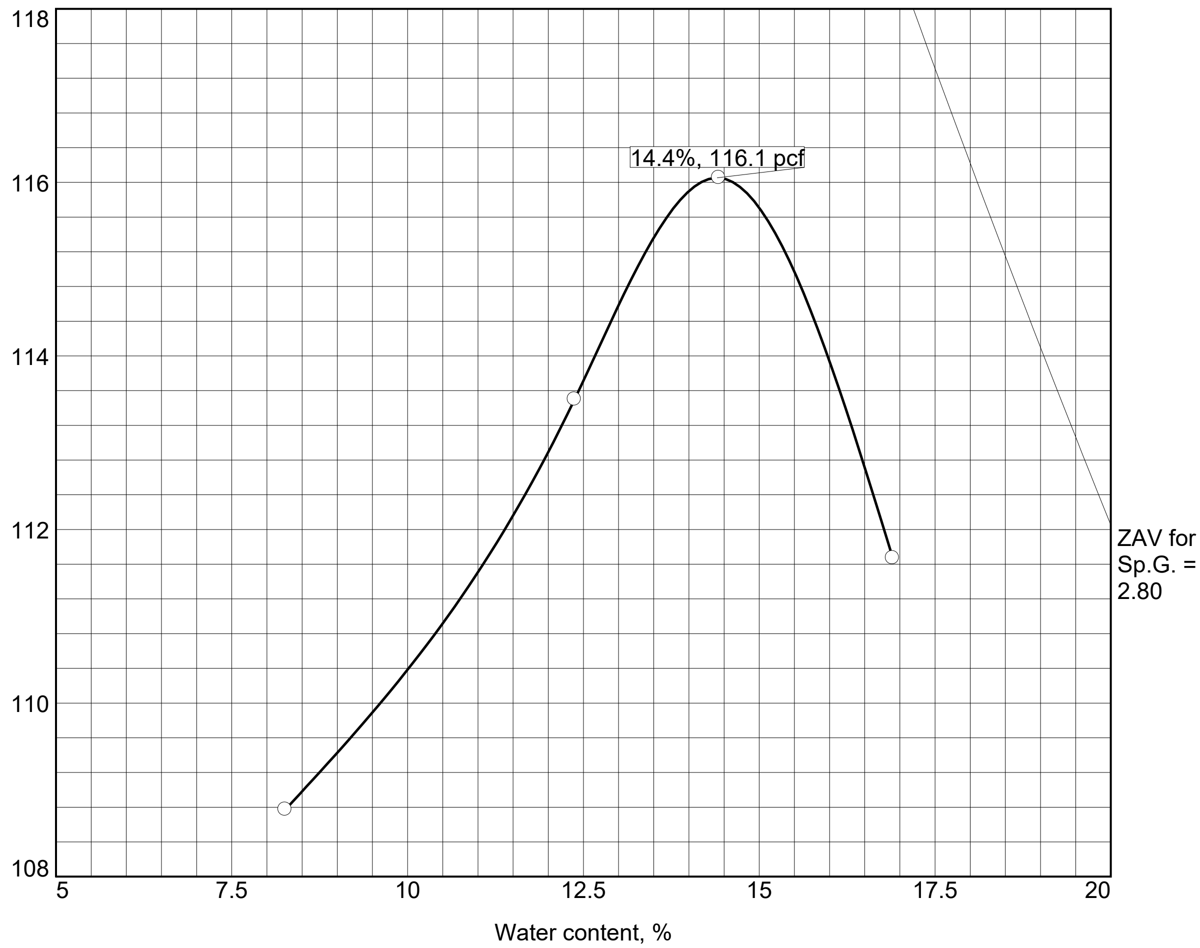
NewFields

Client: South 32
Project: Hermosa

Project No: 475.0014.024   **Figure** 22-034-01

Tested By: EG   **Checked By:** JW

COMPACTION TEST REPORT



Test specification: ASTM D 698-12 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
	SM	A-4(0)		2.8	NP	NP	0.0	41.8

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 116.1 pcf Optimum moisture = 14.4 %	Gray silty sand

Project No. 475.0014.024 **Client:** South 32

Project: Hermosa

Date: 2/24/2022

○ **Location:** Tailings Comp 1 **Sample Number:** 22-034-01

NewFields

Remarks:

*Assumed Specific Gravity

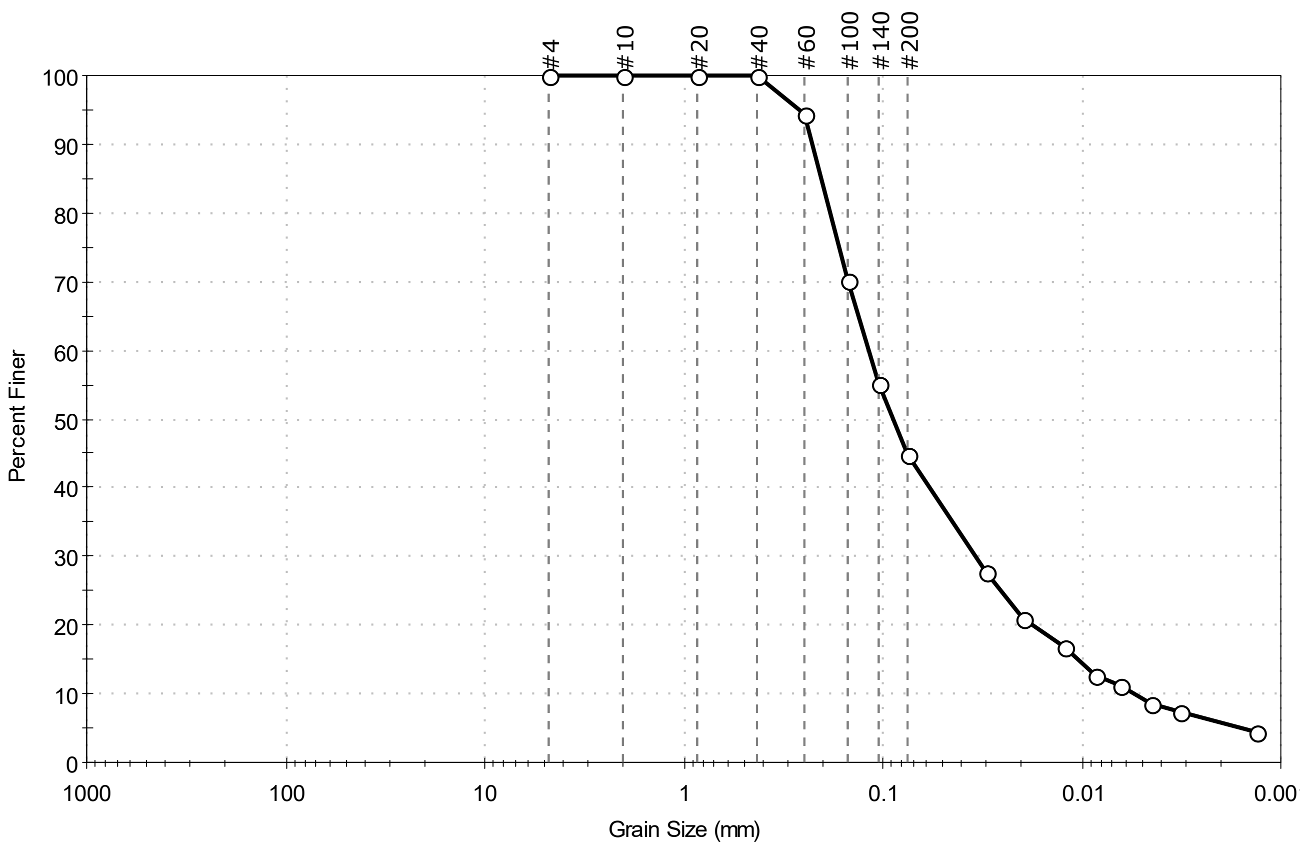
Figure 22-034-01

Tested By: ZM **Checked By:** JW

Client:	NewFields				
Project:	Hermosa				
Location:	Patagonia, AZ			Project No:	GTX-315266
Boring ID:	---	Sample Type:	bucket	Tested By:	ckg
Sample ID:	Composite Ore (Taylor De	Test Date:	09/02/22	Checked By:	n/a
Depth :	---	Test Id:	682666		

Test Comment: ---
Visual Description: Moist, gray silty sand
Sample Comment: ---

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	55.3	44.7

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	100		
#60	0.25	94		
#100	0.15	70		
#140	0.11	55		
#200	0.075	45		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0305	28		
---	0.0196	21		
---	0.0124	17		
---	0.0085	13		
---	0.0064	11		
---	0.0045	9		
---	0.0032	7		
---	0.0013	4		

Coefficients

D_{85} =0.2046 mm D_{30} =0.0344 mm
D_{60} =0.1185 mm D_{15} =0.0105 mm
D_{50} =0.0893 mm D_{10} =0.0054 mm
C_u =21.944 C_c =1.849

Classification

ASTM   Silty SAND (SM)

AASHTO   Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---
Sand/Gravel Hardness : ---
Dispersion Device : Apparatus A - Mech Mixer
Dispersion Period : 1 minute
Est. Specific Gravity : 2.83
Separation of Sample: #200 Sieve

Client:	NewFields				
Project:	Hermosa				
Location:	Patagonia, AZ			Project No:	GTX-315266
Boring ID:	---	Sample Type:	bucket	Tested By:	cam
Sample ID:	Composite Ore (Taylor De	Test Date:	09/01/22	Checked By:	n/a
Depth :	---	Test Id:	682667		

Test Comment: ---
Visual Description: Moist, gray silty sand
Sample Comment: ---

Atterberg Limits - ASTM D4318

Sample Determined to be non-plastic

Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	Composite Ore (Taylor Deposite)	---	---	13	n/a	n/a	n/a	n/a	Silty SAND (SM)

0% Retained on #40 Sieve
Dry Strength: LOW
Dilatancy: RAPID
Toughness: n/a
The sample was determined to be Non-Plastic

Client:	NewFields				
Project:	Hermosa				
Location:	Patagonia, AZ			Project No:	GTX-315266
Boring ID:	---	Sample Type:	bucket	Tested By:	ckg
Sample ID:	Composite Ore (Taylor De	Test Date:	08/29/22	Checked By:	ank
Depth :	---	Test Id:	682665		
Test Comment:	---				
Visual Description:	Moist, gray silty sand				
Sample Comment:	---				

Specific Gravity of Soils by ASTM D854

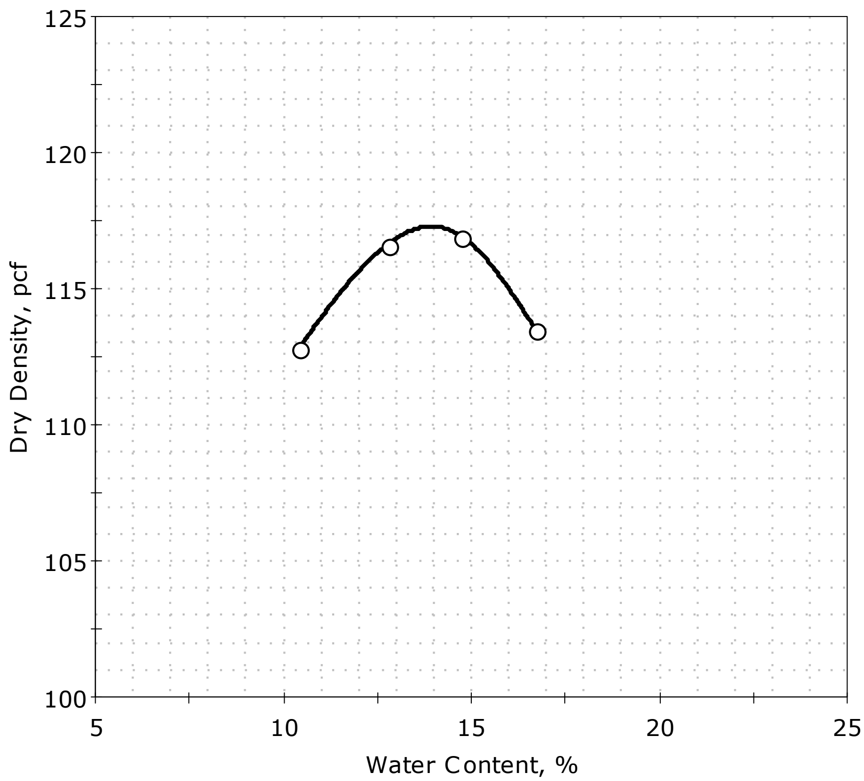
Boring ID	Sample ID	Depth	Visual Description	Specific Gravity
---	Composite Ore (Taylor Deposite)	---	Moist, gray silty sand	2.83

Notes: Specific Gravity performed by using method B (oven dried specimens) of ASTM D854
Moisture Content determined by ASTM D2216.

Client:	NewFields				
Project:	Hermosa				
Location:	Patagonia, AZ			Project No:	GTX-315266
Boring ID:	---	Sample Type:	bucket	Tested By:	cwd
Sample ID:	Composite Ore (Taylor De	Test Date:	08/31/22	Checked By:	n/a
Depth :	---	Test Id:	682945		

Test Comment: ---
Visual Description: Moist, gray silty sand
Sample Comment: ---

Compaction Report - ASTM D698



Data Points	Point 1	Point 2	Point 3	Point 4
Dry density, pcf	112.8	116.6	116.9	113.5
Moisture Content, %	10.4	12.8	14.7	16.7

Method : A

Preparation : DRY

As received Moisture :13 %

Rammer : Manual

Zero voids line based on assumed specific gravity of 2.65

Maximum Dry Density= 117.3 pcf
Optimum Moisture= 13.9 %

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ATTACHMENT B

COMBINED BULK SYNTHETIC TAILINGS SAMPLE FROM 2020

SAMPLE

Boring: Composite
Sample: Bulk
Type: Laboratory Compacted to ~90% SMDD

SPECIMEN

w_o: 13.7 %
γ_{to}: 128.7 pcf
γ_{do}: 113.3 pcf

Specimen Description
USCS: SM

brown silty sand

TEST CONDITIONS

w_c: 18.9 %
γ_{tc}: 136.2 pcf
γ_{dc}: 114.6 pcf
$\bar{\sigma}_{vc}$: 0.68 ksf

Saturation 96.2 %

Summary

Load Form: Sinusoidal
Frequency: 0.5 Hz

SRm
0.16

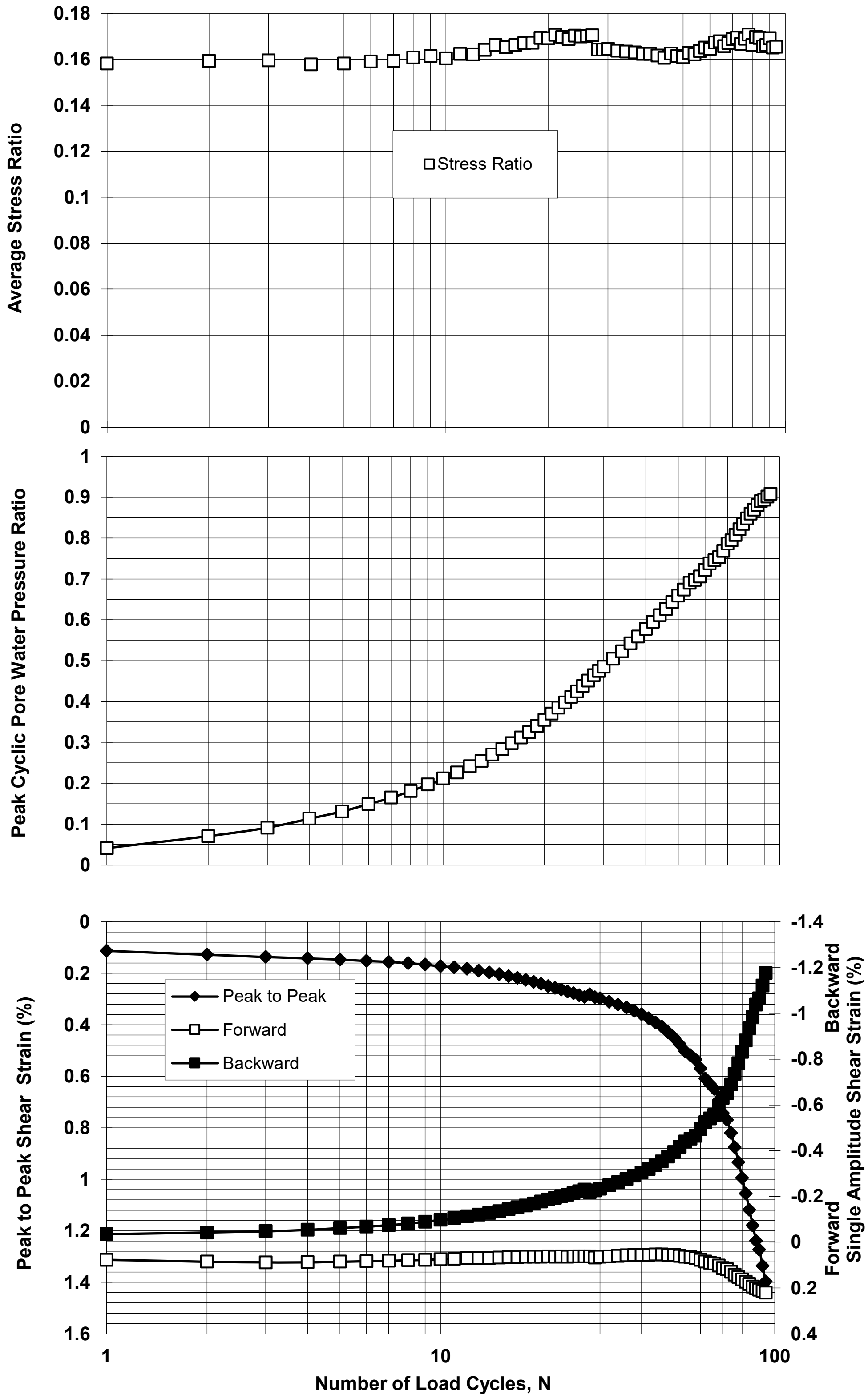
N for γda (%) of

2.5	5.0	10	15
>95	>95	>95	>95

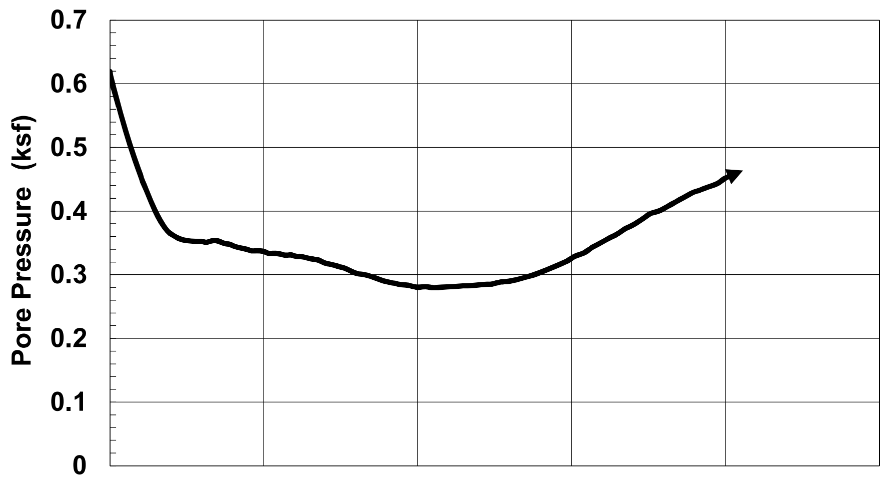
N for Peak Pressure Ratio of

0.1	0.2	0.5	0.95
4	9	32	>95

Test by: GT
Checked by: GET



Project No. 21006426A	Hermosa New Fields	LOAD CONTROL CYCLIC DIRECT SIMPLE SHEAR STRENGTH TEST
TerraSense		Composite Tailings Bulk

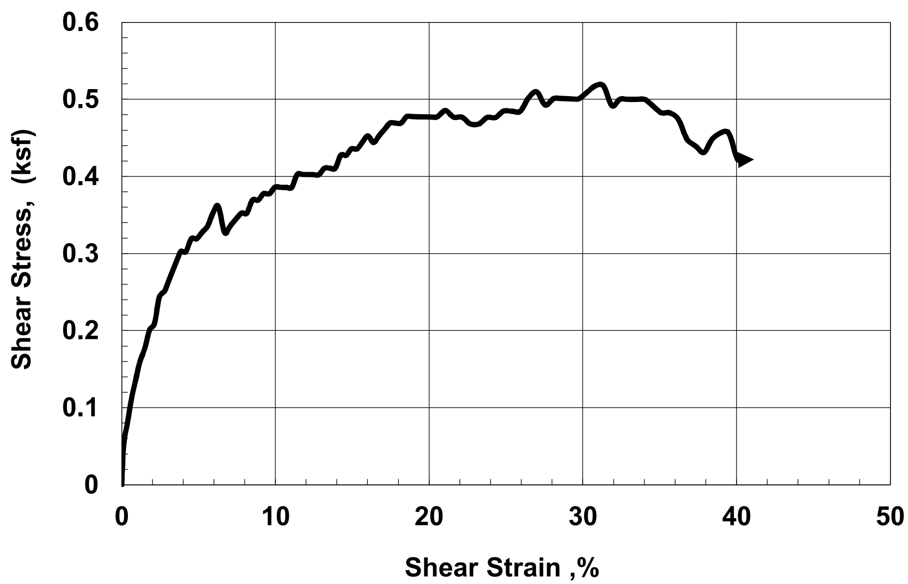


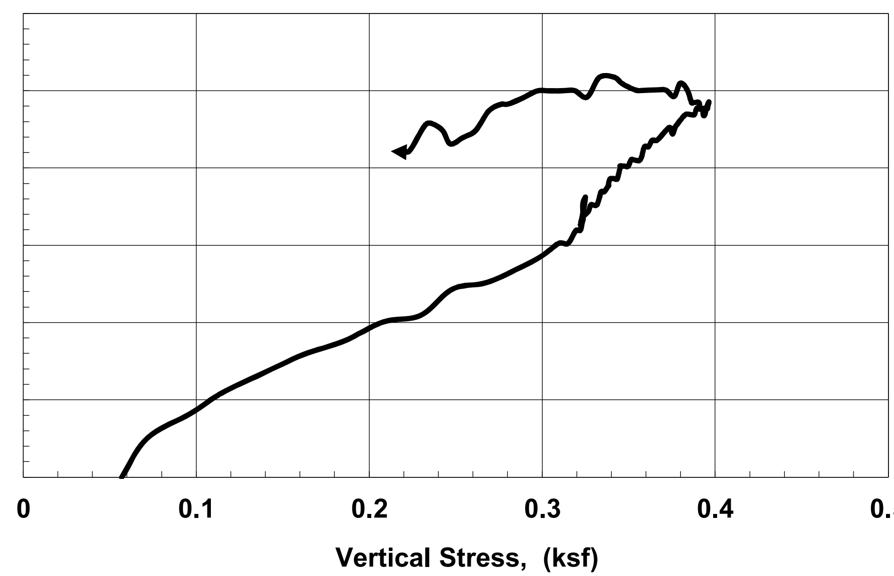
SAMPLE INFORMATION
Boring: Composite Tailings Sample: Bulk
Type: Laboratory Compacted to ~90% SMDD
Description: SM, brown silty sand

SPECIMEN INFORMATION (Initial)
Height: 0.70 Diameter: 2.62 inch Area: 5.40 in²
Water Content: 13.7 % Total Unit Weight: 128.7 pcf

TEST SUMMARY
Vertical Consolidation Stress: 0.68 ksf OCR = 1.0
Water Content: 18.9 % Total Unit Weight: 136.2 pcf
Peak Shear Strength: 0.5 ksf @ 30.8 % Strain
Strain Rate: 0.179 %/min

REMARKS:





Test by: GT	Project No. 21006426A	Hermosa New Fields	CONSTANT VOLUME POST-CYCLIC STATIC DIRECT SIMPLE SHEAR
Checked by: GET	TerraSense		Boring: Composite Tailings Sample: Bulk

SAMPLE

Boring:	Composite
Sample:	Bulk
Type:	Laboratory Compacted to ~90% SMDD

SPECIMEN

w_o:	13.7 %
γ_{to}:	128.0 pcf
γ_{do}:	112.5 pcf

Specimen Description

USCS: SM

brown silty sand

TEST CONDITIONS

w_c:	17.6 %	
γ_{tc}:	133.1	pcf
γ_{dc}:	113.1	pcf
$\bar{\sigma}_{vc}$:	0.68	ksf

Saturation 86.9 %

Summary

Load Form: Sinusoidal

Frequency: 0.5 Hz

SRm
0.19

N for γda (%) of

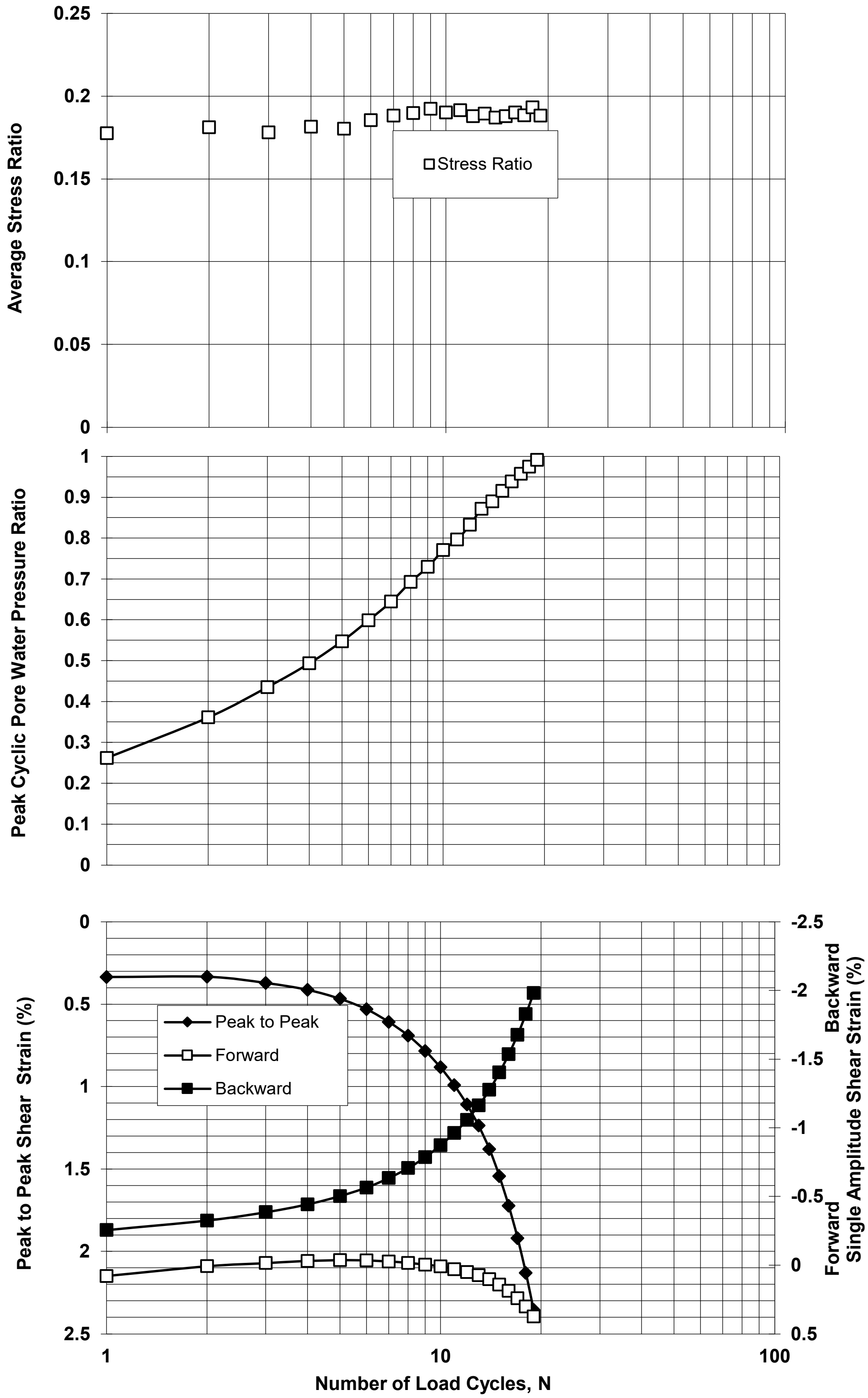
2.5	5.0	10	15
>19	>19	>19	>19

N for Peak Pressure Ratio of

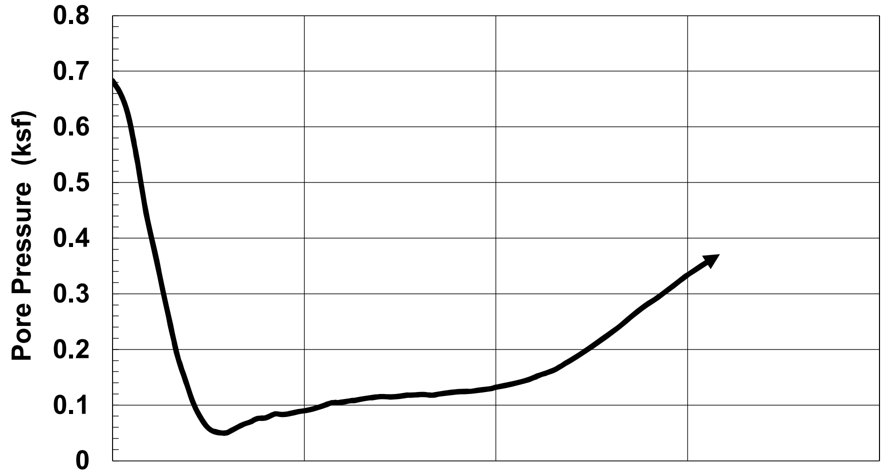
0.1	0.2	0.5	0.95
1	1	5	17

Test by: GT

Checked by: GET



Project No. 21006426A	Hermosa New Fields	**LOAD CONTROL CYCLIC DIRECT SIMPLE SHEAR STRENGTH TEST** Composite Tailings Bulk
	TerraSense	

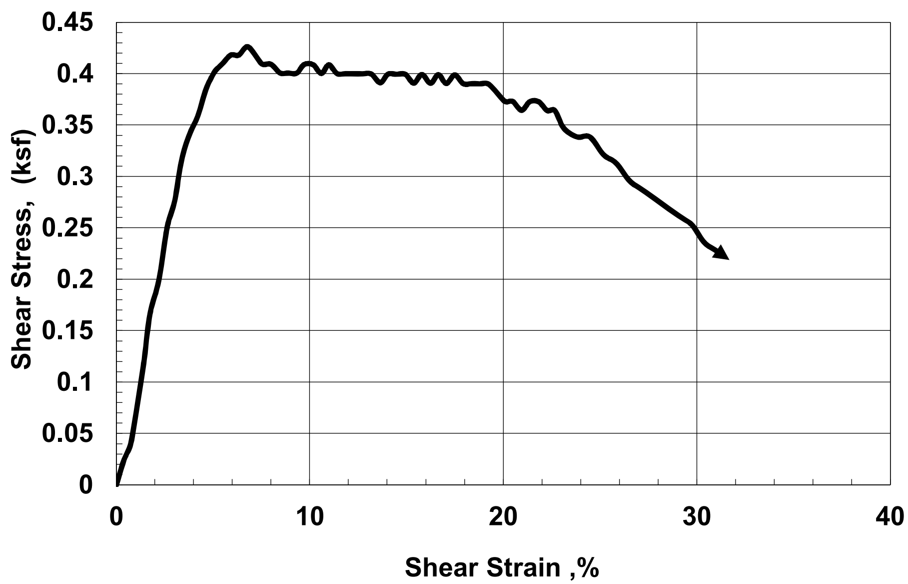


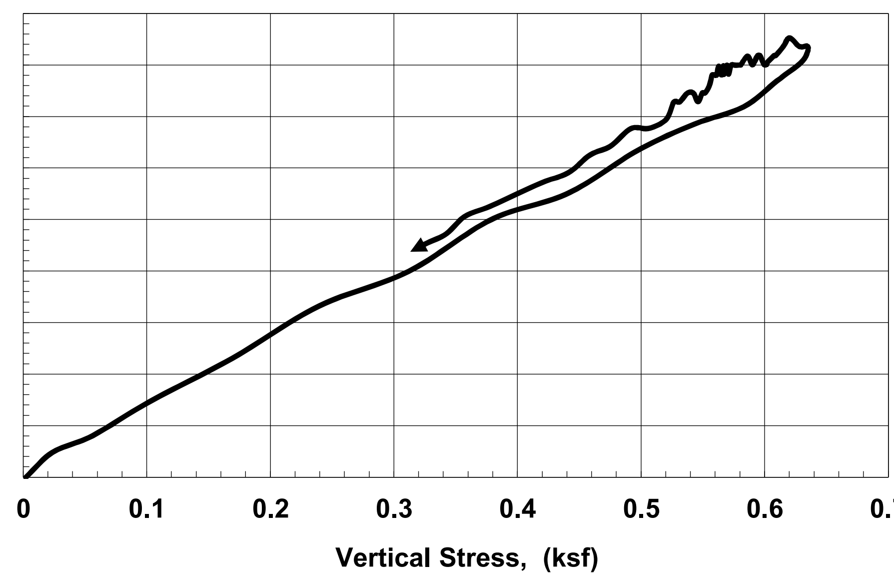
SAMPLE INFORMATION
Boring: Composite Tailings Sample: Bulk
Type: Laboratory Compacted to ~90% SMDD
Description: SM, brown silty sand

SPECIMEN INFORMATION (Initial)
Height: 0.70 Diameter: 2.63 inch Area: 5.44 in²
Water Content: 13.7 % Total Unit Weight: 128.0 pcf

TEST SUMMARY
Vertical Consolidation Stress: 0.68 ksf OCR = 1.0
Water Content: 17.6 % Total Unit Weight: 133.1 pcf
Peak Shear Strength: 0.4 ksf @ 6.8 % Strain
Strain Rate: 0.072 %/min

REMARKS:





Test by: GT Checked by: GET	Project No. 21006426A	Hermosa New Fields	CONSTANT VOLUME POST-CYCLIC STATIC DIRECT SIMPLE SHEAR Boring: Composite Tailings Sample: Bulk
	TerraSense		

SAMPLE

Boring: Composite
Sample: Bulk
Type: Laboratory Compacted to ~90% SMDD

SPECIMEN

w_o: 13.4 %
γ_{to}: 128.0 pcf
γ_{do}: 112.9 pcf

Specimen Description
USCS: SM

brown silty sand

TEST CONDITIONS

w_c: 17.7 %
γ_{tc}: 134.0 pcf
γ_{dc}: 113.9 pcf
$\bar{\sigma}_{vc}$: 0.68 ksf

Saturation 88.7 %

Summary

Load Form: Sinusoidal
Frequency: 0.5 Hz

SRm
0.21

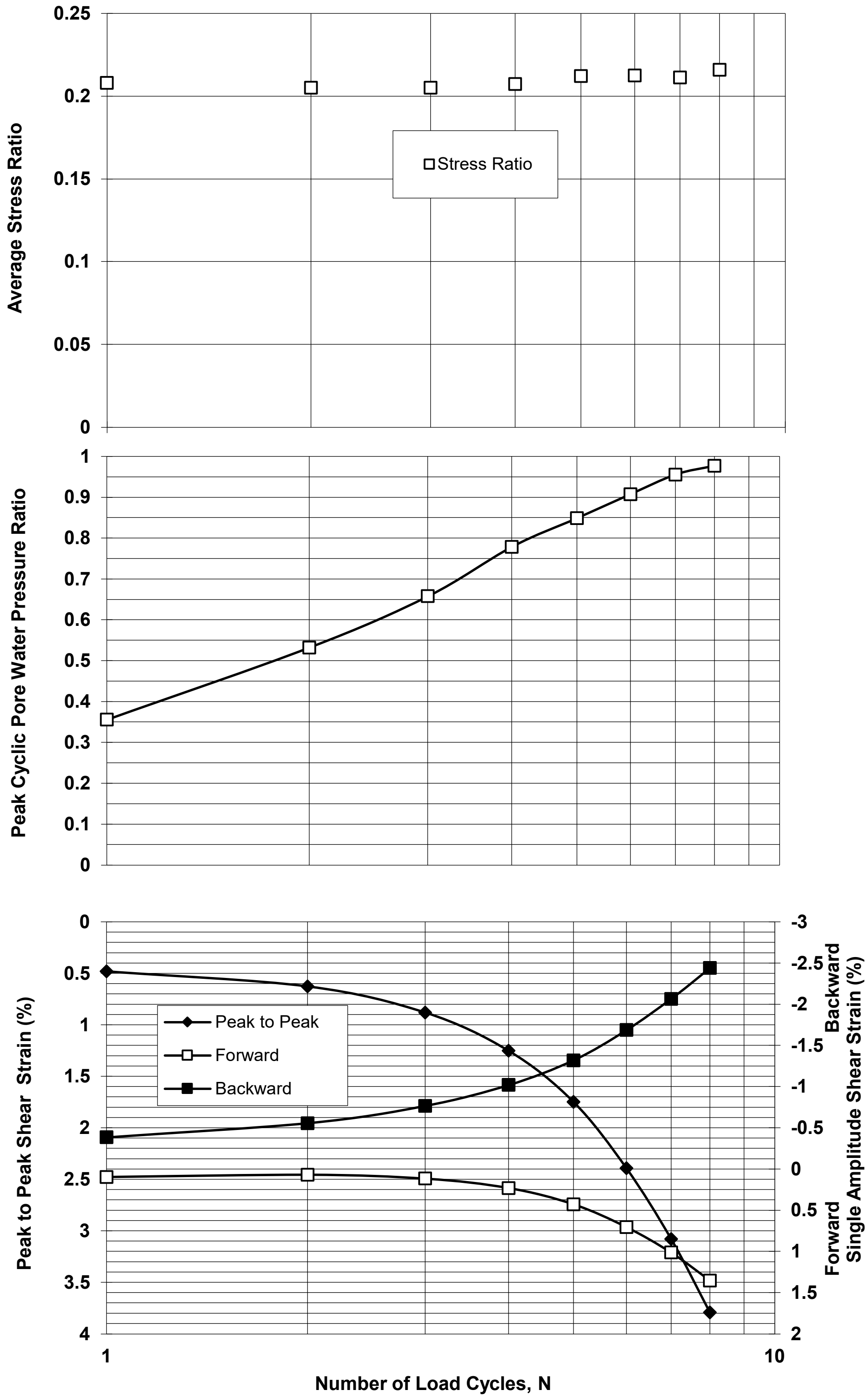
N for γda (%) of

2.5	5.0	10	15
7	>8	>8	>8

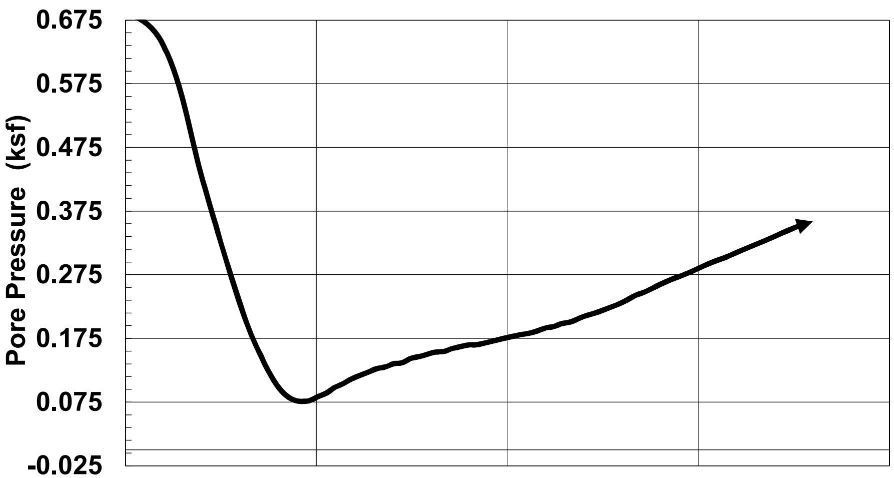
N for Peak Pressure Ratio of

0.1	0.2	0.5	0.95
1	1	2	7

Test by: GT
Checked by: GET



Project No. 21006426A	Hermosa New Fields	**LOAD CONTROL CYCLIC DIRECT SIMPLE SHEAR STRENGTH TEST** Composite Tailings Bulk
	TerraSense	



SAMPLE INFORMATION

Boring: Composite Tailings Sample: Bulk
Type: Laboratory Compacted to ~90% SMDD
Description: SM, brown silty sand

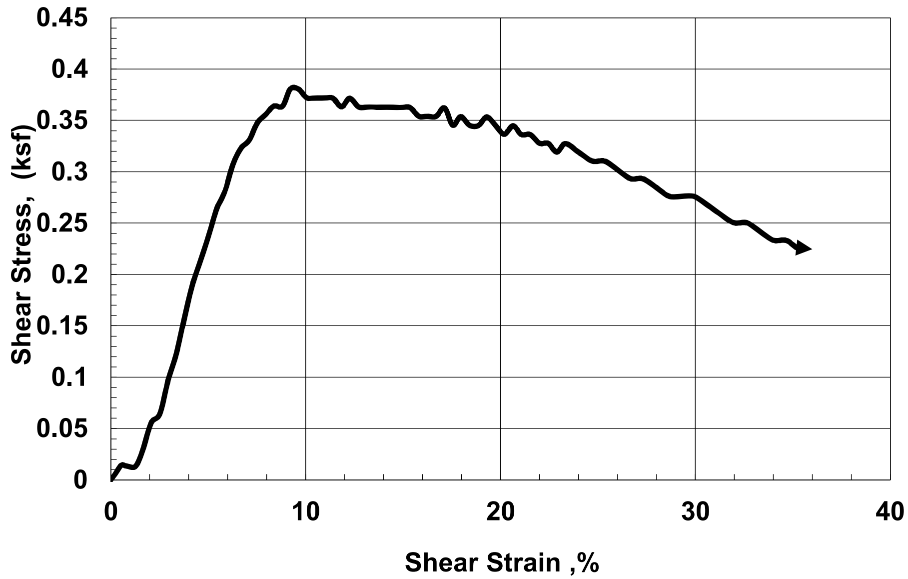
SPECIMEN INFORMATION (Initial)

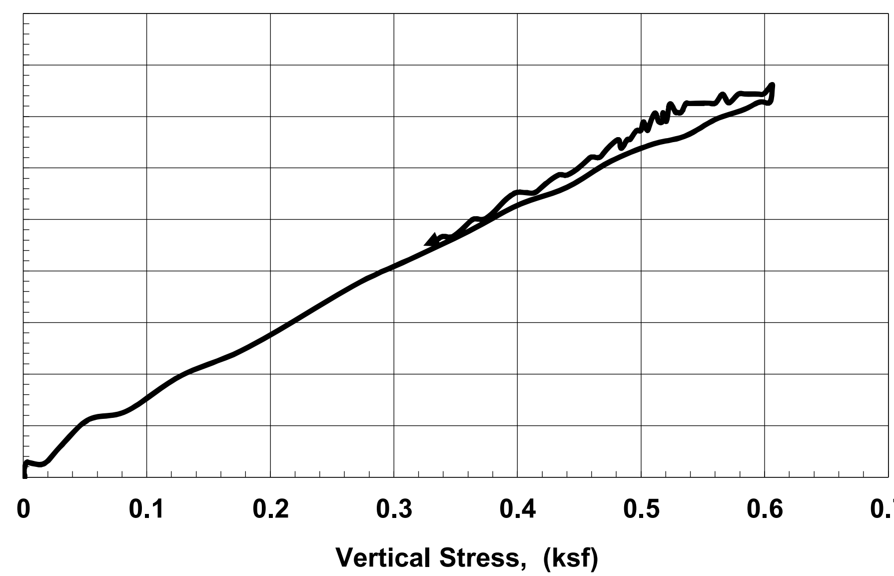
Height: 0.70 Diameter: 2.64 inch Area: 5.46 in²
Water Content: 13.4 % Total Unit Weight: 128.0 pcf

TEST SUMMARY

Vertical Consolidation Stress: 0.68 ksf OCR = 1.0
Water Content: 17.7 % Total Unit Weight: 134.0 pcf
Peak Shear Strength: 0.4 ksf @ 9.2 % Strain
Strain Rate: 0.073 %/min

REMARKS:





Test by: GT	Project No. 21006426A	Hermosa New Fields	CONSTANT VOLUME POST-CYCLIC STATIC DIRECT SIMPLE SHEAR
Checked by: GET	TerraSense		Boring: Composite Tailings Sample: Bulk

SAMPLE

Boring: Composite
Sample: Bulk
Type: Laboratory Compacted to ~90% SMDD

SPECIMEN

w_o: 13.5 %
γ_{to}: 126.1 pcf
γ_{do}: 111.1 pcf

Specimen Description

USCS: SM

brown silty sand

TEST CONDITIONS

w_c: 17.5 %
γ_{tc}: 135.2 pcf
γ_{dc}: 115.0 pcf
$\bar{\sigma}_{vc}$: 3.37 ksf

Saturation 90.5 %

Summary

Load Form: Sinusoidal
Frequency: 0.5 Hz

SRm
0.19

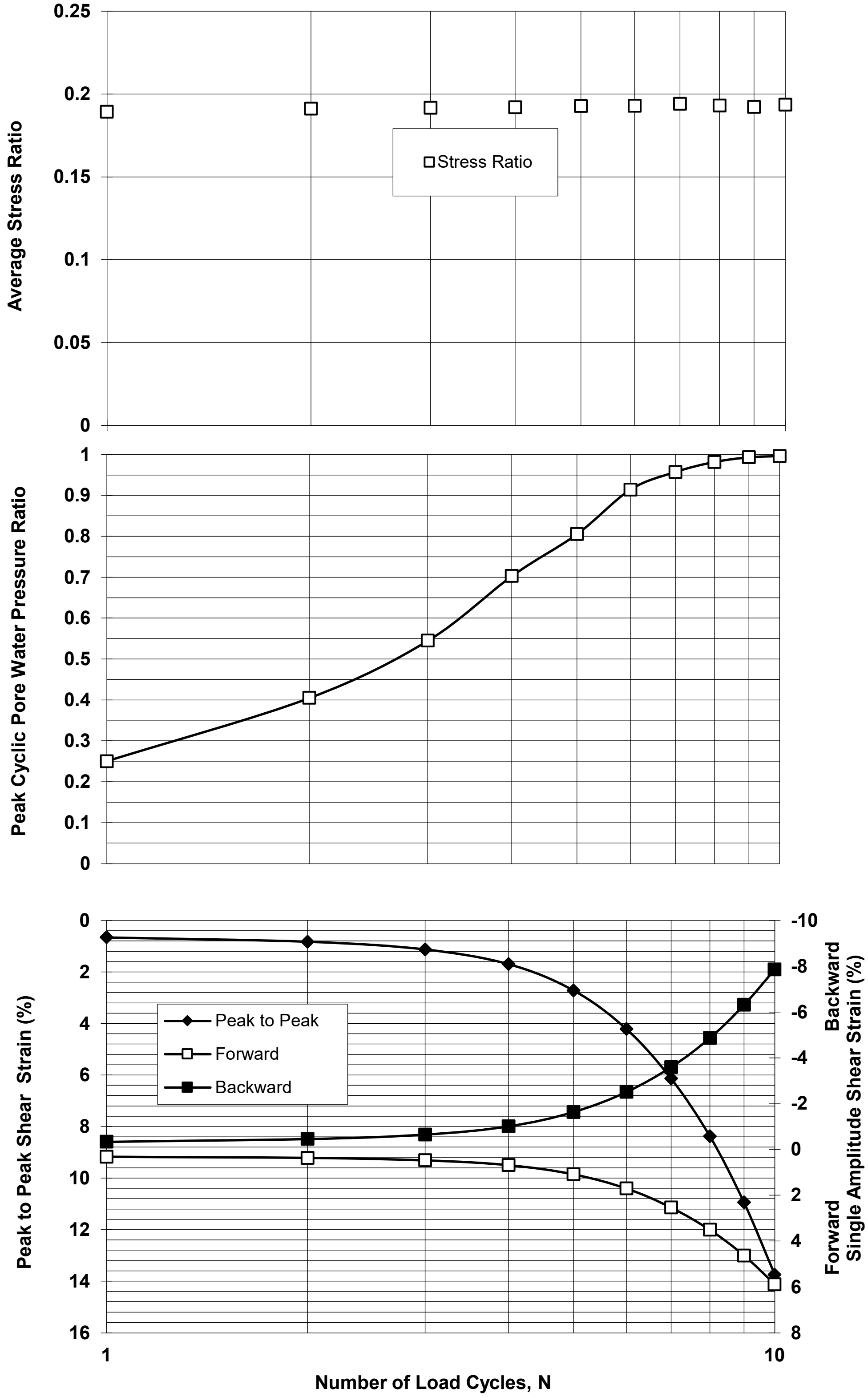
N for γda (%) of

2.5	5.0	10	15
5	7	9	>10

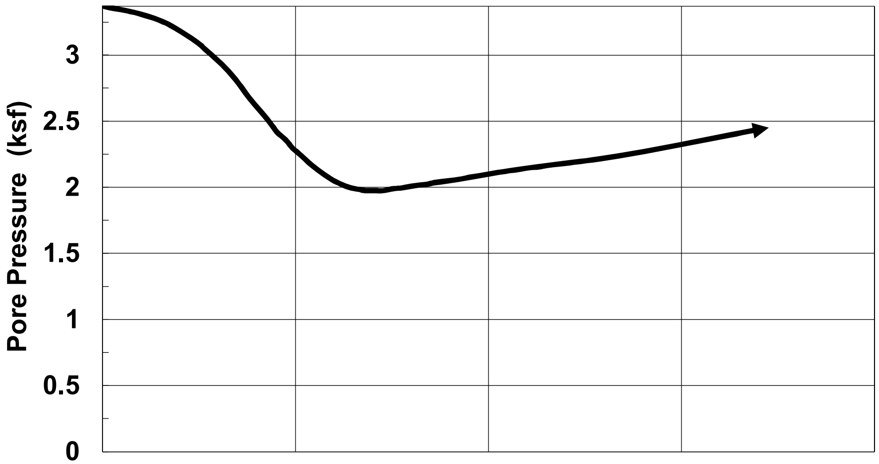
N for Peak Pressure Ratio of

0.1	0.2	0.5	0.95
1	1	3	7

Test by: GT
Checked by: GET



Project No. 21006426A	Hermosa New Fields	**LOAD CONTROL CYCLIC DIRECT SIMPLE SHEAR STRENGTH TEST** Composite Tailings Bulk
	TerraSense	

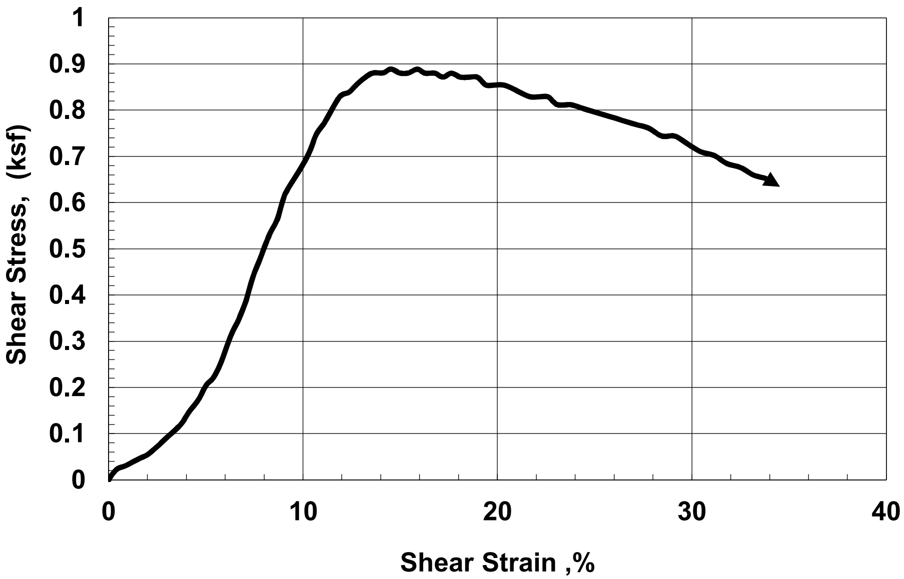


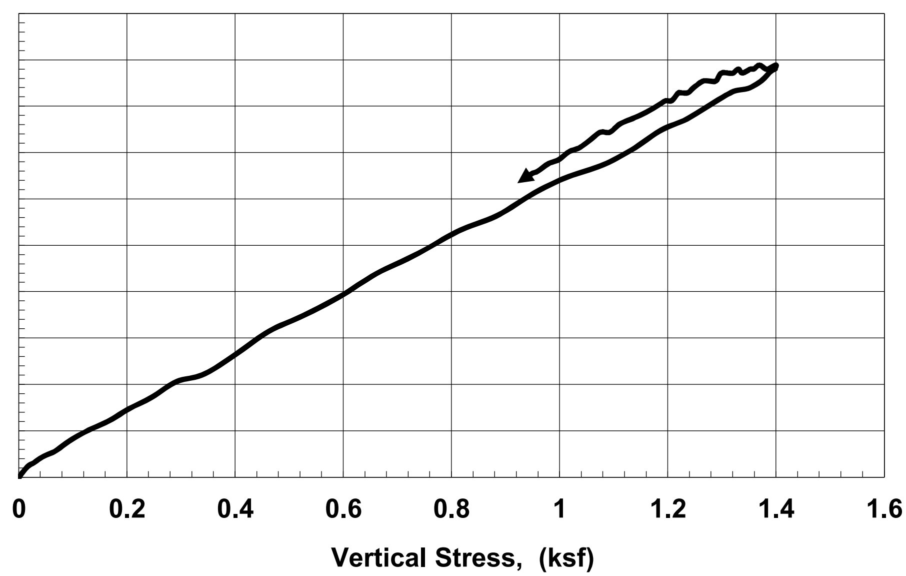
SAMPLE INFORMATION
Boring: Composite Tailings Sample: Bulk
Type: Laboratory Compacted to ~90% SMDD
Description: SM, brown silty sand

SPECIMEN INFORMATION (Initial)
Height: 0.71 Diameter: 2.64 inch Area: 5.47 in²
Water Content: 13.5 % Total Unit Weight: 126.1 pcf

TEST SUMMARY
Vertical Consolidation Stress: 3.37 ksf OCR = 1.0
Water Content: 17.5 % Total Unit Weight: 135.2 pcf
Peak Shear Strength: 0.9 ksf @ 14.5 % Strain
Strain Rate: 0.072 %/min

REMARKS:





Test by: GT	Project No. 21006426A	Hermosa New Fields	CONSTANT VOLUME POST-CYCLIC STATIC DIRECT SIMPLE SHEAR
Checked by: GET	TerraSense		Boring: Composite Tailings Sample: Bulk

SAMPLE

Boring: Composite
Sample: Bulk
Type: Laboratory Compacted to ~85% SMDD

SPECIMEN

w_o: 14.7 %
γ_{to}: 124.1 pcf
γ_{do}: 108.2 pcf

Specimen Description
USCS: SM

brown silty sand

TEST CONDITIONS

w_c: 19.4 %
γ_{tc}: 131.3 pcf
γ_{dc}: 110.0 pcf
$\bar{\sigma}_{vc}$: 0.68 ksf

Saturation 88.6 %

Summary

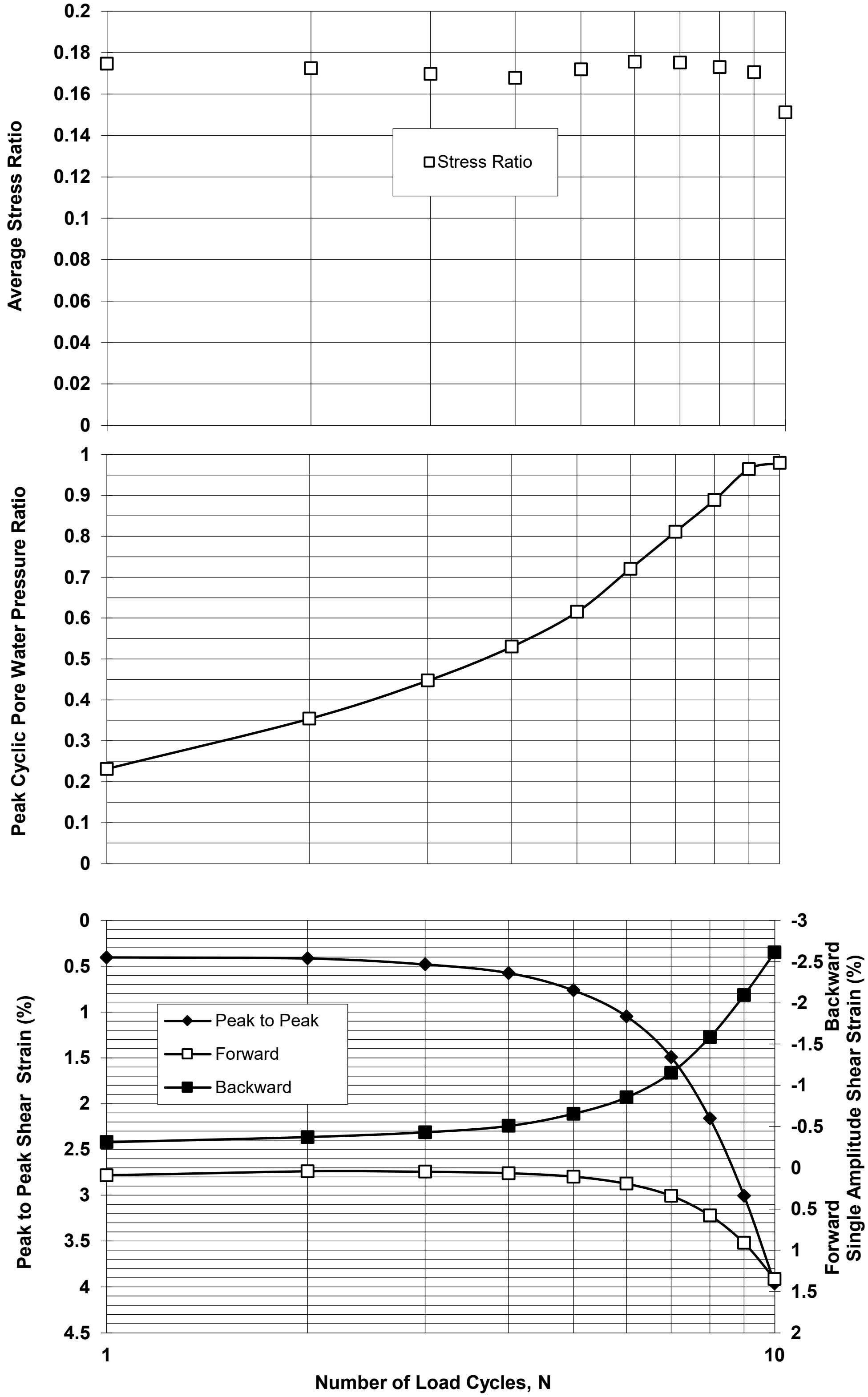
Load Form: Sinusoidal
Frequency: 0.5 Hz

SRm
0.17

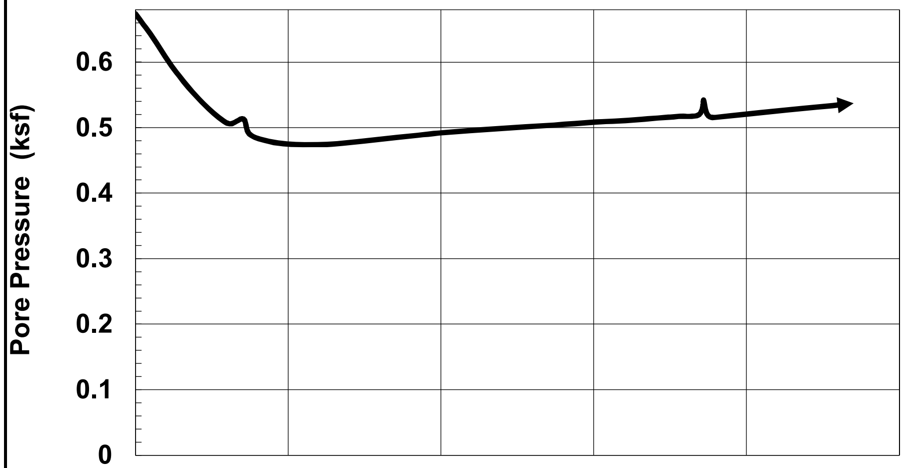
N for γda (%) of			
2.5	5.0	10	15
9	>10	>10	>10

N for Peak Pressure Ratio of			
0.1	0.2	0.5	0.95
1	1	4	9

Test by: GT
Checked by: GET



Project No. 21006426A	Hermosa New Fields	LOAD CONTROL CYCLIC DIRECT SIMPLE SHEAR STRENGTH TEST Composite Tailings Bulk
	TerraSense	

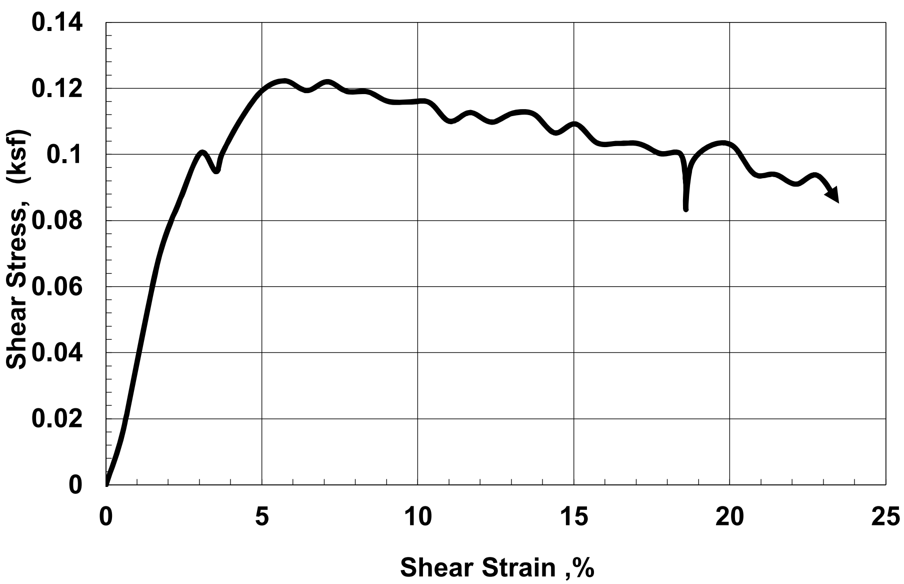


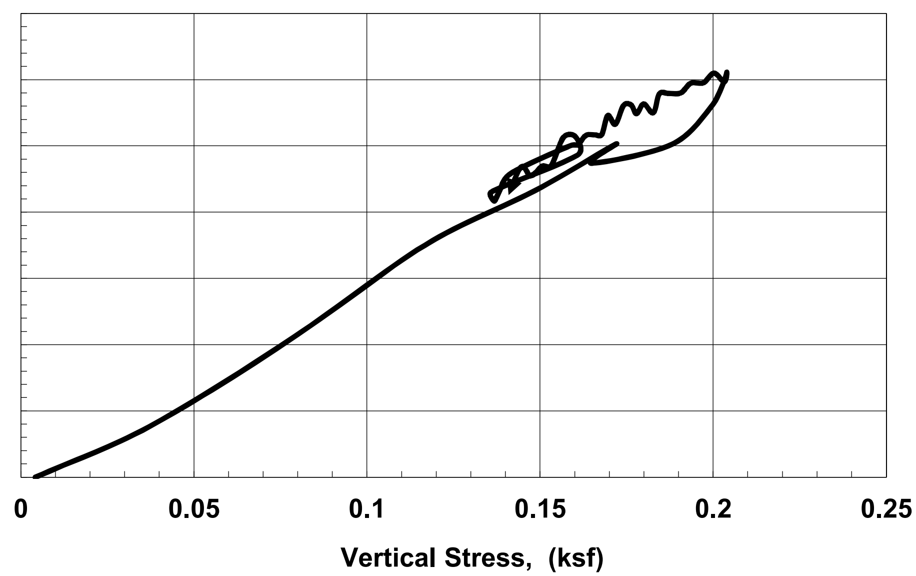
SAMPLE INFORMATION
Boring: Composite Tailings Sample: Bulk
Type: Laboratory Compacted to ~85% SMDD
Description: SM, brown silty sand

SPECIMEN INFORMATION (Initial)
Height: 0.68 Diameter: 2.64 inch Area: 5.47 in²
Water Content: 14.7 % Total Unit Weight: 124.1 pcf

TEST SUMMARY
Vertical Consolidation Stress: 0.68 ksf OCR = 1.0
Water Content: 19.4 % Total Unit Weight: 131.3 pcf
Peak Shear Strength: 0.1 ksf @ 5.7 % Strain
Strain Rate: 0.062 %/min

REMARKS:





Test by: GT	Project No. 21006426A	Hermosa New Fields	CONSTANT VOLUME POST-CYCLIC STATIC DIRECT SIMPLE SHEAR
Checked by: GET		TerraSense	Boring: Composite Tailings Sample: Bulk

SAMPLE

Boring: Composite
Sample: Bulk
Type: Laboratory Compacted to ~95% SMDD

SPECIMEN

w_o: 13.9 %
γ_{to}: 136.0 pcf
γ_{do}: 119.3 pcf

Specimen Description
USCS: SM

brown silty sand

TEST CONDITIONS

w_c: 15.5 %
γ_{tc}: 138.0 pcf
γ_{dc}: 119.4 pcf
$\bar{\sigma}_{vc}$: 0.67 ksf

Saturation 89.5 %

Summary

Load Form: Sinusoidal
Frequency: 0.5 Hz

SRm
0.20

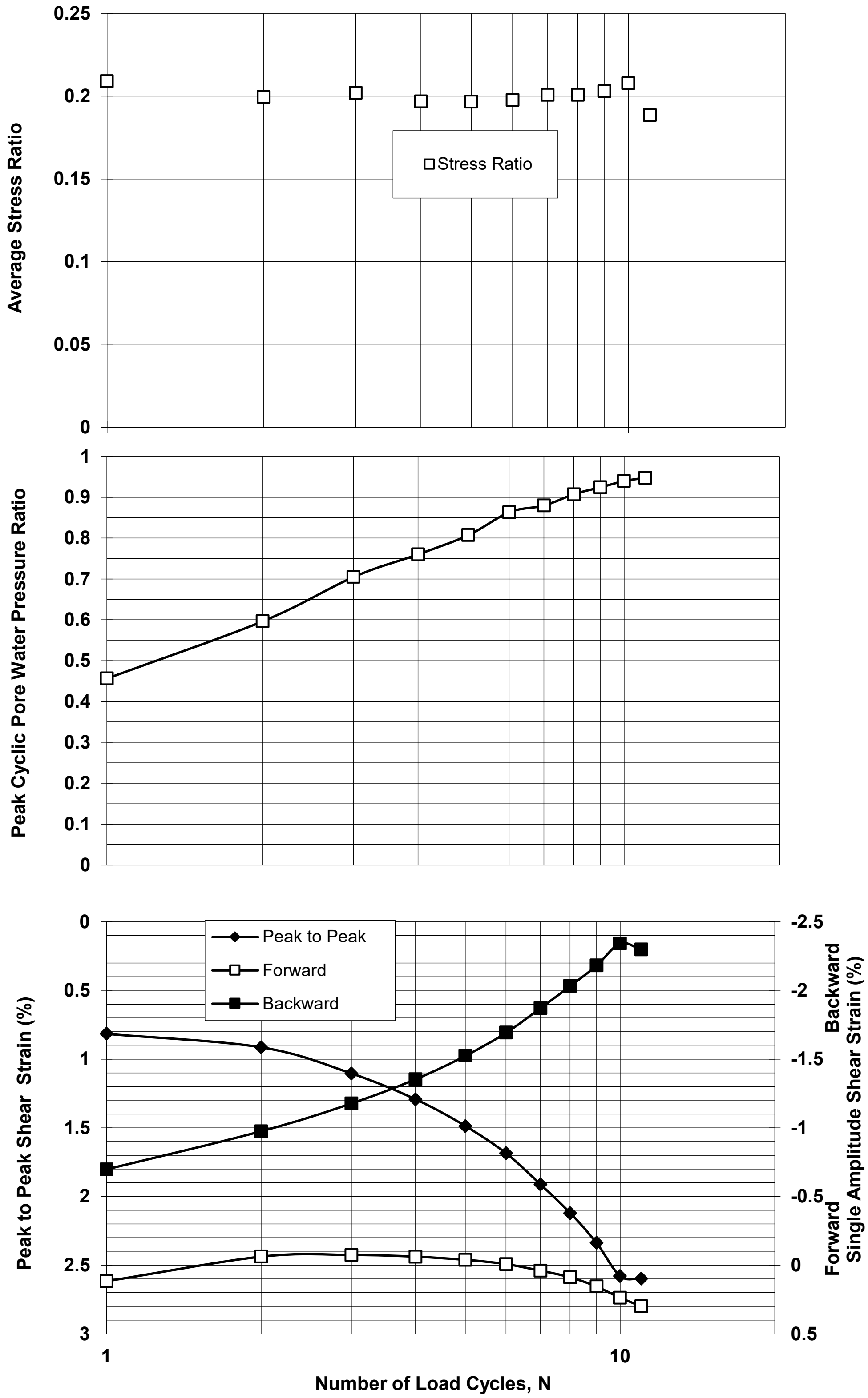
N for γda (%) of

2.5	5.0	10	15
10	>10	>10	>10

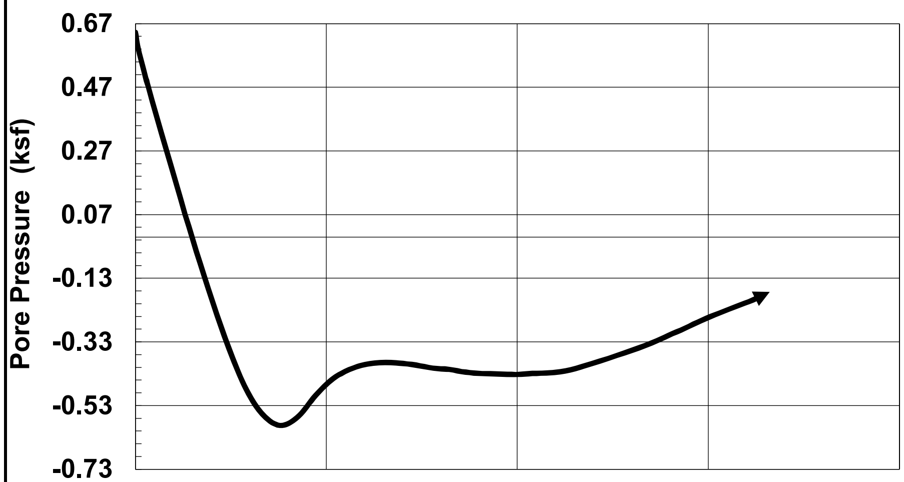
N for Peak Pressure Ratio of

0.1	0.2	0.5	0.95
1	1	2	11

Test by: GT
Checked by: GET



Project No. 21006426A	Hermosa New Fields	LOAD CONTROL CYCLIC DIRECT SIMPLE SHEAR STRENGTH TEST Composite Tailings Bulk
	TerraSense	

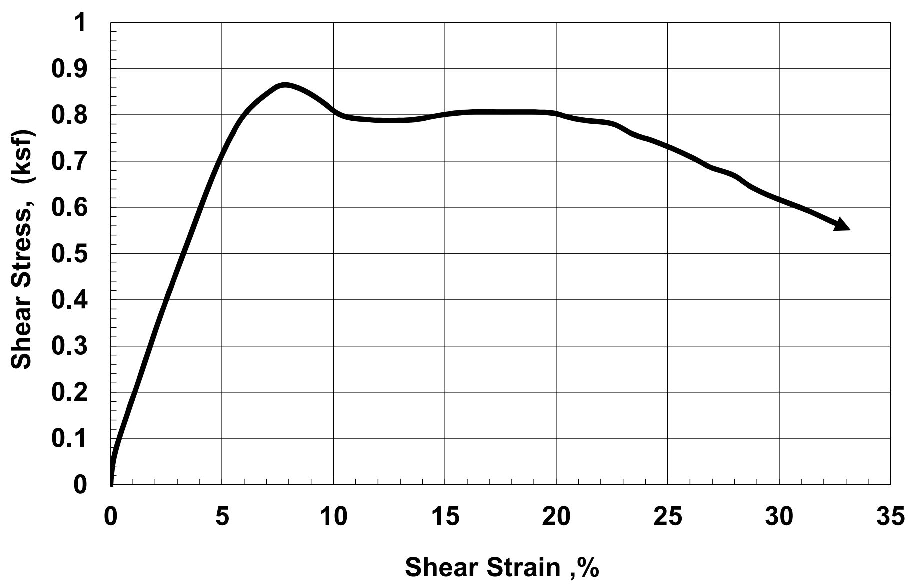


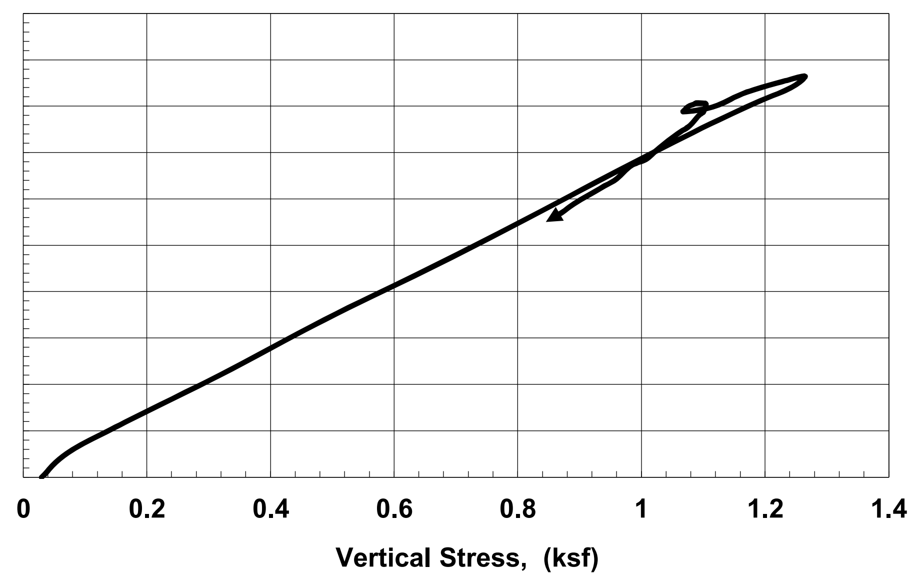
SAMPLE INFORMATION
Boring: Composite Tailings Sample: Bulk
Type: Laboratory Compacted to ~95% SMDD
Description: SM, brown silty sand

SPECIMEN INFORMATION (Initial)
Height: 0.70 Diameter: 2.63 inch Area: 5.44 in²
Water Content: 13.9 % Total Unit Weight: 136.0 pcf

TEST SUMMARY
Vertical Consolidation Stress: 0.67 ksf OCR = 1.0
Water Content: 15.5 % Total Unit Weight: 138.0 pcf
Peak Shear Strength: 0.9 ksf @ 7.7 % Strain
Strain Rate: 0.072 %/min

REMARKS:





Test by: GT	Project No. 21006426A	Hermosa New Fields	CONSTANT VOLUME POST-CYCLIC STATIC DIRECT SIMPLE SHEAR
Checked by: GET	TerraSense		Boring: Composite Tailings Sample: Bulk

TerraSense Analysis File: CDSSstaticV3

12/27/2021 CDSS1052s.xlsx

COMBINED BULK SYNTHETIC TAILINGS SAMPLE FROM 2022

GeoTesting EXPRESS

Consolidated Undrained Cyclic Direct Simple Shear Test under Constant Volume with Load or Displacement Control by ASTM D8296

Client:	NewFields	GTX#:	315266
Project Name	Hermosa	Test Date:	12/22/22
Project Location:	Patagonia, AZ		

Boring ID: ---
Sample ID Composite Ore
Depth, ft: ---

Visual Description: Moist, gray silty sand

Test Equipment: Top and bottom box (circular) = 4.0 inch diameter. Load cells and LVDT’s connected to data acquisition system for shear force, normal load, horizontal and vertical displacement; surface area = 12.57 in^2, soil height = 1.5 inch. Stacked Ring set-up used, which included porous stones with pins.

Test Condition: Inundated prior to consolidating

Sample Type and Preparation: Target Compaction: 90% relative compaction at + 3% moisture content

Parameter	Point 1	Point 2	Point 3	Point 4	Point 5
Test No.	CDSS-1RR	CDSS-2R(3)			
Initial Moisture Content, %	16.1	16.1			
Initial Dry Density, pcf	106.3	106.3			
Vertical Consolidation Stress, psi	14.5	14.5			
Initial Horizontal Stress, psi	0	0			
Cyclic Stress Ratio	0.15	0.18			
Number of cycles completed	17	7			
Frequency, Hz	0.2	0.2			
Final Moisture Content, %	18.8	18.5			
Delay before shearing, sec	60	60			
Nominal Rate of Shear Strain, %/hr	5.0	5.0			
Measured Post-Cyclic Peak Shear Stress, psi	5.66	4.37			
Shear Strain at Post-Cyclic Peak Shear Stress, % (20% realative)	14.2	17.5			
Membrane Correction, psi	0.43	0.41			
Corrected Post-Cyclic Peak Shear Stress, psi	5.23	3.96			
S_r/σ'_{vc}	0.36	0.27			

Comments: Actual post cyclic strength parameters should be determined by an engineer familiar with dynamic testing data.

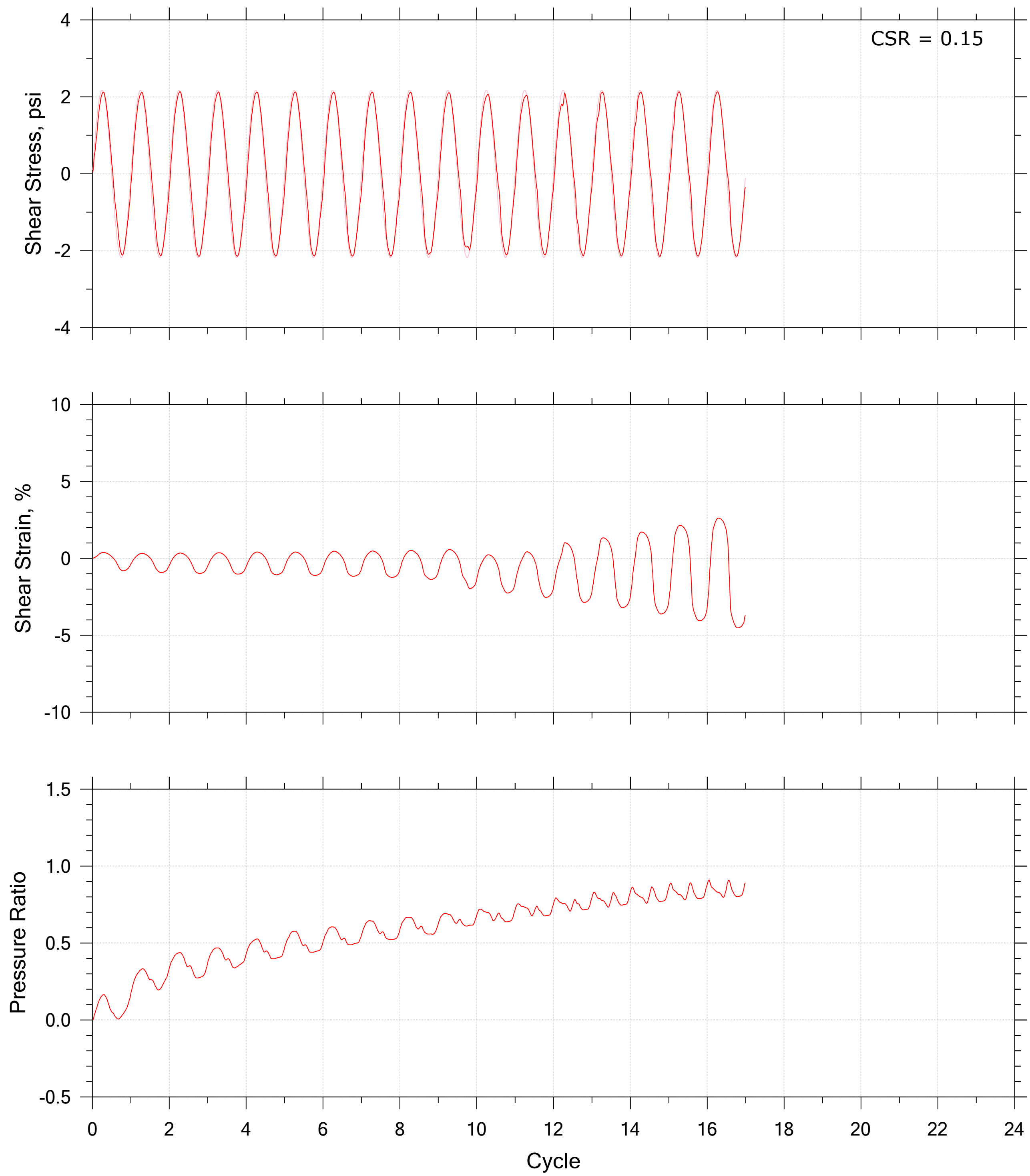
Tested By: jlw Checked By: as

Notes: These results apply only to the sample tested for the specific test conditions. The test procedures employed follow accepted industry practice and the indicated test method. GeoTesting Express has no specific knowledge as to conditioning, origin, sampling procedure or intended use of the material.

Cyclic Simple Shear Test

Cyclic Data

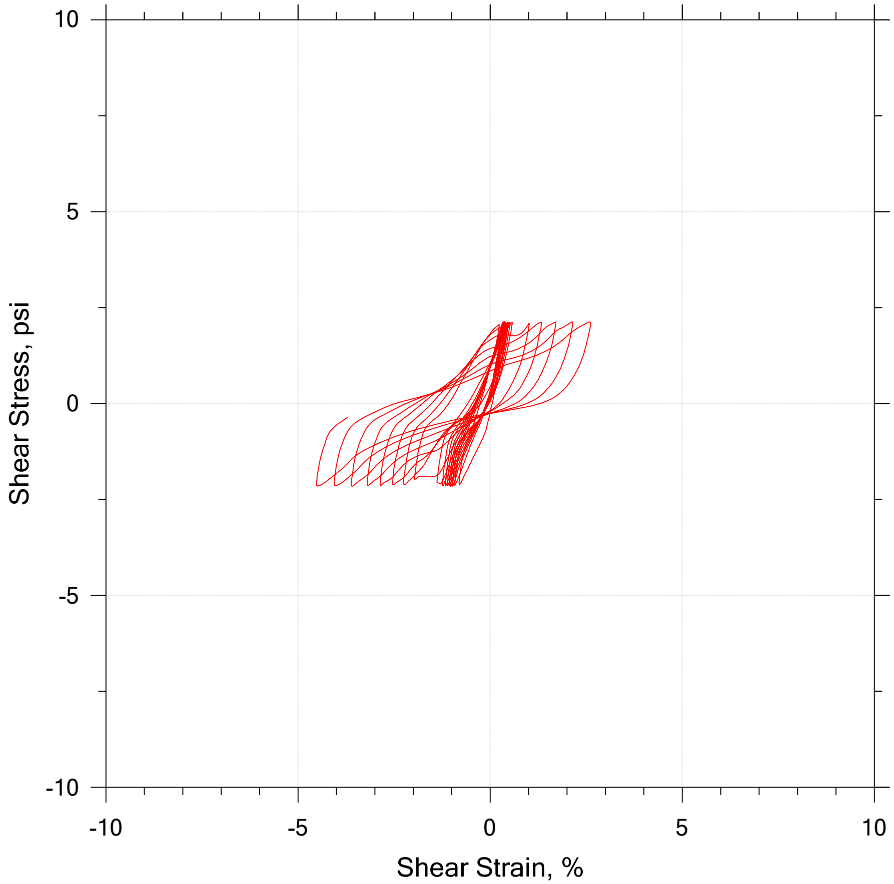
Step 1 of 1

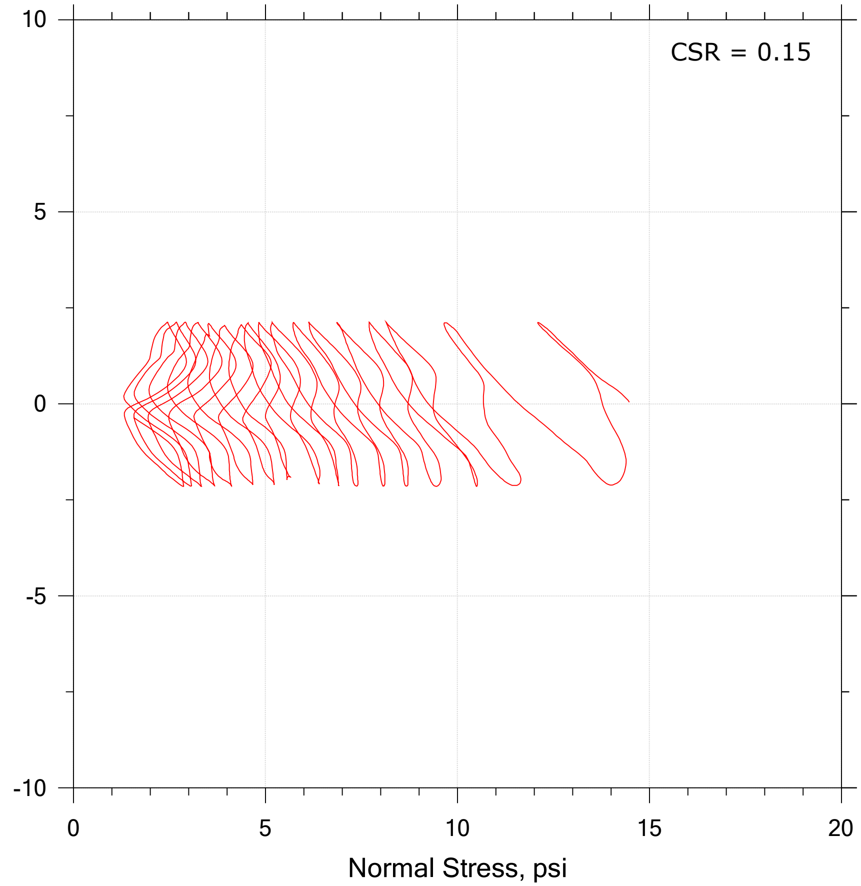


GeoTesting EXPRESS	Project Name: Hermosa	Location: Patagonia, AZ	Project Number: GTX-315266
	Boring Number: ---	Tester: jlw/as	Checker: as
	Sample Number: Composite Ore	Test Date: 11/2/2022	Depth: ---
	Test Number: CDSS-1RR	Preparation: reconstituted	Elevation: ---
	Description: Moist, gray silty sand		
	Remarks: 4" x 1.5" sample dimensions at 90% of relative compaction at +3% mc		
			Page 2 of 9

Cyclic Simple Shear Test

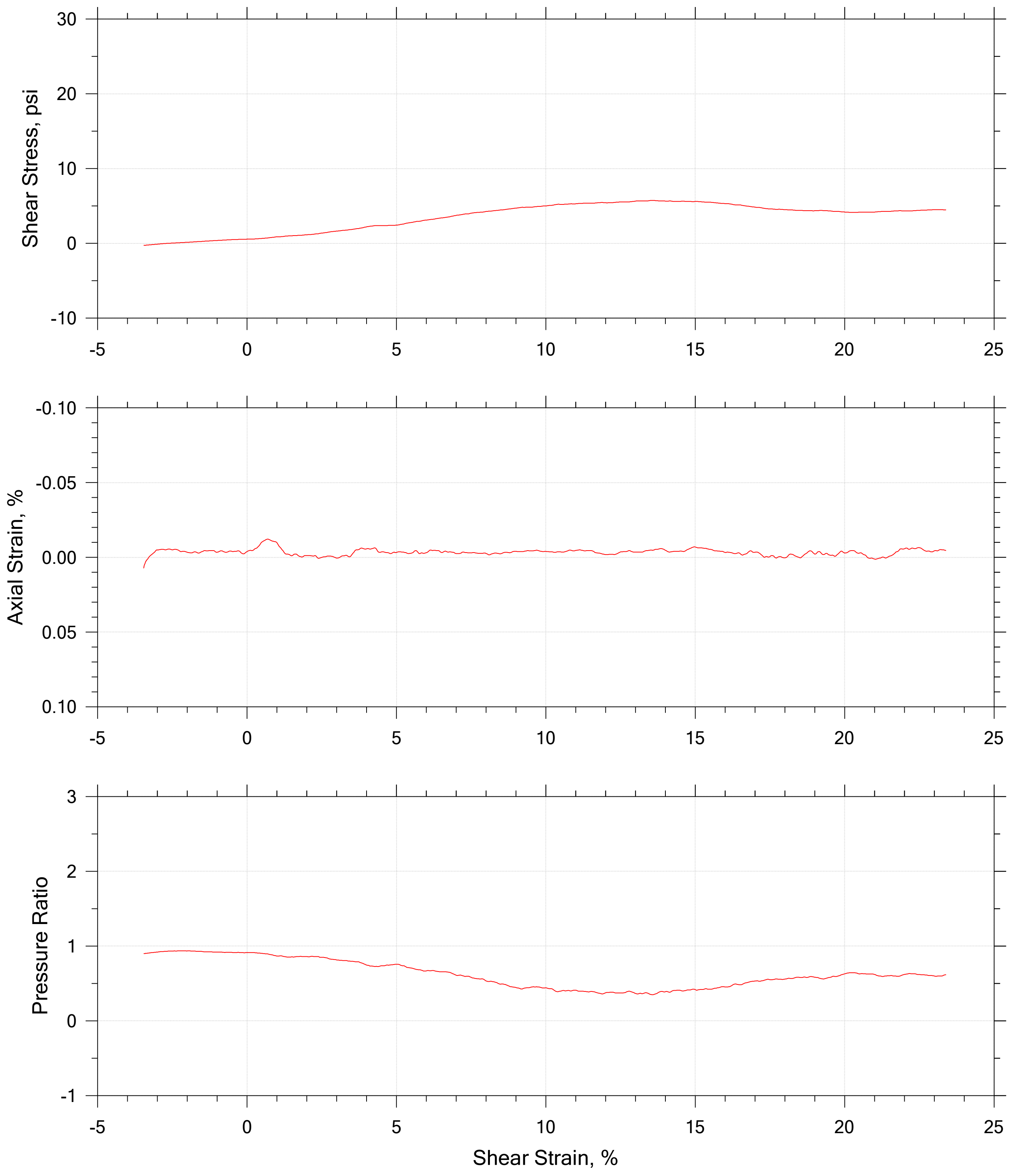
Cyclic Stress Strain Results
Step 1 of 1
Cycle 0.0 to 17.0





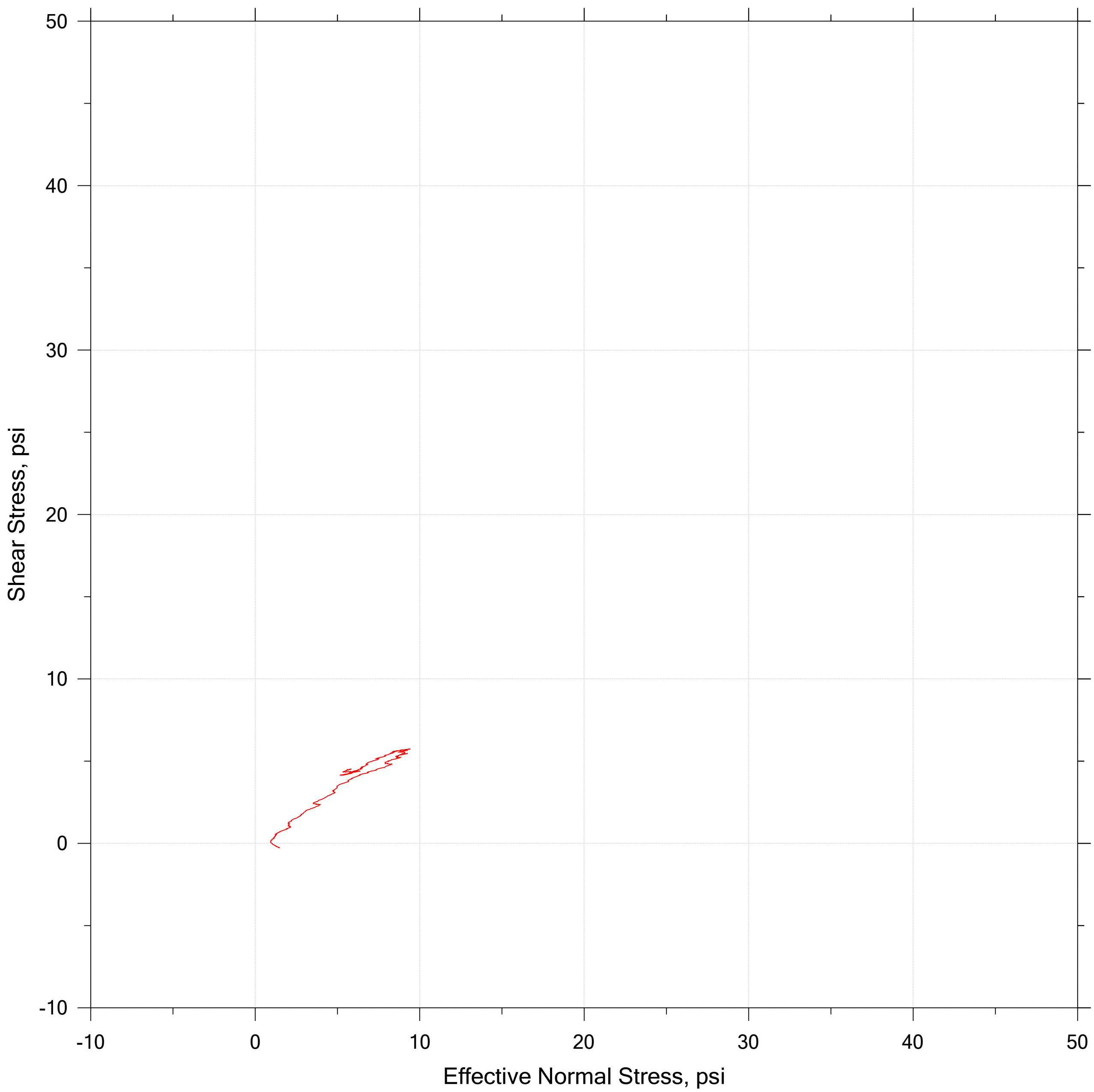
GeoTesting EXPRESS	Project Name: Hermosa	Location: Patagonia, AZ	Project Number: GTX-315266
	Boring Number: ---	Tester: jlw/as	Checker: as
	Sample Number: Composite Ore	Test Date: 11/2/2022	Depth: ---
	Test Number: CDSS-1RR	Preparation: reconstituted	Elevation: ---
	Description: Moist, gray silty sand		
	Remarks: 4" x 1.5" sample dimensions at 90% of relative compaction at +3% mc		

Post Cyclic Simple Shear Test



GeoTesting EXPRESS	Project Name: Hermosa	Location: Patagonia, AZ	Project Number: GTX-315266
	Boring Number: ---	Tester: jlw/as	Checker: as
	Sample Number: Composite Ore	Test Date: 11/2/2022	Depth: ---
	Test Number: CDSS-1RR	Preparation: reconstituted	Elevation: ---
	Description: Moist, gray silty sand		
	Remarks: 4" x 1.5" sample dimensions at 90% of relative compaction at +3% mc		

Post Cyclic Simple Shear Test

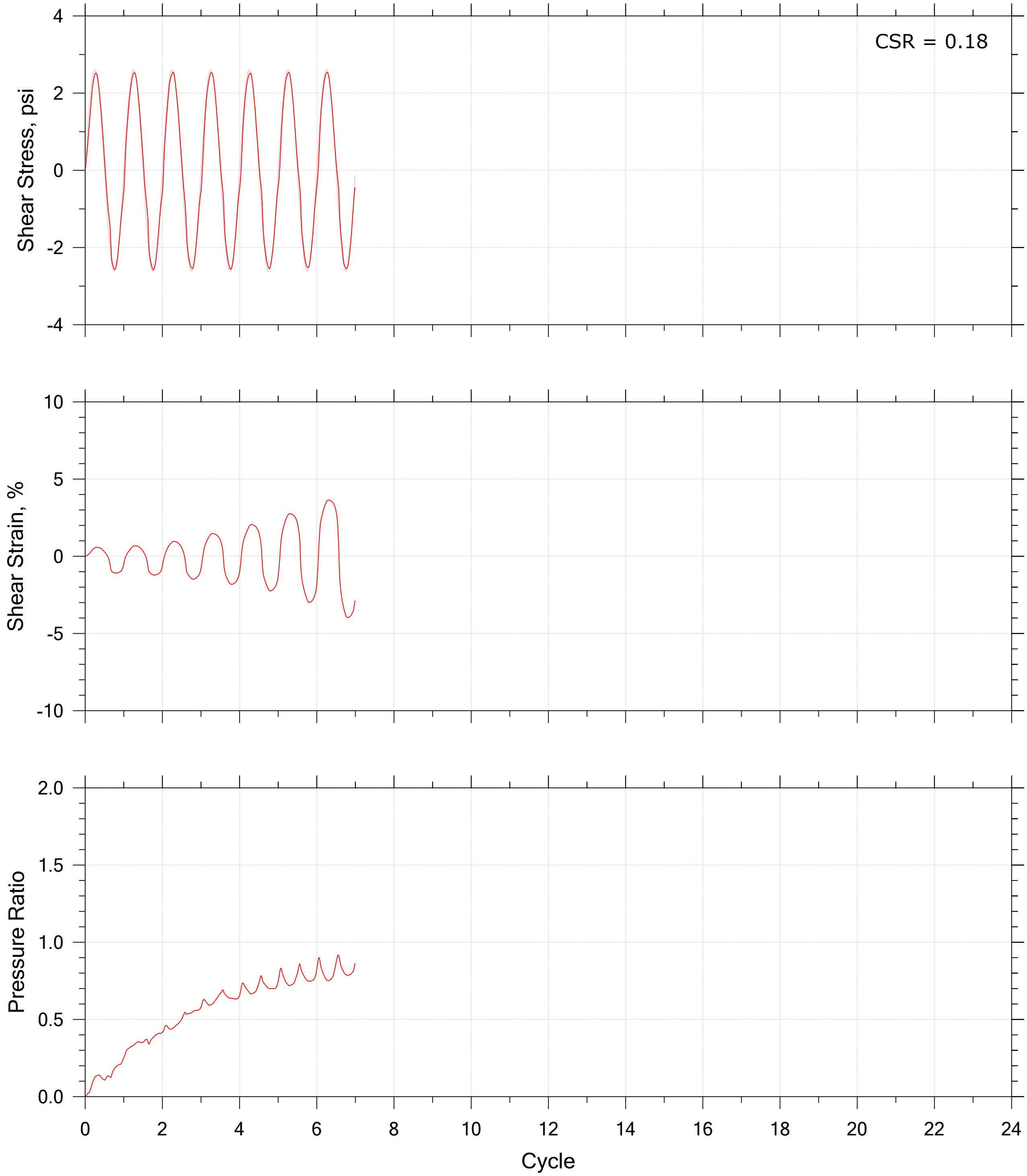


GeoTesting EXPRESS	Project Name: Hermosa	Location: Patagonia, AZ	Project Number: GTX-315266
	Boring Number: ---	Tester: jlw/as	Checker: as
	Sample Number: Composite Ore	Test Date: 11/2/2022	Depth: ---
	Test Number: CDSS-1RR	Preparation: reconstituted	Elevation: ---
	Description: Moist, gray silty sand		
	Remarks: 4" x 1.5" sample dimensions at 90% of relative compaction at +3% mc		

Cyclic Simple Shear Test

Cyclic Data

Step 1 of 1



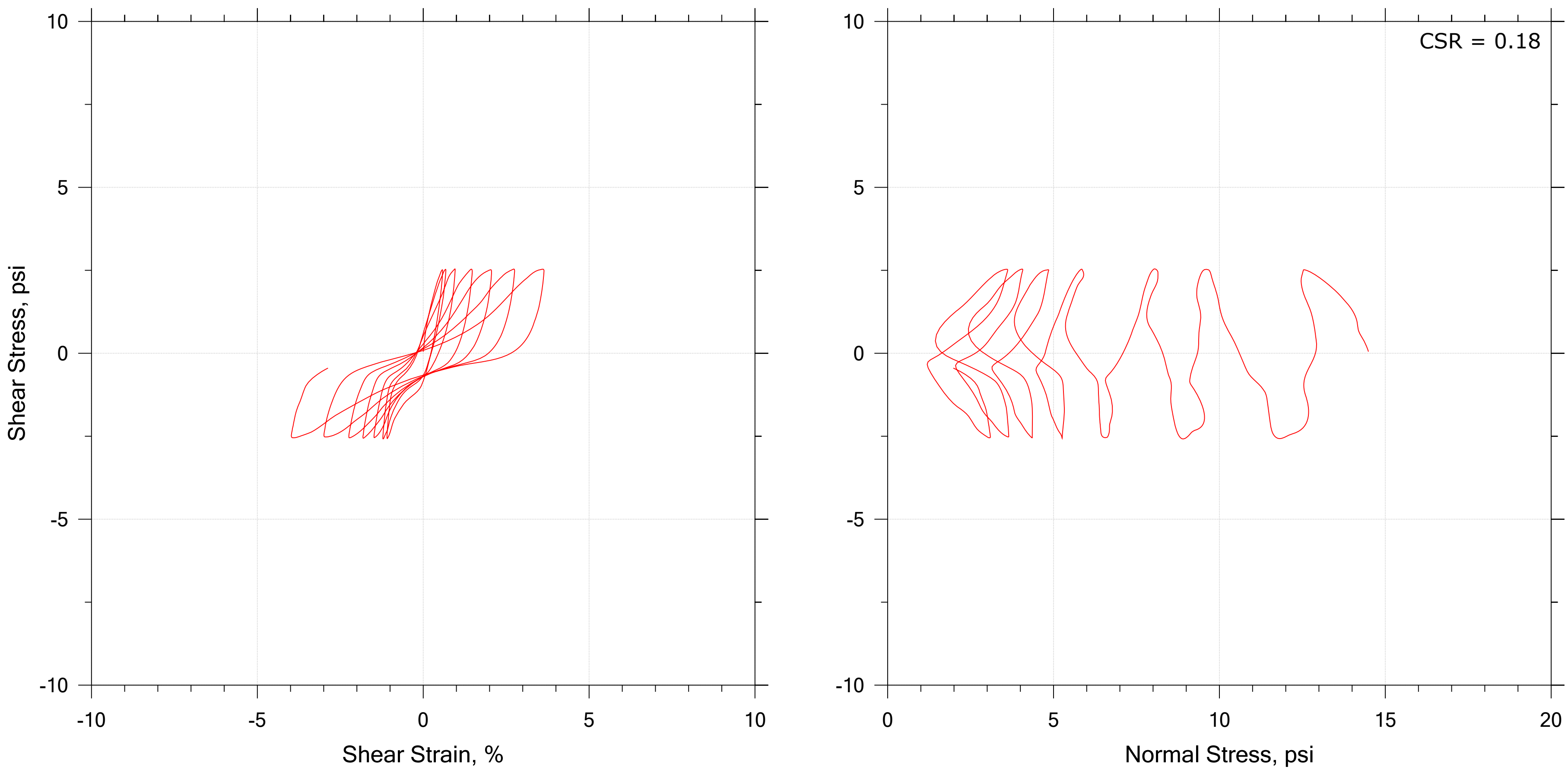
GeoTesting EXPRESS			
	Project Name: Hermosa	Location: Patagonia, AZ	Project Number: GTX-315266
	Boring Number: ---	Tester: jlw	Checker: as
	Sample Number: Composite Ore	Test Date: 12/22/2022	Depth: ---
	Test Number: CDSS- 2R(3)	Preparation: Reconstituted	Elevation: ---
	Description: Moist, gray silt		
	Remarks: 4" x 1.5" sample dimensions, Opt MC +3% and 90% of MDD		

Cyclic Simple Shear Test

Cyclic Stress Strain Results

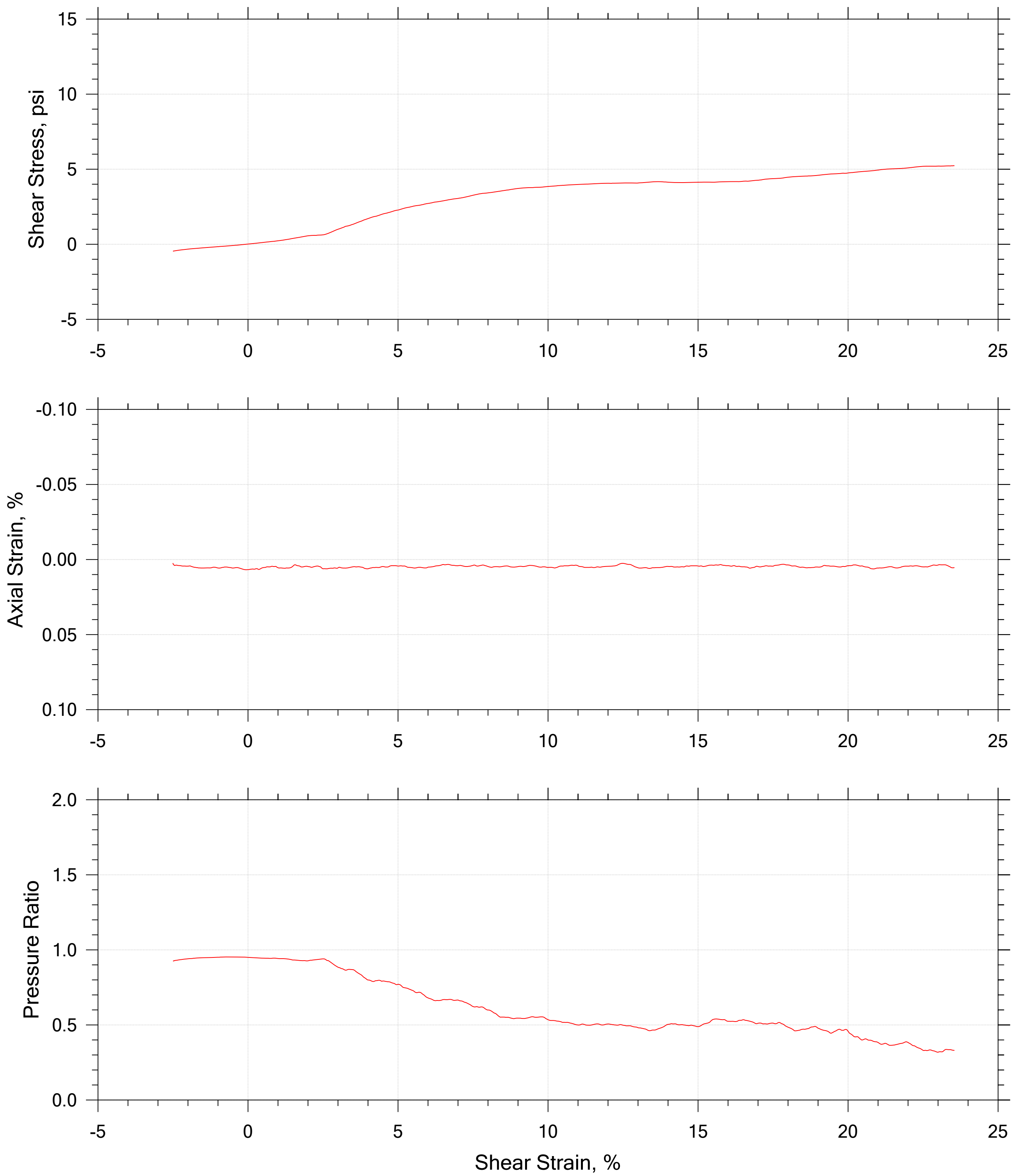
Step 1 of 1

Cycle 0.0 to 24.0



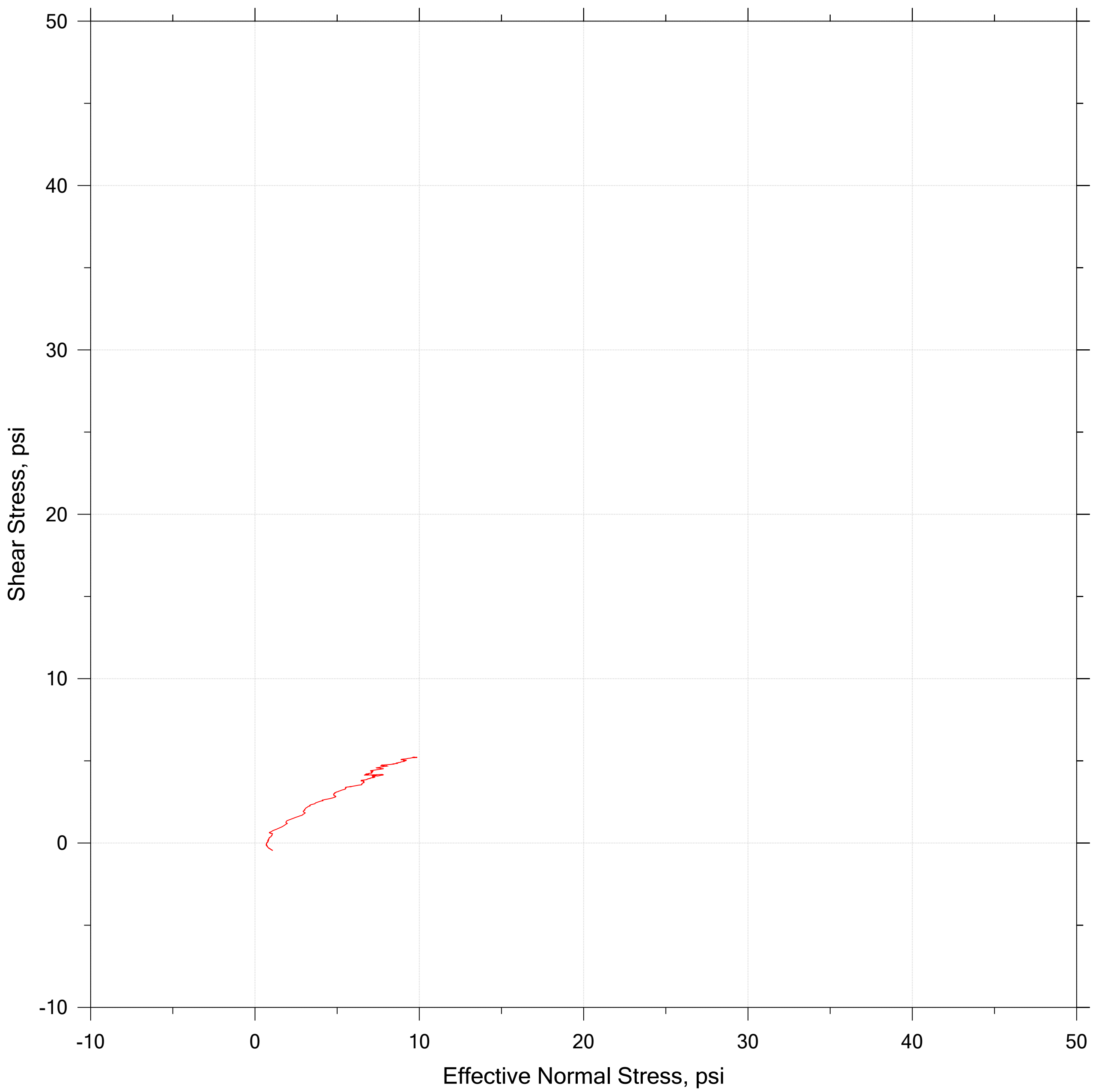
GeoTesting EXPRESS	Project Name: Hermosa	Location: Patagonia, AZ	Project Number: GTX-315266
	Boring Number: ---	Tester: jlw	Checker: as
	Sample Number: Composite Ore	Test Date: 12/22/2022	Depth: ---
	Test Number: CDSS- 2R(3)	Preparation: Reconstituted	Elevation: ---
	Description: Moist, gray silt		
	Remarks: 4" x 1.5" sample dimensions, Opt MC +3% and 90% of MDD		

Post Cyclic Simple Shear Test



GeoTesting EXPRESS	Project Name: Hermosa	Location: Patagonia, AZ	Project Number: GTX-315266
	Boring Number: ---	Tester: jlw	Checker: as
	Sample Number: Composite Ore	Test Date: 12/22/2022	Depth: ---
	Test Number: CDSS- 2R(3)	Preparation: Reconstituted	Elevation: ---
	Description: Moist, gray silt		
	Remarks: 4" x 1.5" sample dimensions, Opt MC +3% and 90% of MDD		

Cyclic Simple Shear Test



GeoTesting EXPRESS	Project Name: Hermosa	Location: Patagonia, AZ	Project Number: GTX-315266
	Boring Number: ---	Tester: jlw	Checker: as
	Sample Number: Composite Ore	Test Date: 12/22/2022	Depth: ---
	Test Number: CDSS- 2R(3)	Preparation: Reconstituted	Elevation: ---
	Description: Moist, gray silt		
	Remarks: 4" x 1.5" sample dimensions, Opt MC +3% and 90% of MDD		

APPENDIX G

Design Calculations

APPENDIX G.1

Composite Liner Leakage Rate

NewFields	CALCULATION COVER SHEET		
Client	South32 Hermosa Inc.	Preparer:	C. Thompson	06/23/23
Project	TSF1 Expansion	Checked:	R. M. Smith	07/25/23
Title	Geomembrane Leakage Rate	Revision	0	

CALCULATION OBJECTIVE

1. Estimate leakage flow rate through geomembrane defects for TSF1 (expanded area only).
2. Estimate leakage flow rate through geomembrane defects for the total TSF area (entire lined geomembrane footprint).
3. Composite liner systems containing geomembrane underlain by low permeability soil layer (LPSL) and geomembrane underlain by geosynthetic clay layer (GCL) to be calculated separately and then added together.

ASSUMPTIONS

1. Four defects per acre (fair/good installation quality) with good contact quality factor.
2. Defects are circular with an area of approximately 1.08E-3 ft^2 (1 cm^2).
3. Hydraulic head above geomembrane is a constant 1.5 ft.
4. LPSL permeability is 3.28E-8 ft/s (1.0E-6 cm/s).
5. GCL permeability is 1.64E-10 ft/s (5.0E-9 cm/s).
6. LPSL thickness is 1 foot.
7. GCL thickness is 0.25 inches.

METHODOLOGY

1. Composite liner systems containing geomembrane/LPSL and geomembrane/GCL to be calculated separately.
2. Geomembrane, LPSL, and GCL areas determined using AutoCAD Civil 3D.

REFERENCES

1. Giroud, J.P. 1997. "Equations for Calculating the Rate of Liquid Migration Through Composite Liners Due to Geomembrane Defects". Geosynthetics International. Vol 4, Nos. 3-4, pp. 335-348.

CONCLUSIONS

1. See attached pages for inputs and results.

Geomembrane Leakage Rate Underlain by Low Permeability Soil (TSF1)	
Project:	Hermosa Project
Client:	South32 Hermsoa Inc
Facility:	Tailings Storage Facility 1 (TSF1)
Engineer:	Craig Thompson
Date	23-Jun-23

NewFields

(yellow)	Inputs
(green)	Outputs

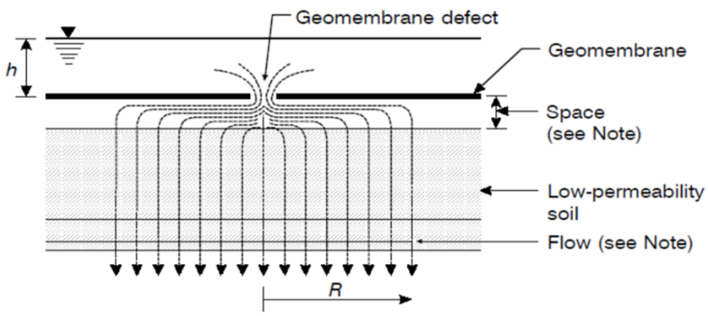


Figure 1. Liquid migration through a composite liner.

$$Q = C_{qo}\left[1 + 0.1\,(h/t_s)^{0.95}\right]a^{0.1}h^{0.9}k_s^{0.74}n$$ (Giroud, 1997)

Where: $n = \left(\frac{A}{43,560\ ft^2} \right) \times DefectsPer\ \ Acre$

$$a = \pi\left(\frac{d^2}{4} \right)$$

Typical Installation Damage

Installation Quality	Defects per Acre
Excellent	Up to 1
Good	1 to 4
Fair	4 to 10
Poor	10 to 20

Assume **4** Defects Per Acre

Contact Quality Factor, C_{qo}

Liner/Soil Contact	Factor (Circ. Defect)
Good	0.21
Poor	1.15

Assume **0.21** for Contact Quality

Inputs Defined:

Q = Leakage Rate
n = Number of Defects in Geomembrane
a = Area of Circular Defect
g = Acceleration of Gravity (32.2 ft/s^2 or 9.81 m/s^2)
h = Hydraulic Head Above Geomembrane
d = Diameter of Circular Defect
A = Area of Geomembrane Lined Facility
C_{qo} = Contact Quality Factor
k_s = Permeability of Underlying Soil Layer
t_s = Thickness of Underlying Soil Layer

Variable Inputs

English Units			Metric Units	
d (in)	0.444		d (m)	0.0113
A (ft^2)	937,400		A (m^2)	87,087
h (ft)	1.5000		h (m)	0.4572
k_s (ft/sec)	3.3E-08		k_s (m/s)	1.0E-08
t_s (ft)	1.0		t_s (m)	0.3

Calculated Values

English Units			Metric Units	
n	86		n	86
a (ft^2)	1.08E-03		a (m^2)	1.00E-04
Q (ft^3/s)	1.73E-04		Q (m^3/s)	4.91E-06

Conversion

$$4.91\text{E-}06\ \frac{m^3}{\sec} \times \frac{60\sec}{\min} \times \frac{264.1 gal}{m^3} = \mathbf{0.0777}\ \frac{gal}{\min}$$

Assumptions

1. Above equations are for a circular defect with a diameter less than 25 mm.
2. The hydraulic head above the liner should be equal to or less than 3 m
3. The typical installation damage assumes a circular defect diameter of aproxiately 3.5 mm given good to excellent quality control.

References

1. Giroud, J.P. 1997. "Equations for Calculating the Rate of Liquid Migration Through Composite Liners Due to Geomembrane Defects". Geosynthetics International. Vol 4, Nos. 3-4, pp. 335-348.

Geomembrane Leakage Rate Underlain by GCL (TSF1)	
Project:	Hermosa Project
Client:	South32 Hermsoa Inc
Facility:	Tailings Storage Facility 1 (TSF1)
Engineer:	Craig Thompson
Date	23-Jun-23

NewFields

Inputs
Outputs

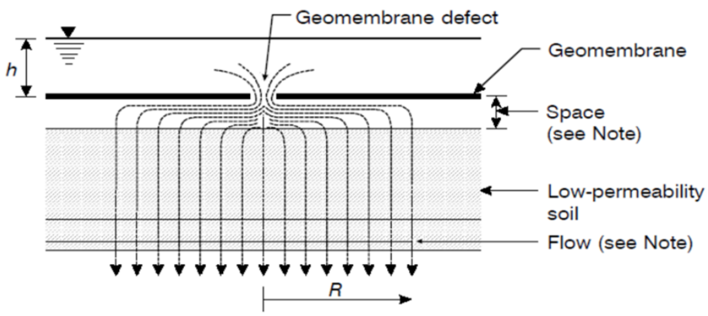


Figure 1. Liquid migration through a composite liner.

$$Q = C_{qo}\left[1 + 0.1\,(h/t_s)^{0.95}\right]a^{0.1}h^{0.9}k_s^{0.74}n \qquad \text{(Giroud, 1997)}$$

Where: $n = \left(A \big/ 43{,}560\ ft^2 \right) \times DefectsPer\ \ Acre$

$$a = \pi \left(d^2 \big/ 4 \right)$$

Typical Installation Damage

Installation Quality	Defects per Acre
Excellent	Up to 1
Good	1 to 4
Fair	4 to 10
Poor	10 to 20

Assume 4 Defects Per Acre

Contact Quality Factor, C_{qo}

Liner/Soil Contact	Factor (Circ. Defect)
Good	0.21
Poor	1.15

Assume 0.21 for Contact Quality

Inputs Defined:

- Q = Leakage Rate
- n = Number of Defects in Geomembrane
- a = Area of Circular Defect
- g = Acceleration of Gravity (32.2 ft/s^2 or 9.81 m/s^2)
- h = Hydraulic Head Above Geomembrane
- d = Diameter of Circular Defect
- A = Area of Geomembrane Lined Facility
- C_{qo} = Contact Quality Factor
- k_s = Permeability of Underlying Soil Layer
- t_s = Thickness of Underlying Soil Layer

Variable Inputs

English Units			Metric Units	
d (in)	0.444		d (m)	0.0113
A (ft^2)	261,000		A (m^2)	24,248
h (ft)	1.5000		h (m)	0.4572
k_s (ft/sec)	1.64E-10		k_s (m/s)	5.0E-11
t_s (ft)	0.021		t_s (m)	0.0064

Calculated Values

English Units			Metric Units	
n	24		n	24
a (ft^2)	1.08E-03		a (m^2)	1.00E-04
Q (ft^3/s)	5.68E-06		Q (m^3/s)	1.61E-07

Conversion

$$1.61\text{E-}07\ \frac{m^3}{\sec} \times \frac{60\ \sec}{\min} \times \frac{264.1\,gal}{m^3} = 0.0025\ \frac{gal}{\min}$$

Assumptions

1. Above equations are for a circular defect with a diameter less than 25 mm.
2. The hydraulic head above the liner should be equal to or less than 3 m
3. The typical installation damage assumes a circular defect diameter of approxiately 3.5 mm given good to excellent quality control.

References

1. Giroud, J.P. 1997. "Equations for Calculating the Rate of Liquid Migration Through Composite Liners Due to Geomembrane Defects". Geosynthetics International. Vol 4, Nos. 3-4, pp. 335-348.

Geomembrane Leakage Rate Underlain by Low Permeability Soil (Total TSF)	
Project:	Hermosa Project
Client:	South32 Hermsoa Inc
Facility:	Tailings Storage Facility 1 (TSF1)
Engineer:	Craig Thompson
Date	23-Jun-23

NewFields

Inputs
Outputs

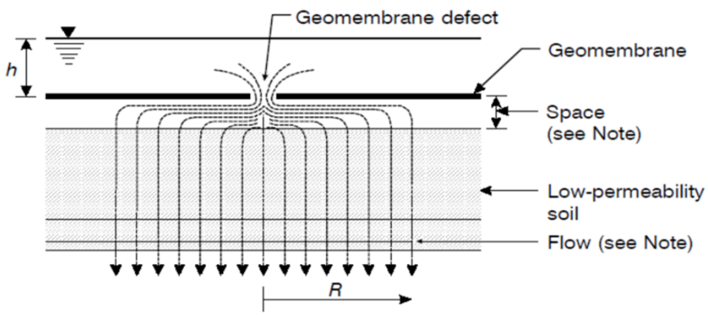


Figure 1. Liquid migration through a composite liner.

$$Q = C_{qo}\left[1 + 0.1\,(h/t_s)^{0.95}\right]a^{0.1}h^{0.9}k_s^{0.74}n$$ (Giroud, 1997)

Where: $n = \left(A \big/ 43{,}560\ \ ft^2 \right) \times DefectsPer\ \ Acre$

$$a = \pi\left(d^2 \big/ 4\right)$$

Typical Installation Damage

Installation Quality	Defects per Acre
Excellent	Up to 1
Good	1 to 4
Fair	4 to 10
Poor	10 to 20

Assume 4 Defects Per Acre

Inputs Defined:

Q = Leakage Rate
n = Number of Defects in Geomembrane
a = Area of Circular Defect
g = Acceleration of Gravity (32.2 ft/s^2 or 9.81 m/s^2)
h = Hydraulic Head Above Geomembrane
d = Diameter of Circular Defect
A = Area of Geomembrane Lined Facility
C_{qo} = Contact Quality Factor
k_s = Permeability of Underlying Soil Layer
t_s = Thickness of Underlying Soil Layer

Contact Quality Factor, C_{qo}

Liner/Soil Contact	Factor (Circ. Defect)
Good	0.21
Poor	1.15

Assume 0.21 for Contact Quality

Variable Inputs

English Units		Metric Units	
d (in)	0.444	d (m)	0.0113
A (ft^2)	1,619,700	A (m^2)	150,475
h (ft)	1.5000	h (m)	0.4572
k_s (ft/sec)	3.3E-08	k_s (m/s)	1.0E-08
t_s (ft)	1.0	t_s (m)	0.3

Calculated Values

English Units		Metric Units	
n	149	n	149
a (ft^2)	1.08E-03	a (m^2)	1.00E-04
Q (ft^3/s)	2.99E-04	Q (m^3/s)	8.48E-06

Conversion

8.48E-06 $\frac{m^3}{\sec} \times \frac{60\sec}{\min} \times \frac{264.1gal}{m^3} =$ 0.1343 $\frac{gal}{\min}$

Assumptions

1. Above equations are for a circular defect with a diameter less than 25 mm.
2. The hydraulic head above the liner should be equal to or less than 3 m
3. The typical installation damage assumes a circular defect diameter of approxiately 3.5 mm given good to excellent quality control.

References

1. Giroud, J.P. 1997. "Equations for Calculating the Rate of Liquid Migration Through Composite Liners Due to Geomembrane Defects". Geosynthetics International. Vol 4, Nos. 3-4, pp. 335-348.

Geomembrane Leakage Rate Underlain by GCL (Total TSF)	
Project:	Hermosa Project
Client:	South32 Hermsoa Inc
Facility:	Tailings Storage Facility 1 (TSF1)
Engineer:	Craig Thompson
Date	23-Jun-23

Inputs
Outputs

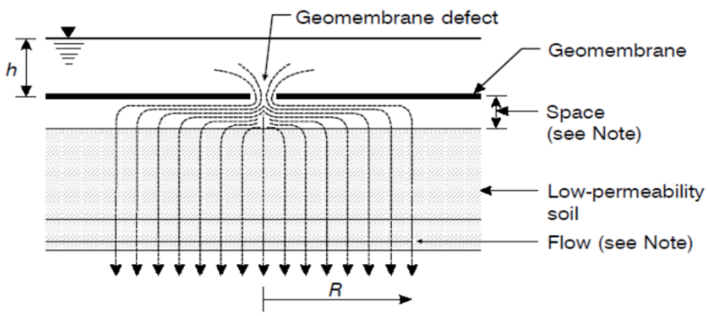


Figure 1. Liquid migration through a composite liner.

$$Q = C_{qo}\left[1 + 0.1\,(h/t_s)^{0.95}\right]a^{0.1}h^{0.9}k_s^{0.74}n \qquad \text{(Giroud, 1997)}$$

Where: $n = \left(A \big/ 43{,}560 \ ft^2 \right) \times DefectsPer \quad Acre$

$$a = \pi\left(d^2 \big/ 4\right)$$

Typical Installation Damage

Installation Quality	Defects per Acre
Excellent	Up to 1
Good	1 to 4
Fair	4 to 10
Poor	10 to 20

Assume **4** Defects Per Acre

Contact Quality Factor, C_{qo}

Liner/Soil Contact	Factor (Circ. Defect)
Good	0.21
Poor	1.15

Assume **0.21** for Contact Quality

Inputs Defined:

- Q = Leakage Rate
- n = Number of Defects in Geomembrane
- a = Area of Circular Defect
- g = Acceleration of Gravity (32.2 ft/s^2 or 9.81 m/s^2)
- h = Hydraulic Head Above Geomembrane
- d = Diameter of Circular Defect
- A = Area of Geomembrane Lined Facility
- C_{qo} = Contact Quality Factor
- k_s = Permeability of Underlying Soil Layer
- t_s = Thickness of Underlying Soil Layer

Variable Inputs

English Units			Metric Units	
d (in)	0.444		d (m)	0.0113
A (ft^2)	840,300		A (m^2)	78,066
h (ft)	1.5000		h (m)	0.4572
k_s (ft/sec)	1.64E-10		k_s (m/s)	5.0E-11
t_s (ft)	0.021		t_s (m)	0.0064

Calculated Values

English Units			Metric Units	
n	77		n	77
a (ft^2)	1.08E-03		a (m^2)	1.00E-04
Q (ft^3/s)	1.83E-05		Q (m^3/s)	5.18E-07

Conversion

$$5.18\text{E-}07 \ \frac{m^3}{\sec} \times \frac{60 \sec}{\min} \times \frac{264.1 gal}{m^3} = \boxed{0.0082} \ \frac{gal}{\min}$$

Assumptions

1. Above equations are for a circular defect with a diameter less than 25 mm.
2. The hydraulic head above the liner should be equal to or less than 3 m
3. The typical installation damage assumes a circular defect diameter of aproxiately 3.5 mm given good to excellent quality control.

References

1. Giroud, J.P. 1997. "Equations for Calculating the Rate of Liquid Migration Through Composite Liners Due to Geomembrane Defects". Geosynthetics International. Vol 4, Nos. 3-4, pp. 335-348.

APPENDIX G.2

Underdrain Collection Pipe Spacing

NewFields		CALCULATION COVER SHEET		
Client	South32 Hermosa Inc.	Preparer:	J. Pfeiffer	05/31/23
Project	Tailings Storage Facility 1 (TSF1) APP BADCT	Checked:	C. Thompson	05/31/23
Title	Underdrain Collection Pipe Calculation	Revision:	A	

CALCULATION OBJECTIVE

Determine the underdrain collection pipe spacing

ASSUMPTIONS

1. Protective layer permeability was modeled as 3.5×10^{-3} cm/sec.
2. Tailings permeability was modeled as 3.5×10^{-6} cm/sec.

METHODOLOGY

1. Area and length measurements were determined using AutoCAD Civil 3D.
2. Maximum head and collector pipe spacing calculated.

REFERENCES

1. AutoCAD Civil 3D version 2022.

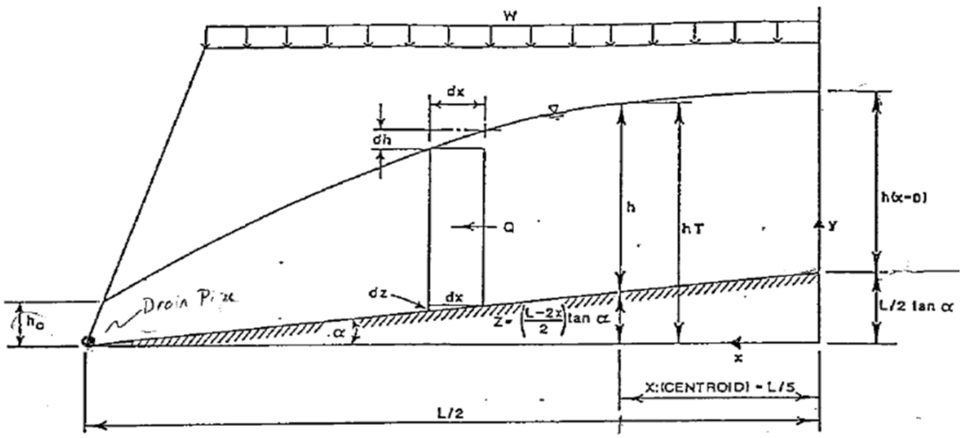
CONCLUSIONS

1. Maximum underdrain collection spacing for lateral 4" dia CPe Underdrain Collection Pipe is 90 ft on center.

Project: Tailings Storage Facility 1 (TSF1) APP BADCT
Client: South32 Hermosa Inc.
Calculation: Underdrain Collection Pipe - Hydraulic Head Calculation

5/31/2023

5/31/2023



h_o = Height of the phreatic surface at its exit from the heap (ft)
W = Infiltration rate ($ft^3/sec/ft^2$)
k = permeability of the heap material (ft/sec)
x = horizontal distance from midpoint between pipes to the desired h (ft)
L = horizontal distance between pipes
ø = pad grade (degrees)
Inputs

Average Head $$h_{avg} = [\frac{21WL^2}{100k} + {h_o}^2 + Lh_o \tan\emptyset + \frac{L^2}{25}\tan^2\emptyset]^{0.5} - \frac{L}{5}\tan\emptyset$$

Maximum Head $$h_{max} = \frac{L}{2} * [\frac{W}{k}]^{0.5}$$

*maximum head is the worst case scenario, and thus assumes a flat slope between pipes

AVERAGE HEAD														
4" Diameter CPeP Collection Pipe														
Tailings Permeability		**Protective Layer Permeability**		**Pipe Spacing**	**Pipe Diameter**	**Pad Slope**	**Pipe Slope**	**EQUATION INPUTS**						**Average Head**
W	**W**	**k**	**k**	**L**	**h_o**	**ø**	**ø**	**21/100 * W/k * L^2**	**h_o^2**	**L*h_o*Tan ø**	**L^2/25 * Tan^2 ø**		**L/5 * Tanø**	**h**
[cm/sec]	**cfs/ft^2**	**[cm/sec]**	**[ft/sec]**	**[ft]**	**[ft]**	**[degrees]**	**[percent]**							**(ft)**
3.5E-06	1.2E-07	3.5E-03	1.2E-04	90	0.33	0.14	0.50	1.70	0.11	0.07	0.00	**1.37**	0.045	**1.33**
3.5E-06	1.2E-07	3.5E-03	1.2E-04	90	0.33	0.29	1.00	1.70	0.11	0.15	0.01	**1.40**	0.090	**1.31**
3.5E-06	1.2E-07	3.5E-03	1.2E-04	90	0.33	0.57	2.00	1.70	0.11	0.30	0.03	**1.46**	0.180	**1.28**
3.5E-06	1.2E-07	3.5E-03	1.2E-04	90	0.33	1.43	5.00	1.70	0.11	0.75	0.20	**1.66**	0.450	**1.21**
3.5E-06	1.2E-07	3.5E-03	1.2E-04	90	0.33	2.86	10.00	1.70	0.11	1.50	0.81	**2.03**	0.898	**1.13**
3.5E-06	1.2E-07	3.5E-03	1.2E-04	90	0.33	5.65	20.00	1.70	0.11	2.97	3.18	**2.82**	1.782	**1.04**

MAXIMUM HEAD						
Application Rate		**Protective Layer Permeability**		**Pipe Spacing**	**Pipe Diameter**	**Maximum Head**
W	**W**	**k**	**k**	**L**	**h_o**	**h**
[cm/sec]	**cfs/ft^2**	**[cm/sec]**	**[ft/sec]**	**[ft]**	**[ft]**	**(ft)**
3.5E-06	1.2E-07	3.5E-03	1.2E-04	90	0.33	**1.42**

APPENDIX G.3

Underdrain Collection Pipe Integrity

Burns and Richard Solution

TSF1 Underdrain Collection System

4" ADS N-12

PIPE PARAMETERS - AASHTO M294, Type S

effective radius (in), R =	2.22
outside diameter (in), D =	4.78
thickness (in), t =	0.34
unit area of wall (in^2/in), A =	0.070
unit moment of inertia (in^4/in), I =	0.0014
flexural modulus (psi), E_f =	110,000
ring compression modulus (psi), E_{rc} =	110,000
flexural stiffness (psi), $K_f = 6E_fI/R^3$ =	84
ring compression stiffness (psi), $K_{rc} = E_{rc}A/R$ =	3,468
distance from inner wall to n.a. (in), c =	0.17

SOIL PARAMETERS - good granular soil

mod of soil reaction at 5' of cover (psi), E'_5 =	700
modulus of soil reaction (psi), E' =	2,316
Poisson's ratio, u =	0.30
constr mod (psi), M*=E*(1-u)/((1+u)(1-2u))=	3118.3
lateral stress ratio = K = u/(1-u) =	0.429
sym lateral stress ratio = B = (1/2)(1+K) =	0.714
antisym lat stress ratio = C = (1/2)(1-K) =	0.286

SOIL/STRUCTURE PARAMETERS (full slippage)

ring flexibility ratio, UF =(1+K)M*/K_{rc} =	1.28
bending flexibility ratio, VF = (1-K)M*/K_f =	21.1

STRESS FUNCTION COEFFICIENTS

constant term, a_0* =	0.075
cos(2*theta), a_2** =	0.938
sin(2*theta), b_2** =	0.907

LOAD PARAMETERS

unit weight of soil (lb/ft^3) =	125
height of fill above crown (ft) =	243.0
surcharge pressure (psi), P =	210.9

RESPONSE OF PIPE WALL

deg c.c.w. from horiz	radial soil press P_r(psi)	radial defl w(in)	tang defl v(in)	circum wall thrust N(#/in)	wall bend mom(M) (#-lb/in)	ring comp stress (psi)	inner bend stress (psi)	outer bend stress (psi)	total stress inner (psi)	total stress outer (psi)
0	128.2	-0.106	0.000	318	21	-4537	-2563	2563	-7100	-1974
10	128.9	-0.094	0.034	317	20	-4530	-2429	2429	-6959	-2101
20	130.8	-0.061	0.064	316	17	-4510	-2042	2042	-6552	-2467
30	133.8	-0.009	0.086	313	12	-4478	-1451	1451	-5929	-3028
40	137.4	0.055	0.097	311	6	-4440	-725	725	-5165	-3715
50	141.3	0.123	0.097	308	0	-4399	48	-48	-4351	-4447
60	144.9	0.187	0.086	305	-6	-4360	774	-774	-3587	-5134
70	147.9	0.239	0.064	303	-11	-4329	1366	-1366	-2963	-5695
80	149.8	0.273	0.034	302	-14	-4309	1752	-1752	-2557	-6060
90	150.5	0.285	0.000	301	-16	-4301	1886	-1886	-2415	-6188
100	149.8	0.273	-0.034	302	-14	-4309	1752	-1752	-2557	-6060
110	147.9	0.239	-0.064	303	-11	-4329	1366	-1366	-2963	-5695
120	144.9	0.187	-0.086	305	-6	-4360	774	-774	-3587	-5134
130	141.3	0.123	-0.097	308	0	-4399	48	-48	-4351	-4447
140	137.4	0.055	-0.097	311	6	-4440	-725	725	-5165	-3715
150	133.8	-0.009	-0.086	313	12	-4478	-1451	1451	-5929	-3028
160	130.8	-0.061	-0.064	316	17	-4510	-2042	2042	-6552	-2467
170	128.9	-0.094	-0.034	317	20	-4530	-2429	2429	-6959	-2101
180	128.2	-0.106	0.000	318	21	-4537	-2563	2563	-7100	-1974

CALCULATION OF RING SHORTENING

deg c.c.w. from horiz	ring comp stress (psi)	ring comp strain (in/in)	ring shortening (in)
0	-4537	-0.041248	-0.0160
10	-4530	-0.0412	-0.0160
20	-4510	-0.040997	-0.0159
30	-4478	-0.040712	-0.0158
40	-4440	-0.040362	-0.0156
50	-4399	-0.03999	-0.0155
60	-4360	-0.03964	-0.0154
70	-4329	-0.039355	-0.0152
80	-4309	-0.039169	-0.0152
90	-4301	-0.039104	-0.0152
100	-4309	-0.039169	-0.0152
110	-4329	-0.039355	-0.0152
120	-4360	-0.03964	-0.0154
130	-4399	-0.03999	-0.0155
140	-4440	-0.040362	-0.0156
150	-4478	-0.040712	-0.0158
160	-4510	-0.040997	-0.0159
170	-4530	-0.0412	-0.0160
180	-4537	-0.041248	-0.0160
		SUM (I/2 circle) =	-0.2962

COMMENTS

1. This is 4" diameter ADS N-12

2. Flexural and compressive modulus are taken as 110,000 psi.

3. Typical E'_5 values (in psi) for various soils are listed in the table below:

Type of soil	Standard AASHTO Relative Compaction 85%	90%	95%
Fine-grained soils with less than 25% sand (CL, ML, DL-ML)	500	700	1000
Coarse-grained soils with fines (SM, SC)	600	1000	1200
Coarse-grained soils with little or no fines (SP, SW, GP, GW)	700	1000	1600

MISC CALCS

Vertical deflection (%) =	12.82
Horizontal deflection (%) =	-9.57
Critical Buckling Pressure (psi), P_{cr}=	169.3
Radial Soil Pressure at Crown (psi), P_{act}=	150.5
Arc length of each sector (in) =	0.3875

CIRCUMFERENCE SHORTENS= -0.59 inches

Burns and Richard Solution

TSF1 Underdrain Collection System

8" ADS N-12

PIPE PARAMETERS - AASHTO M294, Type S

effective radius (in), R =	4.22
outside diameter (in), D =	9.11
thickness (in), t =	0.605
unit area of wall (in^2/in), A =	0.135
unit moment of inertia (in^4/in), I =	0.0070
flexural modulus (psi), E_f =	110,000
ring compression modulus (psi), E_{rc} =	110,000
flexural stiffness (psi), $K_f = 6E_fI/R^3$ =	61
ring compression stiffness (psi), $K_{rc} = E_{rc}A/R$ =	3,519
distance from inner wall to n.a. (in), c =	0.27

SOIL PARAMETERS - good granular soil

mod of soil reaction at 5' of cover (psi), E'_5 =	700
modulus of soil reaction (psi), E' =	2,316
Poisson's ratio, u =	0.30
constr mod (psi), M*=E*(1-u)/((1+u)(1-2u))=	3118.3
lateral stress ratio = K = u/(1-u) =	0.429
sym lateral stress ratio = B = (1/2)(1+K) =	0.714
antisym lat stress ratio = C = (1/2)(1-K) =	0.286

SOIL/STRUCTURE PARAMETERS (full slippage)

ring flexibility ratio, UF =(1+K)M*/K_{rc} =	1.27
bending flexibility ratio, VF = (1-K)M*/K_f =	29.0

STRESS FUNCTION COEFFICIENTS

constant term, a_0* =	0.071
cos(2*theta), a_2** =	0.954
sin(2*theta), b_2** =	0.931

LOAD PARAMETERS

unit weight of soil (lb/ft^3) =	125
height of fill above crown (ft) =	243.0
surcharge pressure (psi), P =	210.9

RESPONSE OF PIPE WALL

deg c.c.w. from horiz	radial soil press P_r(psi)	radial defl w(in)	tang defl v(in)	circum wall thrust N(#/in)	wall bend mom(M) (#-lb/in)	ring comp stress (psi)	inner bend stress (psi)	outer bend stress (psi)	total stress inner (psi)	total stress outer (psi)
0	131.8	-0.211	0.000	603	56	-4463	-2175	2699	-6638	-1765
10	132.3	-0.188	0.065	602	53	-4458	-2061	2557	-6519	-1901
20	133.7	-0.122	0.123	600	45	-4443	-1732	2149	-6175	-2295
30	135.9	-0.021	0.165	597	32	-4420	-1228	1523	-5648	-2897
40	138.6	0.102	0.188	593	16	-4392	-609	756	-5001	-3636
50	141.5	0.234	0.188	589	-1	-4362	49	-61	-4313	-4423
60	144.2	0.357	0.165	585	-17	-4334	667	-828	-3667	-5162
70	146.4	0.458	0.123	582	-30	-4311	1172	-1454	-3140	-5765
80	147.8	0.524	0.065	580	-39	-4296	1501	-1862	-2796	-6158
90	148.3	0.547	0.000	579	-42	-4291	1615	-2004	-2676	-6295
100	147.8	0.524	-0.065	580	-39	-4296	1501	-1862	-2796	-6158
110	146.4	0.458	-0.123	582	-30	-4311	1172	-1454	-3140	-5765
120	144.2	0.357	-0.165	585	-17	-4334	667	-828	-3667	-5162
130	141.5	0.234	-0.188	589	-1	-4362	49	-61	-4313	-4423
140	138.6	0.102	-0.188	593	16	-4392	-609	756	-5001	-3636
150	135.9	-0.021	-0.165	597	32	-4420	-1228	1523	-5648	-2897
160	133.7	-0.122	-0.123	600	45	-4443	-1732	2149	-6175	-2295
170	132.3	-0.188	-0.065	602	53	-4458	-2061	2557	-6519	-1901
180	131.8	-0.211	0.000	603	56	-4463	-2175	2699	-6638	-1765

CALCULATION OF RING SHORTENING

deg c.c.w. from horiz	ring comp stress (psi)	ring comp strain (in/in)	ring shortening (in)
0	-4463	-0.040577	-0.0299
10	-4458	-0.0405	-0.0299
20	-4443	-0.040394	-0.0298
30	-4420	-0.040185	-0.0296
40	-4392	-0.039929	-0.0294
50	-4362	-0.039657	-0.0292
60	-4334	-0.039401	-0.0290
70	-4311	-0.039193	-0.0289
80	-4296	-0.039057	-0.0288
90	-4291	-0.039009	-0.0287
100	-4296	-0.039057	-0.0288
110	-4311	-0.039193	-0.0289
120	-4334	-0.039401	-0.0290
130	-4362	-0.039657	-0.0292
140	-4392	-0.039929	-0.0294
150	-4420	-0.040185	-0.0296
160	-4443	-0.040394	-0.0298
170	-4458	-0.0405	-0.0299
180	-4463	-0.040577	-0.0299
		SUM (l/2 circle) =	-0.5574

COMMENTS

1. This is 8" diameter ADS N-12

2. Flexural and compressive modulus are taken as 110,000 psi.

3. Typical E'_5 values (in psi) for various soils are listed in the table below:

Type of soil	Standard AASHTO Relative Compaction 85%	90%	95%
Fine-grained soils with less than 25% sand (CL, ML, DL-ML)	500	700	1000
Coarse-grained soils with fines (SM, SC)	600	1000	1200
Coarse-grained soils with little or no fines (SP, SW, GP, GW)	700	1000	1600

MISC CALCS

Vertical deflection (%) =	12.95
Horizontal deflection (%) =	-9.99
Critical Buckling Pressure (psi), P_{cr}=	144.4
Radial Soil Pressure at Crown (psi), P_{act}=	148.3
Arc length of each sector (in) =	0.7365

CIRCUMFERENCE SHORTENS= -1.11 inches

Burns and Richard Solution

TSF1 Underdrain Collection System

12" ADS N-12

PIPE PARAMETERS - AASHTO M294, Type S

effective radius (in), R =	6.505
outside diameter (in), D =	14.45
thickness (in), t =	1.15
unit area of wall (in^2/in), A =	0.217
unit moment of inertia (in^4/in), I =	0.035
flexural modulus (psi), E_f =	110,000
ring compression modulus (psi), E_{rc} =	110,000
flexural stiffness (psi), $K_f = 6E_fI/R^3$ =	84
ring compression stiffness (psi), $K_{rc} = E_{rc}A/R$ =	3,669
distance from inner wall to n.a. (in), c =	0.43

SOIL PARAMETERS - good granular soil

mod of soil reaction at 5' of cover (psi), E'_5 =	700
modulus of soil reaction (psi), E' =	2,316
Poisson's ratio, u =	0.30
constr mod (psi), M*=E*(1-u)/((1+u)(1-2u))=	3118.3
lateral stress ratio = K = u/(1-u) =	0.429
sym lateral stress ratio = B = (1/2)(1+K) =	0.714
antisym lat stress ratio = C = (1/2)(1-K) =	0.286

SOIL/STRUCTURE PARAMETERS (full slippage)

ring flexibility ratio, UF =(1+K)M*/K_{rc} =	1.21
bending flexibility ratio, VF = (1-K)M*/K_f =	21.2

STRESS FUNCTION COEFFICIENTS

constant term, a_0* =	0.058
cos(2*theta), a_2** =	0.939
sin(2*theta), b_2** =	0.908

LOAD PARAMETERS

unit weight of soil (lb/ft^3) =	125
height of fill above crown (ft) =	243.0
surcharge pressure (psi), P =	210.9

RESPONSE OF PIPE WALL

deg c.c.w. from horiz	radial soil press P_r(psi)	radial defl w(in)	tang defl v(in)	circum wall thrust N(#/in)	wall bend mom(M) (#-lb/in)	ring comp stress (psi)	inner bend stress (psi)	outer bend stress (psi)	total stress inner (psi)	total stress outer (psi)
0	130.9	-0.321	0.000	948	179	-4367	-2202	3688	-6570	-679
10	131.6	-0.287	0.099	946	170	-4360	-2087	3494	-6447	-867
20	133.5	-0.187	0.186	942	143	-4341	-1753	2935	-6094	-1406
30	136.4	-0.035	0.251	936	101	-4312	-1242	2079	-5554	-2232
40	140.1	0.152	0.285	928	50	-4276	-615	1030	-4891	-3246
50	143.9	0.351	0.285	919	-4	-4237	52	-87	-4185	-4325
60	147.5	0.538	0.251	912	-55	-4201	679	-1137	-3522	-5338
70	150.5	0.691	0.186	905	-97	-4172	1190	-1993	-2981	-6165
80	152.4	0.790	0.099	901	-124	-4152	1524	-2552	-2628	-6704
90	153.1	0.825	0.000	900	-133	-4146	1640	-2746	-2506	-6891
100	152.4	0.790	-0.099	901	-124	-4152	1524	-2552	-2628	-6704
110	150.5	0.691	-0.186	905	-97	-4172	1190	-1993	-2981	-6165
120	147.5	0.538	-0.251	912	-55	-4201	679	-1137	-3522	-5338
130	143.9	0.351	-0.285	919	-4	-4237	52	-87	-4185	-4325
140	140.1	0.152	-0.285	928	50	-4276	-615	1030	-4891	-3246
150	136.4	-0.035	-0.251	936	101	-4312	-1242	2079	-5554	-2232
160	133.5	-0.187	-0.186	942	143	-4341	-1753	2935	-6094	-1406
170	131.6	-0.287	-0.099	946	170	-4360	-2087	3494	-6447	-867
180	130.9	-0.321	0.000	948	179	-4367	-2202	3688	-6570	-679

CALCULATION OF RING SHORTENING

deg c.c.w. from horiz	ring comp stress (psi)	ring comp strain (in/in)	ring shortening (in)
0	-4367	-0.039701	-0.0451
10	-4360	-0.0396	-0.0450
20	-4341	-0.039466	-0.0448
30	-4312	-0.039198	-0.0445
40	-4276	-0.038869	-0.0441
50	-4237	-0.03852	-0.0437
60	-4201	-0.038191	-0.0434
70	-4172	-0.037923	-0.0431
80	-4152	-0.037748	-0.0429
90	-4146	-0.037687	-0.0428
100	-4152	-0.037748	-0.0429
110	-4172	-0.037923	-0.0431
120	-4201	-0.038191	-0.0434
130	-4237	-0.03852	-0.0437
140	-4276	-0.038869	-0.0441
150	-4312	-0.039198	-0.0445
160	-4341	-0.039466	-0.0448
170	-4360	-0.0396	-0.0450
180	-4367	-0.039701	-0.0451
		SUM (l/2 circle) =	-0.8358

COMMENTS

1. This is 12" diameter ADS N-12

2. Flexural and compressive modulus are taken as 110,000 psi.

3. Typical E'_5 values (in psi) for various soils are listed in the table below:

Type of soil	Standard AASHTO Relative Compaction 85%	90%	95%
Fine-grained soils with less than 25% sand (CL, ML, DL-ML)	500	700	1000
Coarse-grained soils with fines (SM, SC)	600	1000	1200
Coarse-grained soils with little or no fines (SP, SW, GP, GW)	700	1000	1600

MISC CALCS

Vertical deflection (%) =	12.68
Horizontal deflection (%) =	-9.87
Critical Buckling Pressure (psi), P_{cr}=	168.8
Radial Soil Pressure at Crown (psi), P_{act}=	153.1
Arc length of each sector (in) =	1.1353

CIRCUMFERENCE SHORTENS= -1.67 inches

Burns and Richard Solution

TSF1 Underdrain Collection System

24" ADS N-12

PIPE PARAMETERS - AASHTO M294, Type S	
effective radius (in), R =	12.78
outside diameter (in), D=	27.8
thickness (in), t =	1.86
unit area of wall (in^2/in), A =	0.324
unit moment of inertia (in^4/in), I =	0.1370
flexural modulus (psi), E_f =	110,000
ring compression modulus (psi), E_{rc} =	110,000
flexural stiffness (psi), $K_f = 6E_fI/R^3$ =	43
ring compression stiffness (psi), $K_{rc} = E_{rc}A/R$ =	2,789
distance from inner wall to n.a. (in), c =	0.74
SOIL PARAMETERS - good granular soil	
mod of soil reaction at 5' of cover (psi), E'_5 =	700
modulus of elasticity (psi), E' =	2,316
Poisson's ratio, ν =	0.3
constr mod (psi), $M^*=E^*(1-\nu)/((1+\nu)(1-2\nu))$=	3118
lateral stress ratio = $K = \nu/(1-\nu)$ =	0.429
sym lateral stress ratio = B = (1/2)(1+K) =	0.714
antisym lat stress ratio = C = (1/2)(1-K) =	0.286
SOIL/STRUCTURE PARAMETERS (full slippage)	
ring flexibility ratio, UF =$(1+K)M^*/K_{rc}$ =	1.60
bending flexibility ratio, VF = $(1-K)M^*/K_f$ =	41.1
STRESS FUNCTION COEFFICIENTS	
constant term, a_0^* =	0.146
cos(2*theta), a_2^{**} =	0.967
sin(2*theta), b_2^{**} =	0.951
LOAD PARAMETERS	
unit weight of soil (lb/ft^3) =	125
height of fill above crown (ft) =	243
surcharge pressure (psi), P =	210.9

RESPONSE OF PIPE WALL

deg c.c.w. from horiz	radial soil press P_r(psi)	radial defl w(in)	tang defl v(in)	circum wall thrust N(#/in)	wall bend mom(M) (#-lb/in)	ring comp stress (psi)	inner bend stress (psi)	outer bend stress (psi)	total stress inner (psi)	total stress outer (psi)
0	122.8	-0.575	0.000	1670	377	-5154	-2036	3081	-7190	-2073
10	123.1	-0.505	0.201	1669	357	-5150	-1931	2922	-7080	-2228
20	124.2	-0.303	0.377	1664	301	-5136	-1628	2464	-6765	-2672
30	125.7	0.007	0.508	1657	216	-5116	-1165	1763	-6280	-3352
40	127.7	0.388	0.578	1649	110	-5090	-596	903	-5687	-4187
50	129.7	0.792	0.578	1640	-2	-5063	9	-13	-5055	-5076
60	131.7	1.172	0.508	1632	-107	-5038	577	-873	-4461	-5911
70	133.2	1.482	0.377	1625	-193	-5017	1040	-1575	-3977	-6592
80	134.3	1.685	0.201	1621	-249	-5003	1343	-2032	-3661	-7036
90	134.6	1.755	0.000	1620	-268	-4999	1448	-2191	-3551	-7190
100	134.3	1.685	-0.201	1621	-249	-5003	1343	-2032	-3661	-7036
110	133.2	1.482	-0.377	1625	-193	-5017	1040	-1575	-3977	-6592
120	131.7	1.172	-0.508	1632	-107	-5038	577	-873	-4461	-5911
130	129.7	0.792	-0.578	1640	-2	-5063	9	-13	-5055	-5076
140	127.7	0.388	-0.578	1649	110	-5090	-596	903	-5687	-4187
150	125.7	0.007	-0.508	1657	216	-5116	-1165	1763	-6280	-3352
160	124.2	-0.303	-0.377	1664	301	-5136	-1628	2464	-6765	-2672
170	123.1	-0.505	-0.201	1669	357	-5150	-1931	2922	-7080	-2228
180	122.8	-0.575	0.000	1670	377	-5154	-2036	3081	-7190	-2073

CALCULATION OF RING SHORTENING

deg c.c.w. from horiz	ring comp stress (psi)	ring comp strain (in/in)	ring shortening (in)
0	-5154	-0.0468587	-0.1045
10	-5150	-0.0468	-0.1044
20	-5136	-0.0466931	-0.1042
30	-5116	-0.0465047	-0.1037
40	-5090	-0.0462737	-0.1032
50	-5063	-0.0460278	-0.1027
60	-5038	-0.0457967	-0.1022
70	-5017	-0.0456084	-0.1017
80	-5003	-0.0454854	-0.1015
90	-4999	-0.0454427	-0.1014
100	-5003	-0.0454854	-0.1015
110	-5017	-0.0456084	-0.1017
120	-5038	-0.0457967	-0.1022
130	-5063	-0.0460278	-0.1027
140	-5090	-0.0462737	-0.1032
150	-5116	-0.0465047	-0.1037
160	-5136	-0.0466931	-0.1042
170	-5150	-0.0468	-0.1044
180	-5154	-0.0468587	-0.1045
		SUM (l/2 circle) =	-1.9575

COMMENTS

1. This is 24" diameter ADS N-12

2. Flexural and compressive modulus are taken as 110,000 psi.

3. Typical E'_5 values (in psi) for various soils are listed in the table below:

Type of soil	Standard AASHTO Relative Compaction 85%	90%	95%
Fine-grained soils with less than 25% sand (CL, ML, DL-ML)	500	700	1000
Coarse-grained soils with fines (SM, SC)	600	1000	1200
Coarse-grained soils with little or no fines (SP, SW, GP, GW)	700	1000	1600

MISC CALCS

Vertical deflection (%) =	13.73
Horizontal deflection (%) =	-9.00
Critical Buckling Pressure (psi), P_{cr}=	121.3
Radial Soil Pressure at Crown (psi), P_{act}=	134.6
Arc length of each sector (in) =	2.2305
CIRCUMFERENCE SHORTENS=	-3.91 inches

APPENDIX G.4
GCL Equivalency

Flow through Single Soil Layer or GCL (Equivalency Calculation)	
Project:	Hermosa Project
Client:	South32 Hermsoa Inc
Facility:	Tailings Storage Facility 1 (TSF1)
Engineer:	Craig Thompson
Date	15-Jun-23

NewFields

	Inputs
	Outputs

“What-If” Scenarios Involving Single Liner Options

If one wants to evaluate “what-if” scenarios (e.g., what GCL hydraulic conductivity will achieve hydraulic equivalency with a certain CCL hydraulic conductivity and thickness?), they can simply set the flux through a GCL equal to the flux through a CCL, to produce the following expression (from Koerner and Daniel, 1993):

$$k_{GCL} = k_{clay}\left(\frac{t_{GCL}}{t_{clay}}\right)\left(\frac{h + t_{clay}}{h + t_{GCL}}\right) \quad (2)$$

Inputs Defined:

k_{GCL} = GCL saturated hydraulic conductivity (cm/sec)

k_{clay} = CCL saturated hydraulic conductivity (cm/sec)

t_{GCL} = thickness of GCL

t_{clay} = thickness of CCL

h = Hydraulic head above geomembrane

Variable Inputs

English Units			Metric Units	
k_{GCL} (ft/sec)	1.6E-10		k_{GCL} (cm/sec)	5.0E-09
k_{clay} (ft/sec)	3.3E-08		k_{clay} (cm/sec)	1.0E-06
t_{GCL} (ft)	0.0230		t_{GCL} (mm)	7.0
t_{clay} (ft)	1.0		t_{clay} (mm)	305
h (ft)	1.5		h (mm)	457

k_{GCL} (cm/sec) ≤ 3.8E-08 The selected GCL must have a saturated hydraulic conductivity less than 3.8×10^{-8} cm/sec. (See next page for a typical GCL Technical Data sheet).

References

1. CETCO (2000). Technical References - 200 Series - General Articles and Papers. TR-208. "Technical Equivalency Assessment of GCLs to CCLs."
2. CETCO (2012). Technical References - 300 Series - GCL Performance and Design Reference. TR-349. InterLoK, a new GCL with K = 1×10^{-9} cm/s.
3. Koerner, R.M., and Daniel, D.E. (1993). “Technical Equivalency Assessment of GCLs to CCLs,” Proceedings of the 7th GRI Seminar, Philadelphia, PA, pp. 255-275.

Flow through Single Soil Layer or GCL (Equivalency Calculation)	
Project:	Hermosa Project
Client:	South32 Hermsoa Inc
Facility:	Tailings Storage Facility 1 (TSF1)
Engineer:	Craig Thompson
Date	15-Jun-23

NewFields

TECHNICAL DATA

BENTOMAT® DN-9

GEOSYNTHETIC CLAY LINER

DESCRIPTION

BENTOMAT DN GCL is a reinforced geosynthetic clay liner (GCL) consisting of a layer of sodium bentonite between two nonwoven geotextiles, which are needlepunched together.

TESTING DATA

PHYSICAL PROPERTIES			
MATERIAL PROPERTY	TEST METHOD	TEST FREQUENCY	REQUIRED VALUES
Bentonite Swell Index[1]	ASTM D5890	1 per 50 tonnes	24 mL/2g min.
Bentonite Fluid Loss[1]	ASTM D5891	1 per 50 tonnes	18 mL max.
Cap Nonwoven Geotextile Mass Per Area	ASTM D5621	200,000 ft^2 (20,000 m^2)	9 oz/yd2 (300 gsm) MARV
Base Nonwoven Geotextile Mass Per Area	ASTM D5621	200,000 ft^2 (20,000 m^2)	6 oz/yd2 (200 gsm) MARV
Bentonite Mass/Area[2]	ASTM D5993	40,000 ft^2 (4,000 m^2)	0.75 lb/ft^2 (3.6 kg/m^2) min.
GCL Grab Strength[3]	ASTM D6768	200,000 ft^2 (20,000 m^2)	50 lbs/in (87.5 N/cm) MARV
GCL Peel Strength[3]	ASTM D6496	40,000 ft^2 (4,000 m^2)	12 lbs/in (21 N/cm) min.
GCL Index Flux[4]	ASTM D5887	Weekly	1×10^{-8} $m^3/m^2/s$ max.
GCL Hydraulic Conductivity[4]	ASTM D5887	Weekly	5×10^{-9} cm/s max.
GCL Hydrated Internal Shear Strength[5]	ASTM D5321 ASTM D6243	Periodic	500 psf (24 kPa) typical @ 200 psf

Notes:

[1] Bentonite property tests performed at a bentonite processing facility before shipment to CETCO's GCL production facilities.

[2] Bentonite mass/area reported at 0% moisture content.

[3] All tensile strength testing is performed in the machine direction using ASTM D6768. All peel strength testing is performed using ASTM D6496. Upon request, tensile and peel results can be reported per modified ASTM D4632 using 4 inch grips.

[4] Index flux and permeability testing with deaired distilled/deionized water at 80 psi (551kPa) cell pressure, 77 psi (531 kPa) headwater pressure and 75 psi (517 kPa) tailwater pressure. Reported value is equivalent to 925 gal/acre/day. This flux value is equivalent to a permeability of 5x10-9 cm/sec for typical GCL thickness. Actual flux values vary with field condition pressures. The last 20 weekly values prior the end of the production date of the supplied GCL may be provided.

[5] Peak values measured at 200 psf (10 kPa) normal stress for a specimen hydrated for 48 hours. Site-specific materials, GCL products, and test conditions must be used to verify internal and interface strength of the proposed design.

APPENDIX G.5

TSF1 Hydrology and Hydraulics

APPENDIX G.5.1

TSF1 Hydrology and Hydraulics

Internal Stormwater Management Structures

NewFields	CALCULATION COVER SHEET		
Client South32 Hermosa Inc.	Preparer:	J. Pfeiffer	6/31/2023
Project TSF1 Expansion	Checked:	C. Thompson	6/31/2023
Title Internal Hydrology	Revision	0	

CALCULATION OBJECTIVE

1. Determine water elevation in the TSF Internal Detention Ponds and Underdrain Collection Pond during extreme storm events.
2. Determine the required size of the internal diversion channels.
3. Internal stormwater conveyance structures refer to structures within the TSF1/UDCP lined containment and are designed to control contact water.
4. External stormwater conveyance structures refer to structures outside the TSF1/UDCP lined containment and are designed to control non-contact water.

ASSUMPTIONS

1. Pond filling curves were extracted from AutoCAD Civil 3D
2. Composite SCS Curve numbers are calculated based on ground type.
3. Mannings n values were estimated as 0.035 as an approximate value for PL.

METHODOLOGY

1. Area and length measurements were determined using AutoCAD Civil 3D.
2. General and Local PMP storm event data were calculated by Ecological Resource Consultants.
3. 100yr/24hr and 1000yr/24hr storm event data are from NOAA Atlas 14.
4. 2030 Climate Change RCP8.5 data was used in operations scenario.

REFERENCES

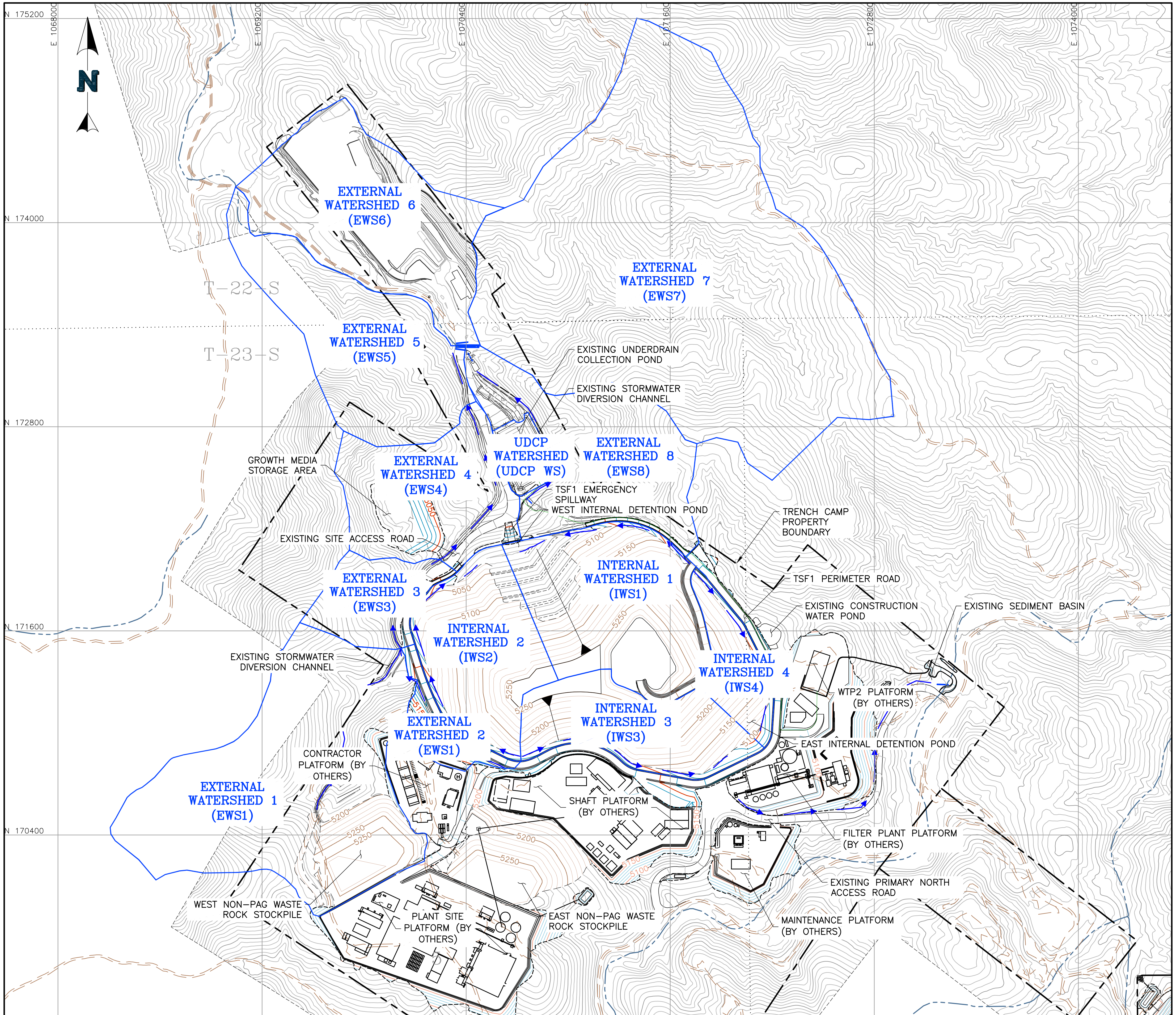
1. AutoCAD Civil 3D version 2022.
2. United States Department of Agriculture Natural Resources Conservation Service (NRCS). (1986). “Urban Hydrology for Small Watersheds, Technical Release 55 Second Edition,” June
3. U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS). “Part 630 Hydrology National Engineering Handbook.” 210-vi, NEH, May 2010.
4. United Stated Department of Commerce, National Oceanic and Atmospheric Administration. (reprinted 1984). “Hydrometeorological Report No. 49, Probably Maximum Precipitation Estimates, Colorado River and Great Basin Drainages,” (HRM 49)
5. United States Army Corps of Engineers. Hydrologic Modeling System (HEC-HMS) Version 4.9, Computer Program (January 2022)
6. NOAA Atlas 14, Volume 8, Version 2 (2013)

CONCLUSIONS

1. See attached pages for inputs and results.

Filename:

P:\Projects\0014.035 Hermosa TSF1-3 Design ADEQ APP Submittal\H-CALCULATIONS\Hydrology\[TSF1-3 Hydrology.xlsx]Hec Calc Cover



LEGEND:

- EXISTING GROUND CONTOURS
- TSF1 CONTOURS
- GROUND CONTOURS (BY OTHERS)
- STACKING GROUND CONTOURS
- EXISTING ROADS/TRAILS
- EXISTING DRAINAGES
- PROPERTY BOUNDARY
- EXISTING FENCE
- DIVERSION CHANNEL
- WATERSHED BOUNDARY
- SECTION LINES
- RECLAIM PIPE

0 300 600 FEET

REFERENCE:

EXISTING GROUND TOPOGRAPHY DEVELOPED FROM MARCH 2020 AND APRIL 2023 AERIAL SURVEY DATA PROVIDED BY SOUTH32 (AMI). DATA PROJECTED TO STATE PLANE ARIZONA CENTRAL NAD 83 FEET, NAVD88.

NewFields	CLIENT SOUTH32 HERMOSA INC.
PROJECT	HERMOSA PROJECT AQUIFER PROTECTION PERMIT
TITLE TSF1 WATERSHED PLAN VIEW	FILENAME 14.035.001F; FIGURE NO. 1; REVISION A

\\nfenglewood\Projects\0014.035 Hermosa TSF1-3 Design ADEQ APP Submittal\A-CAD\FIGS\14.035.001F.dwg-12/5/2023 5:22 PM

NewFields

South32 Hermosa Inc.
TSF1 Expansion
Aquifer Protection Permit
Lag Time Calculation

$$t_p = \frac{l^{0.8}(S+1)^{0.7}}{1900y^{0.5}}$$

t_p	Lag Time (hr.)
l	Length to Divide (ft)
y	Avg. Watershed Slope (%)
CN	Composite Curve Number
S	1000/CN-10 (in.)
Ia	Initial Abstraction (0.2*S)
Input Values	

Lag Time and Watershed Characteristics

Watershed	Area (mi^2)	l (ft)	CN	y	S	t_p (hr)	t_p (min)	Ia
IWS1	0.0327	1,345	85	30.0%	1.76	0.06	3.7	0.35
IWS2	0.0235	818	84	33.4%	1.95	0.04	2.5	0.39
IWS3	0.0201	482	84	32.3%	1.96	0.03	1.7	0.39
IWS4	0.0087	457	83	38.1%	2.10	0.03	1.5	0.42
UDCP WS	0.0041	163	99	38.1%	0.10	0.01	0.3	0.02
Haul Ramp Channel	0.0117	513	85	23.9%	1.76	0.03	1.9	0.35

Reach Data

Reach	Length (ft)	Slope (ft/ft)	n	Type	S. Slope (ft/ft)	Dia. (ft)
24" DIA OUTFALL PIPE 1 -EAST	1728	0.069	0.012	Cirular Pipe	n/a	2
24" DIA OUTFALL PIPE 2 -EAST	1728	0.069	0.012	Cirular Pipe	n/a	2
36" DIA OUTFALL PIPE (EAST)	492	0.041	0.012	Cirular Pipe	n/a	3
24" DIA OUTFALL PIPE 1 -WEST	86	0.374	0.012	Cirular Pipe	n/a	2
24" DIA OUTFALL PIPE 2 -WEST	86	0.374	0.012	Cirular Pipe	n/a	2
36" DIA OUTFALL PIPE (WEST)	536	0.037	0.012	Cirular Pipe	n/a	3

NewFields

South32 Hermosa Inc.
TSF1 Expansion
Aquifer Protection Permit

LOCAL PMP Hec-HMS Results

Hydraulic Element	Drainage Area (Mi^2)	Peak Flow (ft^3/s)	Volume (acre-ft)	Time of Peak	Peak Storage Elev (ft)
IWS1	0.0327	636.6	23.9	01Jan2022, 02:16	
IWS2	0.0235	470.4	17	01Jan2022, 02:16	
West Int Det Pond	0.0562	131.2	29	01Jan2022, 02:22	5040.8
West Outfall Div	0.0562	65.6	14.5	01Jan2022, 02:22	
West 24" Outfall Pipe 1	0.0562	65.6	14.5	01Jan2022, 02:22	
West 24" Outfall Pipe 2	0.0000	65.6	14.5	01Jan2022, 02:22	
West 36" Outfall Pipe	0.0562	131.2	29	01Jan2022, 02:22	
IWS3	0.0186	375.3	13.4	01Jan2022, 02:16	
IWS4	0.0101	211.7	7.2	01Jan2022, 02:15	
East Int Det Pond	0.0287	142.4	20.6	01Jan2022, 02:29	5119.2
East Outfall Div	0.0287	71.2	10.3	01Jan2022, 02:29	
East 24" Outfall Pipe 1	0.0000	71.2	10.3	01Jan2022, 02:30	
East 24" Outfall Pipe 2	0.0287	71.2	10.3	01Jan2022, 02:30	
East 36" Outfall Pipe	0.0287	142.4	20.6	01Jan2022, 02:30	
UDCP WS	0.0041	90.5	3.4	01Jan2022, 02:15	
UDCP	0.0890	200.6	22.6	01Jan2022, 03:45	
UDCP Spillway	0.0890	200.6	22.6	01Jan2022, 03:45	
West Int Pond Spillway	0.0000	692.4	11.7	01Jan2022, 02:22	
UDCP (pond full 30.4ac-ft)	0.0890	292.2	55.3	01Jan2022, 02:30	4962.3
UDCP Spillway (pond full 30.4ac-ft)	0.0890	292.2	55.3	01Jan2022, 02:30	

South32 Hermosa Inc.
TSF1 Expansion
Aquifer Protection Permit
100 Year-24 Hour Hec-HMS Results

Hydraulic Element	Drainage Area (Mi^2)	Peak Flow (ft^3/s)	Volume (acre-ft)	Time of Peak	Peak Storage Elev (ft)
IWS1	0.0327	108.8	6.2	01Jan2022, 11:59	
IWS2	0.0235	79.3	4.3	01Jan2022, 11:58	
West Int Det Pond	0.0562	80.5	10.4	01Jan2022, 12:07	5029.1
West Outfall Div	0.0562	40.2	5.2	01Jan2022, 12:07	
West 24" Outfall Pipe 1	0.0562	40.2	5.2	01Jan2022, 12:07	
West 24" Outfall Pipe 2	0.0000	40.2	5.2	01Jan2022, 12:07	
West 36" Outfall Pipe	0.0562	80.4	10.4	01Jan2022, 12:08	
IWS3	0.0186	63.4	3.4	01Jan2022, 11:58	
IWS4	0.0101	36.1	1.8	01Jan2022, 11:55	
East Int Det Pond	0.0287	70.5	5.2	01Jan2022, 12:02	5102.4
East Outfall Div	0.0287	35.3	2.6	01Jan2022, 12:02	
East 24" Outfall Pipe 1	0.0000	35.2	2.6	01Jan2022, 12:03	
East 24" Outfall Pipe 2	0.0287	35.2	2.6	01Jan2022, 12:03	
East 36" Outfall Pipe	0.0287	70.4	5.2	01Jan2022, 12:03	
UDCP WS	0.0041	19.9	1.1	01Jan2022, 11:53	
UDCP	0.0890	0	0.0	01Jan2022, 00:00	4949.5
UDCP Spillway	0.0890	0	0.0	01Jan2022, 00:00	
West Int Pond Spillway	0.0000	0	0.0	01Jan2022, 00:00	
Stacking Haul Ramp	0.0117	44.8	2.2	01Jan2022, 11:55	

NewFields

South32 Hermosa Inc.
TSF1 Expansion
Aquifer Protection Permit
100 Year-72 Hour Hec-HMS Results

Hydraulic Element	Drainage Area (Mi^2)	Peak Flow (ft^3/s)	Volume (acre-ft)	Time of Peak	Peak Storage Elev (ft)
IWS1	0.0327	158.6	8.1	02Jan2022, 12:09	
IWS2	0.0235	119.8	5.6	02Jan2022, 12:08	
West Int Det Pond	0.0562	90.8	13.5	02Jan2022, 12:20	5031.0
West Outfall Div	0.0562	45.4	6.8	02Jan2022, 12:20	
West 24" Outfall Pipe 1	0.0562	45.4	6.8	02Jan2022, 12:20	
West 24" Outfall Pipe 2	0.0000	45.4	6.8	02Jan2022, 12:20	
West 36" Outfall Pipe	0.0562	90.8	13.5	02Jan2022, 12:20	
IWS3	0.0186	97.2	4.5	02Jan2022, 12:07	
IWS4	0.0101	60	2.4	02Jan2022, 12:06	
East Int Det Pond	0.0287	83.1	6.8	02Jan2022, 12:13	5104.6
East Outfall Div	0.0287	41.6	3.4	02Jan2022, 12:13	
East 24" Outfall Pipe 1	0.0000	41.6	3.4	02Jan2022, 12:14	
East 24" Outfall Pipe 2	0.0287	41.6	3.4	02Jan2022, 12:14	
East 36" Outfall Pipe	0.0287	83.1	6.8	02Jan2022, 12:14	
UDCP WS	0.0041	31.9	1.4	02Jan2022, 12:05	
UDCP	0.0890	0	0.0	01Jan2022, 00:00	4953.8
UDCP Spillway	0.0890	0	0.0	01Jan2022, 00:00	
West Int Pond Spillway	0.0000	0	0.0	01Jan2022, 00:00	
Stacking Haul Ramp	0.0117	75.6	2.9	02Jan2022, 12:05	

NewFields

South32 Hermosa Inc.

TSF1 Expansion

Aquifer Protection Permit

1000 Year-24 Hour Hec-HMS Results

Hydraulic Element	Drainage Area (Mi^2)	Peak Flow (ft^3/s)	Volume (acre-ft)	Time of Peak	Peak Storage Elev (ft)
IWS1	0.0327	156.7	9.1	01Jan2022, 11:59	
IWS2	0.0235	115	6.4	01Jan2022, 11:58	
West Int Det Pond	0.0562	93.4	15.4	01Jan2022, 12:08	5031.5
West Outfall Div	0.0562	46.7	7.7	01Jan2022, 12:08	
West 24" Outfall Pipe 1	0.0562	46.7	7.7	01Jan2022, 12:08	
West 24" Outfall Pipe 2	0.0000	46.7	7.7	01Jan2022, 12:08	
West 36" Outfall Pipe	0.0562	93.4	15.4	01Jan2022, 12:09	
IWS3	0.0186	91.9	5.1	01Jan2022, 11:58	
IWS4	0.0101	52.8	2.7	01Jan2022, 11:55	
East Int Det Pond	0.0287	86.1	7.8	01Jan2022, 12:03	5105.1
East Outfall Div	0.0287	43.1	3.9	01Jan2022, 12:03	
East 24" Outfall Pipe 1	0.0000	43.1	3.9	01Jan2022, 12:04	
East 24" Outfall Pipe 2	0.0287	43.1	3.9	01Jan2022, 12:04	
East 36" Outfall Pipe	0.0287	86	7.8	01Jan2022, 12:04	
UDCP WS	0.0041	26.6	1.5	01Jan2022, 11:53	
UDCP	0.0890	0	0.0	01Jan2022, 00:00	4956.1
UDCP Spillway	0.0890	0	0.0	01Jan2022, 00:00	
West Int Pond Spillway	0.0000	0	0.0	01Jan2022, 00:00	
Stacking Haul Ramp	0.0117	64.4	3.3	01Jan2022, 11:55	

South32 Hermosa Inc.
TSF1 Expansion
Aquifer Protection Permit

Internal Stormwater Collection Channel Summary

Channel	Slope (ft/ft)	Roughness Coefficient	Channel Width (ft)	Channel Side Slopes (ft/ft)	1000yr/24hr or 100yr/72hr (whatever is larger)			
					Flow (ft3/s)	Velocity (ft/s)	Froude Number	Normal Flow Depth (ft)
IWS1 DIVERSION	0.010	0.035	0	2.5	158.6	5.69	0.78	3.3
	0.050	0.035	0	2.5	158.6	10.40	1.65	2.5
	0.150	0.035	0	2.5	158.6	15.70	2.76	2.0
IWS2 DIVERSION	0.010	0.035	0	2.5	119.8	5.30	0.76	3.0
	0.050	0.035	0	2.5	119.8	9.70	1.62	2.2
	0.100	0.035	0	2.5	119.8	12.58	2.24	2.0
IWS3 DIVERSION	0.010	0.035	0	2.5	97.2	5.03	0.75	2.8
	0.050	0.035	0	2.5	97.2	9.20	1.60	2.1
	0.100	0.035	0	2.5	97.2	11.94	2.22	1.8
IWS4 DIVERSION	0.010	0.035	0	2.5	60.0	4.46	0.73	2.3
	0.050	0.035	0	2.5	60.0	8.16	1.55	1.7
	0.100	0.035	0	2.5	60.0	10.58	2.15	1.5

Channel	Slope (ft/ft)	Roughness Coefficient	Channel Width (ft)	Channel Side Slopes (ft/ft)	Local PMP			
					Flow (ft3/s)	Velocity (ft/s)	Froude Number	Normal Flow Depth (ft)
IWS1 DIVERSION	0.010	0.035	0	2.5	636.6	8.05	0.85	5.6
	0.050	0.035	0	2.5	636.6	14.72	1.80	4.2
	0.150	0.035	0	2.5	636.6	22.22	3.01	3.4
IWS2 DIVERSION	0.010	0.035	0	2.5	470.4	7.46	0.83	5.0
	0.050	0.035	0	2.5	470.4	13.65	1.77	3.7
	0.100	0.035	0	2.5	470.4	17.70	2.44	3.3
IWS3 DIVERSION	0.010	0.035	0	2.5	375.3	7.05	0.82	4.6
	0.050	0.035	0	2.5	375.3	12.90	1.74	3.4
	0.100	0.035	0	2.5	375.3	16.73	2.41	3.0
IWS4 DIVERSION	0.010	0.035	0	2.5	211.7	6.11	0.79	3.7
	0.050	0.035	0	2.5	211.7	11.18	1.68	2.8
	0.100	0.035	0	2.5	211.7	14.50	2.33	2.4

Worksheet for IWS1 1%

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035
Channel Slope	0.010 ft/ft
Left Side Slope	2.500 H:V
Right Side Slope	2.500 H:V
Discharge	158.60 cfs

Results

Normal Depth	3.3 ft
Flow Area	27.9 ft²
Wetted Perimeter	18.0 ft
Hydraulic Radius	1.6 ft
Top Width	16.70 ft
Critical Depth	3.0 ft
Critical Slope	0.017 ft/ft
Velocity	5.69 ft/s
Velocity Head	0.50 ft
Specific Energy	3.84 ft
Froude Number	0.776
Flow Type	Subcritical

GVF Input Data

Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	3.3 ft
Critical Depth	3.0 ft
Channel Slope	0.010 ft/ft
Critical Slope	0.017 ft/ft

Worksheet for IWS1 5%

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035
Channel Slope	0.050 ft/ft
Left Side Slope	2.500 H:V
Right Side Slope	2.500 H:V
Discharge	158.60 cfs

Results

Normal Depth	2.5 ft
Flow Area	15.3 ft²
Wetted Perimeter	13.3 ft
Hydraulic Radius	1.1 ft
Top Width	12.35 ft
Critical Depth	3.0 ft
Critical Slope	0.017 ft/ft
Velocity	10.40 ft/s
Velocity Head	1.68 ft
Specific Energy	4.15 ft
Froude Number	1.650
Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	2.5 ft
Critical Depth	3.0 ft
Channel Slope	0.050 ft/ft
Critical Slope	0.017 ft/ft

Worksheet for IWS1 15%

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035
Channel Slope	0.150 ft/ft
Left Side Slope	2.500 H:V
Right Side Slope	2.500 H:V
Discharge	158.60 cfs

Results

Normal Depth	2.0 ft
Flow Area	10.1 ft²
Wetted Perimeter	10.8 ft
Hydraulic Radius	0.9 ft
Top Width	10.05 ft
Critical Depth	3.0 ft
Critical Slope	0.017 ft/ft
Velocity	15.70 ft/s
Velocity Head	3.83 ft
Specific Energy	5.84 ft
Froude Number	2.761
Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	2.0 ft
Critical Depth	3.0 ft
Channel Slope	0.150 ft/ft
Critical Slope	0.017 ft/ft

Worksheet for IWS2 1%

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035
Channel Slope	0.010 ft/ft
Left Side Slope	2.500 H:V
Right Side Slope	2.500 H:V
Discharge	119.80 cfs

Results

Normal Depth	3.0 ft
Flow Area	22.6 ft²
Wetted Perimeter	16.2 ft
Hydraulic Radius	1.4 ft
Top Width	15.03 ft
Critical Depth	2.7 ft
Critical Slope	0.018 ft/ft
Velocity	5.30 ft/s
Velocity Head	0.44 ft
Specific Energy	3.44 ft
Froude Number	0.762
Flow Type	Subcritical

GVF Input Data

Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	3.0 ft
Critical Depth	2.7 ft
Channel Slope	0.010 ft/ft
Critical Slope	0.018 ft/ft

Worksheet for IWS2 5%

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035
Channel Slope	0.050 ft/ft
Left Side Slope	2.500 H:V
Right Side Slope	2.500 H:V
Discharge	119.80 cfs

Results

Normal Depth	2.2 ft
Flow Area	12.4 ft²
Wetted Perimeter	12.0 ft
Hydraulic Radius	1.0 ft
Top Width	11.12 ft
Critical Depth	2.7 ft
Critical Slope	0.018 ft/ft
Velocity	9.70 ft/s
Velocity Head	1.46 ft
Specific Energy	3.68 ft
Froude Number	1.621
Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	2.2 ft
Critical Depth	2.7 ft
Channel Slope	0.050 ft/ft
Critical Slope	0.018 ft/ft

Worksheet for IWS2 10%

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035
Channel Slope	0.100 ft/ft
Left Side Slope	2.500 H:V
Right Side Slope	2.500 H:V
Discharge	119.80 cfs

Results

Normal Depth	2.0 ft
Flow Area	9.5 ft²
Wetted Perimeter	10.5 ft
Hydraulic Radius	0.9 ft
Top Width	9.76 ft
Critical Depth	2.7 ft
Critical Slope	0.018 ft/ft
Velocity	12.58 ft/s
Velocity Head	2.46 ft
Specific Energy	4.41 ft
Froude Number	2.244
Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	2.0 ft
Critical Depth	2.7 ft
Channel Slope	0.100 ft/ft
Critical Slope	0.018 ft/ft

Worksheet for IWS3 1%

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035
Channel Slope	0.010 ft/ft
Left Side Slope	2.500 H:V
Right Side Slope	2.500 H:V
Discharge	97.20 cfs

Results

Normal Depth	2.8 ft
Flow Area	19.3 ft²
Wetted Perimeter	15.0 ft
Hydraulic Radius	1.3 ft
Top Width	13.90 ft
Critical Depth	2.5 ft
Critical Slope	0.018 ft/ft
Velocity	5.03 ft/s
Velocity Head	0.39 ft
Specific Energy	3.17 ft
Froude Number	0.753
Flow Type	Subcritical

GVF Input Data

Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	2.8 ft
Critical Depth	2.5 ft
Channel Slope	0.010 ft/ft
Critical Slope	0.018 ft/ft

Worksheet for IWS3 5%

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035
Channel Slope	0.050 ft/ft
Left Side Slope	2.500 H:V
Right Side Slope	2.500 H:V
Discharge	97.20 cfs

Results

Normal Depth	2.1 ft
Flow Area	10.6 ft²
Wetted Perimeter	11.1 ft
Hydraulic Radius	1.0 ft
Top Width	10.28 ft
Critical Depth	2.5 ft
Critical Slope	0.018 ft/ft
Velocity	9.20 ft/s
Velocity Head	1.32 ft
Specific Energy	3.37 ft
Froude Number	1.600
Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	2.1 ft
Critical Depth	2.5 ft
Channel Slope	0.050 ft/ft
Critical Slope	0.018 ft/ft

Worksheet for IWS3 10%

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035
Channel Slope	0.100 ft/ft
Left Side Slope	2.500 H:V
Right Side Slope	2.500 H:V
Discharge	97.20 cfs

Results

Normal Depth	1.8 ft
Flow Area	8.1 ft²
Wetted Perimeter	9.7 ft
Hydraulic Radius	0.8 ft
Top Width	9.02 ft
Critical Depth	2.5 ft
Critical Slope	0.018 ft/ft
Velocity	11.94 ft/s
Velocity Head	2.21 ft
Specific Energy	4.02 ft
Froude Number	2.215
Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	1.8 ft
Critical Depth	2.5 ft
Channel Slope	0.100 ft/ft
Critical Slope	0.018 ft/ft

Worksheet for IWS4 1%

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.035
Channel Slope	0.010 ft/ft
Left Side Slope	2.500 H:V
Right Side Slope	2.500 H:V
Discharge	60.00 cfs

Results	
Normal Depth	2.3 ft
Flow Area	13.5 ft²
Wetted Perimeter	12.5 ft
Hydraulic Radius	1.1 ft
Top Width	11.60 ft
Critical Depth	2.0 ft
Critical Slope	0.020 ft/ft
Velocity	4.46 ft/s
Velocity Head	0.31 ft
Specific Energy	2.63 ft
Froude Number	0.730
Flow Type	Subcritical

GVF Input Data	
Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	2.3 ft
Critical Depth	2.0 ft
Channel Slope	0.010 ft/ft
Critical Slope	0.020 ft/ft

Worksheet for IWS4 5%

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035
Channel Slope	0.050 ft/ft
Left Side Slope	2.500 H:V
Right Side Slope	2.500 H:V
Discharge	60.00 cfs

Results

Normal Depth	1.7 ft
Flow Area	7.4 ft²
Wetted Perimeter	9.2 ft
Hydraulic Radius	0.8 ft
Top Width	8.58 ft
Critical Depth	2.0 ft
Critical Slope	0.020 ft/ft
Velocity	8.16 ft/s
Velocity Head	1.03 ft
Specific Energy	2.75 ft
Froude Number	1.553
Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	1.7 ft
Critical Depth	2.0 ft
Channel Slope	0.050 ft/ft
Critical Slope	0.020 ft/ft

Worksheet for IWS4 10%

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.035
Channel Slope	0.100 ft/ft
Left Side Slope	2.500 H:V
Right Side Slope	2.500 H:V
Discharge	60.00 cfs

Results	
Normal Depth	1.5 ft
Flow Area	5.7 ft²
Wetted Perimeter	8.1 ft
Hydraulic Radius	0.7 ft
Top Width	7.53 ft
Critical Depth	2.0 ft
Critical Slope	0.020 ft/ft
Velocity	10.58 ft/s
Velocity Head	1.74 ft
Specific Energy	3.24 ft
Froude Number	2.149
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	1.5 ft
Critical Depth	2.0 ft
Channel Slope	0.100 ft/ft
Critical Slope	0.020 ft/ft

Worksheet for IWS1 1% LocalPMP

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035
Channel Slope	0.010 ft/ft
Left Side Slope	2.500 H:V
Right Side Slope	2.500 H:V
Discharge	636.60 cfs

Results

Normal Depth	5.6 ft
Flow Area	79.1 ft²
Wetted Perimeter	30.3 ft
Hydraulic Radius	2.6 ft
Top Width	28.12 ft
Critical Depth	5.3 ft
Critical Slope	0.014 ft/ft
Velocity	8.05 ft/s
Velocity Head	1.01 ft
Specific Energy	6.63 ft
Froude Number	0.846
Flow Type	Subcritical

GVF Input Data

Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	5.6 ft
Critical Depth	5.3 ft
Channel Slope	0.010 ft/ft
Critical Slope	0.014 ft/ft

Worksheet for IWS1 5% LocalPMP

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035
Channel Slope	0.050 ft/ft
Left Side Slope	2.500 H:V
Right Side Slope	2.500 H:V
Discharge	636.60 cfs

Results

Normal Depth	4.2 ft
Flow Area	43.2 ft²
Wetted Perimeter	22.4 ft
Hydraulic Radius	1.9 ft
Top Width	20.80 ft
Critical Depth	5.3 ft
Critical Slope	0.014 ft/ft
Velocity	14.72 ft/s
Velocity Head	3.37 ft
Specific Energy	7.53 ft
Froude Number	1.800
Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	4.2 ft
Critical Depth	5.3 ft
Channel Slope	0.050 ft/ft
Critical Slope	0.014 ft/ft

Worksheet for IWS1 15% LocalPMP

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035
Channel Slope	0.150 ft/ft
Left Side Slope	2.500 H:V
Right Side Slope	2.500 H:V
Discharge	636.60 cfs

Results

Normal Depth	3.4 ft
Flow Area	28.6 ft²
Wetted Perimeter	18.2 ft
Hydraulic Radius	1.6 ft
Top Width	16.92 ft
Critical Depth	5.3 ft
Critical Slope	0.014 ft/ft
Velocity	22.22 ft/s
Velocity Head	7.68 ft
Specific Energy	11.06 ft
Froude Number	3.012
Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	3.4 ft
Critical Depth	5.3 ft
Channel Slope	0.150 ft/ft
Critical Slope	0.014 ft/ft

Worksheet for IWS2 1% LocalPMP

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.035
Channel Slope	0.010 ft/ft
Left Side Slope	2.500 H:V
Right Side Slope	2.500 H:V
Discharge	470.40 cfs

Results	
Normal Depth	5.0 ft
Flow Area	63.0 ft²
Wetted Perimeter	27.0 ft
Hydraulic Radius	2.3 ft
Top Width	25.10 ft
Critical Depth	4.7 ft
Critical Slope	0.015 ft/ft
Velocity	7.46 ft/s
Velocity Head	0.87 ft
Specific Energy	5.89 ft
Froude Number	0.830
Flow Type	Subcritical

GVF Input Data	
Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	5.0 ft
Critical Depth	4.7 ft
Channel Slope	0.010 ft/ft
Critical Slope	0.015 ft/ft

Worksheet for IWS2 5% LocalPMP

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035
Channel Slope	0.050 ft/ft
Left Side Slope	2.500 H:V
Right Side Slope	2.500 H:V
Discharge	470.40 cfs

Results

Normal Depth	3.7 ft
Flow Area	34.5 ft²
Wetted Perimeter	20.0 ft
Hydraulic Radius	1.7 ft
Top Width	18.57 ft
Critical Depth	4.7 ft
Critical Slope	0.015 ft/ft
Velocity	13.65 ft/s
Velocity Head	2.89 ft
Specific Energy	6.61 ft
Froude Number	1.766
Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	3.7 ft
Critical Depth	4.7 ft
Channel Slope	0.050 ft/ft
Critical Slope	0.015 ft/ft

Worksheet for IWS2 10% LocalPMP

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035
Channel Slope	0.100 ft/ft
Left Side Slope	2.500 H:V
Right Side Slope	2.500 H:V
Discharge	470.40 cfs

Results

Normal Depth	3.3 ft
Flow Area	26.6 ft²
Wetted Perimeter	17.6 ft
Hydraulic Radius	1.5 ft
Top Width	16.30 ft
Critical Depth	4.7 ft
Critical Slope	0.015 ft/ft
Velocity	17.70 ft/s
Velocity Head	4.87 ft
Specific Energy	8.13 ft
Froude Number	2.444
Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	3.3 ft
Critical Depth	4.7 ft
Channel Slope	0.100 ft/ft
Critical Slope	0.015 ft/ft

Worksheet for IWS3 1% LocalPMP

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035
Channel Slope	0.010 ft/ft
Left Side Slope	2.500 H:V
Right Side Slope	2.500 H:V
Discharge	375.30 cfs

Results

Normal Depth	4.6 ft
Flow Area	53.2 ft²
Wetted Perimeter	24.8 ft
Hydraulic Radius	2.1 ft
Top Width	23.07 ft
Critical Depth	4.3 ft
Critical Slope	0.015 ft/ft
Velocity	7.05 ft/s
Velocity Head	0.77 ft
Specific Energy	5.39 ft
Froude Number	0.819
Flow Type	Subcritical

GVF Input Data

Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	4.6 ft
Critical Depth	4.3 ft
Channel Slope	0.010 ft/ft
Critical Slope	0.015 ft/ft

Worksheet for IWS3 5% LocalPMP

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035
Channel Slope	0.050 ft/ft
Left Side Slope	2.500 H:V
Right Side Slope	2.500 H:V
Discharge	375.30 cfs

Results

Normal Depth	3.4 ft
Flow Area	29.1 ft²
Wetted Perimeter	18.4 ft
Hydraulic Radius	1.6 ft
Top Width	17.06 ft
Critical Depth	4.3 ft
Critical Slope	0.015 ft/ft
Velocity	12.90 ft/s
Velocity Head	2.59 ft
Specific Energy	6.00 ft
Froude Number	1.741
Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	3.4 ft
Critical Depth	4.3 ft
Channel Slope	0.050 ft/ft
Critical Slope	0.015 ft/ft

Worksheet for IWS3 10% LocalPMP

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035
Channel Slope	0.100 ft/ft
Left Side Slope	2.500 H:V
Right Side Slope	2.500 H:V
Discharge	375.30 cfs

Results

Normal Depth	3.0 ft
Flow Area	22.4 ft²
Wetted Perimeter	16.1 ft
Hydraulic Radius	1.4 ft
Top Width	14.98 ft
Critical Depth	4.3 ft
Critical Slope	0.015 ft/ft
Velocity	16.73 ft/s
Velocity Head	4.35 ft
Specific Energy	7.34 ft
Froude Number	2.410
Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	3.0 ft
Critical Depth	4.3 ft
Channel Slope	0.100 ft/ft
Critical Slope	0.015 ft/ft

Worksheet for IWS4 1% LocalPMP

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035
Channel Slope	0.010 ft/ft
Left Side Slope	2.500 H:V
Right Side Slope	2.500 H:V
Discharge	211.70 cfs

Results

Normal Depth	3.7 ft
Flow Area	34.6 ft²
Wetted Perimeter	20.0 ft
Hydraulic Radius	1.7 ft
Top Width	18.61 ft
Critical Depth	3.4 ft
Critical Slope	0.017 ft/ft
Velocity	6.11 ft/s
Velocity Head	0.58 ft
Specific Energy	4.30 ft
Froude Number	0.790
Flow Type	Subcritical

GVF Input Data

Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	3.7 ft
Critical Depth	3.4 ft
Channel Slope	0.010 ft/ft
Critical Slope	0.017 ft/ft

Worksheet for IWS4 5% LocalPMP

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035
Channel Slope	0.050 ft/ft
Left Side Slope	2.500 H:V
Right Side Slope	2.500 H:V
Discharge	211.70 cfs

Results

Normal Depth	2.8 ft
Flow Area	18.9 ft²
Wetted Perimeter	14.8 ft
Hydraulic Radius	1.3 ft
Top Width	13.76 ft
Critical Depth	3.4 ft
Critical Slope	0.017 ft/ft
Velocity	11.18 ft/s
Velocity Head	1.94 ft
Specific Energy	4.69 ft
Froude Number	1.680
Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	2.8 ft
Critical Depth	3.4 ft
Channel Slope	0.050 ft/ft
Critical Slope	0.017 ft/ft

Worksheet for IWS4 10% LocalPMP

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.035
Channel Slope	0.100 ft/ft
Left Side Slope	2.500 H:V
Right Side Slope	2.500 H:V
Discharge	211.70 cfs

Results	
Normal Depth	2.4 ft
Flow Area	14.6 ft²
Wetted Perimeter	13.0 ft
Hydraulic Radius	1.1 ft
Top Width	12.08 ft
Critical Depth	3.4 ft
Critical Slope	0.017 ft/ft
Velocity	14.50 ft/s
Velocity Head	3.27 ft
Specific Energy	5.68 ft
Froude Number	2.325
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	2.4 ft
Critical Depth	3.4 ft
Channel Slope	0.100 ft/ft
Critical Slope	0.017 ft/ft

HEC-15 RIPRAP DESIGN

TSF1 Haul Ramp Diversion Channel - 100yr/24hr	NOTE: Gray boxes require input, Orange boxes require specific values, Red boxes are calculated

Step 1: Channel Design Parameters			
Bottom Width	B	0	ft
Side Slope	Z	2	x:1
Longitudinal Slope	S	0.1	ft/ft
Flow	Q	44.8	ft^3/s

Step 2: Initial Riprap sizing			
Median Stone Size	D_{50}	**1.25**	ft
Stone Unit Weight	Ys	165	pcf
Riprap Calculation Gradation	D_{100}	25.00	inch
	D_{75}	18.75	inch
	D_{50}	15.00	inch
	D_{30}	10.00	inch
	D_{15}	7.50	inch
	D_{10}	5.00	inch

Step 3: Estimate the Flow Depth			
Initial Flow Depth Estimate	D_i	**1.8**	ft
Area of Channel	A	6.48	ft^2
Wetted Perimeter	P	8.05	ft
Hydraulic Radius	R	0.80	ft
Wetted Top Width	T	7.20	ft
Calculated Average Flow Depth	D_a	0.90	ft

Step 4: Estimate Manning's n and the Implied Discharge			
D_a/D_{50}		0.720	
For $1.5 < D_a/D_{50} < 185$	n	0.171	
Q from mannings	Qi	15.43	ft^3/s
% Difference from Design Discharge		-65.55%	
For $0.3 < D_a/D_{50} < 1.5$	n	0.061	
function(Froude number)	f(Fr)	0.974	
Froude number	Fr	1.284	
Velocity of flow	V	**6.914**	
effective roughness concrentration	b	0.395	
Roughness element geometry	f(REG)	9.853	
Channel geometry	f(CG)	0.440	
Q from mannings	Qi	43.25	ft^3/s
% Difference from Design Discharge		-3.45%	

Step 5:		
If % difference is > 5%, estimate a new depth in Step 3	TRUE	
For 0.3 < D_a/D_{50} < 1.5	FALSE	Proceed to Step 6
If false, proceed to step 6		

Step 6: Calculate Reynolds and Determine Appropriate Shields Parameter & Safety Factor				
Shear Velocity	V_*	2.407		
Reynolds number	R_e	2.47E+05		
Gravity	g	32.2	ft/s^2	
Kinematic Viscosity	v	1.22E-05	ft^2/s	(1.217e-5 for 60 °F)
From Table 6.1	F_*	0.150		
From Table 6.1	SF	1.500		
Specific Gravity of Stone	SG	2.64		
For S < 5%	D_{50}	1.09	ft	

Table 6.1. Selection of Shields' Parameter and Safety Factor			
Reynolds number	F_*	SF	
$\leq 4x10^4$	0.047	1	
$4x10^4$<Re<$2x10^5$	0.180	1.648	(Linear Interpolation)
$\geq 2x10^5$	0.15	1.5	

Step 7: Iterate Solution till Calculated D50 is Acceptably Smaller then Chosen D50				
Difference to Chosen Riprap	87.58%	<	100%	TRUE
IF FALSE GOTO STEP 2, ADJUST RIPRAP SIZE				

Step 8. Side Slope Assessment					
Stone Angle of Repose	ϕ	42.5	°		
For 1.5 < Z < 5	K1	0.802			
	Θ	26.57	°		
	K2	0.75			
Stable D_{50}	$D_{50,s}$	1.17			
Difference to Chosen Riprap		93.71%	<	100%	TRUE

NewFields

CALCULATION COVER SHEET

Client	South32 Hermosa Inc.	Preparer:	J. Pfeiffer	6/31/2023
Project	TSF1 Expansion	Checked:	C. Thompson	6/31/2023
Title	Emergency Spillway Hydrology - TSF	Revision	0	

CALCULATION OBJECTIVE

1. Determine water level through the TSF1 emergency spillway during the Local PMP storm event.

ASSUMPTIONS

1. Pond filling curves were extracted from AutoCAD Civil 3D
2. Composite SCS Curve numbers are calculated based on ground type.
3. Mannings n values were estimated as 0.035 as an approximate value for PL.
4. Flowmaster was used to determine a spillway elevation-dischage curve.
5. West underdrain outfall pipes assumed to be non-functioning.
6. West internal detention pond assumed to be full to the spillway invert at the beginning of the Local PMP storm.
7. Entire contents of TSF emergency spillway drain to the Underdrain Collection Pond.

METHODOLOGY

1. Area and length measurements were determined using AutoCAD Civil 3D.
2. Local PMP storm event data was calculated by Ecological Resource Consultants.
3. 100yr/24hr and 1000yr/24hr storm event data are from NOAA Atlas 14.
4. 2030 Climate Change RCP8.5 data was used in operations scenario.

REFERENCES

1. AutoCAD Civil 3D version 2022.
2. United States Department of Agriculture Natural Resources Conservation Service (NRCS). (1986). “Urban Hydrology for Small Watersheds, Technical Release 55 Second Edition,” June
3. U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS). “Part 630 Hydrology National Engineering Handbook.” 210-vi, NEH, May 2010.
4. United Stated Department of Commerce, National Oceanic and Atmospheric Administration. (reprinted 1984). “Hydrometeorological Report No. 49, Probably Maximum Precipitation Estimates, Colorado River and Great Basin Drainages,” (HRM 49)
5. United States Army Corps of Engineers. Hydrologic Modeling System (HEC-HMS) Version 4.9, Computer Program (January 2022)
6. NOAA Atlas 14, Volume 8, Version 2 (2013)

CONCLUSIONS

1. See attached pages for inputs and results.

Filename:

P:\Projects\0014.035 Hermosa TSF1-3 Design ADEQ APP Submittal\H-CALCULATIONS\Hydrology\[TSF1-3 Hydrology.xlsx]Hec Calc Cover (TSF Spillway)

South32 Hermosa Inc.
TSF1 Expansion
Aquifer Protection Permit

LOCAL PMP Hec-HMS Results

Hydraulic Element	Drainage Area (Mi^2)	Peak Flow (ft^3/s)	Volume (acre-ft)	Time of Peak	Peak Storage Elev (ft)
IWS1	0.0327	636.6	23.9	01Jan2022, 02:16	
IWS2	0.0235	470.4	17	01Jan2022, 02:16	
West Int Det Pond	0.0562	1074.6	40.9	01Jan2022, 02:18	5041.5

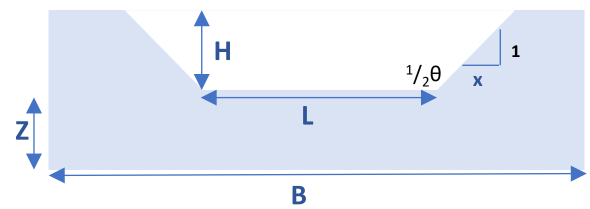
TRAPEZOIDAL WEIR (TSF1-3 EMERGENCY SPILLWAY)

$$Q_R = C_d \frac{2}{3}\sqrt{2g}LH^{3/2} \qquad Q_T = C_d \frac{8}{15}\sqrt{2g}H^{5/2}\tan\left(\frac{\theta}{2}\right)$$

$$C_d = 0.611 + .08\frac{H}{Z}$$

User Inputs

Weir Length, *ft*	L	40
Weir Height, *ft*	H	3
Base Height, *ft*	Z	0
Side Slope, x:1 (H:V)	x	10



do not touch:

Gravitational Constant, *ft/s* ^{2}	g	32.2
Notch Angle, degrees:	θ	2.9
Loss Coefficent	C_d	0.61
Triangular Portion of Flow, *cfs*	Q_T	407.6
Rectangular Portion of Flow, cfs	Q_R	679.4

Computed Flow Rate

Total Flow Rate, *cfs* :	Q_{TOTAL}	**1087.1**

to pass local PMF during operations (1074.6cfs)

PRESTO GEOSYSTEMS
670 North Perkins Street
Appleton, WI 54914 USA
Tel: 1 920 738 1104
Email: sam.justice@prestogeo.com

June 16, 2023

Craig Thompson, PE
NEWFIELDS
9540 Maroon Cir., Ste. 300
Englewood, CO 80112

RE: PR23346 AQUIFER PROTECTION (SPILLWAY)
Channel Protection System

Dear Craig:

Presto Geosystems has completed the evaluation for the Aquifer Protection (Spillway) Channel Protection System project, located in Tucson, AZ. Our recommendations are provided and detailed in the attached cross section and calculation. The evaluation is copyrighted and based on the unique engineering properties of Geoweb® system. Any use of this evaluation for any product other than that manufactured by Presto Products makes this evaluation invalid.

The objective of this evaluation is to propose a Geoweb cellular confinement system for stabilization of the channel. It is assumed herein that the channel is stable against failure except for the problem of surface erosion.

As the originator and leader in geocell technology, Presto offers the following advantages:

- Manufacturer Certificate of Analysis. Presto Geosystems manufactures Geoweb, ATRA keys and ATRA Stake Clips in accordance with stringent ISO and CE quality standards. Our quality management system allows Presto to provide Certificates of Compliance (COC) and Certificates of Analysis (COA) that allow traceability on all materials produced and supplied for this project. We do not provide geocell materials through private label manufacturers, which is often the case with our competitors. The ability for the Owner to receive COC and COA for geocell is critical to the integrity of the project.

- Design Calculations. The attached calculations are based specifically on Geoweb material characteristics, research/testing and accessories. Our design calculations are based on the site-specific characteristics and information contained in the request for project evaluation. The recommendations are based on Geoweb panels, ATRA® key connection device and ATRA stake clips. The anchorage recommendations are specific to our product and DO NOT apply to any other geocell manufacturers.

- ATRA Key connection device. ATRA keys provide a permanent and stronger panel connection compared to metal staples or zip ties. ATRA keys are made of high density polyethylene and are the strongest method available for panel connection. ATRA keys will not corrode or degrade and provide a permanent connection. ATRA keys were used to determine the anchorage recommendations. If a different connection device is proposed, the Presto recommendation DOES NOT apply. ATRA keys allow multiple panels to be installed concurrently decreasing installation time and preventing panel separation during installation and compaction. Panel separation may occur with metal staples or zip ties during installation, which can lead to long-term maintenance issues.

- Installation Assistance. Representatives of Presto, or the local distributor, are available to be on-site at the beginning of construction to ensure that the Geoweb panels and accessories are installed as the design intended. We are committed to train the Contractor based on our in-depth product knowledge and installation experience. Our past project successes will minimize installation time and issues. As with any material, there are advantageous techniques of installation, which we can offer during our visit.

Design and Materials

It is our understanding that the relevant dimensions of the channel, for the purpose of this analysis, are as follows:

Parameters:

Flow, ft^3/s	1,075
Velocity, ft/s	29.23
Base Width, ft	40
Side Slopes	5H:1V
Channel Depth, ft	3
Bed Slope, %	50%
Friction Angle ϕ, degree:	30
Infill Type:	Concrete
Infill Weight γ, lbs/ft^3	145

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Based on the evaluation, the following materials are recommended for the Geoweb application at the site:

1. Presto Geosystems Geoweb GW30V3 (3-inch) panels.
2. Provide a non-woven geotextile separation layer over the prepared sub grade. Install in accordance with Manufacturer recommendations including overlaps.
3. Connect the Geoweb sections with ATRA® Keys at each interleaf and end to end connection.
4. Provide 24 inch ATRA® Anchors in cells 1, 4 and 7 in the horizontal and every 3rd row down the slope (3 x 3 cell pattern).
5. Pre-shape the Geoweb system before infill placement.
6. Provide Geoweb crest anchorage as shown on the cross section, including concrete anchors embedded within the concrete spillway and concrete stilling basin.
7. Limit the drop of the infill into the Geoweb panels to prevent distortion.
8. Geoweb infill shall be concrete.
9. Adjust the concrete slump in the field as necessary to allow for installation. Screed the concrete flush with the top of the Geoweb cell walls. Do not overfill.
10. Include weep holes through the concrete if groundwater or pore pressure buildup is a concern.

For additional Channel Protection Resources, click here:
[Channel Design Engineering Resource Package]

If you have any questions or need any additional information, please call.

Sincerely,

Sam Justice

Sam Justice, P.E.
Civil Design Engineer
Presto Geosystems

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Product Specification - GEOWEB® GW30V3 Geocell

GENERAL

GEOWEB product is manufactured from textured, perforated strips of high density polyethylene that are bonded together to create a network of interconnected cells. The GEOWEB cells can be filled with soil, aggregate, concrete, pulverized debris, recycled asphalt pavement, or other infill material for geotechnical applications such as: 1) load support for unpaved and paved roads, railways, ports, heavy-duty pavements, container yard, and basal embankments stabilization; 2) retaining structures, free-standing structures, and fascia walls; and, 3) slope, channel, and geomembrane protection.

DIMENSIONS

Parameter	Units	Value
Cell Depth	Inches (mm)	3 (75)
Cell Size (Length x Width +/- 10%)	Inches (mm)	11.3 x 12.6 (287 x 320)
Expanded Section Width	No. Cells	8
	Feet (m)	Varies: 7.7 to 9.2 (2.3 to 2.8)
Expanded Section Length	No. Cells	18, 21, 25, 29, or 34
	Feet (m)	Varies: 15.4 to 35.1 (4.7 to 10.7)

STRUCTURAL INTEGRITY AND SYSTEM PERFORMANCE

Parameter	Units	Value
Minimum Short Term Seam Peel Strength	lb (N)	240 (1,060)
Long-Term Seam Peel Strength (standard 4-inch sample width)[1]	lb (N)	160 (710)
Internal Junction Efficiency[2]	%	≥100
Mechanical Junction Efficiency (Connection Type: ATRA Key)[2]	%	≥100
Peak Friction Angle Ratio (δ/Ø)[3]	Unitless	0.95

MATERIAL PROPERTIES

Parameter	Test Method	Units	Value
Polymer Density	ASTM D1505 or D792	g/cm^3	0.935 - 0.965
Flexural Storage Modulus	ISO 6721	Mpa	≥800
Carbon Black Content[4]	ASTM D1603	%	1.5 - 2.0
Sheet Thickness Prior to Texture	ASTM D5199	mm (mil)	1.27 (50), -5% +10%
Sheet Thickness After Texture	ASTM D5199	mm (mil)	1.52 (60), -5% +10%
Texture Density (Texture Type/Shape: Rhomboidal)	--	$indentations/cm^2$	22 - 31

DURABILITY

Parameter	Test Method	Units	Value
Environmental Stress Crack Resistance	ASTM D1693	hrs	>5,000
Resistance to Oxidation[5]	EN ISO 13438	yrs	≥100
Resistance to Weathering[6]	EN 12224	%	100

Notes:

1) A 100-mm (4.0 in.) wide seam sample shall support a 72.5 kg (160 lb) load for a period of 7 days minimum in a a temperature-controlled environment undergoing a temperature change on a 10 hour cycle from ambient room to 54° C (130° F). Ambient room temperature is per ASTM E 41.

2) Junction efficiency determined as a percentage of junction performance (EN ISO 13426-1) to perforated strip performance (EN ISO 10319).

3) Typical design value for clean granular infill material (i.e. - coarse sand or crushed aggregate). Consult with manufacturer to confirm value for other types of infill materials.

4) Standard black HDPE strips. For tan/green GEOWEB, hindered amine light stabilizer (HALS) content will be 2.0% by weight of carrier.

5) Predicted to be durable for a minimum of 100 years in natural soil with a pH between 4 and 9 and at a soil temperature ≤ 25°C.

6) 100% of original tensile strength retained following exposure to 370 hours of ultraviolet light and accelerated weathering in accordance with EN 12224.

UK CA 0338 | 21
CE 2895 | 22
ISO 9001:2015 Certified

Notes:

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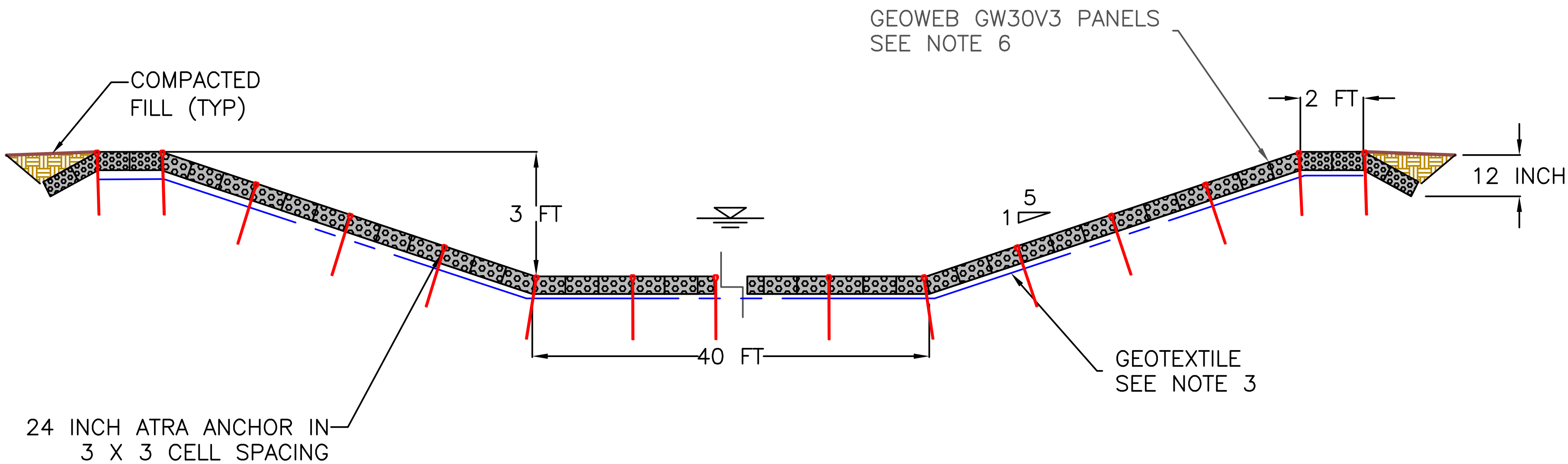
2. The evaluation assumes that the channel is globally stable.
3. Provide a non–woven geotextile layer and install per Manufacturer recommendations including overlaps.
4. The GEOWEB panels shall be connected with ATRA® keys at each interleaf and end to end connection.
5. Provide ATRA Anchors in the recommended anchorage pattern for stability.
6. Geoweb infill shall be concrete. Adjust concrete slump in the field as necessary to allow for installation. Screed the concrete flush with the top of the Geoweb cell walls. Do not overfill.
7. Include weep holes through the concrete if groundwater and pore pressure buildup is a concern.
8. Limit the drop of infill to prevent panel distortion.



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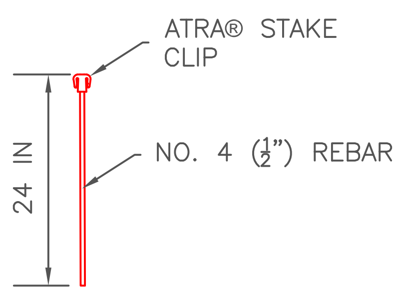

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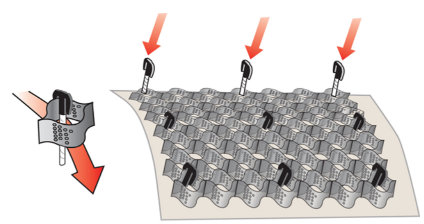

ANCHOR INSTALLATION

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PR23346 AQUIFER PROTECTION (SPILLWAY)
GEOWEB CHANNEL PROTECTION

DATE	JUNE 16, 2023	FILE NAME	SHEET 1
SCALE	NTS	SHEET	1 OF 3

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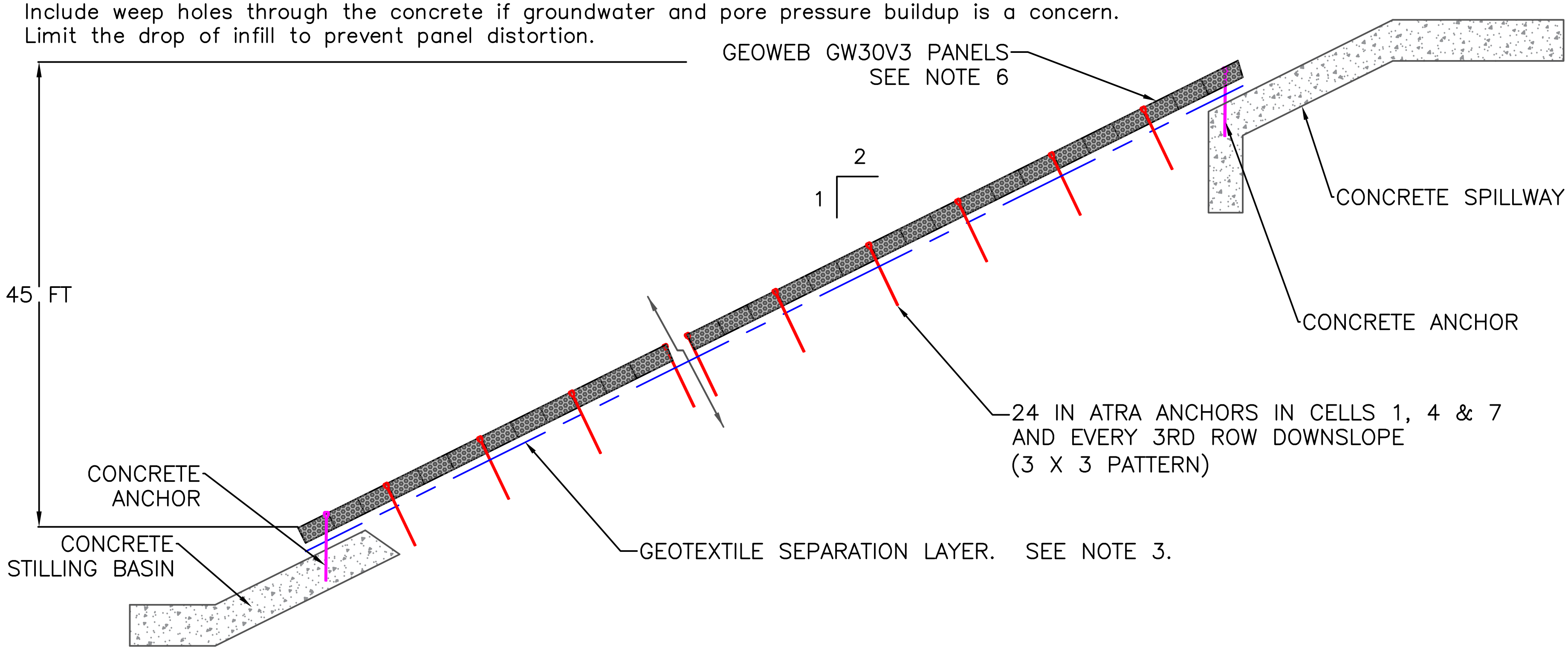

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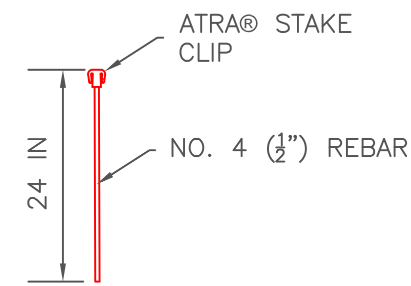

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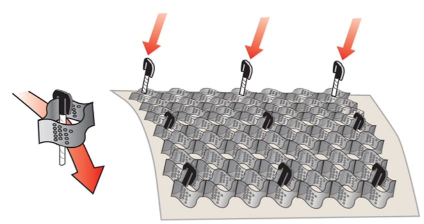

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SCALE	NTS	SHEET	2 OF 3

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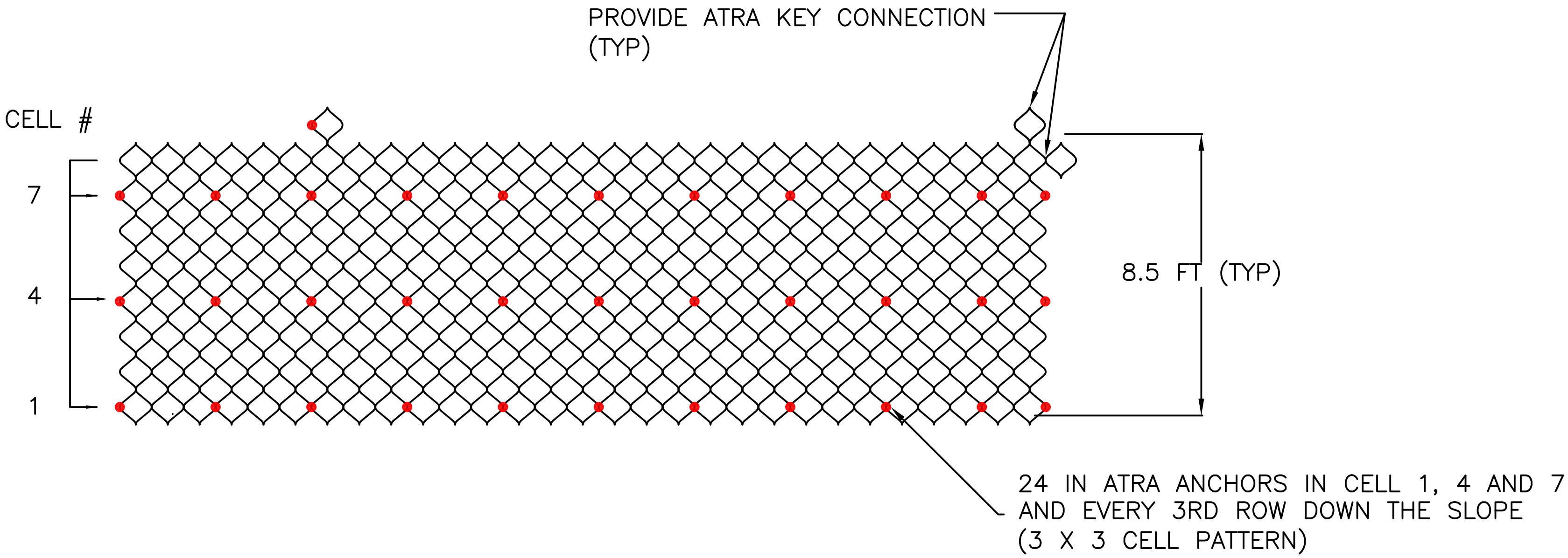


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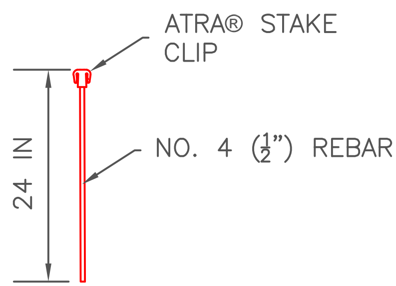

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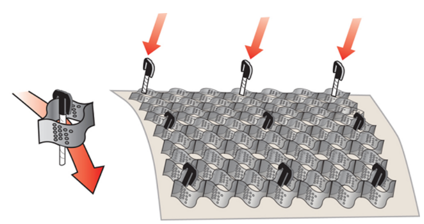
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DATE	JUNE 16, 2023	FILE NAME	SHEET 3
SCALE	NTS	SHEET	3 OF 3

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CHANNEL PROTECTION GEOWEB

Project Name: **AQUIFER PROTECTION (SPILLWAY)**
Presto Project Number: **PR 23346**
Date: **6/16/2023**

INPUT PARAMETERS				
English or Metric (E or M)	E		Coefficient, Cm	Gravity
			1.49	32.174
Channel Lining System			Typical Kb Values	
Invert:	Concrete		Straight Reach: 1.0	
Sides:	Concrete		Mild Meandors: 1.1 to 1.4	
Kb (Bend Coefficient)	1.00		Looping Meandors: 1.5 to 1.8	
Max Discharge (cfs)	1075.0		Sharp Turns: 1.9 to 2.1	
Bed Slope, %	50.0		Typical N Values for Lined Channel	
Channel Depth (ft)	3.00		Concrete Rough = 0.018 to 0.027	
Manning's Coefficient Invert	0.030		Aggregate Firm = 0.023	
Manning's Coefficient Side Slopes	0.030		Vegetated w/Grass & Weeds = 0.025	
Trial Channel Dimensions				
Base Width (ft)	40.00	Flow Area	36.84	
Water Depth (ft)	0.83	Wetted Perimeter	48.51	
Side Slope (xH:1V)	5.00	Hydraulic Radius	0.759	
Top Width 'T' of Flow line	48.34	R^2/3	0.832	
Velocity (ft/s)	29.23			
Flow (cfs)	1076.91	Compare to Specified Flow Rate		
Froude No., F	6.02			
Channel Bottom - Stream Direction Stresses				
Geoweb Thickness (in)	3	0.25 ft		
Unit Weight of Infill (lb/ft3)	145			
Interface Friction (Geoweb/Infill)	30	0.524		
Depth of Flow (ft)	0.83			
Bedslope (%)	50.00	0.464 radians		
Unit Weight of Water (lb/ft3)	62.4			
Coefficient of Friction (Infill/Soil)	0.58			
Tractive Shear Stress (lb/ft2)	26.02			

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SLOPE PROTECTION SYSTEM GEOWEB®

Project Name:	**AQUIFER PROTECTION (SPILLWAY)**
Presto Project Number:	**PR 23346**
Date:	**6/16/2023**

INPUT PARAMETERS

English or Metric (E or M)	E	
Slope Angle	26.5	Slope (H:V)
Slope Length (ft)	100.85	2.01
Vertical Height (ft)	45	
Minimum Interface Friction Angle (degrees)	30	Between Different Surfaces
Geoweb Cell Type	GW30V	
Web Thickness (in)	3	
Infill type	Concrete	Infill Weight (lb/ft)
Infill Unit Weight (lb/ft3)	145	3655.9
Additional Cover (in.)	0	Cover Weight (lb/ft)
Cover Unit Weight (lb/ft3)	0	0.0
Design Factor of Safety	1.4	Total Weight (lb/ft)
Tractive Force (lb/ft)	21.7	3655.9
Passive Resistance at toe (Y or N)	No	Tractive force = 26.05 psf @ 0.83 ft water depth.
Angle of internal friction of soil at toe	0	
Unit weight of soil at toe (lb/ft3)	0	

Calculations

Factored Geoweb Seam Strength (lb/ft)	176.00	Allowable Tensile
Driving Force (lb/ft)	1,652.98	Weight+Toe Load (Gravity)
Factored Driving Force (lb/ft)	2,283.75	Weight Only
Factored Driving Force (lb/ft)	2,305.48	Weight+Toe Load
Resisting Force (lb/ft)	1,888.96	Shear Only (Min Between Surfaces)
Passive Earth Force (lb/ft)	0.00	
Available Resistance (lb/ft)	0.00	Geoweb
Factor of Safety	1.14	Shear Only
Maximum Available F.S.	1.25	Shear and Geoweb Seam Strength

ATRA® KEY

Connection Strength	275 lbs/ft

Note: Anchorage pattern is based on the use of ATRA keys for panel to panel connection. If staples or zip ties are used, the anchorage pattern will increase.

ATRA Key
Clickable Spec

ATRA® ANCHOR DETAILS

Net Driving (lb/sqft)	4.13	Factored
Max. Unrestrained GW length (ft)	42.6	Unrestrained

Input Parameters

Length (in)	24	ATRA Anchor	Spacing (in)
Diameter or Width (in)	0.50	Downslope Spacing	
Downslope spacing (# of cells)	3	14	34.2
Horizontal spacing (# of cells)	3		37.8
Soil Friction Angle (degrees)	35		
Soil Cohesion (lb/ft2)	0		
Slope Soil Type	Native		
Unit Weight (lb/ft3)	125		
Kp (Coefficient)	3.69		
Buried Anchor Length (ft)	1.75		
Anchor Resistance (lb)	29.43	Single Anchor	
Number of Rows of Anchors	36		
Anchor Resistance (lb/ft)	336.3	Resultant	
Anchor Resistance (lb/ft2)	3.34	Net Resultant	
Resisting Force (lb/ft)	2,225	Shear plus Anchors	
Anchor density (anchors/ft2)	0.11		
Anchors per Geoweb Section Width	115		
Factor of Safety	1.35	Shear and Atra Anchored Geoweb	

Note: Anchorage pattern is based on the use of ATRA keys for panel to panel connection. If staples or zip ties are used, the anchorage pattern will increase.

ATRA Anchors
Clickable Spec

PRESTO

SLOPE PROTECTION SYSTEM
GEOWEB®

TENDONS

Required Tension (lb/ft)	80	Tendons only	

Input Parameters

Tendon Type	No Tendons		
Ultimate Strength (lb)	0		
F.S. (Creep)	1.10		
F.S. (Knots)	1.10		
F.S. (Construction damage)	1.10		
F.S. (Chemical/Biological Durability)	1.10		
F.S. (Overall Uncertainties)	1.25	Overall Factor of Safety	1.83
Number of Tendons/GW Section	0		
ATRA Tendon Clip Spacing (no. of cells downslope)	0	Maximum Allowable	0
Tendon Hole Spacing (in)	12.6		
Available Tension/tendon (lb)	0		
Average No. of Tendons/slot	0		
Available Tension/slot (lb)	0.0		
Available Tension (lb/ft)	0	OK	
Tendon density (ft/ft2)	0.000	Includes 15% extra for knots and wastage	
Tendon Length per 8.5' Geoweb Section	0	and deadman bury length.	
Atra Tendon Clips/8.5' Geoweb Section	0	Atra Tendon Clip Density (#/ft2)	0.000
Factor of Safety	No Tendons	Shear and Tendon Anchorage	

Note: Tendons and load transfer device quantity and spacing is based on the use of only ATRA Tendon Clips for load transfer. If substitute devices are used, this analysis is void.

ATRA Tendon Clip
Clickable Spec

CREST/SLOPE ANCHORAGE

Required Anchorage (lb/ft)	89	

Input Parameters

Horizontal Embedment Length (ft)	0	From Slope Face to Key Trench
Depth Below Crest (in)	0	Crest to Bottom of Geoweb
Slope Angle of Key Trench (degrees)	0	
Depth of Key Trench (in)	0	
Horiz. Length at Bottom of Trench (in)	0	
Soil Unit Weight (lb/ft3)	0	
Soil Friction (degrees)	0	
Available Resisting Force (lb/ft)	0.00	OK
Factor of Safety	1.35	Crest Anchorage and Atra Anchors

Limitation of Use:

Project	South32 TSF1-3 Spillway
Title	Energy Dissipation Design Calculations
Preparer	Troy Thompson, ERC
Date	7/27/2023

Objective:

Calculate hydraulic requirements for an energy dissipation structure for the downstream end of the TSF spillway

Given Information:

Geometry of the spillway was provided by NewFields. Includes a spillway with a 40 foot crest width and 5:1 side slopes.
Design flow was provided by NewFields from HEC-HMS modeling. Design flow was 1,075 cfs

Design Reference:

*Engineering Monograph No. 25, “Hydraulic Design of Stilling Basins and Energy Dissipators” (usbr.gov)

Energy Dissipation Type:

USBR Type III

Check Unit Discharge to Confirm Type III Dissipator is Appropriate

q=Q/B 26.875 cfs
Confirms as q < 200 cfs

Froude Number for Type III Dissipator

Appropriate for Fr > 4

Evaluate Hydraulics and Geometry for Various Potential Spillway Roughness Factors

Results of Normal Flow Runs for Different Manning's N Values — From Fig 12 of reference

Mann n	V (fps)	Y (ft)	Shear (psf)	Fr		Conjugate Depth (ft)		L/D2	Type III Basin Length (ft)	
0.01	60	0.44	13.8	16		9.7		2.75	26.7	Fr OK
0.015	47	0.57	17.7	11		8.6		2.78	23.9	
0.02	38	0.66	20.5	8.2		7.3		2.6	19	
0.03	31	0.86	27	5.9		6.8		2.45	16.7	
0.035	28	0.95	29.6	5.1		6.4		2.35	15	
0.04	24	0.99	30.8	4.3		5.5		2.4	13.2	
0.045	22	1.06	32.9	3.9		5.3		2.4	12.7	FR too Low
0.05	21	1.12	35	3.5		5		2.3	11.5	
0.06	18.6	1.25	39	2.9		4.5		2.2	9.9	
0.075	16.1	1.41	44	2.4		4.1		2.2	9	

Select Target Manning's n of 0.03 for design

Inlet to Basin - 40 Foot Wide Channel

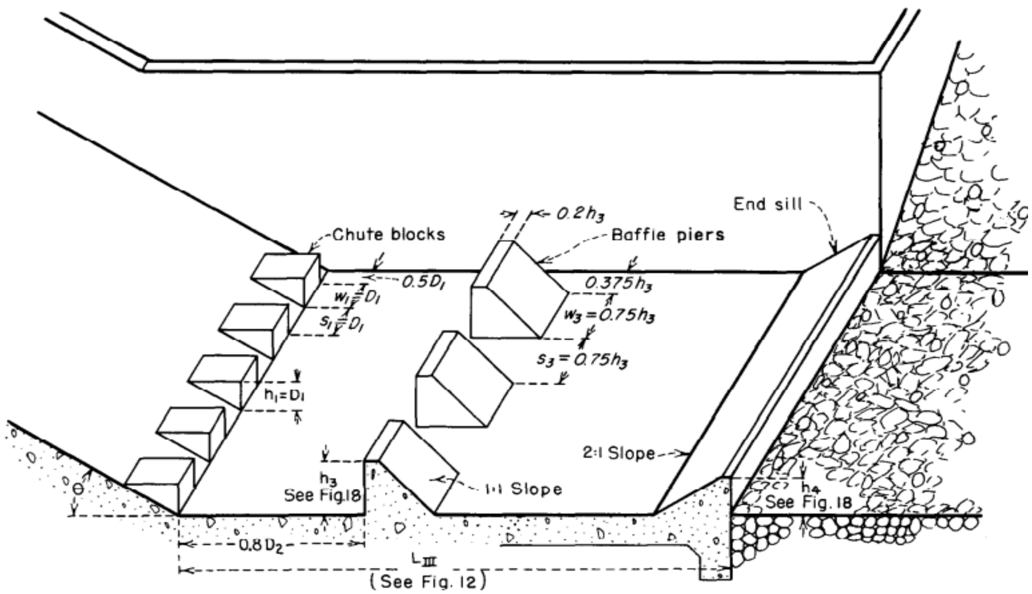
																baffle piers	end sill			
Mann n	V (fps)	Y (ft)	Shear (psf)	Fr		Conjugate Depth (ft)				L/D2	Type III Basin Length (ft)	h1 (ft)	s1 (ft)	w1 (ft)	h3 (ft)	h4 (ft)	s3 (ft)	w3 (ft)	D1 (ft)
0.03	31	0.86	27	5.9			6.8			2.45	16.7	0.86	0.86	0.86	1.376	1.1696	1.032	1.032	0.86

Design Material

Spillway armoring to be provided by concrete filled geocells

Surface roughness to be introduced by placing gravel/cobble sized material on surface of the concrete to introduce roughness

NewFields confirmed with manufacturer that this acieves the desired Manning's n roughness



NewFields	CALCULATION COVER SHEET		
Client	South32 Hermosa Inc.	Preparer:	J. Pfeiffer	6/31/2023
Project	TSF1 Expansion	Checked:	C. Thompson	6/31/2023
Title	Emergency Spillway Hydrology - UDCP	Revision	0	

CALCULATION OBJECTIVE

1. Determine water level through the UDCP emergency spillway during the Local PMP storm event.

ASSUMPTIONS

1. Pond filling curves were extracted from AutoCAD Civil 3D
2. Composite SCS Curve numbers are calculated based on ground type.
3. Mannings n values were estimated as 0.035 as an approximate value for PL.
4. Flowmaster was used to determine a spillway elevation-dischage curve.
5. Underdrain outfall pipes assumed to be functioning as intended.
6. Internal detention ponds assumed to be empty at the beginning of the Local PMP storm.
7. Underdrain Collection Pond assumed to be full to the spillway invert at the beginning of the Local PMP storm.
8. TSF emergency spillway to spill to the Underdrain Collection Pond.

METHODOLOGY

1. Area and length measurements were determined using AutoCAD Civil 3D.
2. Local PMP storm event data was calculated by Ecological Resource Consultants.
3. 100yr/24hr and 1000yr/24hr storm event data are from NOAA Atlas 14.
4. 2030 Climate Change RCP8.5 data was used in operations scenario.

REFERENCES

1. AutoCAD Civil 3D version 2022.
2. United States Department of Agriculture Natural Resources Conservation Service (NRCS). (1986). “Urban Hydrology for Small Watersheds, Technical Release 55 Second Edition,” June
3. U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS). “Part 630 Hydrology National Engineering Handbook.” 210-vi, NEH, May 2010.
4. United Stated Department of Commerce, National Oceanic and Atmospheric Administration. (reprinted 1984). “Hydrometeorological Report No. 49, Probably Maximum Precipitation Estimates, Colorado River and Great Basin Drainages,” (HRM 49)
5. United States Army Corps of Engineers. Hydrologic Modeling System (HEC-HMS) Version 4.9, Computer Program (January 2022)
6. NOAA Atlas 14, Volume 8, Version 2 (2013)

CONCLUSIONS

1. See attached pages for inputs and results.

Filename:

P:\Projects\0014.035 Hermosa TSF1-3 Design ADEQ APP Submittal\H-CALCULATIONS\Hydrology\[TSF1-3 Hydrology.xlsx]Hec Calc Cover (UDCP Spillway)

South32 Hermosa Inc.
TSF1 Expansion
Aquifer Protection Permit

LOCAL PMP Hec-HMS Results

Hydraulic Element	Drainage Area (Mi^2)	Peak Flow (ft^3/s)	Volume (acre-ft)	Time of Peak	Peak Storage Elev (ft)
IWS1	0.0327	636.6	23.9	01Jan2022, 02:16	
IWS2	0.0235	470.4	17	01Jan2022, 02:16	
West Int Det Pond	0.0562	135.3	31.3	01Jan2022, 02:22	5040.8
West Outfall Div	0.0562	67.7	15.6	01Jan2022, 02:22	
West 24" Outfall Pipe 1	0.0562	67.7	15.6	01Jan2022, 02:22	
West 24" Outfall Pipe 2	0.0000	67.7	15.6	01Jan2022, 02:22	
West 36" Outfall Pipe	0.0562	135.3	31.2	01Jan2022, 02:22	
IWS3	0.0186	375.3	13.4	01Jan2022, 02:16	
IWS4	0.0101	211.7	7.2	01Jan2022, 02:15	
East Int Det Pond	0.0287	142.4	20.6	01Jan2022, 02:29	5119.2
East Outfall Div	0.0287	71.2	10.3	01Jan2022, 02:29	
East 24" Outfall Pipe 1	0.0000	71.2	10.3	01Jan2022, 02:30	
East 24" Outfall Pipe 2	0.0287	71.2	10.3	01Jan2022, 02:30	
East 36" Outfall Pipe	0.0287	142.4	20.6	01Jan2022, 02:30	
UDCP WS	0.0041	90.5	3.4	01Jan2022, 02:15	
UDCP	0.0890	682.3	64.7	01Jan2022, 02:26	4963.6
UDCP Spillway	0.0890	682.3	64.7	01Jan2022, 02:26	

APPENDIX G.5.2

TSF1 Hydrology and Hydraulics

External Stormwater Management Structures

NewFields	CALCULATION COVER SHEET		
Client	South32 Hermosa Inc.	Preparer:	J. Pfeiffer	6/31/2023
Project	TSF1 Expansion	Checked:	C. Thompson	6/31/2023
Title	External Hydrology	Revision	0	

CALCULATION OBJECTIVE

1. Determine the required size of the new external diversion channel.
2. Internal stormwater conveyance structures refer to structures within the TSF1/UDCP lined containment and are designed to control contact water.
3. External stormwater conveyance structures refer to structures outside the TSF1/UDCP lined containment and are designed to control non-contact water.

ASSUMPTIONS

1. Composite SCS Curve numbers are calculated based on ground type.
2. Mannings n values were estimated using HEC-15 revetment calculation and sized for the 100yr/24 hr storm.

METHODOLOGY

1. Area and length measurements were determined using AutoCAD Civil 3D.
2. General and Local PMP storm event data were calculated by Ecological Resource Consultants.
3. 100yr/24hr and 1000yr/24hr storm event data are from NOAA Atlas 14.
4. 2030 Climate Change RCP8.5 data was used in operations scenario.

REFERENCES

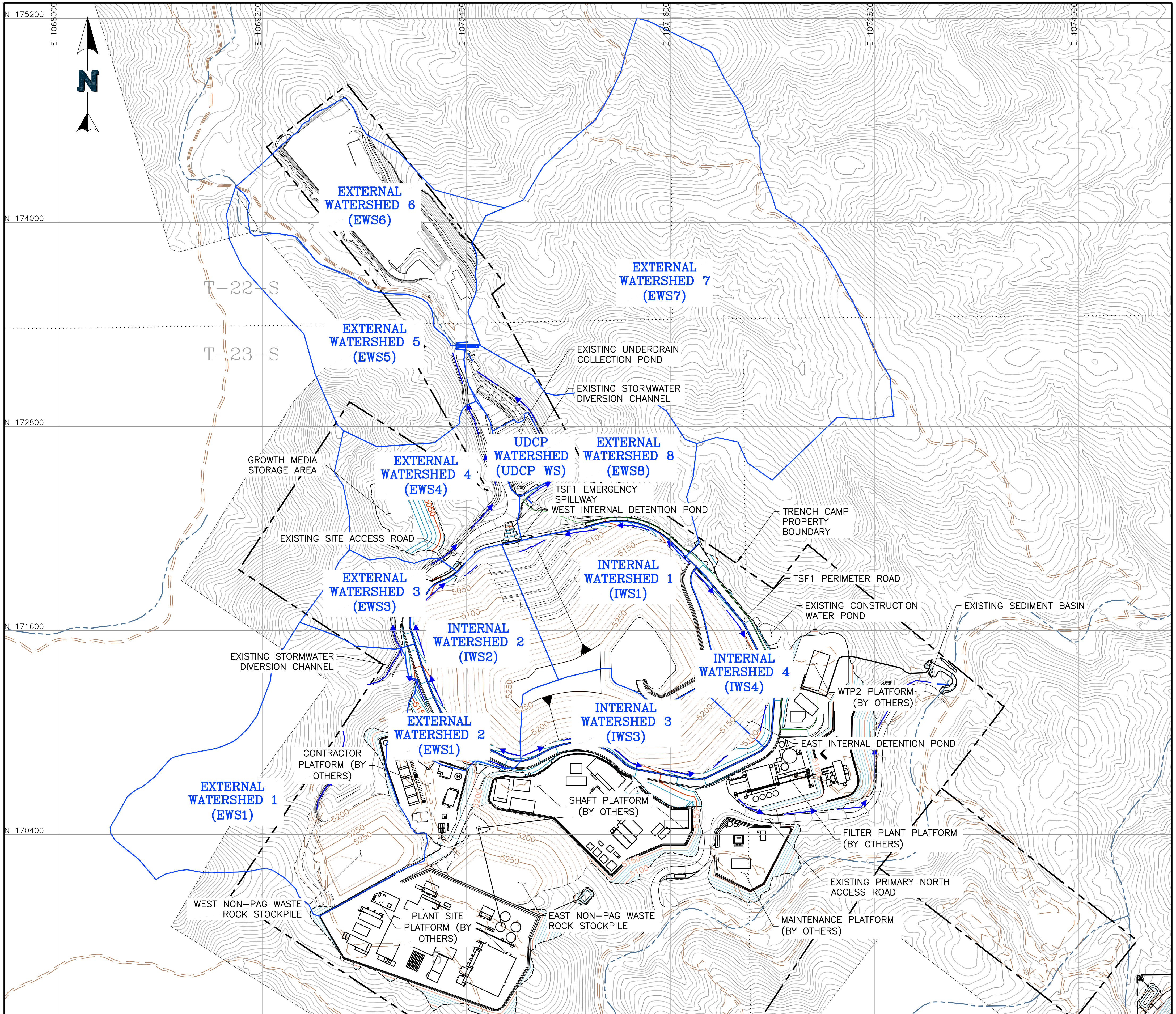
1. AutoCAD Civil 3D version 2022.
2. United States Department of Agriculture Natural Resources Conservation Service (NRCS). (1986). “Urban Hydrology for Small Watersheds, Technical Release 55 Second Edition,” June
3. U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS). “Part 630 Hydrology National Engineering Handbook.” 210-vi, NEH, May 2010.
4. United Stated Department of Commerce, National Oceanic and Atmospheric Administration. (reprinted 1984). “Hydrometeorological Report No. 49, Probably Maximum Precipitation Estimates, Colorado River and Great Basin Drainages,” (HRM 49)
5. United States Army Corps of Engineers. Hydrologic Modeling System (HEC-HMS) Version 4.9, Computer Program (January 2022)
6. NOAA Atlas 14, Volume 8, Version 2 (2013)

CONCLUSIONS

1. See attached pages for inputs and results.

Filename:

P:\Projects\0014.035 Hermosa TSF1-3 Design ADEQ APP Submittal\H-CALCULATIONS\Hydrology\[TSF1-3 Hydrology.xlsx]Hec Calc Cover (2)



LEGEND:

EXISTING GROUND CONTOURS
TSF1 CONTOURS
GROUND CONTOURS (BY OTHERS)
STACKING GROUND CONTOURS
EXISTING ROADS/TRAILS
EXISTING DRAINAGES
PROPERTY BOUNDARY
EXISTING FENCE
DIVERSION CHANNEL
WATERSHED BOUNDARY
SECTION LINES
RECLAIM PIPE

0 300 600 FEET

REFERENCE:

EXISTING GROUND TOPOGRAPHY DEVELOPED FROM MARCH 2020 AND APRIL 2023 AERIAL SURVEY DATA PROVIDED BY SOUTH32 (AMI). DATA PROJECTED TO STATE PLANE ARIZONA CENTRAL NAD 83 FEET, NAVD88.

NewFields

CLIENT: SOUTH32 HERMOSA INC.

PROJECT: HERMOSA PROJECT AQUIFER PROTECTION PERMIT

TITLE: TSF1 WATERSHED PLAN VIEW

FILENAME: 14.035.001F

FIGURE NO.: 1

REVISION: A

\\nfenglewood\Projects\0014.035 Hermosa TSF1-3 Design ADEQ APP Submittal\A-CAD\FIGS\14.035.001F.dwg-12/5/2023 5:22 PM

South32 Hermosa Inc.
TSF1 Expansion
Aquifer Protection Permit
Lag Time Calculation

$$t_p = \frac{l^{0.8}(S+1)^{0.7}}{1900y^{0.5}}$$

t_p	Lag Time (hr.)
l	Length to Divide (ft)
y	Avg. Watershed Slope (%)
CN	Composite Curve Number
S	1000/CN-10 (in.)
Ia	Initial Abstraction (0.2*S)
Input Values	

Lag Time and Watershed Characteristics								
Watershed	**Area (mi^2)**	**l (ft)**	**CN**	**y**	**S**	**t_p (hr)**	**t_p (min)**	**Ia**
EWS1	0.0636	2,030	72	45.0%	3.89	0.11	6.3	0.78
EWS2	0.0054	186	95	42.5%	0.53	0.01	0.4	0.11
EWS3	0.0112	645	79	39.2%	2.62	0.04	2.2	0.52
EWS4	0.0254	1,253	78	40.9%	2.85	0.06	3.8	0.57
EWS5	0.0332	835	73	48.7%	3.68	0.05	2.9	0.74
EWS6	0.0377	1,960	87	45.8%	1.43	0.06	3.7	0.29
EWS7	0.1306	2,771	72	36.4%	3.89	0.15	9.0	0.78
EWS8	0.0312	1,077	81	47.5%	2.42	0.05	2.9	0.48

Reach Data						
Reach	**Length (ft)**	**Slope (ft/ft)**	**n**	**Type**	**S. Slope (ft/ft)**	**Dia. or Width (ft)**
TSF1-3 HAUL ROAD CHANNEL	781	0.0986	0.067	Triangular Channel	2	
EXTERNAL DIVERSION CHANNEL REACH 1	592	0.0591	0.067	Trapezoidal Channel	2	12.5
EXTERNAL DIVERSION CHANNEL REACH 2	1037	0.1003	0.067	Trapezoidal Channel	2	12.5
EXTERNAL DIVERSION CHANNEL REACH 3	327	0.1254	0.067	Trapezoidal Channel	2	12.5
UDCP DIVERSION CHANNEL	1044	0.0670	0.067	Triangular Channel	2	
UDCP DIVERSION CULVERTS	68	0.0296	0.067	Circular Pipe	n/a	3
ACCESS ROAD CULVERTS	133	0.0150	0.067	Circular Pipe	n/a	2

South32 Hermosa Inc.
TSF1 Expansion
Aquifer Protection Permit

LOCAL PMP Hec-HMS Results

Hydraulic Element	Drainage Area (Mi^2)	Peak Flow (ft^3/s)	Volume (acre-ft)	Time of Peak
EWS1	0.0636	1047.8	39.9	01Jan2022, 02:17
EWS2	0.0054	118.8	4.3	01Jan2022, 02:15
EWS3	0.0112	229.5	7.7	01Jan2022, 02:15
EWS4	0.0254	496	17.2	01Jan2022, 02:15
EWS5	0.0332	634.7	21.1	01Jan2022, 02:15
EWS6	0.0377	793.5	28.1	01Jan2022, 02:15
EWS7	0.1306	1884.9	82	01Jan2022, 02:20
EWS8	0.0312	641.1	21.8	01Jan2022, 02:15
EXT CHANNEL OUTLET	0.3383	5525.8	222.1	01Jan2022, 02:17
EXT CHANNEL 1	0.0802	1343.9	51.9	01Jan2022, 02:16
EXT CHANNEL 2	0.1056	1830.9	69	01Jan2022, 02:17
EXT CHANNEL 3	0.1388	2415.3	90.2	01Jan2022, 02:16
EXT UDCP DIV	0.0312	639.3	21.8	01Jan2022, 02:16
HAUL ROAD CHANNEL	0.0054	119.7	4.3	01Jan2022, 02:16

South32 Hermosa Inc.
TSF1 Expansion
Aquifer Protection Permit
100 Year-24 Hour Hec-HMS Results

Hydraulic Element	Drainage Area (Mi^2)	Peak Flow (ft^3/s)	Volume (acre-ft)	Peak Storage Elev (ft)
EWS1	0.0636	140.5	8.0	01Jan2022, 12:00
EWS2	0.0054	25.5	1.3	01Jan2022, 11:53
EWS3	0.0112	36.5	1.8	01Jan2022, 11:55
EWS4	0.0254	75.7	3.9	01Jan2022, 11:57
EWS5	0.0332	87	4.3	01Jan2022, 11:56
EWS6	0.0377	142	7.6	01Jan2022, 11:57
EWS7	0.1306	256.6	16.5	01Jan2022, 12:03
EWS8	0.0312	104.6	5.3	01Jan2022, 11:56
EXT CHANNEL OUTLET	0.3383	795.9	48.8	01Jan2022, 12:00
EXT CHANNEL 1	0.0802	187.6	11.2	01Jan2022, 12:00
EXT CHANNEL 2	0.1056	259.2	15.1	01Jan2022, 12:00
EXT CHANNEL 3	0.1388	333.3	19.4	01Jan2022, 12:00
EXT UDCP DIV	0.0312	104.2	5.3	01Jan2022, 11:58
HAUL ROAD CHANNEL	0.0054	25.3	1.3	01Jan2022, 11:54

South32 Hermosa Inc.
TSF1 Expansion
Aquifer Protection Permit
100 Year-72 Hour Hec-HMS Results

Hydraulic Element	Drainage Area (Mi^2)	Peak Flow (ft^3/s)	Volume (acre-ft)	Peak Storage Elev (ft)
EWS1	0.0636	217.8	11.1	02Jan2022, 12:09
EWS2	0.0054	41.3	1.7	02Jan2022, 12:05
EWS3	0.0112	62.4	2.4	02Jan2022, 12:05
EWS4	0.0254	122.9	5.2	02Jan2022, 12:07
EWS5	0.0332	151.9	6.0	02Jan2022, 12:06
EWS6	0.0377	219.7	9.7	02Jan2022, 12:07
EWS7	0.1306	383.1	22.8	02Jan2022, 12:12
EWS8	0.0312	173.7	7.0	02Jan2022, 12:06
EXT CHANNEL OUTLET	0.3383	1205	65.7	02Jan2022, 12:08
EXT CHANNEL 1	0.0802	283	15.1	02Jan2022, 12:08
EXT CHANNEL 2	0.1056	399.6	20.3	02Jan2022, 12:09
EXT CHANNEL 3	0.1388	518.5	26.3	02Jan2022, 12:08
EXT UDCP DIV	0.0312	170.4	6.9	02Jan2022, 12:08
HAUL ROAD CHANNEL	0.0054	41.3	1.7	02Jan2022, 12:06

NewFields

South32 Hermosa Inc.
TSF1 Expansion
Aquifer Protection Permit
1000 Year-24 Hour Hec-HMS Results

Hydraulic Element	Drainage Area (Mi^2)	Peak Flow (ft^3/s)	Volume (acre-ft)	Peak Storage Elev (ft)
EWS1	0.0636	226.4	13.0	01Jan2022, 12:00
EWS2	0.0054	34.5	1.8	01Jan2022, 11:53
EWS3	0.0112	55	2.7	01Jan2022, 11:55
EWS4	0.0254	115.2	6.0	01Jan2022, 11:57
EWS5	0.0332	138.6	7.0	01Jan2022, 11:56
EWS6	0.0377	201.3	11.0	01Jan2022, 11:57
EWS7	0.1306	414.5	26.6	01Jan2022, 12:02
EWS8	0.0312	155.3	8.0	01Jan2022, 11:56
EXT CHANNEL OUTLET	0.3383	1237.4	76.1	01Jan2022, 11:59
EXT CHANNEL 1	0.0802	295	17.5	01Jan2022, 11:59
EXT CHANNEL 2	0.1056	404.4	23.6	01Jan2022, 12:00
EXT CHANNEL 3	0.1388	525.5	30.5	01Jan2022, 11:59
EXT UDCP DIV	0.0312	154.4	8.0	01Jan2022, 11:58
HAUL ROAD CHANNEL	0.0054	34.3	1.8	01Jan2022, 11:54

NewFields

South32 Hermosa Inc.
TSF1 Expansion
Aquifer Protection Permit

External Channel Summary

Channel	Slope (ft/ft)	Roughness Coefficient	Channel Width (ft)	Channel Side Slopes (ft/ft)	1000yr/24hr or 100yr/72hr (whatever is larger)			
					Flow (ft3/s)	Velocity (ft/s)	Froude Number	Normal Flow Depth (ft)
TSF1 Haul Road Diversion Channel	0.100	0.063	0	2.5	41.3	6.20	1.21	1.6

Channel	Slope (ft/ft)	Roughness Coefficient	Channel Width (ft)	Channel Side Slopes (ft/ft)	Local PMP			
					Flow (ft3/s)	Velocity (ft/s)	Froude Number	Normal Flow Depth (ft)
TSF1 Haul Road Diversion Channel	0.100	0.063	0	2.5	119.7	8.09	1.29	2.4

Worksheet for TSF1 Haul Road Diversion Channel 100yr72hr

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.063
Channel Slope	0.100 ft/ft
Left Side Slope	2.500 H:V
Right Side Slope	2.500 H:V
Discharge	41.30 cfs

Results

Normal Depth	1.6 ft
Flow Area	6.7 ft²
Wetted Perimeter	8.8 ft
Hydraulic Radius	0.8 ft
Top Width	8.16 ft
Critical Depth	1.8 ft
Critical Slope	0.067 ft/ft
Velocity	6.20 ft/s
Velocity Head	0.60 ft
Specific Energy	2.23 ft
Froude Number	1.209
Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	1.6 ft
Critical Depth	1.8 ft
Channel Slope	0.100 ft/ft
Critical Slope	0.067 ft/ft

Worksheet for TSF1 Haul Road Diversion Channel LocalPMP

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.063
Channel Slope	0.100 ft/ft
Left Side Slope	2.500 H:V
Right Side Slope	2.500 H:V
Discharge	119.70 cfs

Results

Normal Depth	2.4 ft
Flow Area	14.8 ft²
Wetted Perimeter	13.1 ft
Hydraulic Radius	1.1 ft
Top Width	12.16 ft
Critical Depth	2.7 ft
Critical Slope	0.058 ft/ft
Velocity	8.09 ft/s
Velocity Head	1.02 ft
Specific Energy	3.45 ft
Froude Number	1.293
Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	2.4 ft
Critical Depth	2.7 ft
Channel Slope	0.100 ft/ft
Critical Slope	0.058 ft/ft

HEC-15 RIPRAP DESIGN

TSF1 External Haul Road Diversion Channel - 100yr/24hr	NOTE: Gray boxes require input, Orange boxes require specific values, Red boxes are calculated

Step 1: Channel Design Parameters			
Bottom Width	B	0	ft
Side Slope	Z	2.5	x:1
Longitudinal Slope	S	0.1	ft/ft
Flow	Q	25.3	ft^3/s

Step 2: Initial Riprap sizing			
Median Stone Size	D_{50}	**1**	ft
Stone Unit Weight	Ys	165	pcf
Riprap Calculation Gradation	D_{100}	20.00	inch
	D_{75}	15.00	inch
	D_{50}	12.00	inch
	D_{30}	8.00	inch
	D_{15}	6.00	inch
	D_{10}	4.00	inch

Step 3: Estimate the Flow Depth			
Initial Flow Depth Estimate	D_i	**1.35**	ft
Area of Channel	A	4.56	ft^2
Wetted Perimeter	P	7.27	ft
Hydraulic Radius	R	0.63	ft
Wetted Top Width	T	6.75	ft
Calculated Average Flow Depth	D_a	0.68	ft

Step 4: Estimate Manning's n and the Implied Discharge			
D_a/D_{50}		0.675	
For $1.5 < D_a/D_{50} < 185$	n	0.181	
Q from mannings	Qi	8.70	ft^3/s
% Difference from Design Discharge		-65.63%	
For $0.3 < D_a/D_{50} < 1.5$	n	0.063	
function(Froude number)	f(Fr)	0.985	
Froude number	Fr	1.191	
Velocity of flow	V	**5.553**	
effective roughness concrentration	b	0.349	
Roughness element geometry	f(REG)	8.882	
Channel geometry	f(CG)	0.448	
Q from mannings	Qi	25.07	ft^3/s
% Difference from Design Discharge		-0.90%	

Step 5:		
If % difference is > 5%, estimate a new depth in Step 3	TRUE	
For $0.3 < D_a/D_{50} < 1.5$	FALSE	Proceed to Step 6
If false, proceed to step 6		

Step 6: Calculate Reynolds and Determine Appropriate Shields Parameter & Safety Factor				
Shear Velocity	V_*	2.085		
Reynolds number	R_e	1.71E+05		
Gravity	g	32.2	ft/s^2	
Kinematic Viscosity	v	1.22E-05	ft^2/s	(1.217e-5 for 60 °F)
From Table 6.1	F_*	0.132		
From Table 6.1	SF	1.410		
Specific Gravity of Stone	SG	2.64		
For S < 5%	D_{50}	0.88	ft	

Table 6.1. Selection of Shields' Parameter and Safety Factor			
Reynolds number	F_*	SF	
$\leq 4x10^4$	0.047	1	
$4x10^4<Re<2x10^5$	0.132	1.410	(Linear Interpolation)
$\geq 2x10^5$	0.15	1.5	

Step 7: Iterate Solution till Calculated D50 is Acceptably Smaller then Chosen D50				
Difference to Chosen Riprap	88.04%	<	100%	TRUE
IF FALSE GOTO STEP 2, ADJUST RIPRAP SIZE				

Step 8. Side Slope Assessment					
Stone Angle of Repose	ϕ	42.5	°		
For 1.5 < Z < 5	K1	0.835			
	ϴ	21.80	°		
	K2	0.84			
Stable D_{50}	$D_{50,s}$	0.88			
Difference to Chosen Riprap		88.00%	<	100%	TRUE

APPENDIX G.5.3

TSF1 Hydrology and Hydraulics

Closure Stormwater Management Structures

NewFields	CALCULATION COVER SHEET			
Client	South32 Hermosa Inc.	Preparer:	J. Pfeiffer	07/31/23
Project	TSF1 Expansion	Checked:	C. Thompson	07/31/23
Title	Closure Hydrology	Revision	0	

CALCULATION OBJECTIVE

1. Estimate the peak runoff from TSF1 during extreme storm events during closure.
2. Determine the required size of the internal closure diversion channels as well as the active closure spillway culverts and passive closure spillway.

ASSUMPTIONS

1. Pond filling curves were extracted from AutoCAD Civil 3D.
2. A curve number of 72 was used to represent the TSF closure surface.
3. Mannings n values were estimated using HEC-15 revetment calculation and were sized for the 100yr/24hr storm.
4. Active closure culverts were sized for the 100yr/24hr storm.

METHODOLOGY

1. Area and length measurements were determined using AutoCAD Civil 3D.
2. Local PMP storm event data was calculated by Ecological Resource Consultants.
3. 100yr/24hr and 1000yr/24hr storm event data are from NOAA Atlas 14.
4. 2090 Climate Change RCP8.5 data was used in closure scenario.

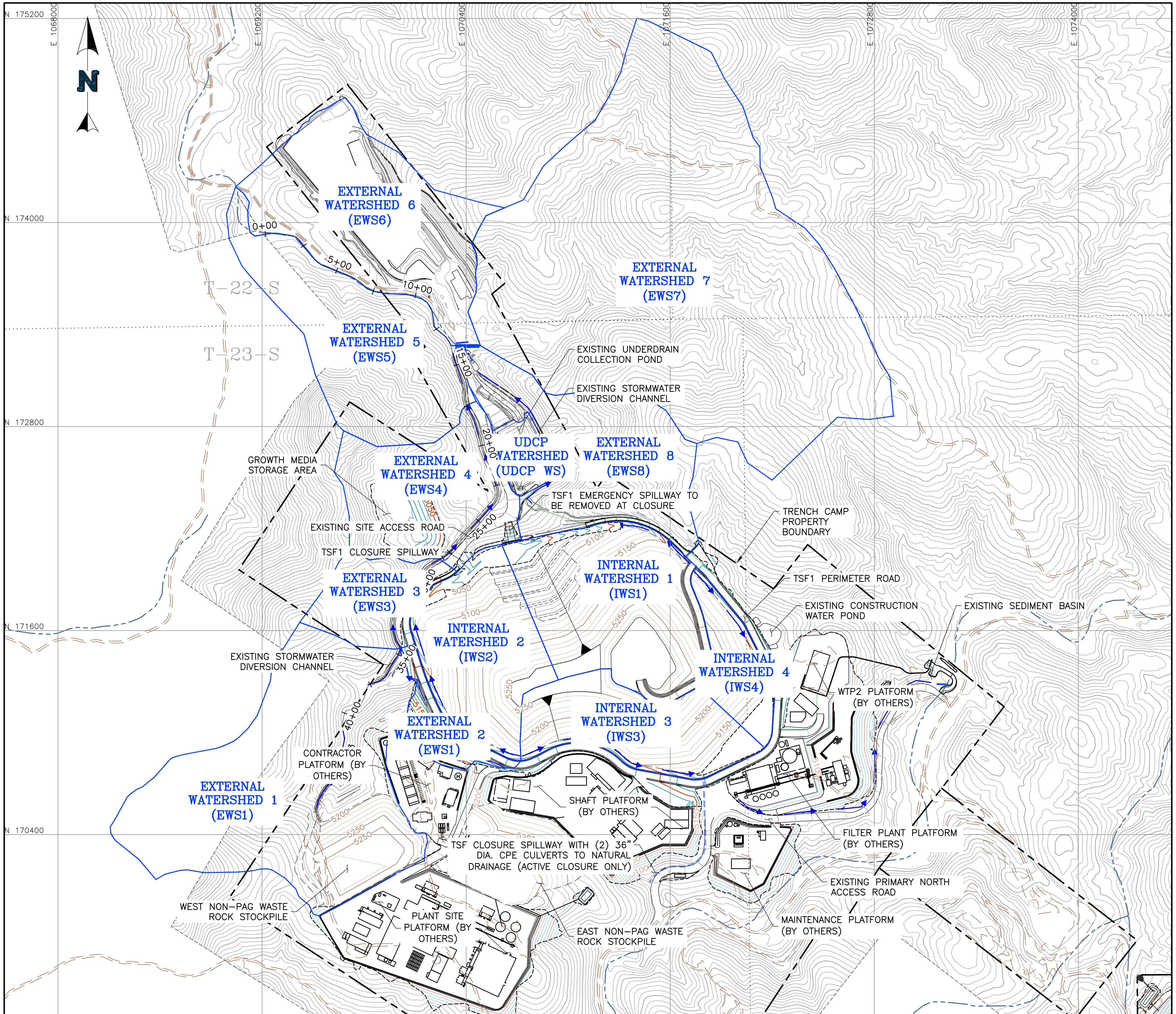
REFERENCES

1. AutoCAD Civil 3D version 2022.
2. United States Department of Agriculture Natural Resources Conservation Service (NRCS). (1986). "Urban Hydrology for Small Watersheds, Technical Release 55 Second Edition," June
3. U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS). "Part 630 Hydrology National Engineering Handbook." 210-vi, NEH, May 2010.
4. United Stated Department of Commerce, National Oceanic and Atmospheric Administration. (reprinted 1984). "Hydrometeorological Report No. 49, Probably Maximum Precipitation Estimates, Colorado River and Great Basin Drainages," (HRM 49)
5. United States Army Corps of Engineers. Hydrologic Modeling System (HEC-HMS) Version 4.9, Computer Program (January 2022)
6. NOAA Atlas 14, Volume 8, Version 2 (2013)

CONCLUSIONS

1. See attached pages for inputs and results.

Filename:
P:\Projects\0014.035 Hermosa TSF1-3 Design ADEQ APP Submittal\H-CALCULATIONS\Hydrology\[TSF1-3 Hydrology.xlsx]Hec Calc Cover (CLOSURE)



LEGEND:

- EXISTING GROUND CONTOURS
- TSF1 CONTOURS
- GROUND CONTOURS (BY OTHERS)
- STACKING GROUND CONTOURS
- EXISTING ROADS/TRAILS
- EXISTING DRAINAGES
- PROPERTY BOUNDARY
- EXISTING FENCE
- DIVERSION CHANNEL
- WATERSHED BOUNDARY
- SECTION LINES
- RECLAIM PIPE

0 300 600 FEET

REFERENCE:

EXISTING GROUND TOPOGRAPHY DEVELOPED FROM MARCH 2020 AND APRIL 2023 AERIAL SURVEY DATA PROVIDED BY SOUTH32 (AMI). DATA PROJECTED TO STATE PLANE ARIZONA CENTRAL NAD 83 FEET, NAVD88.

NewFields

CLIENT: SOUTH32 HERMOSA INC.

PROJECT: HERMOSA PROJECT AQUIFER PROTECTION PERMIT

TITLE: TSF1 WATERSHED PLAN VIEW - CLOSURE

FILENAME: 14.035.011F

FIGURE NO.: 2

REVISION: A

\\nfenglewood\Projects\0014.035 Hermosa TSF1-3 Design ADEQ APP Submittal\A-CAD\FIGS\14.035.011F.dwg-12/5/2023 5:11 PM

South32 Hermosa Inc.
TSF1 Expansion
Aquifer Protection Permit
Lag Time Calculation

$$t_p = \frac{l^{0.8}(S+1)^{0.7}}{1900y^{0.5}}$$

t_p	Lag Time (hr.)
l	Length to Divide (ft)
y	Avg. Watershed Slope (%)
CN	Composite Curve Number
S	1000/CN-10 (in.)
Ia	Initial Abstraction (0.2*S)
Input Values	

Lag Time and Watershed Characteristics

Watershed	Area (mi^2)	l (ft)	CN	y	S	t_p (hr)	t_p (min)	Ia
IWS1	0.0327	1,345	72	30.0%	3.89	0.09	5.6	0.78
IWS2	0.0235	818	72	33.4%	3.89	0.06	3.5	0.78
IWS3	0.0201	482	72	32.3%	3.89	0.04	2.4	0.78
IWS4	0.0087	457	72	38.1%	3.89	0.03	2.1	0.78
EWS1	0.0651	2,030	75	45.0%	3.35	0.10	5.8	0.67
EWS2	0.0054	186	95	42.5%	0.53	0.01	0.4	0.11
EWS3	0.0112	645	79	39.2%	2.62	0.04	2.2	0.52
EWS4	0.0254	1,253	78	40.9%	2.85	0.06	3.8	0.57
EWS5	0.0332	835	73	48.7%	3.68	0.05	2.9	0.74
EWS6	0.0377	1,960	87	45.8%	1.43	0.06	3.7	0.29
EWS7	0.1306	2,771	72	36.4%	3.89	0.15	9.0	0.78
EWS8	0.0312	1,077	81	47.5%	2.42	0.05	2.9	0.48

Reach Data

Reach	Length (ft)	Slope (ft/ft)	n	Type	S. Slope (ft/ft)	Dia. or Width (ft)
TSF1-3 HAUL ROAD CHANNEL	781	0.099	0.067	Triangular Channel	2	
EXTERNAL DIVERSION CHANNEL REACH 1	592	0.059	0.067	Trapezoidal Channel	2	12.5
EXTERNAL DIVERSION CHANNEL REACH 2	1037	0.100	0.067	Trapezoidal Channel	2	12.5
EXTERNAL DIVERSION CHANNEL REACH 3	327	0.125	0.067	Trapezoidal Channel	2	12.5
UDCP DIVERSION CHANNEL	1044	0.067	0.067	Triangular Channel	2	
UDCP DIVERSION CULVERTS	68	0.030	0.067	Circular Pipe	n/a	3
ACCESS ROAD CULVERTS	133	0.015	0.067	Circular Pipe	n/a	2

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LOCAL PMP Hec-HMS Results

Hydraulic Element	Drainage Area (Mi^2)	Peak Discharge (ft^3/s)	Discharged Volume (acre-ft)
EAST CLOSURE SPILLWAY	0.0288	433.2	22.5
EWS1	0.0651	1026.4	52.6
EWS2	0.0054	104.8	5.2
EWS3	0.0112	187	9.4
EWS4	0.0254	418	21.2
EWS5	0.0332	507.6	26.3
EWS6	0.0377	689.4	34.1
EWS7	0.1306	1771.4	102.2
EWS8	0.0312	533.6	26.8
EXT CHANNEL OUTLET	0.396	5825.8	323.9
EXT CHANNEL 1	0.0817	1259.3	67.8
EXT CHANNEL 2	0.1633	2407.2	134.1
EXT CHANNEL 3	0.1965	2878	160.5
EXT UDCP DIV	0.0312	487	27
HAUL ROAD CHANNEL	0.0054	96	5.2
IWS-1	0.0327	491.8	25.6
IWS-2	0.0235	353.5	18.4
IWS-3	0.0201	302.3	15.7
IWS-4	0.0087	130.9	6.8
Junction-1	0.1379	2104.6	111.8
WEST CLOSURE SPILLWAY	0.0562	845.3	44

South32 Hermosa Inc.
TSF1 Expansion
Aquifer Protection Permit

100yr/24hr Hec-HMS Results

Hydraulic Element	Drainage Area (Mi^2)	Peak Discharge (ft^3/s)	Discharged Volume (acre-ft)
EAST CLOSURE SPILLWAY	0.0288	63.6	4.9
EWS1	0.0651	157.6	12
EWS2	0.0054	19.4	1.6
EWS3	0.0112	30.3	2.3
EWS4	0.0254	66.7	5.1
EWS5	0.0332	75.7	5.8
EWS6	0.0377	121	9.5
EWS7	0.1306	266.9	22.1
EWS8	0.0312	88.3	6.8
EXT CHANNEL OUTLET	0.396	898.1	75.2
EXT CHANNEL 1	0.0817	195.2	16.1
EXT CHANNEL 2	0.1633	362.4	30.9
EXT CHANNEL 3	0.1965	430.5	36.7
EXT UDCP DIV	0.0312	79.6	6.8
HAUL ROAD CHANNEL	0.0054	17.7	1.6
IWS-1	0.0327	72.2	5.5
IWS-2	0.0235	51.9	4
IWS-3	0.0201	44.4	3.4
IWS-4	0.0087	19.2	1.5
Junction-1	0.1379	319.4	25.6
WEST CLOSURE SPILLWAY	0.0562	124.2	9.5

NewFields

South32 Hermosa Inc.
TSF1 Expansion
Aquifer Protection Permit

1000yr/24hr Hec-HMS Results

Hydraulic Element	Drainage Area (Mi^2)	Peak Discharge (ft^3/s)	Discharged Volume (acre-ft)
EAST CLOSURE SPILLWAY	0.0288	99.9	7.6
EWS1	0.0651	241.1	18.5
EWS2	0.0054	26.1	2.2
EWS3	0.0112	44.8	3.5
EWS4	0.0254	99.7	7.7
EWS5	0.0332	117.8	9
EWS6	0.0377	170	13.6
EWS7	0.1306	420.2	34.6
EWS8	0.0312	129	10
EXT CHANNEL OUTLET	0.396	1376.8	114.6
EXT CHANNEL 1	0.0817	296.7	24.3
EXT CHANNEL 2	0.1633	560.8	47.2
EXT CHANNEL 3	0.1965	668.8	56.3
EXT UDCP DIV	0.0312	117.9	10.1
HAUL ROAD CHANNEL	0.0054	24.1	2.2
IWS-1	0.0327	113.4	8.7
IWS-2	0.0235	81.5	6.2
IWS-3	0.0201	69.7	5.3
IWS-4	0.0087	30.2	2.3
Junction-1	0.1379	491.7	39.2
WEST CLOSURE SPILLWAY	0.0562	194.9	14.9

South32 Hermosa Inc.
TSF1 Expansion
Aquifer Protection Permit

Internal Stormwater Collection Channel Summary

Channel	Slope (ft/ft)	Roughness Coefficient	Riprap (D50, in)	Channel Width (ft)	Channel Side Slopes (ft/ft)	Local PMP			
						Flow (ft3/s)	Velocity (ft/s)	Froude Number	Normal Flow Depth (ft)
Internal Closure Channel	0.005	0.035	None	4.5	2.5	491.8	5.82	0.61	5.0
Internal Closure Channel	0.010	0.059	6.0	4.5	2.5	491.8	5.10	0.51	5.4
Internal Closure Channel	0.050	0.062	12.0	4.5	2.5	491.8	8.97	1.04	3.9
Internal Closure Channel	0.100	0.069	18.0	4.5	2.5	491.8	10.72	1.31	3.5
Internal Closure Channel	0.150	0.072	24.0	4.5	2.5	491.8	12.08	1.52	3.2
W CLOSURE SPILLWAY	0.010	0.062	6.0	15	2.5	845.3	7.09	0.70	4.5
E SPILLWAY - PASSIVE CLOSURE	0.020	0.066	12.0	12	2.5	433.2	5.72	0.64	3.6

Note: Largest flow used to calculate channel dimensions (IWS-1)

Culvert Calculator Report
E Closure Spillway-100yr24hr

Solve For: Section Size

Culvert Summary					
Allowable HW Elevation	5,128.00	ft	Headwater Depth/Height	1.59	
Computed Headwater Elevation	5,126.57	ft	Discharge	63.60	cfs
Inlet Control HW Elev.	5,126.57	ft	Tailwater Elevation	0.00	ft
Outlet Control HW Elev.	5,126.36	ft	Control Type	Inlet Control	

Grades					
Upstream Invert	5,123.00	ft	Downstream Invert	5,120.00	ft
Length	300.00	ft	Constructed Slope	0.010000	ft/ft

Hydraulic Profile					
Profile	S2		Depth, Downstream	1.75	ft
Slope Type	Steep		Normal Depth	1.75	ft
Flow Regime	Supercritical		Critical Depth	1.94	ft
Velocity Downstream	9.60	ft/s	Critical Slope	0.008278	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.012	
Section Material	Corrugated HDPE (Smooth Interior)		Span	2.25	ft
Section Size	27 inch		Rise	2.25	ft
Number Sections	2				

Outlet Control Properties					
Outlet Control HW Elev.	5,126.36	ft	Upstream Velocity Head	1.18	ft
Ke	0.20		Entrance Loss	0.24	ft

Inlet Control Properties					
Inlet Control HW Elev.	5,126.57	ft	Flow Control	Submerged	
Inlet Type	Groove end projecting		Area Full	8.0	ft²
K	0.00450		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	3	
C	0.03170		Equation Form	1	
Y	0.69000				

Culvert Calculator Report
W Closure Spillway-100yr24hr

Solve For: Section Size

Culvert Summary

Allowable HW Elevation	5,027.00 ft	Headwater Depth/Height	0.85
Computed Headwater Elevation	5,026.99 ft	Discharge	124.20 cfs
Inlet Control HW Elev.	5,026.87 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	5,026.99 ft	Control Type	Entrance Control

Grades

Upstream Invert	5,024.00 ft	Downstream Invert	5,022.00 ft
Length	83.00 ft	Constructed Slope	0.024096 ft/ft

Hydraulic Profile

Profile	S2	Depth, Downstream	1.30 ft
Slope Type	Steep	Normal Depth	1.18 ft
Flow Regime	Supercritical	Critical Depth	2.00 ft
Velocity Downstream	12.79 ft/s	Critical Slope	0.003704 ft/ft

Section

Section Shape	Circular	Mannings Coefficient	0.012
Section Material	Corrugated HDPE (Smooth Interior)	Span	3.50 ft
Section Size	42 inch	Rise	3.50 ft
Number Sections	3		

Outlet Control Properties

Outlet Control HW Elev.	5,026.99 ft	Upstream Velocity Head	0.82 ft
Ke	0.20	Entrance Loss	0.16 ft

Inlet Control Properties

Inlet Control HW Elev.	5,026.87 ft	Flow Control	N/A
Inlet Type	Groove end projecting	Area Full	28.9 ft²
K	0.00450	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	3
C	0.03170	Equation Form	1
Y	0.69000		

Worksheet for E Spillway LocalPMP

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.066
Channel Slope	0.020 ft/ft
Left Side Slope	2.500 H:V
Right Side Slope	2.500 H:V
Bottom Width	12.00 ft
Discharge	433.20 cfs

Results

Normal Depth	3.6 ft
Flow Area	75.7 ft²
Wetted Perimeter	31.4 ft
Hydraulic Radius	2.4 ft
Top Width	30.01 ft
Critical Depth	2.8 ft
Critical Slope	0.053 ft/ft
Velocity	5.72 ft/s
Velocity Head	0.51 ft
Specific Energy	4.11 ft
Froude Number	0.635
Flow Type	Subcritical

GVF Input Data

Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	3.6 ft
Critical Depth	2.8 ft
Channel Slope	0.020 ft/ft
Critical Slope	0.053 ft/ft

Worksheet for W Spillway LocalPMP

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.062
Channel Slope	0.020 ft/ft
Left Side Slope	2.500 H:V
Right Side Slope	2.500 H:V
Bottom Width	15.00 ft
Discharge	845.30 cfs

Results

Normal Depth	4.5 ft
Flow Area	119.2 ft²
Wetted Perimeter	39.4 ft
Hydraulic Radius	3.0 ft
Top Width	37.64 ft
Critical Depth	3.7 ft
Critical Slope	0.043 ft/ft
Velocity	7.09 ft/s
Velocity Head	0.78 ft
Specific Energy	5.31 ft
Froude Number	0.703
Flow Type	Subcritical

GVF Input Data

Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	4.5 ft
Critical Depth	3.7 ft
Channel Slope	0.020 ft/ft
Critical Slope	0.043 ft/ft

HEC-15 RIPRAP DESIGN

TSF1 Closure West Spillway - 100yr24hr	NOTE: Gray boxes require input, Orange boxes require specific values, Red boxes are calculated

Step 1: Channel Design Parameters			
Bottom Width	B	15	ft
Side Slope	Z	2.5	x:1
Longitudinal Slope	S	0.02	ft/ft
Flow	Q	124.2	ft^3/s

Step 2: Initial Riprap sizing			
Median Stone Size	D_{50}	**0.5**	ft
Stone Unit Weight	Ys	165	pcf
Riprap Calculation Gradation	D_{100}	10.00	inch
	D_{75}	7.50	inch
	D_{50}	6.00	inch
	D_{30}	4.00	inch
	D_{15}	3.00	inch
	D_{10}	2.00	inch

Step 3: Estimate the Flow Depth			
Initial Flow Depth Estimate	D_i	**1.6**	ft
Area of Channel	A	30.40	ft^2
Wetted Perimeter	P	23.62	ft
Hydraulic Radius	R	1.29	ft
Wetted Top Width	T	23.00	ft
Calculated Average Flow Depth	D_a	1.32	ft

Step 4: Estimate Manning's n and the Implied Discharge			
D_a/D_{50}		2.643	
For $1.5 < D_a/D_{50} < 185$	n	0.062	
Q from mannings	Qi	123.12	ft^3/s
% Difference from Design Discharge		-0.87%	
For $0.3 < D_a/D_{50} < 1.5$	n	0.051	
function(Froude number)	f(Fr)	0.807	
Froude number	Fr	0.626	
Velocity of flow	V	**4.086**	
effective roughness concrentration	b	0.444	
Roughness element geometry	f(REG)	23.897	
Channel geometry	f(CG)	0.281	
Q from mannings	Qi	149.55	ft^3/s
% Difference from Design Discharge		20.41%	

Step 5:		
If % difference is > 5%, estimate a new depth in Step 3	FALSE	Proceed to Step 6
For 0.3 < D_a/D_{50} < 1.5	TRUE	
If false, proceed to step 6		

Step 6: Calculate Reynolds and Determine Appropriate Shields Parameter & Safety Factor				
Shear Velocity	V_*	1.015		
Reynolds number	R_e	4.17E+04		
Gravity	g	32.2	ft/s^2	
Kinematic Viscosity	v	1.22E-05	ft^2/s	(1.217e-5 for 60 °F)
From Table 6.1	F_*	0.048		
From Table 6.1	SF	1.005		
Specific Gravity of Stone	SG	2.64		
For S < 5%	D_{50}	0.41	ft	

Table 6.1. Selection of Shields' Parameter and Safety Factor			
Reynolds number	F_*	SF	
≤ $4x10^4$	0.047	1	
$4x10^4$<Re<$2x10^5$	0.048	1.005	(Linear Interpolation)
≥ $2x10^5$	0.15	1.5	

Step 7: Iterate Solution till Calculated D50 is Acceptably Smaller then Chosen D50				
Difference to Chosen Riprap	81.36%	<	100%	TRUE
IF FALSE GOTO STEP 2, ADJUST RIPRAP SIZE				

Step 8. Side Slope Assessment					
Stone Angle of Repose	ϕ	42.5	°		
For 1.5 < Z < 5	K1	0.835			
	Θ	21.80	°		
	K2	0.84			
Stable D_{50}	$D_{50,s}$	0.41			
Difference to Chosen Riprap		81.33%	<	100%	TRUE

HEC-15 RIPRAP DESIGN

TSF1 Closure East Spillway - 100yr24hr	NOTE: Gray boxes require input, Orange boxes require specific values, Red boxes are calculated

Step 1: Channel Design Parameters			
Bottom Width	B	12	ft
Side Slope	Z	2.5	x:1
Longitudinal Slope	S	0.1	ft/ft
Flow	Q	63.6	ft^3/s

Step 2: Initial Riprap sizing			
Median Stone Size	D_{50}	**1**	ft
Stone Unit Weight	Ys	165	pcf
Riprap Calculation Gradation	D_{100}	20.00	inch
	D_{75}	15.00	inch
	D_{50}	12.00	inch
	D_{30}	8.00	inch
	D_{15}	6.00	inch
	D_{10}	4.00	inch

Step 3: Estimate the Flow Depth			
Initial Flow Depth Estimate	D_i	**0.83**	ft
Area of Channel	A	11.68	ft^2
Wetted Perimeter	P	16.47	ft
Hydraulic Radius	R	0.71	ft
Wetted Top Width	T	16.15	ft
Calculated Average Flow Depth	D_a	0.72	ft

Step 4: Estimate Manning's n and the Implied Discharge			
D_a/D_{50}		0.723	
For $1.5 < D_a/D_{50} < 185$	n	0.164	
Q from mannings	Qi	26.71	ft^3/s
% Difference from Design Discharge		-58.00%	
For $0.3 < D_a/D_{50} < 1.5$	n	0.066	
function(Froude number)	f(Fr)	1.123	
Froude number	Fr	1.128	
Velocity of flow	V	**5.444**	
effective roughness concrentration	b	0.248	
Roughness element geometry	f(REG)	7.273	
Channel geometry	f(CG)	0.462	
Q from mannings	Qi	66.46	ft^3/s
% Difference from Design Discharge		4.49%	

Step 5:			
If % difference is > 5%, estimate a new depth in Step 3		TRUE	
For $0.3 < D_a/D_{50} < 1.5$		FALSE	Proceed to Step 6
If false, proceed to step 6			

Step 6: Calculate Reynolds and Determine Appropriate Shields Parameter & Safety Factor				
Shear Velocity	V_*	1.635		
Reynolds number	R_e	1.34E+05		
Gravity	g	32.2	ft/s^2	
Kinematic Viscosity	v	1.22E-05	ft^2/s	(1.217e-5 for 60 °F)
From Table 6.1	F_*	0.108		
From Table 6.1	SF	1.295		
Specific Gravity of Stone	SG	2.64		
For S < 5%	D_{50}	0.61	ft	

Table 6.1. Selection of Shields' Parameter and Safety Factor			
Reynolds number	F_*	SF	
$\leq 4x10^4$	0.047	1	
$4x10^4<Re<2x10^5$	0.108	1.295	(Linear Interpolation)
$\geq 2x10^5$	0.15	1.5	

Step 7: Iterate Solution till Calculated D50 is Acceptably Smaller then Chosen D50				
Difference to Chosen Riprap	60.67%	<	100%	TRUE
IF FALSE GOTO STEP 2, ADJUST RIPRAP SIZE				

Step 8. Side Slope Assessment					
Stone Angle of Repose	ϕ	42.5	°		
For 1.5 < Z < 5	K1	0.835			
	Θ	21.80	°		
	K2	0.84			
Stable D_{50}	$D_{50,s}$	0.61			
Difference to Chosen Riprap		60.65%	<	100%	TRUE

HEC-15 RIPRAP DESIGN

TSF1 Closure Channel - 100yr24hr	NOTE: Gray boxes require input, Orange boxes require specific values, Red boxes are calculated

Step 1: Channel Design Parameters			
Bottom Width	B	4.5	ft
Side Slope	Z	2.5	x:1
Longitudinal Slope	S	0.01	ft/ft
Flow	Q	72.2	ft^3/s

Step 2: Initial Riprap sizing			
Median Stone Size	D_{50}	**0.5**	ft
Stone Unit Weight	Ys	165	pcf
Riprap Calculation Gradation	D_{100}	10.00	inch
	D_{75}	7.50	inch
	D_{50}	6.00	inch
	D_{30}	4.00	inch
	D_{15}	3.00	inch
	D_{10}	2.00	inch

Step 3: Estimate the Flow Depth			
Initial Flow Depth Estimate	D_i	**2.3**	ft
Area of Channel	A	23.58	ft^2
Wetted Perimeter	P	16.89	ft
Hydraulic Radius	R	1.40	ft
Wetted Top Width	T	16.00	ft
Calculated Average Flow Depth	D_a	1.47	ft

Step 4: Estimate Manning's n and the Implied Discharge			
D_a/D_{50}		2.947	
For $1.5 < D_a/D_{50} < 185$	n	0.059	
Q from mannings	Qi	73.86	ft^3/s
% Difference from Design Discharge		2.31%	
For $0.3 < D_a/D_{50} < 1.5$	n	0.042	
function(Froude number)	f(Fr)	0.832	
Froude number	Fr	0.445	
Velocity of flow	V	**3.063**	
effective roughness concrentration	b	0.572	
Roughness element geometry	f(REG)	31.191	
Channel geometry	f(CG)	0.256	
Q from mannings	Qi	103.96	ft^3/s
% Difference from Design Discharge		43.99%	

Step 5:		
If % difference is > 5%, estimate a new depth in Step 3	FALSE	Proceed to Step 6
For $0.3 < D_a/D_{50} < 1.5$	TRUE	
If false, proceed to step 6		

Step 6: Calculate Reynolds and Determine Appropriate Shields Parameter & Safety Factor				
Shear Velocity	V_*	0.861		
Reynolds number	R_e	3.54E+04		
Gravity	g	32.2	ft/s^2	
Kinematic Viscosity	v	1.22E-05	ft^2/s	(1.217e-5 for 60 °F)
From Table 6.1	F_*	0.047		
From Table 6.1	SF	1.000		
Specific Gravity of Stone	SG	2.64		
For S < 5%	D_{50}	0.30	ft	

Table 6.1. Selection of Shields' Parameter and Safety Factor			
Reynolds number	F_*	SF	
$\leq 4x10^4$	0.047	1	
$4x10^4<Re<2x10^5$	0.044	0.985	(Linear Interpolation)
$\geq 2x10^5$	0.15	1.5	

Step 7: Iterate Solution till Calculated D50 is Acceptably Smaller then Chosen D50				
Difference to Chosen Riprap	59.52%	<	100%	TRUE
IF FALSE GOTO STEP 2, ADJUST RIPRAP SIZE				

Step 8. Side Slope Assessment					
Stone Angle of Repose	ϕ	42.5 °			
For 1.5 < Z < 5	K1	0.835			
	ϴ	21.80 °			
	K2	0.84			
Stable D_{50}	$D_{50,s}$	0.30			
Difference to Chosen Riprap		59.50%	<	100%	TRUE

TSF1 Closure Channel - 100yr24hr	NOTE: Gray boxes require input, Orange boxes require specific values, Red boxes are calculated

Step 1: Channel Design Parameters			
Bottom Width	B	4.5	ft
Side Slope	Z	2.5	x:1
Longitudinal Slope	S	0.05	ft/ft
Flow	Q	72.2	ft^3/s

Step 2: Initial Riprap sizing			
Median Stone Size	D_{50}	**1**	ft
Stone Unit Weight	Ys	165	pcf
Riprap Calculation Gradation	D_{100}	20.00	inch
	D_{75}	15.00	inch
	D_{50}	12.00	inch
	D_{30}	8.00	inch
	D_{15}	6.00	inch
	D_{10}	4.00	inch

Step 3: Estimate the Flow Depth			
Initial Flow Depth Estimate	D_i	**1.6**	ft
Area of Channel	A	13.60	ft^2
Wetted Perimeter	P	13.12	ft
Hydraulic Radius	R	1.04	ft
Wetted Top Width	T	12.50	ft
Calculated Average Flow Depth	D_a	1.09	ft

Step 4: Estimate Manning's n and the Implied Discharge			
D_a/D_{50}		1.088	
For $1.5 < D_a/D_{50} < 185$	n	0.109	
Q from mannings	Qi	42.65	ft^3/s
% Difference from Design Discharge		-40.92%	
For $0.3 < D_a/D_{50} < 1.5$	n	0.062	
function(Froude number)	f(Fr)	0.882	
Froude number	Fr	0.897	
Velocity of flow	V	**5.309**	
effective roughness concrentration	b	0.389	
Roughness element geometry	f(REG)	12.632	
Channel geometry	f(CG)	0.387	
Q from mannings	Qi	75.12	ft^3/s
% Difference from Design Discharge		4.05%	

Step 5:		
If % difference is > 5%, estimate a new depth in Step 3	TRUE	
For $0.3 < D_a/D_{50} < 1.5$	FALSE	Proceed to Step 6
If false, proceed to step 6		

Step 6: Calculate Reynolds and Determine Appropriate Shields Parameter & Safety Factor				
Shear Velocity	V_*	1.605		
Reynolds number	R_e	1.32E+05		
Gravity	g	32.2	ft/s^2	
Kinematic Viscosity	v	1.22E-05	ft^2/s	(1.217e-5 for 60 °F)
From Table 6.1	F_*	0.106		
From Table 6.1	SF	1.287		
Specific Gravity of Stone	SG	2.64		
For S < 5%	D_{50}	0.59	ft	

Table 6.1. Selection of Shields' Parameter and Safety Factor			
Reynolds number	F_*	SF	
$\leq 4x10^4$	0.047	1	
$4x10^4<Re<2x10^5$	0.106	1.287	(Linear Interpolation)
$\geq 2x10^5$	0.15	1.5	

Step 7: Iterate Solution till Calculated D50 is Acceptably Smaller then Chosen D50				
Difference to Chosen Riprap	59.00%	<	100%	TRUE
IF FALSE GOTO STEP 2, ADJUST RIPRAP SIZE				

Step 8. Side Slope Assessment					
Stone Angle of Repose	ϕ	42.5	°		
For 1.5 < Z < 5	K1	0.835			
	ϴ	21.80	°		
	K2	0.84			
Stable D_{50}	$D_{50,s}$	0.59			
Difference to Chosen Riprap		58.97%	<	100%	TRUE

HEC-15 RIPRAP DESIGN

TSF1 Closure Channel - 100yr24hr	NOTE: Gray boxes require input, Orange boxes require specific values, Red boxes are calculated

Step 1: Channel Design Parameters			
Bottom Width	B	4.5	ft
Side Slope	Z	2.5	x:1
Longitudinal Slope	S	0.1	ft/ft
Flow	Q	72.2	ft^3/s

Step 2: Initial Riprap sizing			
Median Stone Size	D_{50}	**1.5**	ft
Stone Unit Weight	Ys	165	pcf
Riprap Calculation Gradation	D_{100}	30.00	inch
	D_{75}	22.50	inch
	D_{50}	18.00	inch
	D_{30}	12.00	inch
	D_{15}	9.00	inch
	D_{10}	6.00	inch

Step 3: Estimate the Flow Depth			
Initial Flow Depth Estimate	D_i	**1.4**	ft
Area of Channel	A	11.20	ft^2
Wetted Perimeter	P	12.04	ft
Hydraulic Radius	R	0.93	ft
Wetted Top Width	T	11.50	ft
Calculated Average Flow Depth	D_a	0.97	ft

Step 4: Estimate Manning's n and the Implied Discharge			
D_a/D_{50}		0.649	
For $1.5 < D_a/D_{50} < 185$	n	0.206	
Q from mannings	Qi	24.47	ft^3/s
% Difference from Design Discharge		-66.11%	
For $0.3 < D_a/D_{50} < 1.5$	n	0.069	
function(Froude number)	f(Fr)	1.004	
Froude number	Fr	1.151	
Velocity of flow	V	**6.446**	
effective roughness concrentration	b	0.319	
Roughness element geometry	f(REG)	8.246	
Channel geometry	f(CG)	0.455	
Q from mannings	Qi	72.51	ft^3/s
% Difference from Design Discharge		0.43%	

Step 5:		
If % difference is > 5%, estimate a new depth in Step 3	TRUE	
For $0.3 < D_a/D_{50} < 1.5$	FALSE	Proceed to Step 6
If false, proceed to step 6		

Step 6: Calculate Reynolds and Determine Appropriate Shields Parameter & Safety Factor				
Shear Velocity	V_*	2.123		
Reynolds number	R_e	2.62E+05		
Gravity	g	32.2	ft/s^2	
Kinematic Viscosity	v	1.22E-05	ft^2/s	(1.217e-5 for 60 °F)
From Table 6.1	F_*	0.150		
From Table 6.1	SF	1.500		
Specific Gravity of Stone	SG	2.64		
For S < 5%	D_{50}	0.85	ft	

Table 6.1. Selection of Shields' Parameter and Safety Factor			
Reynolds number	F_*	SF	
$\leq 4x10^4$	0.047	1	
$4x10^4<Re<2x10^5$	0.190	1.693	(Linear Interpolation)
$\geq 2x10^5$	0.15	1.5	

Step 7: Iterate Solution till Calculated D50 is Acceptably Smaller then Chosen D50				
Difference to Chosen Riprap	56.76%	<	100%	TRUE
IF FALSE GOTO STEP 2, ADJUST RIPRAP SIZE				

Step 8. Side Slope Assessment					
Stone Angle of Repose	ϕ	42.5	°		
For 1.5 < Z < 5	K1	0.835			
	Θ	21.80	°		
	K2	0.84			
Stable D_{50}	$D_{50,s}$	0.85			
Difference to Chosen Riprap		56.74%	<	100%	TRUE

Step 9. Steep Grade Assessment					
Angle of Channel Bottom	α	5.71	°		
Angle b/t weight vector and the resultant in the plane of the side slope	β	20.48	°		
Shear Stress	τ	7.29	lb/ft^2		
Stability Number	η	0.32			
	Δ	1.68			
For S > 10%	D_{50}	1.43			
Difference to Chosen Riprap		95.16%	<	100%	TRUE

TSF1 Closure Channel - 100yr24hr	NOTE: Gray boxes require input, Orange boxes require specific values, Red boxes are calculated

Step 1: Channel Design Parameters			
Bottom Width	B	4.5	ft
Side Slope	Z	2.5	x:1
Longitudinal Slope	S	0.15	ft/ft
Flow	Q	72.2	ft^3/s

Step 2: Initial Riprap sizing			
Median Stone Size	D_{50}	**2**	ft
Stone Unit Weight	Ys	165	pcf
Riprap Calculation Gradation	D_{100}	40.00	inch
	D_{75}	30.00	inch
	D_{50}	24.00	inch
	D_{30}	16.00	inch
	D_{15}	12.00	inch
	D_{10}	8.00	inch

Step 3: Estimate the Flow Depth			
Initial Flow Depth Estimate	D_i	**1.26**	ft
Area of Channel	A	9.64	ft^2
Wetted Perimeter	P	11.29	ft
Hydraulic Radius	R	0.85	ft
Wetted Top Width	T	10.80	ft
Calculated Average Flow Depth	D_a	0.89	ft

Step 4: Estimate Manning's n and the Implied Discharge			
D_a/D_{50}		0.446	
For $1.5 < D_a/D_{50} < 185$	n	0.616	
Q from mannings	Qi	8.13	ft^3/s
% Difference from Design Discharge		-88.74%	
For $0.3 < D_a/D_{50} < 1.5$	n	0.072	
function(Froude number)	f(Fr)	1.166	
Froude number	Fr	1.397	
Velocity of flow	V	**7.490**	
effective roughness concrentration	b	0.275	
Roughness element geometry	f(REG)	6.138	
Channel geometry	f(CG)	0.503	
Q from mannings	Qi	70.03	ft^3/s
% Difference from Design Discharge		-3.01%	

Step 5:			
If % difference is > 5%, estimate a new depth in Step 3		TRUE	
For 0.3 < D_a/D_{50} < 1.5		FALSE	Proceed to Step 6
If false, proceed to step 6			

Step 6: Calculate Reynolds and Determine Appropriate Shields Parameter & Safety Factor				
Shear Velocity	V_*	2.467		
Reynolds number	R_e	4.05E+05		
Gravity	g	32.2	ft/s^2	
Kinematic Viscosity	v	1.22E-05	ft^2/s	(1.217e-5 for 60 °F)
From Table 6.1	F_*	0.150		
From Table 6.1	SF	1.500		
Specific Gravity of Stone	SG	2.64		
For S < 5%	D_{50}	1.15	ft	

Table 6.1. Selection of Shields' Parameter and Safety Factor			
Reynolds number	F_*	SF	
$\leq 4x10^4$	0.047	1	
$4x10^4$<Re<$2x10^5$	0.282	2.142	(Linear Interpolation)
$\geq 2x10^5$	0.15	1.5	

Step 7: Iterate Solution till Calculated D50 is Acceptably Smaller then Chosen D50				
Difference to Chosen Riprap	57.47%	<	100%	TRUE
IF FALSE GOTO STEP 2, ADJUST RIPRAP SIZE				

Step 8. Side Slope Assessment						
Stone Angle of Repose	ϕ	42.5	°			
For 1.5 < Z < 5	K1	0.835				
	Θ	21.80	°			
	K2	0.84				
Stable D_{50}	$D_{50,s}$	1.15				
Difference to Chosen Riprap		57.45%		<	100%	TRUE

Step 9. Steep Grade Assessment						
Angle of Channel Bottom	α	8.53	°			
Angle b/t weight vector and the resultant in the plane of the side slope	β	20.24	°			
Shear Stress	τ	9.85	lb/ft^2			
Stability Number	η	0.32				
	Δ	1.73				
For S > 10%	D_{50}	1.99				
Difference to Chosen Riprap		99.27%		<	100%	TRUE

NewFields	CALCULATION COVER SHEET			
Client	South32 Hermosa Inc.	Preparer:	S. Breidt	07/31/23
Project	TSF1 Expansion	Checked:	C. Thompson	07/31/23
Title	Closure Hydrology - HEC-RAS Analysis	Revision	0	

CALCULATION OBJECTIVE

1. Analyze the existing external stormwater diversion channel during the active and passive closure scenarios of TSF1.
2. Analyze the proposed TSF1 internal channels that outlet to the west spillway during closure.

ASSUMPTIONS

1. Steady state flow was used during the analysis.
2. No major modifications to the external diversion channel occur prior to or during closure.
3. The channels, TSF active closure culverts, and TSF passive closure spillway are kept in good repair so that no sections are blocked by debris.

METHODOLOGY

1. Area and length measurements were determined using AutoCAD Civil 3D.
2. Local PMP storm event data was calculated by Ecological Resource Consultants.
3. 100yr/24hr and 1000yr/24hr storm event data are from NOAA Atlas 14.
4. 2090 Climate Change RCP8.5 data was used in closure scenario.

REFERENCES

1. AutoCAD Civil 3D version 2022.
2. United States Department of Agriculture Natural Resources Conservation Service (NRCS). (1986). “Urban Hydrology for Small Watersheds, Technical Release 55 Second Edition,” June
3. U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS). “Part 630 Hydrology National Engineering Handbook.” 210-vi, NEH, May 2010.
4. United Stated Department of Commerce, National Oceanic and Atmospheric Administration. (reprinted 1984). “Hydrometeorological Report No. 49, Probably Maximum Precipitation Estimates, Colorado River and Great Basin Drainages,” (HRM 49)
5. United States Army Corps of Engineers. Hydrologic Modeling System (HEC-HMS) Version 4.9, Computer Program (January 2022)
6. United States Army Corps of Engineers. River Analysis System (HEC-RAS) Version 6.4, Computer Program (June 2023)
7. NOAA Atlas 14, Volume 8, Version 2 (2013)

CONCLUSIONS

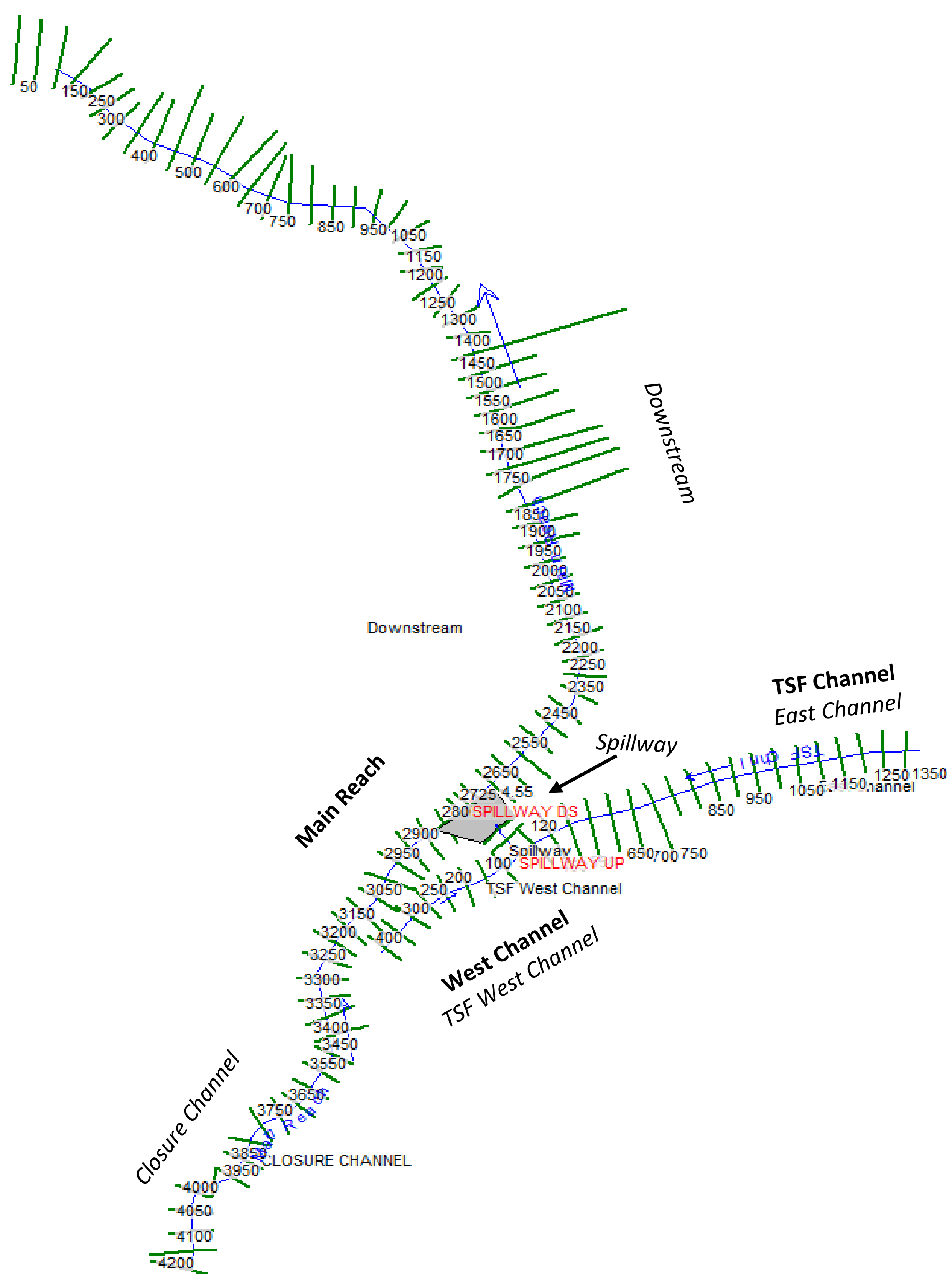
1. See attached pages for inputs and results.

Filename:

P:\Projects\0014.035 Hermosa TSF1-3 Design ADEQ APP Submittal\H-CALCULATIONS\Hydrology\HEC-RAS\[TSF External Channel Closure HECRAS Results.xlsx]Hec Ca

TSF Climate Change Channel Hydraulics

Plan: Active Closure



Culverts:

# barrels	2	
diameter	42	inches
length	79	feet
manning's n	0.015	

Invert El.

Upstream	5023.23
Downstream	5021.23

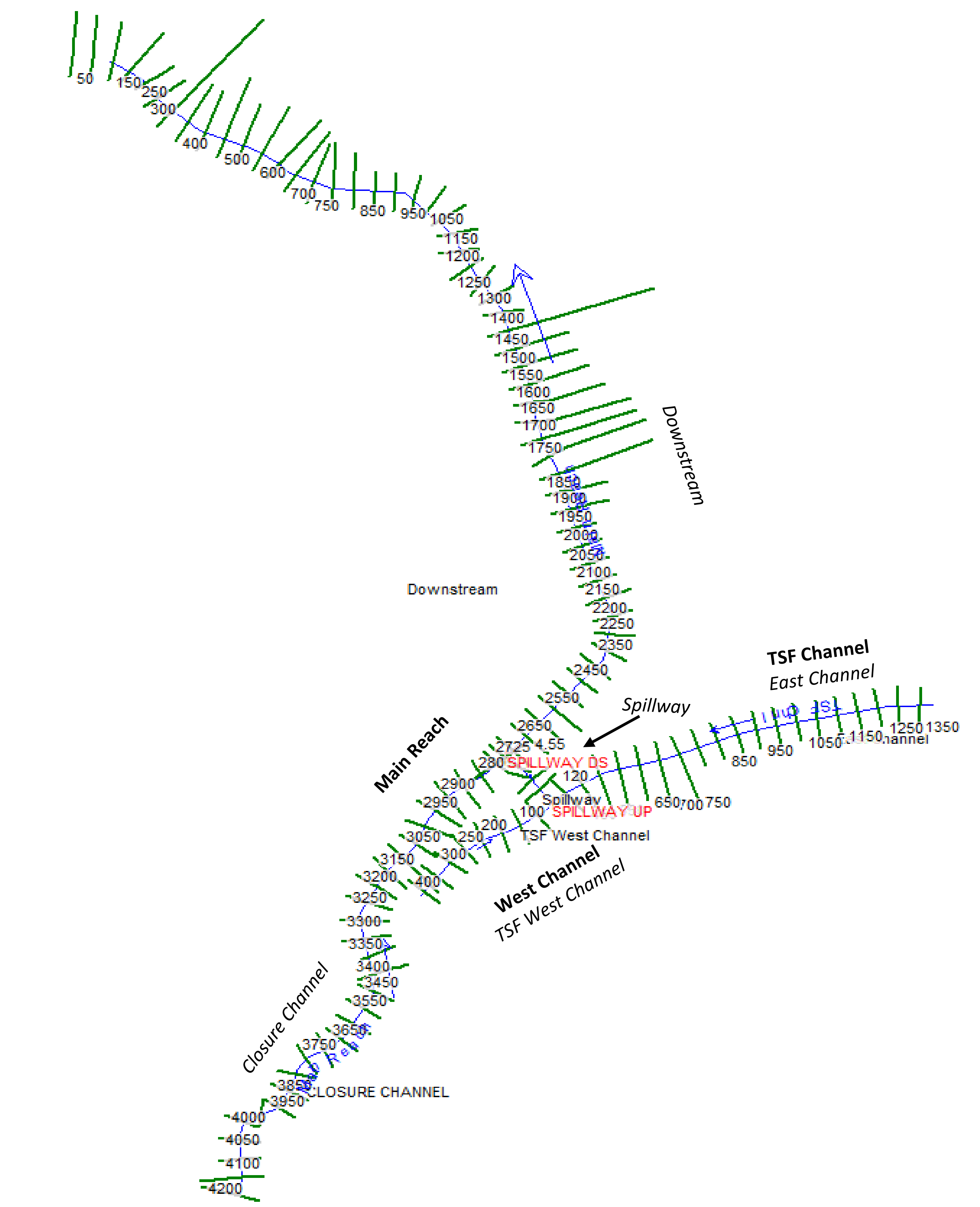
River	Reach	RS	1000yr 24hr RCP8.5
Main Reach	Closure Channel	4200	296.7
		2800	560.8
		2700	560.8
	Downstream	1750	668.8
		1400	1376.8
TSF Chnl	East Channel	1350	113.4
	Spillway	120	194.9
West Channel	TSF West Channel	400	81.5

River	Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Vel Chnl	Flow Area	Top Width	Froude #	Notes
HEC-RAS Plan: Active Closure Profile: 1000yr-24 hr RCP8.5-2090										
			(cfs)	*(ft)*	*(ft)*	*(ft/s)*	*(sq ft)*	*(ft)*	Chl	
West Channel	TSF West Channel	400	81.5	5056.1	5057.9	4.9	16.6	13.7	0.79	
		350	81.5	5053.0	5054.7	5.4	15.0	13.1	0.89	
		300	81.5	5049.9	5051.7	4.8	16.9	13.8	0.77	
		250	81.5	5046.8	5048.5	5.6	14.6	12.9	0.92	
		200	81.5	5043.7	5045.6	4.6	17.6	14.0	0.73	
		150	81.5	5040.6	5042.2	5.9	13.9	12.6	0.99	
		100	81.5	5035.5	5037.1	6.0	13.6	12.5	1.01	
		50	81.5	5030.4	5032.0	6.0	13.6	12.5	1.01	
TSF Chnl	East Channel	1350	113.4	5106.7	5108.5	6.2	18.4	15.3	0.99	
		1300	113.4	5100.7	5102.6	6.3	18.0	14.1	0.99	
		1250	113.4	5093.7	5095.7	6.3	18.0	14.1	0.99	
		1200	113.4	5086.8	5088.7	6.3	18.0	14.2	0.98	
		1150	113.4	5079.9	5081.8	6.3	18.0	14.2	0.98	
		1100	113.4	5073.0	5074.9	6.3	18.0	14.2	0.98	
		1050	113.4	5066.0	5068.0	6.3	18.0	14.2	0.99	
		1000	113.4	5059.6	5061.5	6.3	18.0	14.2	0.99	
		950	113.4	5053.2	5055.1	6.3	18.0	14.2	0.99	
		900	113.4	5045.9	5047.9	6.3	18.0	14.2	0.99	
		850	113.4	5038.7	5040.7	6.3	18.1	14.2	0.98	
		800	113.4	5034.9	5037.6	3.8	30.0	17.9	0.51	
		750	113.4	5033.9	5036.8	3.3	34.7	19.2	0.43	
		700	113.4	5033.1	5036.1	3.3	34.7	19.2	0.43	
		650	113.4	5032.4	5035.4	3.3	34.6	19.2	0.43	
		600	113.4	5031.7	5034.6	3.3	34.8	19.2	0.43	
		550	113.4	5031.0	5033.9	3.2	35.2	19.3	0.42	
		500	113.4	5030.3	5033.3	3.1	36.6	19.7	0.40	
		450	113.4	5029.5	5031.5	6.3	17.9	14.1	0.99	
	Spillway	120	194.9	5025.7	5029.2	2.4	81.5	32.5	0.27	
		90	194.9	5023.5	5029.2	1.2	163.3	43.1	0.11	
		86				*Culvert*				
		see station 27+00 of *Main Reach Downstream* Channel								
Main Reach	CLOSURE CHANNEL	4200	296.7	5106.8	5108.8	7.2	41.5	27.2	1.00	
		4150	296.7	5101.6	5104.5	7.4	40.6	21.9	0.91	
		4100	296.7	5100.0	5102.7	6.5	46.4	23.1	0.77	
		4050	296.7	5097.6	5100.2	7.6	39.0	22.4	1.00	
		4000	296.7	5093.6	5095.8	7.0	42.7	28.9	1.01	
		3950	296.7	5089.9	5092.0	7.1	41.8	27.2	1.01	
		3900	296.7	5086.0	5088.7	6.6	45.4	23.6	0.80	
		3850	296.7	5083.7	5086.1	7.2	41.1	26.3	1.01	
		3800	296.7	5080.6	5083.0	3.6	83.6	50.2	0.48	
		3750	296.7	5080.0	5082.1	3.9	75.4	49.3	0.56	
		3700	296.7	5077.0	5080.2	6.5	45.5	24.6	0.85	
		3650	296.7	5075.5	5078.2	6.4	46.4	24.4	0.81	
		3600	296.7	5073.9	5076.5	6.0	49.7	25.4	0.73	
		3550	296.7	5071.6	5074.0	7.4	40.0	23.7	1.00	
		3500	296.7	5069.5	5073.1	4.3	70.4	28.2	0.45	
		3450	296.7	5068.9	5072.7	3.6	83.1	31.9	0.37	
		3400	296.7	5068.0	5072.4	3.7	85.2	30.1	0.34	
		3350	296.7	5068.0	5072.1	3.6	85.2	28.7	0.33	
		3300	296.7	5068.0	5071.6	4.4	69.4	26.1	0.43	
		3250	296.7	5067.6	5070.9	5.1	58.8	24.6	0.55	
		3200	296.7	5066.4	5068.9	7.6	39.1	22.2	1.01	
		3150	296.7	5064.0	5066.4	7.5	39.8	22.4	0.99	
		3100	296.7	5060.6	5063.3	7.6	39.2	21.4	0.98	
		3050	296.7	5054.3	5056.9	7.6	39.0	21.7	1.00	
		3000	296.7	5049.1	5051.5	7.7	38.6	21.4	1.01	
		2950	296.7	5045.2	5047.6	7.4	40.1	23.3	0.99	
		2900	296.7	5040.9	5043.4	7.6	38.9	22.1	1.01	
		2850	296.7	5037.0	5039.4	7.5	39.8	23.3	1.01	
		2800	560.8	5031.5	5034.9	9.1	62.9	26.2	0.97	
		2750	560.8	5027.2	5031.9	6.5	89.9	31.6	0.58	
		2725	560.8	5027.2	5031.1	8.9	65.6	27.4	0.88	

HEC-RAS Plan: Active Closure Profile: 1000yr-24 hr RCP8.5-2090											
River	Reach	River Sta	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Notes
Main Reach	Downstream	2700	560.8	5021.4	5025.1	8.7	67.3	29.9	0.86	
		2650	560.8	5016.0	5019.4	8.7	66.7	30.2	0.91	
		2600	560.8	5011.6	5014.9	8.4	69.1	33.2	0.88	
		2550	560.8	5006.3	5009.9	7.6	75.1	34.9	0.74	
		2500	560.8	4995.7	4999.1	8.6	65.3	28.9	1.01	
		2450	560.8	4984.8	4988.4	8.7	64.7	28.1	1.01	
		2400	560.8	4974.5	4977.7	8.5	66.0	29.9	1.01	
		2350	560.8	4963.8	4967.4	8.9	63.2	26.2	1.01	
		2300	560.8	4956.4	4959.8	8.9	63.4	26.4	1.01	
		2250	560.8	4953.0	4958.6	4.6	123.4	34.5	0.42	
		2200	560.8	4954.0	4957.3	7.5	79.9	44.1	0.81	
		2150	560.8	4951.8	4956.4	5.4	103.3	35.0	0.56	
		2100	560.8	4951.0	4955.6	5.2	108.0	34.4	0.52	
		2050	560.8	4950.2	4954.9	5.4	104.7	34.1	0.54	
		2000	560.8	4949.7	4953.3	7.4	75.5	29.8	0.82	
		1950	560.8	4948.5	4952.1	8.5	66.3	30.3	1.01	
		1900	560.8	4944.9	4948.5	8.9	64.8	28.2	0.93	
		1850	560.8	4940.1	4943.6	8.4	67.4	31.0	0.94	
		1800	560.8	4935.7	4939.2	8.6	68.0	30.2	0.87	
		1750	668.8	4930.4	4934.3	9.2	76.9	30.3	0.88	
		1700	668.8	4926.2	4930.2	9.0	76.8	31.6	0.87	
		1650	668.8	4921.4	4925.1	8.9	77.2	33.2	0.93	
		1600	668.8	4915.6	4919.5	8.9	79.4	32.7	0.85	Limits of TSF and appurtenant infrastructure
		1550	668.8	4910.8	4914.3	8.6	77.6	34.1	0.98	Downstream of TSF and appurtenant infrastructure
		1500	668.8	4905.9	4909.2	9.0	73.2	33.0	0.98	
		1450	668.8	4901.9	4905.2	9.1	71.4	31.7	0.99	
		1400	1376.8	4893.3	4898.7	10.7	128.2	36.2	1.01	
		1350	1376.8	4883.7	4890.5	8.8	157.4	34.8	0.73	
		1300	1376.8	4881.9	4888.8	9.7	141.9	31.9	0.81	
		1250	1376.8	4880.0	4887.0	9.9	139.6	31.1	0.82	
		1200	1376.8	4878.9	4884.9	10.5	131.1	31.8	0.91	
		1150	1376.8	4876.5	4882.4	11.1	124.4	33.1	1.01	
		1100	1376.8	4873.9	4880.4	8.9	155.0	39.9	0.79	
		1050	1376.8	4873.0	4879.2	8.2	170.0	47.7	0.70	
		1000	1376.8	4871.0	4877.5	9.5	149.3	44.2	0.81	
		950	1376.8	4869.8	4876.3	9.0	159.6	42.9	0.71	
		900	1376.8	4868.7	4875.6	7.3	189.5	45.1	0.61	
		850	1376.8	4867.5	4873.1	10.9	127.0	35.2	1.00	
		800	1376.8	4866.0	4871.0	8.2	170.4	55.8	0.76	
		750	1376.8	4865.0	4869.4	9.4	160.2	64.5	0.85	Channel outside of property boundary

TSF Climate Change Channel Hydraulics

Plan: Passive Closure



River	Reach	RS	Local PMP RCP8.5-2090
Main Reach	Closure Channel	4200	1259.3
		2800	2407.2
	Downstream	2700	2407.2
		1750	2878
		1400	5825.8
TSF Chnl	East Channel	1350	491.8
	Spillway	120	845.5
West Channel	TSF West Channel	400	353.5

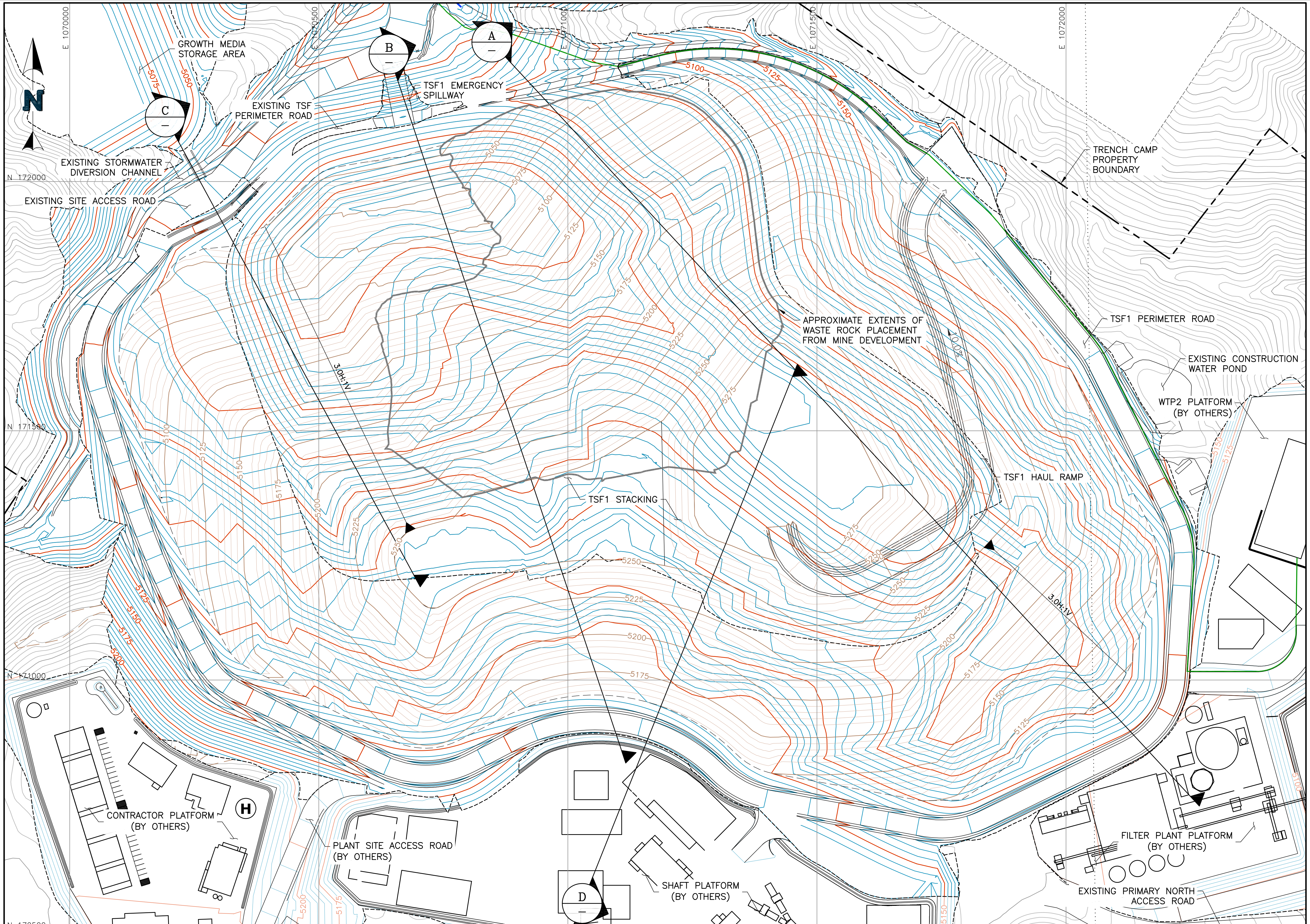
HEC-RAS Plan: Passive Closure Profile: Local PMP RCP8.5										
River	Reach	River Sta	Q Total *(cfs)*	Min Ch El *(ft)*	W.S. Elev *(ft)*	Vel Chnl *(ft/s)*	Flow Area *(sq ft)*	Top Width *(ft)*	Froude # Chl	Notes
West Channel	TSF West Channel	400	353.5	5056.1	5059.7	7.3	48.2	22.4	0.88	
		350	353.5	5053.0	5056.4	7.7	45.7	21.9	0.94	
		300	353.5	5049.9	5053.5	7.2	48.9	22.6	0.87	
		250	353.5	5046.8	5050.2	7.9	44.8	21.6	0.97	
		200	353.5	5043.7	5047.4	7.0	50.3	22.9	0.83	
		150	353.5	5040.6	5043.9	8.2	43.2	21.3	1.01	
		100	353.5	5035.5	5038.9	8.2	43.4	21.3	1.01	
		50	353.5	5030.4	5033.7	8.1	43.4	21.3	1.01	
TSF Chnl	East Channel	1350	491.8	5106.7	5110.5	8.5	58.2	25.6	0.99	
		1300	491.8	5100.7	5104.6	8.6	57.0	24.3	0.99	
		1250	491.8	5093.7	5097.7	8.6	57.0	24.3	0.99	
		1200	491.8	5086.8	5090.8	8.6	57.1	24.3	0.99	
		1150	491.8	5079.9	5083.8	8.8	55.8	24.1	1.02	
		1100	491.8	5073.0	5076.9	8.6	57.1	24.3	0.99	
		1050	491.8	5066.0	5070.0	8.6	57.0	24.3	0.99	
		1000	491.8	5059.6	5063.9	2.5	139.4	72.1	0.26	
		950	491.8	5053.2	5057.2	1.6	155.9	62.6	0.19	
		900	491.8	5045.9	5050.0	2.6	124.1	62.7	0.30	
		850	491.8	5038.7	5042.9	7.2	68.9	44.6	0.80	
		800	491.8	5034.9	5040.2	5.3	93.7	31.0	0.53	
		750	491.8	5033.9	5039.5	4.8	103.6	32.5	0.47	
		700	491.8	5033.1	5038.7	4.8	103.5	32.5	0.47	
		650	491.8	5032.4	5038.0	4.8	103.3	32.5	0.47	
		600	491.8	5031.7	5037.3	4.8	103.3	32.4	0.47	
		550	491.8	5031.0	5036.6	4.8	102.8	32.4	0.47	
		500	491.8	5030.3	5035.8	4.8	101.6	32.2	0.48	
		450	491.8	5029.5	5033.5	8.7	56.6	24.2	1.00	
	Spillway	120	845.5	5025.7	5030.2	7.2	116.9	37.6	0.72	
		90	845.5	5023.5	5030.3	4.0	213.5	48.5	0.33	
		see station 27+00 of *Main Reach Downstream* Channel								
Main Reach	CLOSURE CHANNEL	4200	1259.3	5106.8	5111.3	10.7	123.6	37.4	0.93	
		4150	1259.3	5101.6	5107.4	11.3	119.4	32.8	0.90	
		4100	1259.3	5100.0	5105.2	11.4	117.6	31.9	0.91	
		4050	1259.3	5097.6	5103.0	11.1	120.2	33.7	0.90	
		4000	1259.3	5093.6	5098.2	10.1	130.9	44.2	0.92	
		3950	1259.3	5089.9	5094.5	10.4	127.6	40.6	0.91	
		3900	1259.3	5086.0	5091.2	11.2	119.5	33.4	0.91	
		3850	1259.3	5083.7	5088.7	10.4	128.8	41.9	0.90	
		3800	1259.3	5080.6	5085.4	5.8	223.4	65.4	0.51	
		3750	1259.3	5080.0	5084.9	5.4	239.3	67.3	0.47	
		3700	1259.3	5077.0	5082.8	10.1	129.5	44.2	0.90	
		3650	1259.3	5075.5	5080.7	10.9	122.7	36.3	0.90	
		3600	1259.3	5073.9	5078.9	10.7	125.1	37.5	0.89	
		3550	1259.3	5071.6	5076.8	10.7	124.7	37.5	0.89	
		3500	1259.3	5069.5	5075.8	8.2	165.2	41.8	0.61	
		3450	1259.3	5068.9	5075.7	5.3	283.0	96.0	0.38	
		3400	1259.3	5068.0	5075.4	5.7	272.6	90.3	0.39	
		3350	1259.3	5068.0	5075.0	5.9	260.8	85.6	0.40	
		3300	1259.3	5068.0	5074.6	6.6	234.3	84.8	0.47	
		3250	1259.3	5067.6	5073.4	8.8	173.5	78.3	0.68	
		3200	1259.3	5066.4	5072.2	8.6	170.8	82.2	0.70	
		3150	1259.3	5064.0	5069.3	11.4	118.4	33.2	0.95	
		3100	1259.3	5060.6	5066.4	9.0	214.0	105.2	0.73	
		3050	1259.3	5054.3	5059.8	11.7	121.1	35.5	0.95	
		3000	1259.3	5049.1	5054.7	10.7	138.0	59.3	0.86	
		2950	1259.3	5045.2	5050.0	12.2	111.6	45.8	1.07	
		2900	1259.3	5040.9	5046.2	11.6	117.0	35.7	0.99	
		2850	1259.3	5037.0	5042.1	11.4	120.0	39.3	0.98	
		2800	2407.2	5031.5	5039.2	13.9	209.5	42.0	0.93	
		2750	2407.2	5027.2	5035.6	7.7	329.8	97.3	0.49	
		2725	2407.2	5027.2	5034.9	10.2	266.6	94.5	0.67	

HEC-RAS Plan: Passive Closure Profile: Local PMP RCP8.5										
River	Reach	River Sta	Q Total *(cfs)*	Min Ch El *(ft)*	W.S. Elev *(ft)*	Vel Chnl *(ft/s)*	Flow Area *(sq ft)*	Top Width *(ft)*	Froude # Chl	Notes
Main Reach	Downstream	2700	2407.2	5021.4	5028.6	10.1	253.6	83.2	0.69	
		2650	2407.2	5016.0	5022.7	10.0	247.7	79.6	0.71	
		2600	2407.2	5011.6	5017.8	9.2	251.6	81.9	0.68	
		2550	2407.2	5006.3	5012.6	8.5	270.9	93.2	0.61	
		2500	2407.2	4995.7	5002.7	12.0	200.9	45.6	1.01	
		2450	2407.2	4984.8	4992.1	11.9	201.9	45.9	1.00	
		2400	2407.2	4974.5	4981.2	11.8	204.3	48.0	1.01	
		2350	2407.2	4963.8	4971.3	12.0	200.7	45.5	1.01	
		2300	2407.2	4956.4	4963.6	12.3	196.2	42.4	1.01	
		2250	2407.2	4953.0	4961.7	9.7	248.8	45.7	0.73	
		2200	2407.2	4954.0	4961.7	6.7	385.7	82.7	0.44	
		2150	2407.2	4951.8	4961.0	7.1	337.8	66.2	0.56	
		2100	2407.2	4951.0	4960.1	8.0	300.2	52.0	0.59	
		2050	2407.2	4950.2	4959.2	8.2	292.8	52.1	0.61	
		2000	2407.2	4949.7	4956.6	12.1	199.2	44.5	1.01	
		1950	2407.2	4948.5	4955.6	12.4	199.1	44.6	0.95	
		1900	2407.2	4944.9	4952.3	10.3	253.7	84.7	0.71	
		1850	2407.2	4940.1	4946.7	9.4	255.3	90.9	0.70	
		1800	2407.2	4935.7	4941.2	7.6	314.6	164.2	0.59	
		1750	2878.0	4930.4	4936.7	8.1	338.3	143.5	0.60	
		1700	2878.0	4926.2	4933.0	8.7	318.9	119.9	0.62	
		1650	2878.0	4921.4	4926.3	1.9	719.1	191.7	0.16	
		1600	2878.0	4915.6	4921.1	2.6	607.2	158.2	0.20	Limits of TSF and appurtenant infrastructure
		1550	2878.0	4910.8	4916.0	1.9	676.5	158.4	0.16	Downstream of TSF and appurtenant infrastructure
		1500	2878.0	4905.9	4912.0	3.3	395.9	149.6	0.25	
		1450	2878.0	4901.9	4909.2	4.9	369.1	141.7	0.33	
		1400	5825.8	4893.3	4904.2	15.2	381.3	56.9	1.01	
		1350	5825.8	4883.7	4896.7	14.2	431.4	54.4	0.78	
		1300	5825.8	4881.9	4895.3	14.2	421.1	54.3	0.81	
		1250	5825.8	4880.0	4892.9	15.6	373.1	48.8	0.98	
		1200	5825.8	4878.9	4890.9	15.8	373.2	50.9	0.96	
		1150	5825.8	4876.5	4888.5	15.2	410.1	62.7	0.88	
		1100	5825.8	4873.9	4885.4	14.1	446.1	77.1	0.85	
		1050	5825.8	4873.0	4884.4	11.7	532.8	81.5	0.67	
		1000	5825.8	4871.0	4882.2	14.4	432.3	69.3	0.84	
		950	5825.8	4869.8	4881.0	14.4	442.8	70.2	0.82	
		900	5825.8	4868.7	4880.0	13.3	469.5	74.8	0.79	
		850	5825.8	4867.5	4878.6	14.2	454.9	80.3	0.83	
		800	5825.8	4866.0	4875.0	13.7	459.2	87.4	0.88	
		750	5825.8	4865.0	4873.2	13.4	466.5	95.5	0.86	Channel outside of property boundary

River	Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Max Chnl Q Depth	Ch Top El (Left)	Depth	WS Ex Depth	Ch Top El Right	Depth	WS Ex Depth	Notes
Passive Closure Local PMP RCP8.5 2090													
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
West Channel	TSF West Channel	400	353.5	5056.1	5059.7	3.6	5069.2	13.1	-9.6				Lowest side of channel is on left.
		350	353.5	5053.0	5056.4	3.5	5065.2	12.3	-8.8				
		300	353.5	5049.9	5053.5	3.6	5060.5	10.7	-7.0				
		250	353.5	5046.8	5050.2	3.4	5055.6	8.8	-5.4				
		200	353.5	5043.7	5047.4	3.7	5051.6	7.9	-4.2				
		150	353.5	5040.6	5043.9	3.4	5048.9	8.4	-5.0				
		100	353.5	5035.5	5038.9	3.4	5041.5	6.0	-2.6				
		50	353.5	5030.4	5033.7	3.4	5036.4	6.0	-2.6				
TSF Chnl	East Channel	1350	491.8	5106.7	5110.5	3.8				5117.9	11.2	-7.4	Lowest side of channel is on right.
		1300	491.8	5100.7	5104.6	4.0				5104.7	4.0	0.0	
		1250	491.8	5093.7	5097.7	4.0				5097.7	4.0	0.0	
		1200	491.8	5086.8	5090.8	4.0				5090.8	4.0	0.0	
		1150	491.8	5079.9	5083.8	3.9				5083.9	4.0	-0.1	
		1100	491.8	5073.0	5076.9	4.0				5077.0	4.0	0.0	
		1050	491.8	5066.0	5070.0	4.7				5070.0	4.0	0.0	
		1000	491.8	5059.6	5063.9	5.5				5063.6	4.0	0.3	Possible flooding; resolved with minor berm raise; see dwg A615
		950	491.8	5053.2	5057.2	6.8				5057.3	4.2	-0.1	
		900	491.8	5045.9	5050.0	4.7				5049.9	4.0	0.0	
		850	491.8	5038.7	5042.9	4.2				5042.7	4.0	0.2	
		800	491.8	5034.9	5040.2	5.3				5040.4	5.5	-0.2	
		750	491.8	5033.9	5039.5	5.6				5039.9	6.0	-0.4	
		700	491.8	5033.1	5038.7	5.6				5039.1	6.0	-0.4	
		650	491.8	5032.4	5038.0	5.6				5038.4	6.0	-0.4	
		600	491.8	5031.7	5037.3	5.6				5037.7	6.0	-0.4	
		550	491.8	5031.0	5036.6	5.6				5037.0	6.0	-0.4	
		500	491.8	5030.3	5035.8	5.5				5036.3	6.0	-0.5	
		450	491.8	5029.5	5033.5	3.9				5036.5	7.0	-3.1	
	Spillway	120	845.5	5025.7	5030.2	4.5				5042.9	17.2	-12.7	Lowest side of channel is on right.
		90	845.5	5023.5	5030.3	6.8				5039.5	16.0	-9.2	
		see station 27+00 of *Main Reach Downstream* Channel											
Main Reach	Closure Channel	4200	1259.3	5106.8	5111.3	4.5				> 5132.0			Lowest side of channel is on right.
		4150	1259.3	5101.6	5107.4	5.7				> 5131.4			
		4100	1259.3	5100.0	5105.2	5.2				> 5127.2			
		4050	1259.3	5097.6	5103.0	5.5				> 5117.6			
		4000	1259.3	5093.6	5098.2	4.6				> 5100.7			
		3950	1259.3	5089.9	5094.5	4.6				> 5100.8			
		3900	1259.3	5086.0	5091.2	5.3				> 5100.5			
		3850	1259.3	5083.7	5088.7	5.0				> 5098.4			
		3800	1259.3	5080.6	5085.4	4.8				> 5089.9			
		3750	1259.3	5080.0	5084.9	4.9				> 5090.9			
		3700	1259.3	5077.0	5082.8	5.8				> 5095.2			
		3650	1259.3	5075.5	5080.7	5.2				5088.5	13.0		
		3600	1259.3	5073.9	5078.9	5.0				5084.0	10.1	-5.1	
		3550	1259.3	5071.6	5076.8	5.2				5082.1	10.5	-5.3	
		3500	1259.3	5069.5	5075.8	6.3				5082.0	12.5	-6.2	
		3450	1259.3	5068.9	5075.7	6.8				5073.0	4.1	2.7	Possible road flooding; install revetment in passive closure as shown on Dwg A615
		3400	1259.3	5068.0	5075.4	7.4				5073.0	5.0	2.4	
		3350	1259.3	5068.0	5075.0	7.0				5072.2	4.2	2.8	
		3300	1259.3	5068.0	5074.6	6.6				5073.0	5.0	1.6	
		3250	1259.3	5067.6	5073.4	5.8				5072.4	4.8	1.0	
		3200	1259.3	5066.4	5072.2	5.9				5071.0	4.6	1.2	
		3150	1259.3	5064.0	5069.3	5.3				5069.3	5.3	-0.1	
		3100	1259.3	5060.6	5066.4	5.9				5065.8	5.2	0.7	
		3050	1259.3	5054.3	5059.8	5.5				5059.9	5.6	-0.1	
		3000	1259.3	5049.1	5054.7	5.6				5053.8	4.8	0.8	
		2950	1259.3	5045.2	5050.0	4.9				5050.0	4.9	0.0	
		2900	1259.3	5040.9	5046.2	5.3				5046.2	5.3	0.0	
		2850	1259.3	5037.0	5042.1	5.1				5042.1	5.1	0.0	
		2800	2407.2	5031.5	5039.2	7.7				5039.9	8.3	-0.7	
		2750	2407.2	5027.2	5035.6	8.4				5033.8	6.6	1.8	
		2725	2407.2	5027.2	5034.9	7.7				5033.8	6.6	1.2	

Passive Closure Local PMP RCP8.5 2090													
River	Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Max Chnl Q Depth	Ch Top El (Left)	Depth	WS Ex Depth	Ch Top El Right	Depth	WS Ex Depth	Notes
			(cfs)	*(ft)*	*(ft)*	(ft)	*(ft)*	*(ft)*	*(ft)*	*(ft)*	*(ft)*	*(ft)*	
Main Reach	Downstream	2700	2407.2	5021.4	5028.6	7.2				5027.0	5.6	1.6	Possible road flooding; install revetment in passive closure as shown on Dwg A615
		2650	2407.2	5016.0	5022.7	6.7				5020.9	4.8	1.8	
		2600	2407.2	5011.6	5017.8	6.2				5015.3	3.7	2.5	
		2550	2407.2	5006.3	5012.6	6.3				5011.0	4.7	1.6	
		2500	2407.2	4995.7	5002.7	6.9				5006.7	10.9	-4.0	
		2450	2407.2	4984.8	4992.1	7.2				4998.2	13.3	-6.1	
		2400	2407.2	4974.5	4981.2	6.7				4985.7	11.2	-4.4	
		2350	2407.2	4963.8	4971.3	7.5				4976.2	12.4	-4.9	
		2300	2407.2	4956.4	4963.6	7.3				4971.1	14.7	-7.4	
		2250	2407.2	4953.0	4961.7	8.7				4967.0	14.0	-5.3	
		2200	2407.2	4954.0	4961.7	7.7				> 4965.0			
		2150	2407.2	4951.8	4961.0	9.2				4963.0	11.2	-2.0	
		2100	2407.2	4951.0	4960.1	9.1				4962.0	11.0	-1.9	
		2050	2407.2	4950.2	4959.2	9.1				4961.1	10.9	-1.8	
		2000	2407.2	4949.7	4956.6	6.9				4959.0	9.3	-2.4	
		1950	2407.2	4948.5	4955.6	7.1				4956.2	7.7	-0.6	
		1900	2407.2	4944.9	4952.3	7.4				4950.0	5.1	2.3	Possible road flooding; install revetment in passive closure as shown on Dwg A615
		1850	2407.2	4940.1	4946.7	7.9				4944.3	4.2	2.3	
		1800	2407.2	4935.7	4941.2	8.2				4940.5	4.8	0.7	
		1750	2878.0	4930.4	4936.7	9.3				4935.8	5.4	0.8	
		1700	2878.0	4926.2	4933.0	10.3				4931.4	5.2	1.6	
		1650	2878.0	4921.4	4926.3	10.0				4926.3	4.9	0.0	
		1600	2878.0	4915.6	4921.1	8.1				4921.1	5.5	0.0	Limits of TSF and appurtenant infrastructure
		1550	2878.0	4910.8	4916.0	9.0				4916.0	5.2	0.0	Downstream of TSF and appurtenant infrastructure
		1500	2878.0	4905.9	4912.0	6.1				4911.4	5.5	0.6	
		1450	2878.0	4901.9	4909.2	7.3				4909.0	7.1	0.1	
		1400	5825.8	4893.3	4904.2	10.9				> 4908			
		1350	5825.8	4883.7	4896.7	12.9				> 4905.0			
		1300	5825.8	4881.9	4895.3	13.5				> 4902.3			
		1250	5825.8	4880.0	4892.9	13.0				> 4894.9			
		1200	5825.8	4878.9	4890.9	11.9				> 4895.9			
		1150	5825.8	4876.5	4888.5	12.1				> 4891.7			
		1100	5825.8	4873.9	4885.4	11.5				> 4889.1			
		1050	5825.8	4873.0	4884.4	11.4				> 4888.0			
		1000	5825.8	4871.0	4882.2	11.3				> 4889.9			
		950	5825.8	4869.8	4881.0	11.2				> 4883.3			
		900	5825.8	4868.7	4880.0	11.3				> 4881.9			
		850	5825.8	4867.5	4878.6	11.1				> 4891.5			
		800	5825.8	4866.0	4875.0	9.0				> 4886.6			
		750	5825.8	4865.0	4873.2	8.2							Channel outside of property boundary

APPENDIX H
Stability Graphics



LEGEND:

- EXISTING GROUND CONTOURS
- TSF BASIN CONTOURS
- PROPOSED CONTOURS (OUTSIDE OF TSF BASIN)
- PROPOSED STACKING CONTOURS
- EXISTING ROADS/TRAILS
- PROJECT BOUNDARY
- SECTION LINES
- WASTE ROCK LIMITS

NOTES:

1. FOR APPROXIMATE LIMITS OF LOW PERMEABILITY SOIL LAYER AND GCL WITHIN THE TSF FOOTPRINT REFERENCE DRAWING A220.

0 100 200 FEET

REFERENCE:

EXISTING GROUND TOPOGRAPHY DEVELOPED FROM MARCH 2020 AND APRIL 2023 AERIAL SURVEY DATA PROVIDED BY SOUTH32 (AMI). DATA PROJECTED TO STATE PLANE ARIZONA CENTRAL NAD 83 FEET, NAVD88.

NewFields

CLIENT: SOUTH32 HERMOSA INC..

PROJECT: HERMOSA PROJECT AQUIFER PROTECTION PERMIT (TSF1)

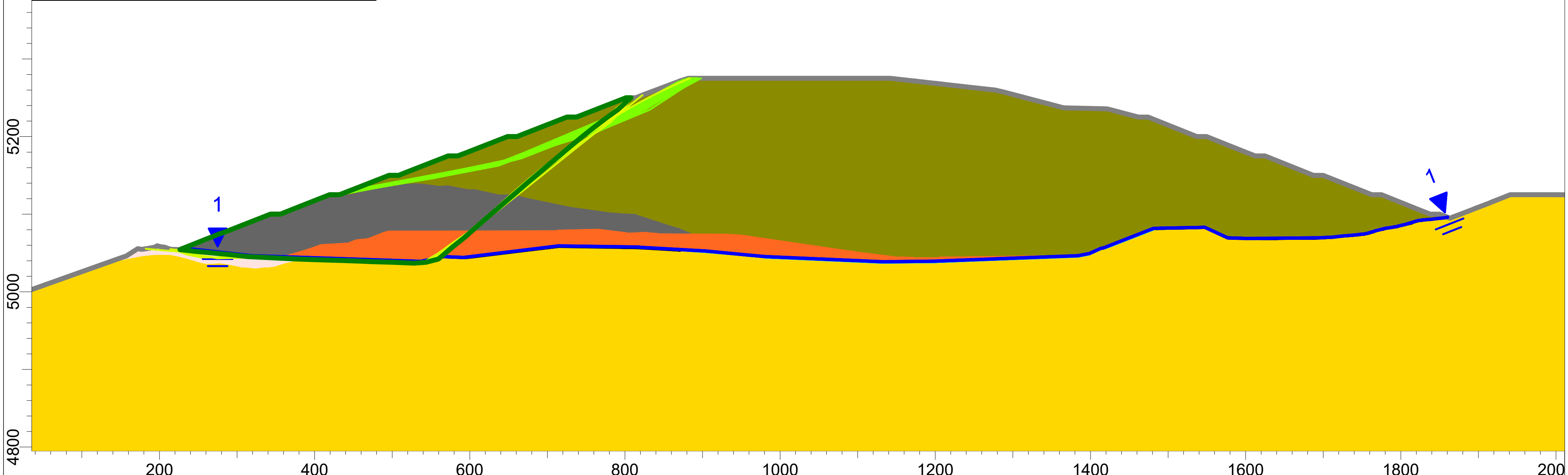
TITLE: SLOPE STABILITY EVALUATION SECTIONS TSF1

FILENAME	
14.035.008F	
FIGURE NO.	REVISION
1	A

P:\Projects\0014.035 Hermosa TSF1-3 Design ADEQ APP Submittal\A-CAD\FIGS\14.035.008F.dwg-7/25/2023 2:00 PM

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)	Shear/Normal Function	a	b	Water Surface
Production Tailings		125	Mohr-Coulomb	0	36				Piezometric Line 1
Reclaimed Tailings		130	Mohr-Coulomb	0	34				Piezometric Line 1
Engineered Fill		135	Mohr-Coulomb	0	32				None
HDPE/GCL		120	Shear/Normal Function			Non-Linear Function			None
HDPE/LPSL		135	Power Curve				0.908	0.9174	None
Foundation		130	Mohr-Coulomb	0	38				None
Waste Rock		130	Shear/Normal Function			LEPS (AVERAGE BOUND)			Piezometric Line 1

Method Name	Min FS
Spencer	1.7
GLE / Morgenstern-Price	1.7



NewFields

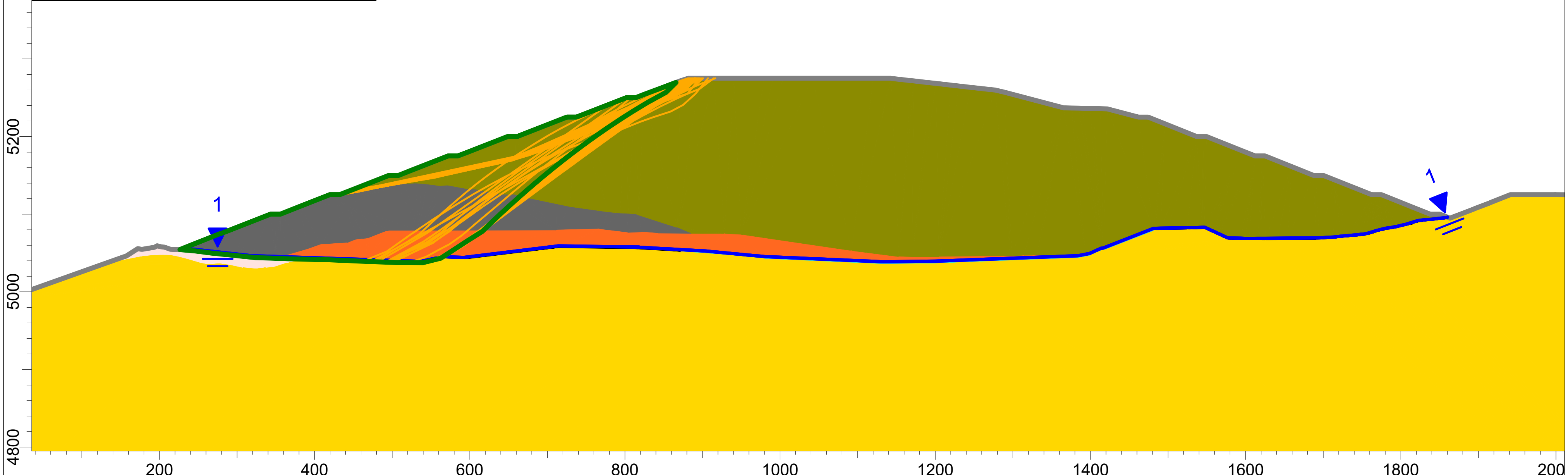
SLIDEINTERPRET 9.028

Hermosa Project TSF1 Design

Analysis Description	Section A (NW) - Static Loading Conditions
Drawn By	S. Amieiro
Scale	1:2300
Company	South32 Hermosa Inc.
Date Printed	8/10/2023
File Name	Section A (NW).slmd

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)	Shear/Normal Function	a	b	Water Surface
Production Tailings - PS		125	Mohr-Coulomb	0	28				Piezometric Line 1
Reclaimed Tailings - PS		130	Mohr-Coulomb	0	27				Piezometric Line 1
Engineered Fill		135	Mohr-Coulomb	0	32				None
HDPE/GCL		120	Shear/Normal Function			Non-Linear Function			None
HDPE/LPSL		135	Power Curve				0.908	0.9174	None
Foundation		130	Mohr-Coulomb	0	38				None
Waste Rock		130	Shear/Normal Function			LEPS (AVERAGE BOUND)			Piezometric Line 1

Method Name	Min FS
Spencer	1.1
GLE / Morgenstern-Price	1.1



NewFields

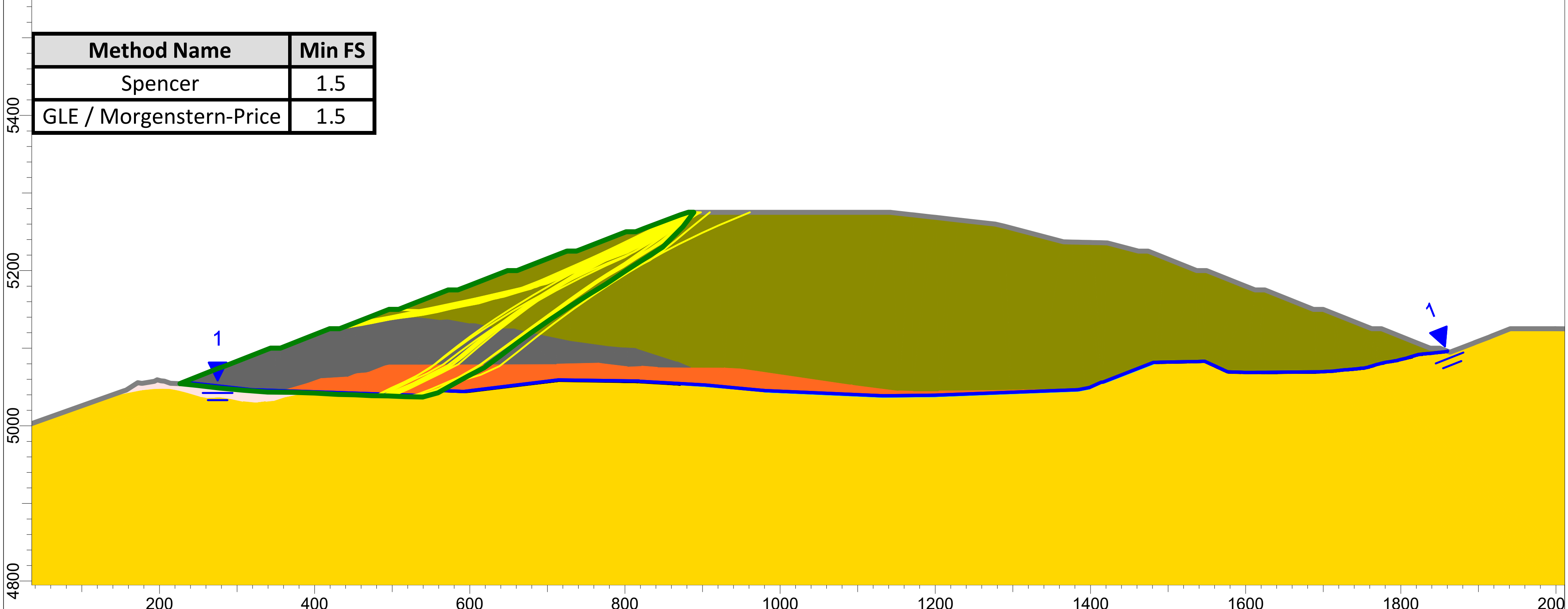
Hermosa Project TSF1 Design

Analysis Description	Section A (NW) - Pseudostatic Loading Conditions		
Drawn By S. Amieiro	*Scale* 1:2300	*Company* South32 Hermosa Inc.	
Date Printed 8/10/2023		*File Name* Section A (NW).slmd	

SLIDEINTERPRET 9.028

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)	Shear/Normal Function	a	b	Water Surface
Production Tailings - PS		125	Mohr-Coulomb	0	28				Piezometric Line 1
Reclaimed Tailings - PS		130	Mohr-Coulomb	0	27				Piezometric Line 1
Engineered Fill		135	Mohr-Coulomb	0	32				None
HDPE/GCL		120	Shear/Normal Function			Non-Linear Function			None
HDPE/LPSL		135	Power Curve				0.908	0.9174	None
Foundation		130	Mohr-Coulomb	0	38				None
Waste Rock		130	Shear/Normal Function			LEPS (AVERAGE BOUND)			Piezometric Line 1

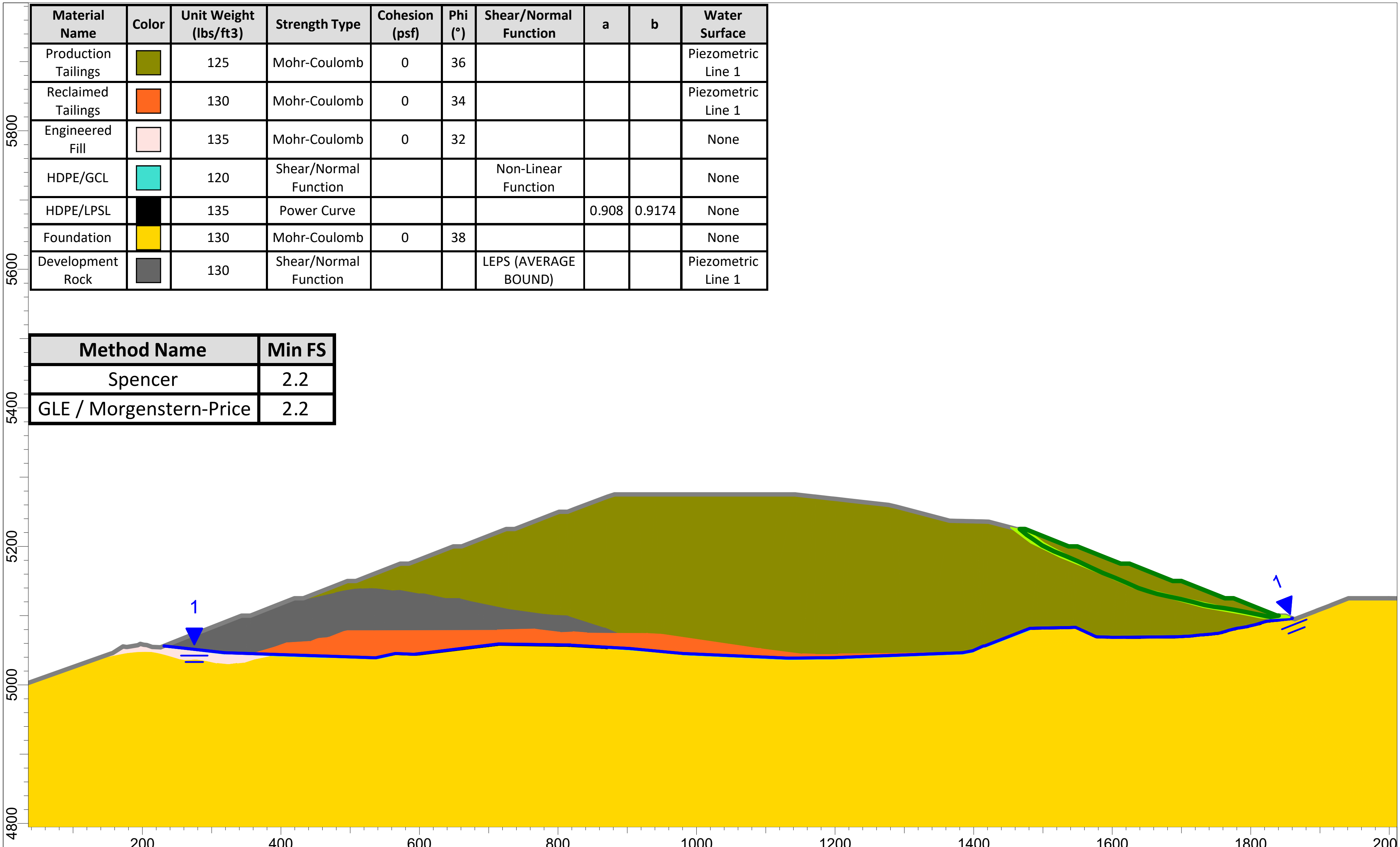
Method Name	Min FS
Spencer	1.5
GLE / Morgenstern-Price	1.5



NewFields	Hermosa Project TSF1 Design		
	Analysis Description Section A (NW) - Post Seismic Loading Conditions		
	Drawn By S. Amieiro	*Scale* 1:2300	*Company* South32 Hermosa Inc.
SLIDEINTERPRET 9.028	*Date Printed* 8/10/2023		*File Name* Section A (NW).slmd

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)	Shear/Normal Function	a	b	Water Surface
Production Tailings		125	Mohr-Coulomb	0	36				Piezometric Line 1
Reclaimed Tailings		130	Mohr-Coulomb	0	34				Piezometric Line 1
Engineered Fill		135	Mohr-Coulomb	0	32				None
HDPE/GCL		120	Shear/Normal Function			Non-Linear Function			None
HDPE/LPSL		135	Power Curve				0.908	0.9174	None
Foundation		130	Mohr-Coulomb	0	38				None
Development Rock		130	Shear/Normal Function			LEPS (AVERAGE BOUND)			Piezometric Line 1

Method Name	Min FS
Spencer	2.2
GLE / Morgenstern-Price	2.2



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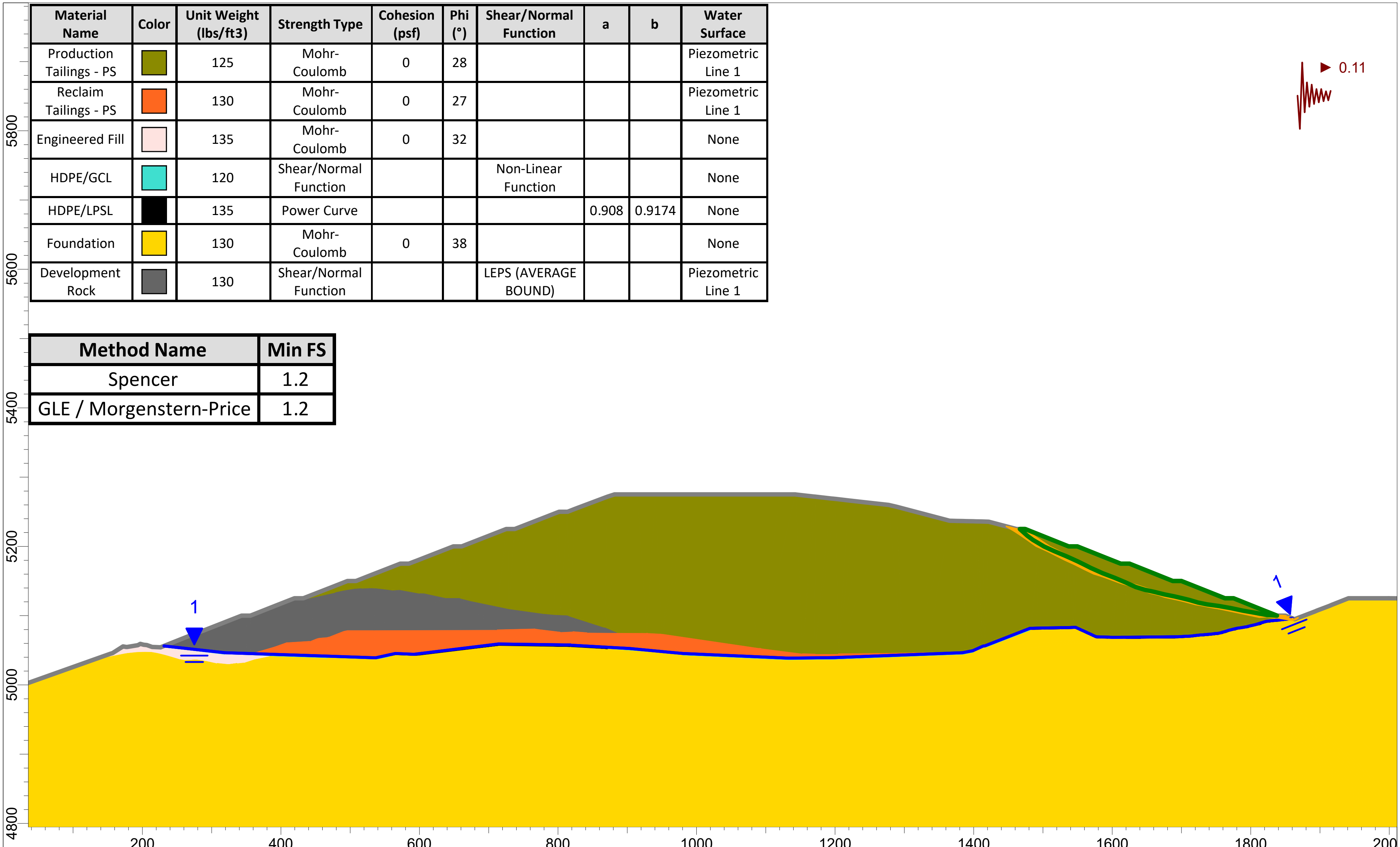
	Analysis Description Section A (SE) - Static Loading Conditions		
	Drawn By S. Amieiro	*Scale* 1:2300	*Company* South32 (AMI)
SLIDEINTERPRET 9.028	*Date Printed* 8/10/2023		*File Name* Section A (SE).slmd

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)	Shear/Normal Function	a	b	Water Surface
Production Tailings - PS		125	Mohr-Coulomb	0	28				Piezometric Line 1
Reclaim Tailings - PS		130	Mohr-Coulomb	0	27				Piezometric Line 1
Engineered Fill		135	Mohr-Coulomb	0	32				None
HDPE/GCL		120	Shear/Normal Function			Non-Linear Function			None
HDPE/LPSL		135	Power Curve				0.908	0.9174	None
Foundation		130	Mohr-Coulomb	0	38				None
Development Rock		130	Shear/Normal Function			LEPS (AVERAGE BOUND)			Piezometric Line 1

Method Name	Min FS
Spencer	1.2
GLE / Morgenstern-Price	1.2



NewFields

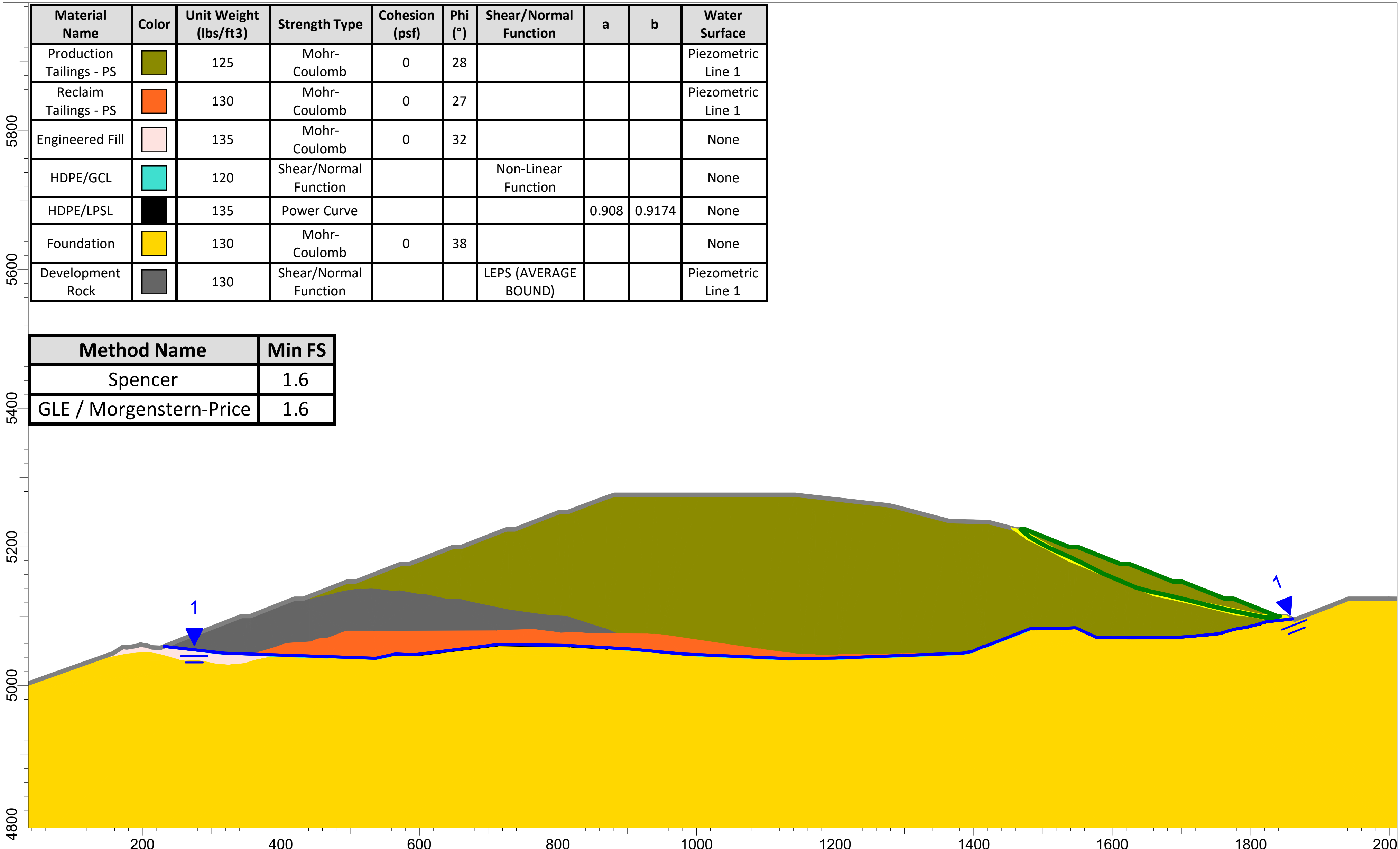
SLIDEINTERPRET 9.028

Hermosa Project TSF1 Design

Analysis Description	Section A (SE) - Pseudostatic Loading Conditions
Drawn By	S. Amieiro
Scale	1:2300
Company	South32 (AMI)
Date Printed	8/10/2023
File Name	Section A (SE).slmd

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)	Shear/Normal Function	a	b	Water Surface
Production Tailings - PS		125	Mohr-Coulomb	0	28				Piezometric Line 1
Reclaim Tailings - PS		130	Mohr-Coulomb	0	27				Piezometric Line 1
Engineered Fill		135	Mohr-Coulomb	0	32				None
HDPE/GCL		120	Shear/Normal Function			Non-Linear Function			None
HDPE/LPSL		135	Power Curve				0.908	0.9174	None
Foundation		130	Mohr-Coulomb	0	38				None
Development Rock		130	Shear/Normal Function			LEPS (AVERAGE BOUND)			Piezometric Line 1

Method Name	Min FS
Spencer	1.6
GLE / Morgenstern-Price	1.6



NewFields

Hermosa Project TSF1 Design

Analysis Description Section A (SE) - Post Seismic Loading Conditions

Drawn By S. Amieiro | *Scale* 1:2300 | *Company* South32 (AMI)

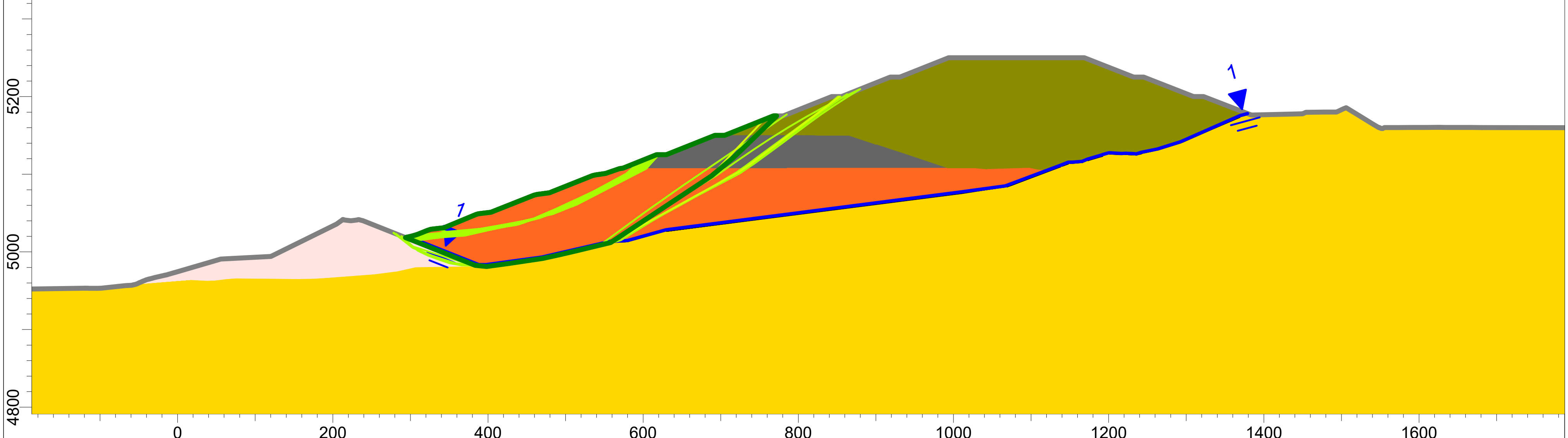
Date Printed 8/10/2023 | *File Name* Section A (SE).slmd

SLIDEINTERPRET 9.028

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)	Shear/ Normal Function	a	b	Water Surface
Production Tailings		125	Mohr-Coulomb	0	36				Piezometric Line 1
Reclaimed Tailings		130	Mohr-Coulomb	0	34				Piezometric Line 1
Engineered Fill		135	Mohr-Coulomb	0	32				None
HDPE/GCL		120	Shear/ Normal Function			Non-Linear Function			None
HDPE/LPSL		135	Power Curve				0.908	0.9174	None
Foundation		130	Mohr-Coulomb	0	38				None

Method Name	Min FS
Spencer	1.9
GLE / Morgenstern-Price	1.9

5800
5600
5400



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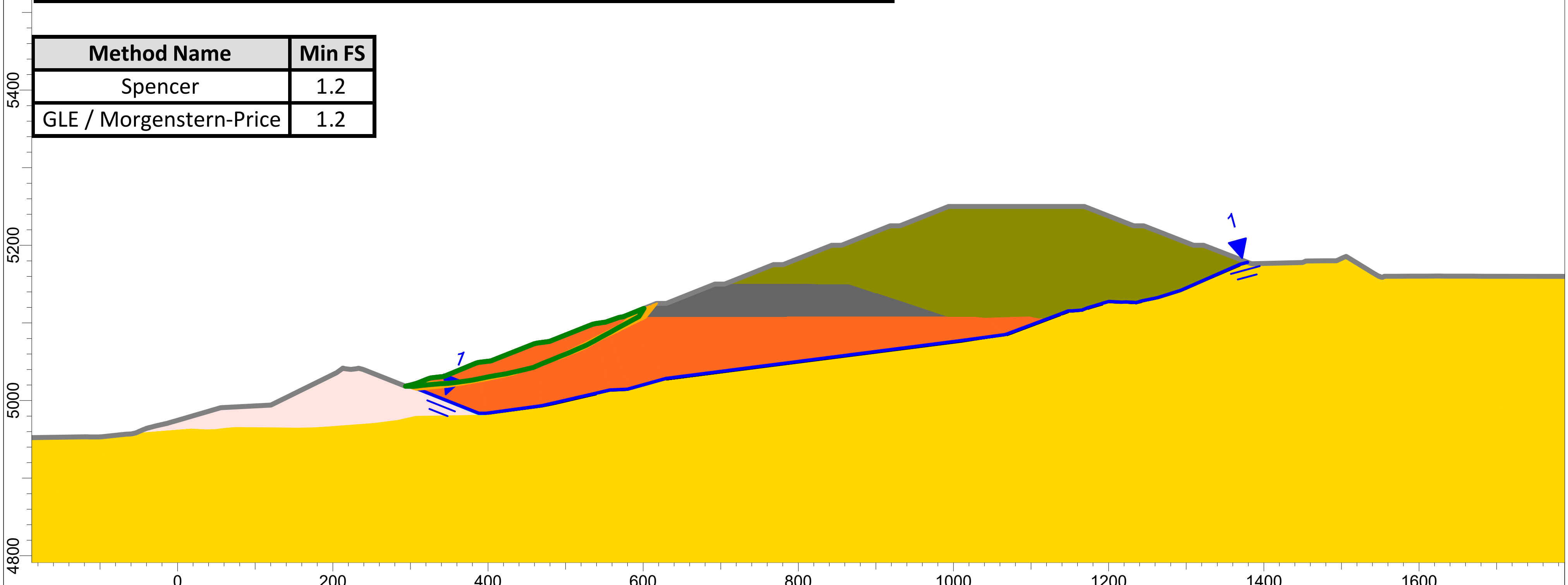
	Analysis Description Section B - Static Loading Conditions			
	Drawn By S. Amieiro	*Scale* 1:2300	*Company* South32 Hermosa Inc.	
SLIDEINTERPRET 9.028	*Date Printed* 8/10/2023		*File Name* Section B.slmd	

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)	Shear/ Normal Function	a	b	Water Surface
Production Tailings - PS		125	Mohr-Coulomb	0	28				Piezometric Line 1
Reclaim Tailings - PS		130	Mohr-Coulomb	0	27				Piezometric Line 1
Engineered Fill		135	Mohr-Coulomb	0	32				None
HDPE/GCL		120	Shear/ Normal Function			Non-Linear Function			None
HDPE/LPSL		135	Power Curve				0.908	0.9174	None
Foundation		130	Mohr-Coulomb	0	38				None

Method Name	Min FS
Spencer	1.2
GLE / Morgenstern-Price	1.2



NewFields

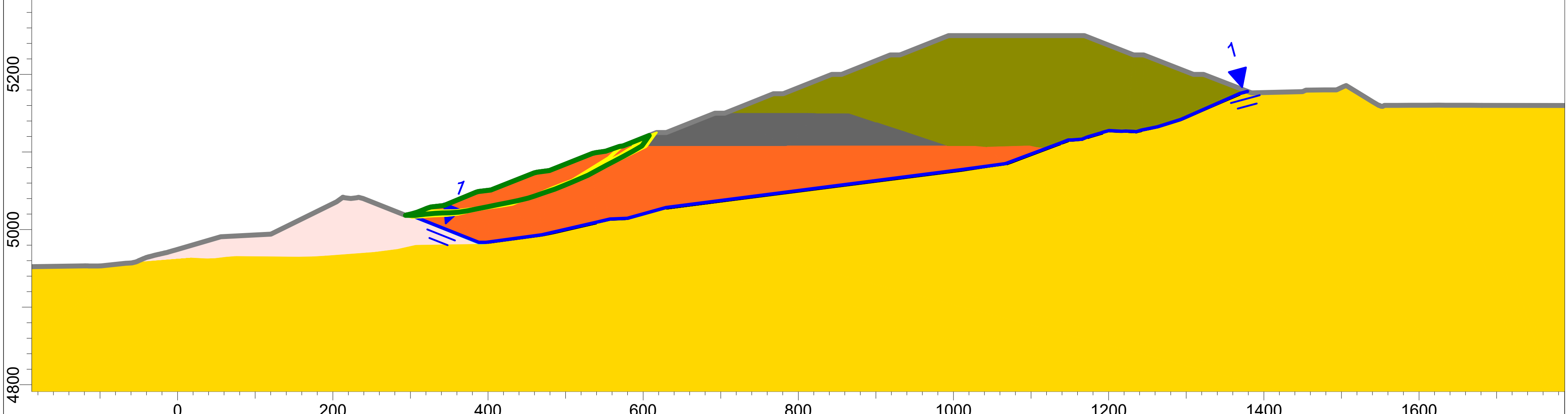
Hermosa Project TSF1 Design

Analysis Description	Section B - Pseudostatic Loading Conditions		
Drawn By S. Amieiro	*Scale* 1:2300	*Company* South32 Hermosa Inc.	
Date Printed 8/10/2023		*File Name* Section B.slmd	

SLIDEINTERPRET 9.028

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)	Shear/ Normal Function	a	b	Water Surface
Production Tailings - PS		125	Mohr-Coulomb	0	28				Piezometric Line 1
Reclaim Tailings - PS		130	Mohr-Coulomb	0	27				Piezometric Line 1
Engineered Fill		135	Mohr-Coulomb	0	32				None
HDPE/GCL		120	Shear/ Normal Function			Non-Linear Function			None
HDPE/LPSL		135	Power Curve				0.908	0.9174	None
Foundation		130	Mohr-Coulomb	0	38				None

Method Name	Min FS
Spencer	1.6
GLE / Morgenstern-Price	1.6



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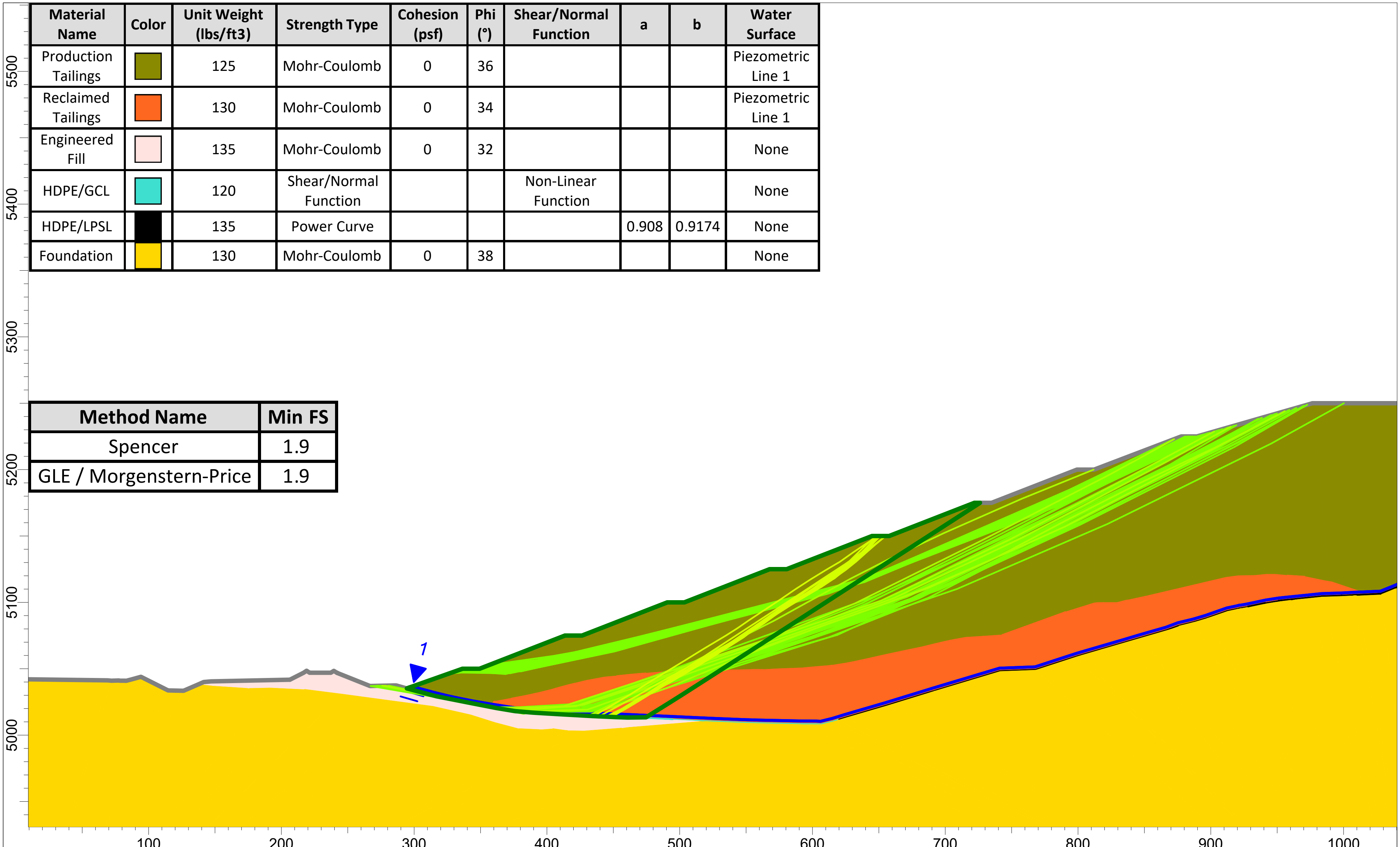
	Analysis Description Section B - Post Seismic Loading Conditions		
	Drawn By S. Amieiro	*Scale* 1:2300	*Company* South32 Hermosa Inc.
SLIDEINTERPRET 9.028	*Date Printed* 8/10/2023		*File Name* Section B.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)	Shear/Normal Function	a	b	Water Surface
Production Tailings		125	Mohr-Coulomb	0	36				Piezometric Line 1
Reclaimed Tailings		130	Mohr-Coulomb	0	34				Piezometric Line 1
Engineered Fill		135	Mohr-Coulomb	0	32				None
HDPE/GCL		120	Shear/Normal Function			Non-Linear Function			None
HDPE/LPSL		135	Power Curve				0.908	0.9174	None
Foundation		130	Mohr-Coulomb	0	38				None

Method Name	Min FS
Spencer	1.9
GLE / Morgenstern-Price	1.9



NewFields

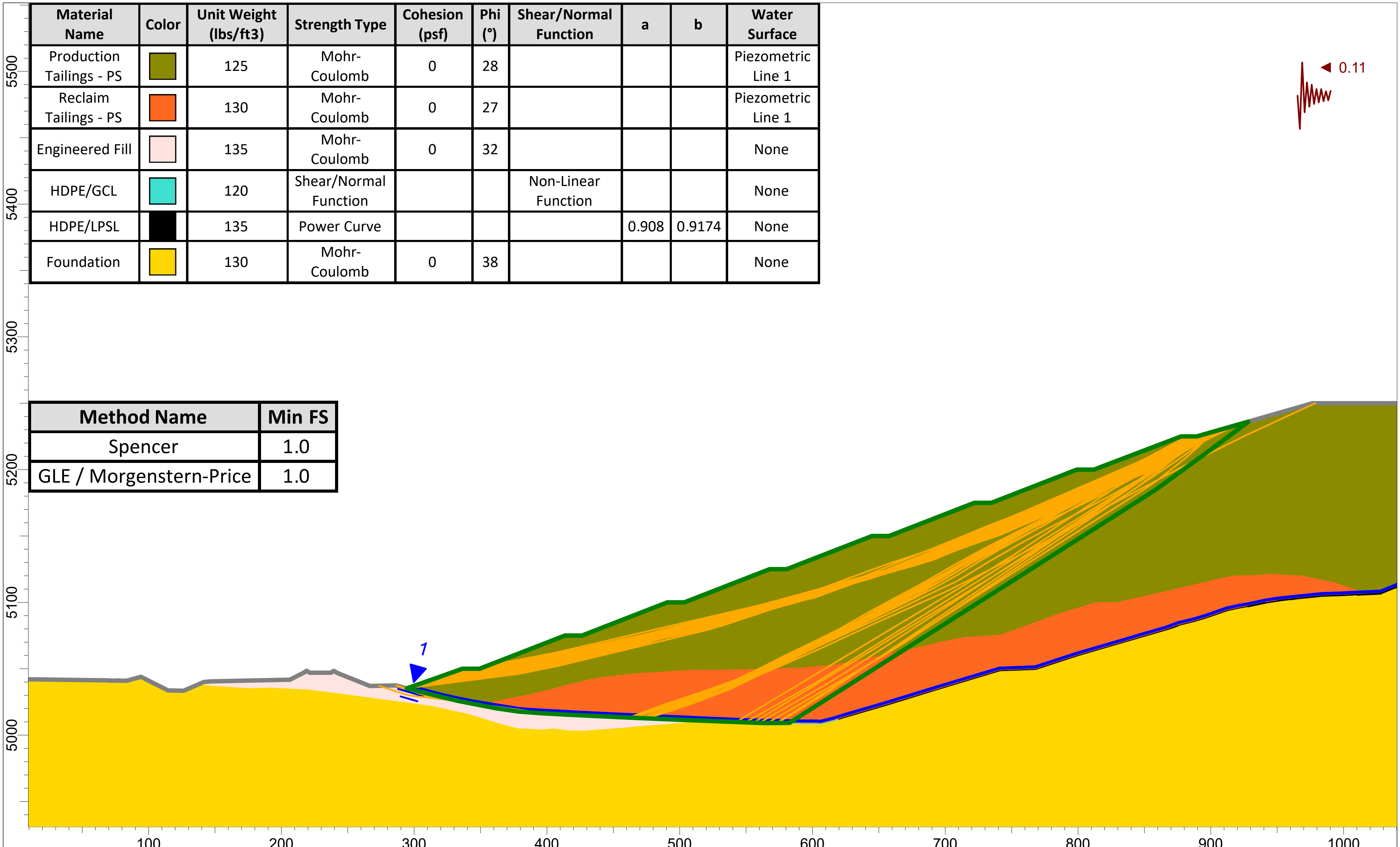
Hermosa Project TSF1 Design

Analysis Description	Section C - Static Loading Conditions		
Drawn By S. Amieiro	*Scale* 1:1200	*Company* South32 Hermosa Inc.	
Date Printed 8/10/2023		*File Name* Section C.slmd	

SLIDEINTERPRET 9.028

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)	Shear/Normal Function	a	b	Water Surface
Production Tailings - PS		125	Mohr-Coulomb	0	28				Piezometric Line 1
Reclaim Tailings - PS		130	Mohr-Coulomb	0	27				Piezometric Line 1
Engineered Fill		135	Mohr-Coulomb	0	32				None
HDPE/GCL		120	Shear/Normal Function			Non-Linear Function			None
HDPE/LPSL		135	Power Curve				0.908	0.9174	None
Foundation		130	Mohr-Coulomb	0	38				None

Method Name	Min FS
Spencer	1.0
GLE / Morgenstern-Price	1.0



NewFields

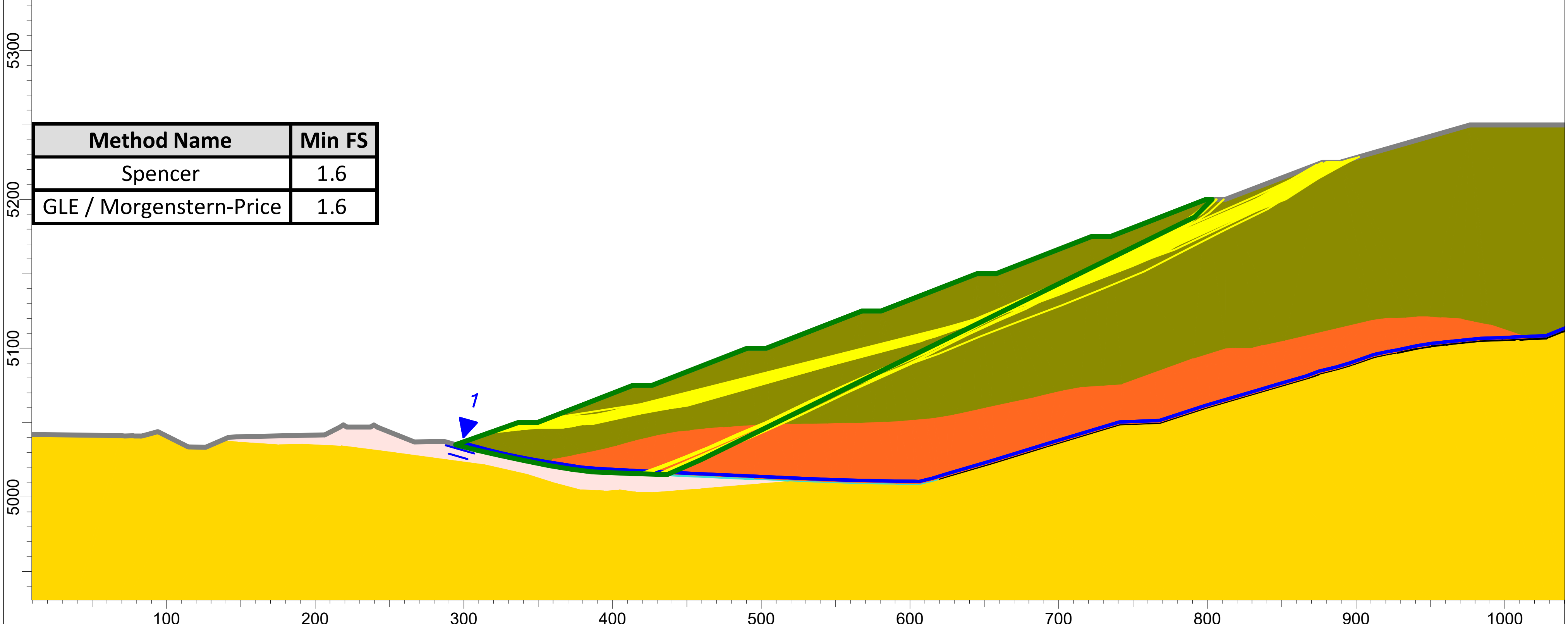
Hermosa Project TSF1 Design

Analysis Description	Section C - Pseudostatic Loading Conditions		
Drawn By S. Amieiro	*Scale* 1:1200	*Company*	South32 Hermosa Inc.
Date Printed	8/10/2023	*File Name*	Section C.slmd

SLIDEINTERPRET 9.028

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)	Shear/Normal Function	a	b	Water Surface
Production Tailings - PS		125	Mohr-Coulomb	0	28				Piezometric Line 1
Reclaim Tailings - PS		130	Mohr-Coulomb	0	27				Piezometric Line 1
Engineered Fill		135	Mohr-Coulomb	0	32				None
HDPE/GCL		120	Shear/Normal Function			Non-Linear Function			None
HDPE/LPSL		135	Power Curve				0.908	0.9174	None
Foundation		130	Mohr-Coulomb	0	38				None

Method Name	Min FS
Spencer	1.6
GLE / Morgenstern-Price	1.6



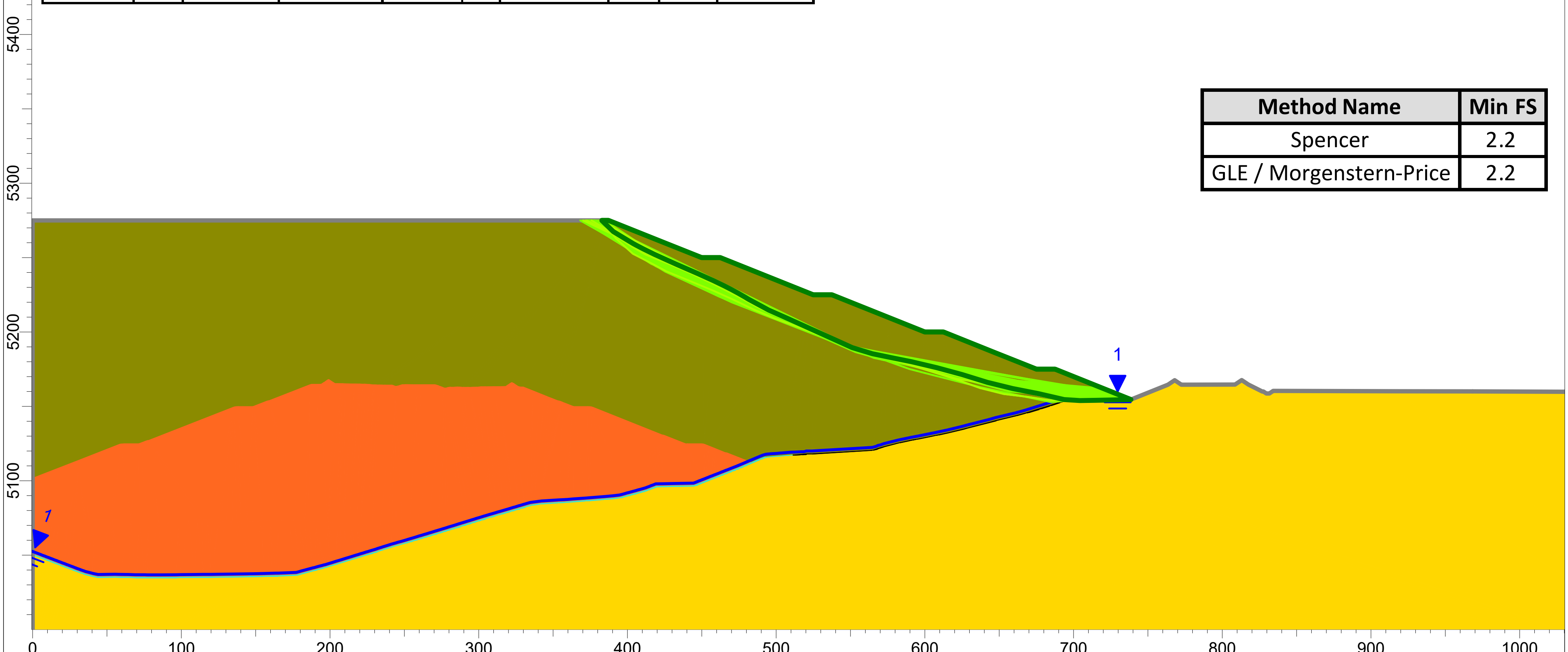
NewFields

SLIDEINTERPRET 9.028

Hermosa Project TSF1 Design			
Analysis Description	Section C - Post Seismic Loading Conditions		
Drawn By S. Amieiro	*Scale* 1:1200	*Company* South32 Hermosa Inc.	
Date Printed 8/10/2023		*File Name* Section C.slmd	

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)	Shear/ Normal Function	a	b	Water Surface
Production Tailings		125	Mohr-Coulomb	0	36				Piezometric Line 1
Reclaimed Tailings		130	Mohr-Coulomb	0	34				Piezometric Line 1
HDPE/GCL		120	Shear/ Normal Function			Non-Linear Function			None
HDPE/LPSL		135	Power Curve				0.908	0.9174	None
Foundation		130	Mohr-Coulomb	0	38				None

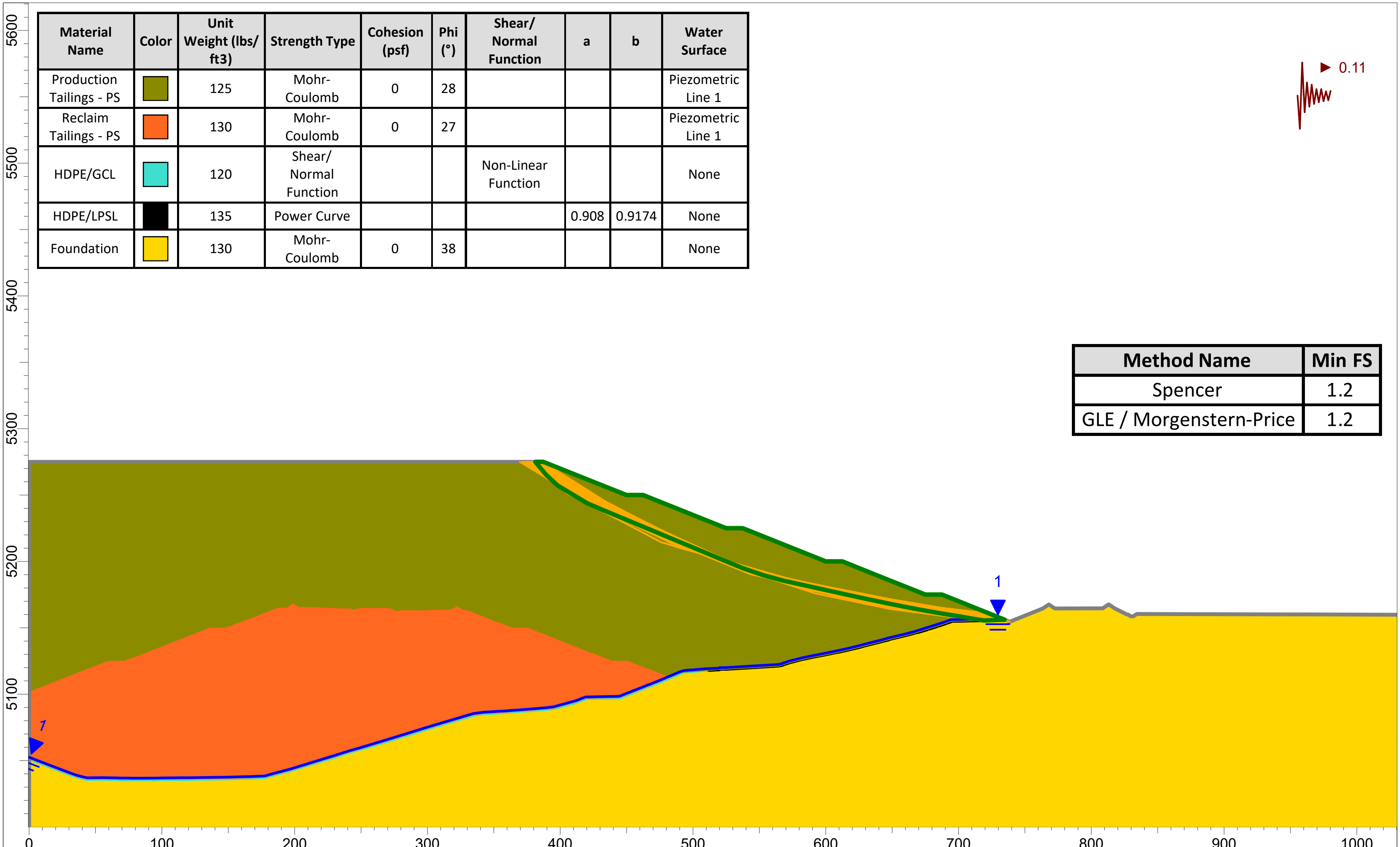
Method Name	Min FS
Spencer	2.2
GLE / Morgenstern-Price	2.2



NewFields	Hermosa Project TSF1 Design		
	Analysis Description Section D - Static Loading Conditions		
	Drawn By S. Amieiro	*Scale* 1:1200	*Company* South32 Hermosa Inc.
SLIDEINTERPRET 9.028	*Date Printed* 8/10/2023		*File Name* Section D.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)	Shear/ Normal Function	a	b	Water Surface
Production Tailings - PS		125	Mohr-Coulomb	0	28				Piezometric Line 1
Reclaim Tailings - PS		130	Mohr-Coulomb	0	27				Piezometric Line 1
HDPE/GCL		120	Shear/ Normal Function			Non-Linear Function			None
HDPE/LPSL		135	Power Curve				0.908	0.9174	None
Foundation		130	Mohr-Coulomb	0	38				None

Method Name	Min FS
Spencer	1.2
GLE / Morgenstern-Price	1.2



NewFields

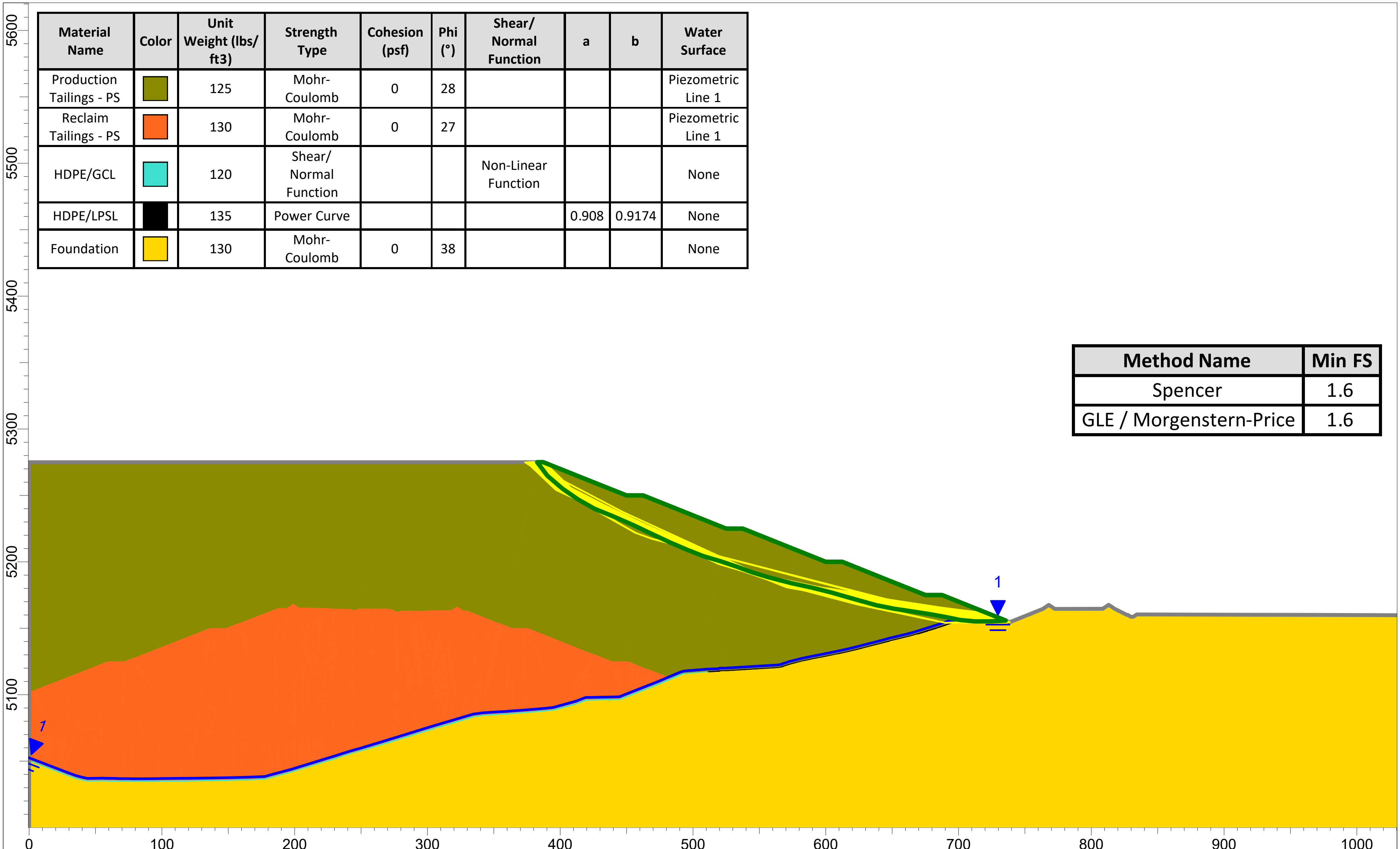
SLIDEINTERPRET 9.028

Hermosa Project TSF1 Design

Analysis Description Section D - Pseudostatic Loading Conditions

Drawn By S. Amieiro *Scale* 1:1200 *Company* South32 Hermosa Inc.

Date Printed 8/10/2023 *File Name* Section D.slmd



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)	Shear/ Normal Function	a	b	Water Surface
Production Tailings - PS		125	Mohr-Coulomb	0	28				Piezometric Line 1
Reclaim Tailings - PS		130	Mohr-Coulomb	0	27				Piezometric Line 1
HDPE/GCL		120	Shear/ Normal Function			Non-Linear Function			None
HDPE/LPSL		135	Power Curve				0.908	0.9174	None
Foundation		130	Mohr-Coulomb	0	38				None

Method Name	Min FS
Spencer	1.6
GLE / Morgenstern-Price	1.6

NewFields

SLIDEINTERPRET 9.028

Hermosa Project TSF1 Design

Analysis Description	Section D - Post Seismic Loading Conditions		
Drawn By S. Amieiro	*Scale* 1:1200	*Company*	South32 Hermosa Inc.
Date Printed	8/10/2023	*File Name*	Section D.slmd

APPENDIX I

Water Balance

Ecological Resource Consultants, LLC
225 Union Blvd, Suite 325 ~ Lakewood, CO ~ 80228 ~ (303) 679-4820

Technical Memorandum

Date: December 20, 2023

To: Craig Thompson, NewFields

From: Troy Thompson/Sharad Upadhyaya

Re: TSF Water Balance Assessment

1.0 Introduction

Ecological Resource Consultants, LLC (ERC) was retained by NewFields to complete an updated assessment of the water balance analysis for the Tailings Storage Facility 1 (TSF1) located at the Hermosa Project near Patagonia, AZ. The model includes the following facilities: TSF1, the existing external Underdrain Collection Pond (UDCP) located downstream of TSF1, the existing Water Treatment Plant 1 (WTP1), and the existing Water Treatment Plant 2 (WTP2). Inflows to the facilities are based on direct precipitation and runoff/seepage from the developing TSF footprint and inflows from mine workings. Water release occurs via the water treatment plants. The purpose of this water balance analysis is to determine the pumping rates required at the UDCP to maintain freeboard for the estimated lifespan of the mine given the constructed size of the existing UDCP and planned operations. The model shows the fluctuation of water volume in the UDCP based on anticipated inflows and water treatment rates and establishes the maximum operational storage capacity considering the design criteria established for the UDCP. Results obtained from the water balance model are presented below.

2.0 Objectives

The water balance is an important planning and operational consideration of this project. Mine practices and regulations prohibit the release of contact water (water that comes into contact with the tailings or other potentially contaminated workings) to the natural environment. To meet this requirement, the systems must be sized correctly. An understanding of water volume fluctuations in the UDCP given a range of potential meteorological conditions from year to year and at different times of the year is critical to manage water within the system.

Water volumes reporting to the UDCP are dependent on the evolving configuration of the lined TSF footprint, the runoff characteristics of exposed areas (i.e., geomembrane liner, tailings, protective layer, etc.) and daily precipitation and evaporation rates. Other factors that impact the water balance include inflows to the WTP1 from historic mine workings and operational elements including enhanced evaporation and water treatment. The water balance model was developed as a tool to aid in water management and assist with future water management decisions.

The model is configured to determine minimum pumping requirements necessary to maintain water levels at or below the UDCP freeboard elevation considering the daily inflows and outflows in addition to a theoretical design storm. The model also evaluates the system's response to an extreme wet condition with an approximately 1 in 1,000 annual exceedance probability.

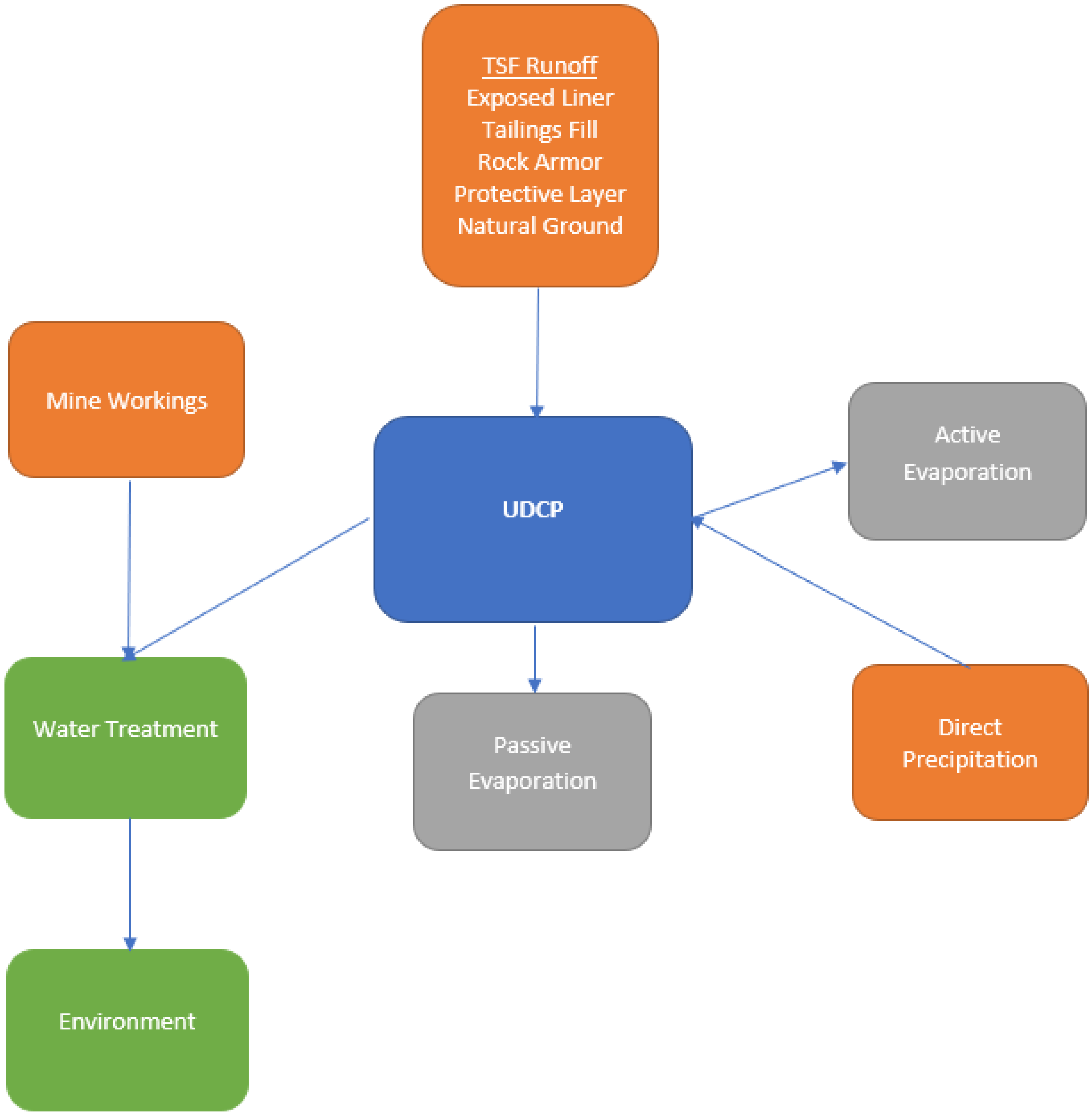
3.0 Water Balance Components

The water balance model was configured based on a daily time-step and tracks inflows to and losses from the system. The model calculates the resulting storage in the UDCP at the end of each day. Inflows and losses that contribute to the water balance are summarized in **Table 3.1**. **Figure 3.1** shows a schematic of the water balance as it is configured in the model.

Table 3.1 – Water Balance Components

Water Inputs	System Losses
Precipitation	Passive Evaporation
Stormwater Runoff	Active Evaporation
Tailings Draindown	Pumping to WTP1 from UDCP
Historic Mine Workings	Pumping to WTP2 from UDCP

Figure 3.1. Water Balance Model Schematic



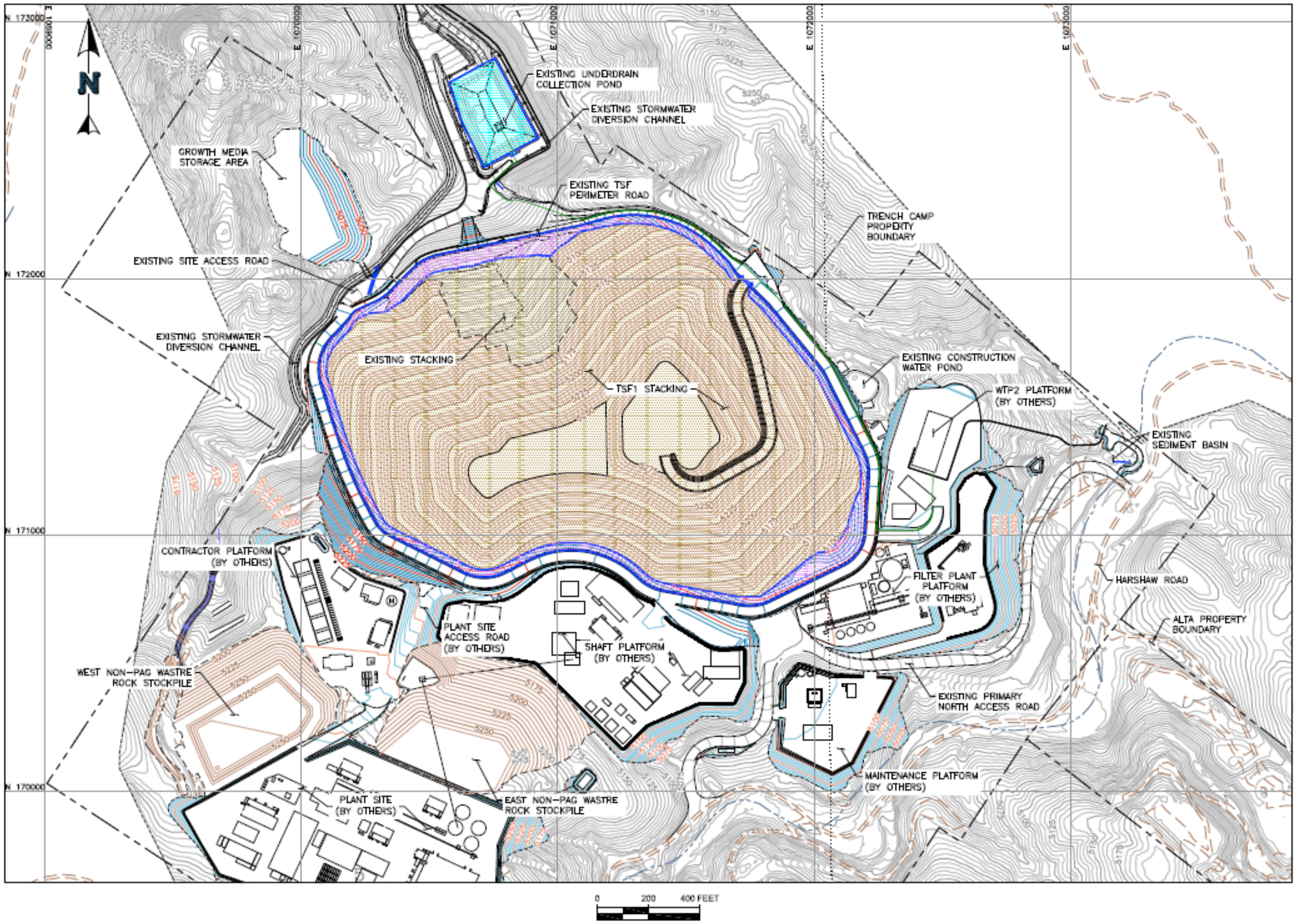
3.1 Water Balance Components

The water balance incorporates water inputs into the system based on existing and the proposed future conditions (TSF1). Inputs that contribute water to the UDCP include direct rainfall on the geomembrane lined footprint of the pond, stormwater runoff and percolation from the TSF, and inputs from dewatering mine workings. Runoff from the TSF is subdivided into runoff based on the various land types that exist and include the exposed geomembrane liner, tailings surface and a rock armor layer, a protective layer placed over geomembrane liner and natural ground. All water that enters the TSF/UDCP is considered contact water which requires treatment before it can be released. The model is configured to allow a maximum pumping rate of 120 gallons per minute (gpm) from the UDCP to WTP1. The maximum pumping rate from the UDCP to WTP2 was allowed to vary to evaluate the impacts on stored water in the UDCP. In addition to treatment, water from the UDCP is eliminated from the system through both passive and active evaporation.

The model tracks normal daily inflows and runoff/percolation to the UDCP. Pond storage volumes are tracked against capacities. A site map prepared by NewFields showing the different elements and their locations is provided as **Figure 3.2**.

The existing TSF, UDCP and WTP1 were constructed from 2017 through 2020 in Stages 1 and 2 as part of the Voluntary Remediation Program (VRP). Subsequently, WTP2 was constructed from 2022 to 2023. As part of a transition to mining production, the existing TSF will require an expansion which includes expansion of the TSF geomembrane lined area for placement of future filtered tailings. No modifications are proposed to the existing UDCP (except potential pumping rate changes).

Figure 3.2. Site Map with Water Balance Components



TSF MATERIAL AREAS	
	AREA (SF)
GEOMEMBRANE – UNDERDRAIN COLLECTION POND	80,760
PROTECTIVE LAYER – TSF	220,664
TAILINGS OR ROCK ARMOR	2,150,308

NOTE:

1. RECLAIM PIPE (DESIGNED BY OTHERS) RUNS FROM THE EXISTING UNDERDRAIN COLLECTION POND TO WTP2.

4.0 TSF and UDCP Design Criteria

South32 is utilizing the following design standards, regulations, and/or guidelines for the TSF1 and UDCP at the Hermosa Project:

- Arizona Department of Environmental Quality (ADEQ) Best Available Demonstrated Control Technology (BADCT) guidance manual.
- Arizona Department of Water Resources (ADWR) Dam Safety Regulations. ADWR Dam Safety Regulations apply to the UDCP.
- Australian National Committee on Large Dams (ANCOLD) Guidelines on Tailings Dams.
- Global Industry Standard on Tailings Management (GISTM).
- South32 Dam Management Standard (South32 requirements within company).

Standards, regulations, and/or guidelines pertinent to the water balance analysis are design storms requiring containment of contact water. The required design storms are listed below:

- ADEQ BADCT guidance manual specifies the 100-year/24-hour storm event with an additional 2 ft of freeboard.
- ANCOLD guidance manual specifies the 100-year/72-hour storm event with an additional 1.64 ft (0.5 m) freeboard (fall back method).

Please note, the TSF passes all water via gravity to the UDCP for temporary storage prior to directing contact water to the treatment plants. Therefore, the water balance does not include water storage in the TSF. The UDCP requires modelling of water storage to establish maximum operational storage volume and pumping rates required to maintain adequate storage capacity for the design storms listed above.

4.0 Model Assumptions / Inputs

4.1 Facility Areas

The areas contributing runoff and direct precipitation to the UDCP considering the TSF1 expanded footprint were input to the water balance model. The land types and surface areas used to model runoff characteristics are presented in **Appendix A** as a function of time. Land type, rainfall and runoff characteristics of the different land types determine the stormwater runoff potential.

4.2 Climatologic and Hydrologic Inputs

4.2.1 *Precipitation*

The goal of the water balance model is to evaluate fluctuations in the water systems on a day-to-day basis. The site has distinct wet and dry seasons including a monsoon system that typically occurs in summer. Given the amount of rainfall that may occur on individual days and weeks, a daily time step was selected so that the model can predict responses to these short-duration events. To accomplish this, actual historic daily site precipitation and precipitation estimates that include modifications for future climate impact were included in the model. Daily precipitation values for the site from 2008-2022 were provided by South32 and represent a 14-year record of actual site data. **Table 4.2** presents precipitation totals for each month and year in the period of record. Site precipitation was missing for January 1 – February 6, 2018 (except for February 2nd). Data from 2017 was used to fill in the missing days to complete the table. The water balance model was set up to evaluate conditions over nine years of operations (2024 – 2032) utilizing precipitation that mimics actual values from 2008 – 2022.

It Is worth noting that 2017 contained an extreme wet period that included several extreme precipitation events in July of that year's monsoon season. A peak daily precipitation amount of 4.56 inches was recorded on July 22nd. In the seven days from July 16 – July 22 a total of 12.39 inches of rainfall were recorded including 3.47 inches on July 16th. For comparison the 24-hour 25-year, 50-year and 100-year storm events for the site are 3.93 inches, 4.40 inches and 4.88 inches, respectively (ERC 2017). The 30-day stretch of July 12th through August 10th produced 18.1 inches of rainfall. The large rain events in this period have a recurrence interval greater than the 1,000-year storm meaning there is less than a 1-in-1,000 chance of this reoccurring. Modeling the performance of the TSF and UDCP using 2017 precipitation provides an understanding of how the system would perform in a scenario that is extremely unlikely to occur during the relatively short operational lifetime of the facility.

Table 4.2. Monthly Precipitation Totals (2008-2022) in inches

Yr/Mon	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2008	0.87	0.90	3.44	0.00	0.89	0.49	7.19	4.66	2.63	0.33	0.60	1.03	**23.03**
2009	0.25	0.71	2.42	0.18	0.45	0.90	2.53	3.26	3.92	0.85	0.04	1.00	**16.51**
2010	4.78	2.82	3.44	0.63	0.00	0.00	6.51	5.47	3.60	0.72	0.05	1.08	**29.10**
2011	0.27	0.40	2.01	0.48	0.00	0.00	6.34	4.09	5.00	0.09	1.37	2.96	**23.01**
2012	0.17	0.04	2.92	0.13	0.48	0.53	4.61	7.13	1.64	0.00	0.19	1.71	**19.55**
2013	1.54	0.72	0.35	0.00	1.00	0.35	4.10	2.70	2.95	0.00	1.09	0.65	**15.45**
2014	0.01	0.12	4.02	0.03	0.00	0.01	5.74	5.82	6.96	1.90	0.00	1.17	**25.78**
2015	2.79	0.17	0.94	0.63	0.19	3.44	4.42	4.94	2.97	1.62	0.77	0.84	**23.72**
2016	2.30	1.00	0.00	0.00	0.00	1.05	2.85	5.65	4.30	0.00	0.20	1.65	**19.00**
2017	1.79	0.46	0.00	0.09	0.38	0.27	17.63	3.59	0.04	0.11	0.12	0.79	**25.27**
2018	1.79	4.45	0.91	0.01	0.21	1.29	5.07	4.30	1.97	4.48	0.24	1.94	**26.65**
2019	2.05	2.94	1.73	0.50	0.79	0.74	3.65	4.99	3.57	0.30	6.57	1.74	**29.56**
2020	0.41	0.94	2.65	0.08	0.61	0.68	4.33	4.19	0.50	0.01	0.34	0.54	**15.24**
2021	1.96	0.01	0.24	0.00	0.00	0.03	6.73	5.60	1.65	0.00	0.04	1.81	**18.07**
2022	0.85	0.73	0.94	0.00	0.30	2.65	5.25	7.02	2.26	1.16	0.42	3.47	**25.05**

As part of the water balance analysis, the system was evaluated for a 100-year, 24-hour storm occurring at the end of each day over a period of average precipitation. For this assessment, precipitation from 2011 was selected to represent average conditions. The total precipitation recorded in 2011 of 23.01 inches was 3% greater than the 15-year average. Monthly totals from July, August and September of 2011 were 6.34 inches, 4.09 inches and 5.00 inches, respectively. Each of these monthly totals exceeds the average monthly total during the monsoon season. ERC considers the 2011 dataset to be a conservative representation of average conditions.

4.2.1.1 Climate Change

Because this analysis includes predicting precipitation and evaporation from the current time through 2032, climate change effects were considered. Based on the NewFields TSF1 APP Significant Amendment Design Report from December 2023, annual precipitation is expected to decrease in future years while rainfall from the design storms is predicted to increase (NewFields, 2023). Evaporation is also expected to increase because climate change is anticipated to result in an increase in solar radiation and wind speed, both of which increase evaporation. **Table 4.3** summarizes the percent changes expected for the Representative Concentration Pathways (RCP) 4.5 and 8.5. RCP 4.5 is described by the Intergovernmental Panel on Climate Change (IPCC) as a moderate scenario in which emissions peak around 2040 and then decline. RCP 8.5 is the highest baseline emissions scenario in which emissions continue to rise throughout the twenty-first century.

Since this water balance model was run for a period of 2024 to 2032, the 2030 scenario was considered more representative than the 2050 or 2090 scenario and used for our assessment. The two predictions suggest that by 2030 average annual precipitation is expected to decrease by between 3.6% and 10.2%. Over this same period the 100-year storm is predicted to increase by between 6.5% and 7%. For conservatism to ensure adequate capacity is maintained, no reductions in the amount of annual precipitation or changes in annual evaporation were assumed while the 100-year storm volume was increased by 7%.

Table 4.3. Climate Change Summary

Climate Parameter	Description	Percent Modifications (%)					
		RCP 4.5			RCP 8.5		
		2030	2050	2090	2030	2050	2090
Rainfall	Annual Average	-10.2	-12.2	-11.5	-3.6	-7.5	-8.1
Rainfall	Design Storm Intensity 100-yr,	+6.5	+10.1	+13.8	+7.0	+13.0	+27.4
Solar Radiation	Annual Mean Daily Solar Exposure	+0.2	+0.3	+0.4	+0.2	+0.4	+0.8
Wind Speed	Annual Near Surface Wind Speed	+1.1	+1.7	+2.2	+1.3	+2.3	+4.7

4.2.1.2 Design Storm

To meet freeboard requirements set by Arizona and the ANCOLD, precipitation depths caused by the 100-year, 24-hour recurrence interval storm at the project site were obtained from NOAA Atlas 14 Point Precipitation Frequency Data Server. The state of Arizona requires containment of the 100yr-24hr storm volume on top of the maximum operational volume determined from water balance modeling (discussed in the paragraph below). ANCOLD requires containment of the 100yr-72hr storm volume on top of the maximum operational volume. These two prescriptive standards require a minimum freeboard of 2 ft and 1.64 ft (0.5m), respectively. Freeboard is measured from the maximum water surface elevation and the spillway invert on the UDCP.

Since this water balance model was run for a period of 2024 to 2032, the 2030 scenarios were considered as it is believed to best represent climate change over the period of operation for this facility. The two predictions suggest that by 2030 average annual precipitation is expected to decrease by between 3.6% and 10.2%. Over this same period the 100-year storm is predicted to increase by between 6.5% and 7%. For conservatism to ensure adequate capacity is maintained, no reductions in the amount of annual precipitation or changes in annual evaporation were assumed while the 100-year storm volume was increased by 7%. **Table 4.4** summarizes the precipitation depths with modifications set by the predicted climate change effects on design storm intensity for the year 2030.

Table 4.4. Design Storm 100-Year Precipitation

Storm Duration (hr)	2022 Precipitation (in)	2030 RCP8.5 Precipitation (in)
24	4.88	5.22
72	6.11	6.54

4.2.2 *Curve Numbers*

Curve Numbers were used to model the daily runoff to the system from daily precipitation. Curve numbers predict runoff from effective precipitation or the amount of precipitation available for runoff. Effective precipitation is the direct precipitation that is not intercepted, infiltrated or evaporated. Effective rainfall, E, using the NRCS CN method, is defined as

$$E = \frac{(P - I)^2}{(P + S - I)}$$

Where

P = daily precipitation
I = initial abstraction (or amount of rain absorbed before runoff is produced)
S = moisture retention of the soil.

Moisture retention is related to the curve number by the formula, $S = \left(\frac{1000}{CN} - 10\right)^{1.15}$. Antecedent Moisture Conditions (AMC) are intended to factor in the amount of precipitation and hence soil moisture in preceding days as that can influence runoff. The idea is that the more precipitation that has recently occurred, the wetter the soil and the greater the runoff can be expected to be. Curve numbers were increased to the wet AMC condition (called AMC3) when precipitation over the preceding five (5) days exceeded the initial abstraction for the given ground type. **Table 4.5** presents relevant curve number related values for the different land use types modeled.

Table 4.5. Curve Numbers Information for Modeled Land Types

Tributary Area	Curve Number
UDCP	100
Exposed Geomembrane Liner	100
Tailings Fill/Armor	95
Protective Layer	72
Natural Ground	72

4.2.3 Passive Evaporation Losses

Daily evaporation losses were modeled for the UDCP water surfaces, using monthly pond evaporation rates (ERC 2017). Monthly pond evaporation data was converted to daily values by dividing by the number of days in each month. The values of daily pond evaporation used for the free water surface in the UDCP are included in **Table 4.6**.

Table 4.6. Mean Monthly Evaporation

Month	Monthly Pond Evaporation (in)	Days per Month	Daily Evaporation (in)
January	2.26	31	0.07
February	2.71	28	0.10
March	3.94	31	0.13
April	4.48	30	0.15
May	6.44	31	0.21
June	7.50	30	0.25
July	3.72	31	0.12
August	3.40	31	0.11
September	3.33	30	0.11
October	4.27	31	0.14
November	3.13	30	0.10
December	2.14	31	0.07

4.2.4 Enhanced Evaporation Losses

In addition to passive evaporation, South32 can enhance evaporation from the UDCP using evaporative blowers, as needed. Currently, evaporative blowers are used rarely and only as a contingency at the UDCP. ERC estimated the monthly efficiency of the evaporative blowers by relating pan evaporation values at the Hermosa Project to measured monthly evaporator efficiencies and pan evaporation values at another site. **Table 4.7** shows estimated monthly evaporator efficiencies at the Hermosa Project.

Table 4.7. Estimated Evaporator Efficiencies at Hermosa Site

Month	Site Pan Evaporation (in)	Assumed Site Evaporator Efficiency (%)
January	3.13	10%
February	3.76	15%
March	5.47	50%
April	6.22	52%
May	8.94	56%
June	10.41	59%
July	5.16	48%
August	4.72	46%
September	4.63	46%
October	5.93	50%
November	4.35	24%
December	2.98	7%
Annual	65.70	39%

Losses from enhanced evaporation were taken as the total flow to the evaporators multiplied by the efficiency factors above. In the water balance model, it is assumed that three (3) evaporators are being run from July through September with a feed rate of 50 gpm and a utilization rate of 50%. No active evaporation (using evaporators) is modeled over the remaining nine months. For runs made to evaluate the capacity of the UDCP for the 100-year design storm, evaporators were assumed to not be operational to add conservatism to the analysis. For model runs which contain the 1 in 1,000 year wet period from 2017, evaporators were assumed to be operational.

4.3 UDCP Pond Geometry

Specific filling curve geometry for the existing UDCP was provided by NewFields and is presented in **Table 4.8**. In the table, purple denotes the pond crest, blue denotes the freeboard limit and green denotes the spillway invert. A dead pool volume representing the lowest level that the pond can be pumped down to with the in-situ pumping system, was defined to be water surface elevation of 4,920 ft, which corresponds to a depth of approximately 5ft. This water level corresponds to a dead pool volume of 8,033 $ft^{3.}$ This value is shown in red on the table.

Table 4.8. UDCP Geometry

ELEV	VOL CY	CU FT	GALLONS	MILLION GALLONS	AC-FT
4,915.0	0	0	0	0.00	0.00
4,916.0	27	734	5,488	0.01	0.02
4,917.0	46	1,252	9,363	0.01	0.03
4,918.0	73	1,961	14,672	0.01	0.05
4,919.0	122	3,289	24,601	0.02	0.08
4,920.0	298	8,033	60,090	0.06	0.18
4,921.0	580	15,661	117,142	0.12	0.36
4,922.0	899	24,280	181,616	0.18	0.56
4,923.0	1,253	33,833	253,069	0.25	0.78
4,924.0	1,643	44,348	331,722	0.33	1.02
4,925.0	2,069	55,859	417,825	0.42	1.28
4,926.0	2,533	68,394	511,589	0.51	1.57
4,927.0	3,036	81,976	613,184	0.61	1.88
4,928.0	3,579	96,631	722,802	0.72	2.22
4,929.0	4,162	112,387	840,653	0.84	2.58
4,930.0	4,788	129,273	966,960	0.97	2.97
4,931.0	5,456	147,321	1,101,961	1.10	3.38
4,932.0	6,169	166,564	1,245,899	1.25	3.82
4,933.0	6,927	187,034	1,399,017	1.40	4.29
4,934.0	7,732	208,765	1,561,561	1.56	4.79
4,935.0	8,585	231,788	1,733,774	1.73	5.32
4,936.0	9,487	256,136	1,915,899	1.92	5.88
4,937.0	10,439	281,842	2,108,179	2.11	6.47
4,938.0	11,442	308,938	2,310,857	2.31	7.09
4,939.0	12,498	337,454	2,524,156	2.52	7.75
4,940.0	13,608	367,417	2,748,279	2.75	8.43
4,941.0	14,773	398,858	2,983,455	2.98	9.16
4,942.0	15,993	431,807	3,229,917	3.23	9.91
4,943.0	17,270	466,297	3,487,900	3.49	10.70
4,944.0	18,606	502,358	3,757,641	3.76	11.53
4,945.0	20,001	540,024	4,039,381	4.04	12.40
4,946.0	21,457	579,326	4,333,357	4.33	13.30
4,947.0	22,974	620,296	4,639,811	4.64	14.24
4,948.0	24,554	662,966	4,958,982	4.96	15.22
4,949.0	26,199	707,368	5,291,110	5.29	16.24
4,950.0	27,909	753,535	5,636,439	5.64	17.30
4,951.0	29,685	801,499	5,995,214	6.00	18.40
4,952.0	31,529	851,293	6,367,673	6.37	19.54

4,953.0	33,443	902,948	6,754,048	6.75	20.73
4,954.0	35,426	956,493	7,154,567	7.15	21.96
4,955.0	37,480	1,011,960	7,569,458	7.57	23.23
4,956.0	39,607	1,069,378	7,998,950	8.00	24.55
4,957.0	41,807	1,128,779	8,443,270	8.44	25.91
4,958.0	44,081	1,190,193	8,902,646	8.90	27.32
4,959.0	46,431	1,253,650	9,377,305	9.38	28.78
4,960.0	48,859	1,319,182	9,867,479	9.87	30.28
4,961.0	51,364	1,386,829	10,373,484	10.37	31.84
4,962.0	53,951	1,456,670	10,895,889	10.90	33.44
4,963.0	56,621	1,528,772	11,435,218	11.44	35.10
4,964.0	59,375	1,603,126	11,991,384	11.99	36.80
4,965.0	62,214	1,679,786	12,564,800	12.56	38.56

4.4 Tailings

Water is expected to drain down through the base of the stacked filtered tailings. Filtered tailings draindown was modeled based on estimates of draindown occurring at the existing TSF (Stage 2) after periods of no precipitation (e.g., over 30 days of no precipitation). The current draindown rate is estimated at approximately 1 gpm. This flow rate was proportioned to the current TSF area and pro-rated for the proposed TSF1 expansion.

4.5 Miscellaneous Inflows

Additional water that may report to the system includes water from mine working. In the water balance model ERC assumed that inflows from mine workings are a constant 20 gpm to WTP1. It is expected that once production begins, dewatering will eliminate this inflow, but it was included in the model for conservatism.

4.6 Pumping

It was assumed that pumping would be used to draw down water levels in the ponds over time. From the UDCP, water would be pumped to both of the water treatment plants. A maximum pumping rate of 120 gpm was used from the UDCP to WTP1. The pumping rate from the UDCP to WTP2 was varied in the model to determine the corresponding water level in the UDCP and identify the minimum pumping rate necessary to meet freeboard requirements set by the state of Arizona and ANCOLD.

5.0 Model Runs and Results

The water balance model was developed using an analytical spreadsheet model developed in Microsoft Excel. The water balance calculated the daily storage volume in the UDCP as a function of the variable precipitation, the TSF1 geometry and different pumping capacities from the UDCP.

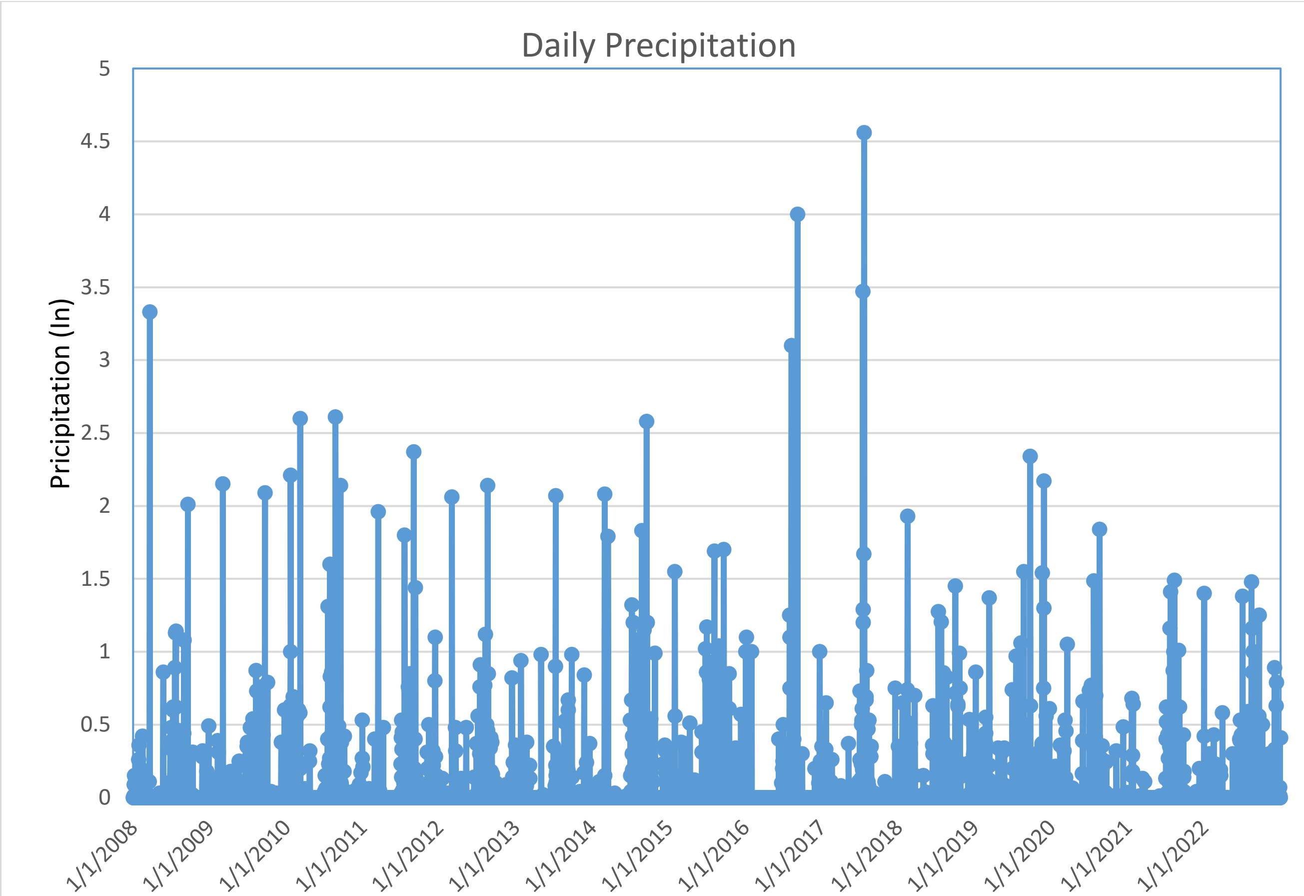
Two different conditions were evaluated. In the first condition the model evaluates the system's response to average precipitation plus the 100-year, 24-hour storm. Daily precipitation from 2011 was utilized to represent average precipitation. In the second condition, the model was run for variable precipitation utilizing the 15-years of available site data. These scenarios included evaluating the system's response to precipitation that occurred in 2017, that was comparable to a 1 in 1,000 wet period. For all runs, the model included a time period of January 2024 to September 2032 (105 months).

For the second condition evaluated, to understand how the system would respond to the different precipitation amounts and sequences, 15 different water balance runs were made. In the first model, observed site precipitation from 2008 was used for the first model year (2024), precipitation from 2009 was used for the second model year (2025) and so on with precipitation from 2016 used for the ninth (final) year of the model. In the second model run, precipitation from 2009 was used for the first year in the model with 2017 used for the last. This same pattern was followed for the fifteen model runs completed. When necessary, precipitation from 2008 followed 2022. This process allowed the model to evaluate the full set of site specific historic precipitation data that could occur at any time during planned TSF operations.

5.1 Precipitation

Monthly precipitation values from each of the fifteen years of data are presented in **Figure 5.1.** Note that the variability in precipitation presented in this figure provides the basis for the range of predicted results for other water balance elements. As discussed above, 2017 contained an extreme wet period that included several extreme precipitation events in July of that year's monsoon season. Modeling this extreme precipitation shows the effects of multiple large storms in a short period of time on the system. As noted above, the probability of this occurring during the life of the facility is extremely low given that the monsoon of 2017 resulted in precipitation totals that are expected to occur only roughly once every 1,000 years.

Figure 5.1. Modeled Precipitation

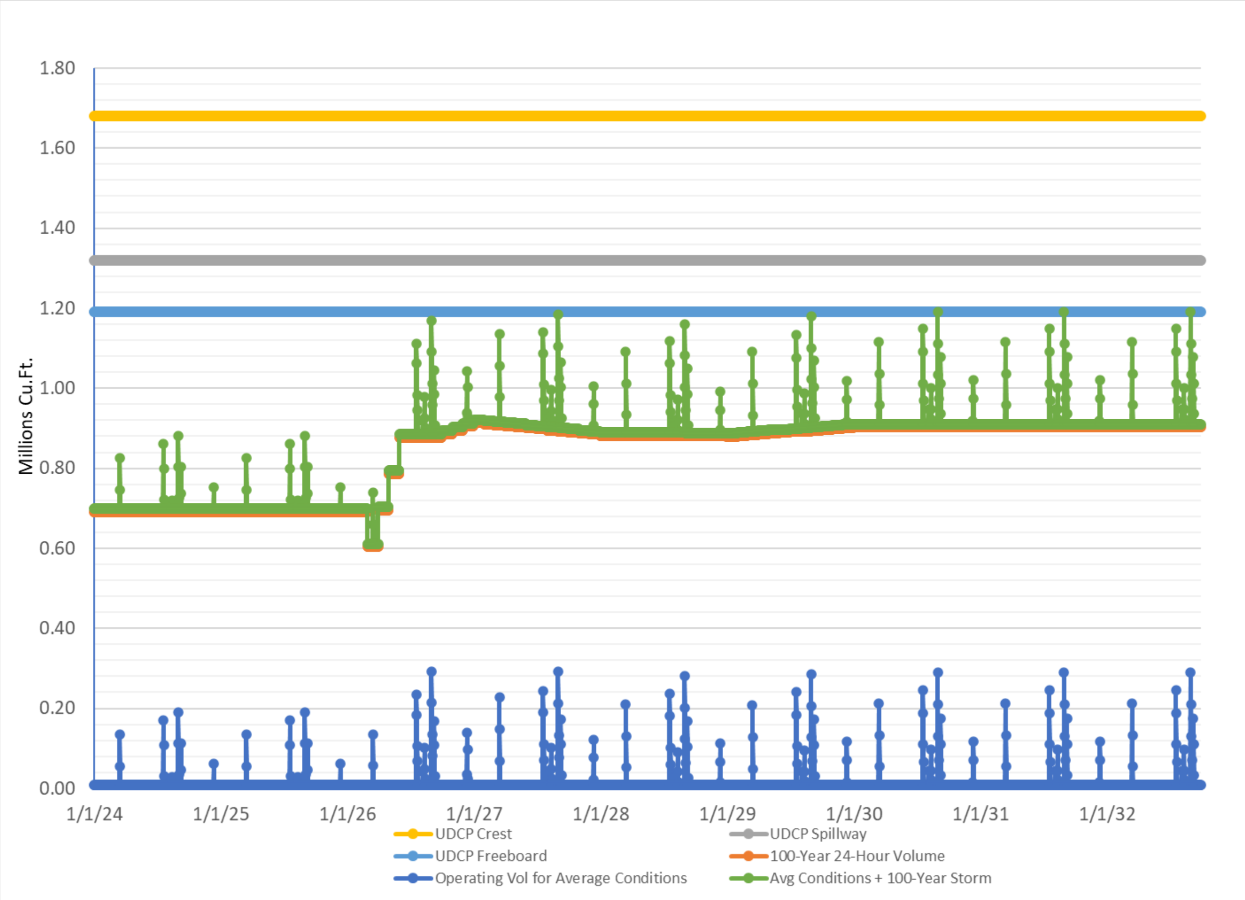


5.2 UDCP Results – Average Precipitation Plus 100-year, 24-Hour Storm

The model was run for average precipitation (2011 daily precipitation) and the 100-year, 24-hour storm event. Pumping capacities from the UDCP to water treatment were varied such that the additive volume of water stored in the UDCP for average precipitation and the 100-year storm volume were always maintained below the required two-foot freeboard level. For this assessment it was conservatively assumed that enhanced evaporation was not occurring at any time. It was determined that pumping capacity of 400 gpm from the UDCP to water treatment was required.

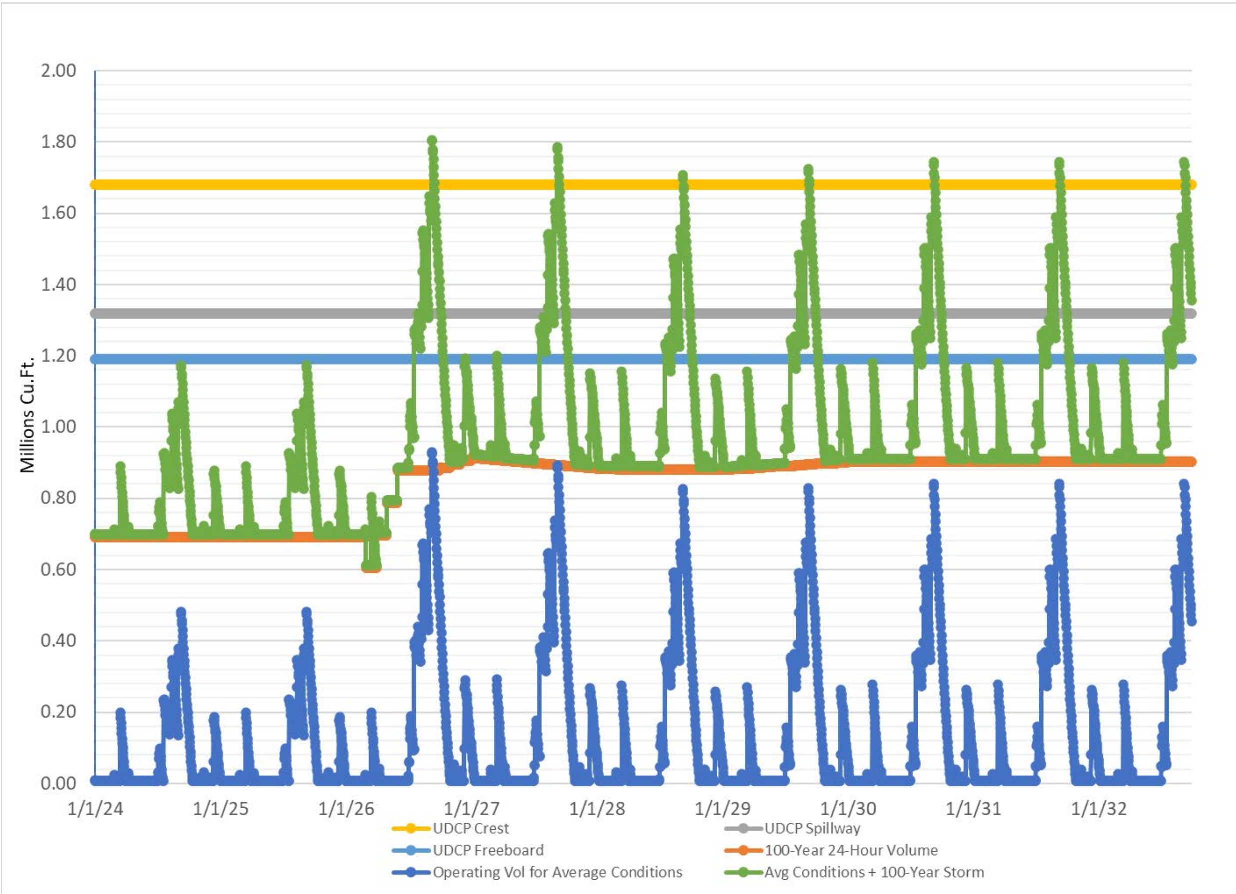
Figure 5.2 provides results of this run. The dark blue line shows the expected volume of water stored in the UDCP for average (2011) precipitation. The red line illustrates the 100-year, 24-hour storm volume and the green line presents the sum of the storm volume and the average operating volume. Results suggest that with pumping capacity of 400 gpm, water levels would approach the freeboard level with average conditions and the 100-year storm starting in 2026. In 2024 and 2025, water levels would remain well below the freeboard.

Figure 5.2. Average Precipitation and 100-Year, 24-Hour Storm with 400 gpm Pumping Capacity



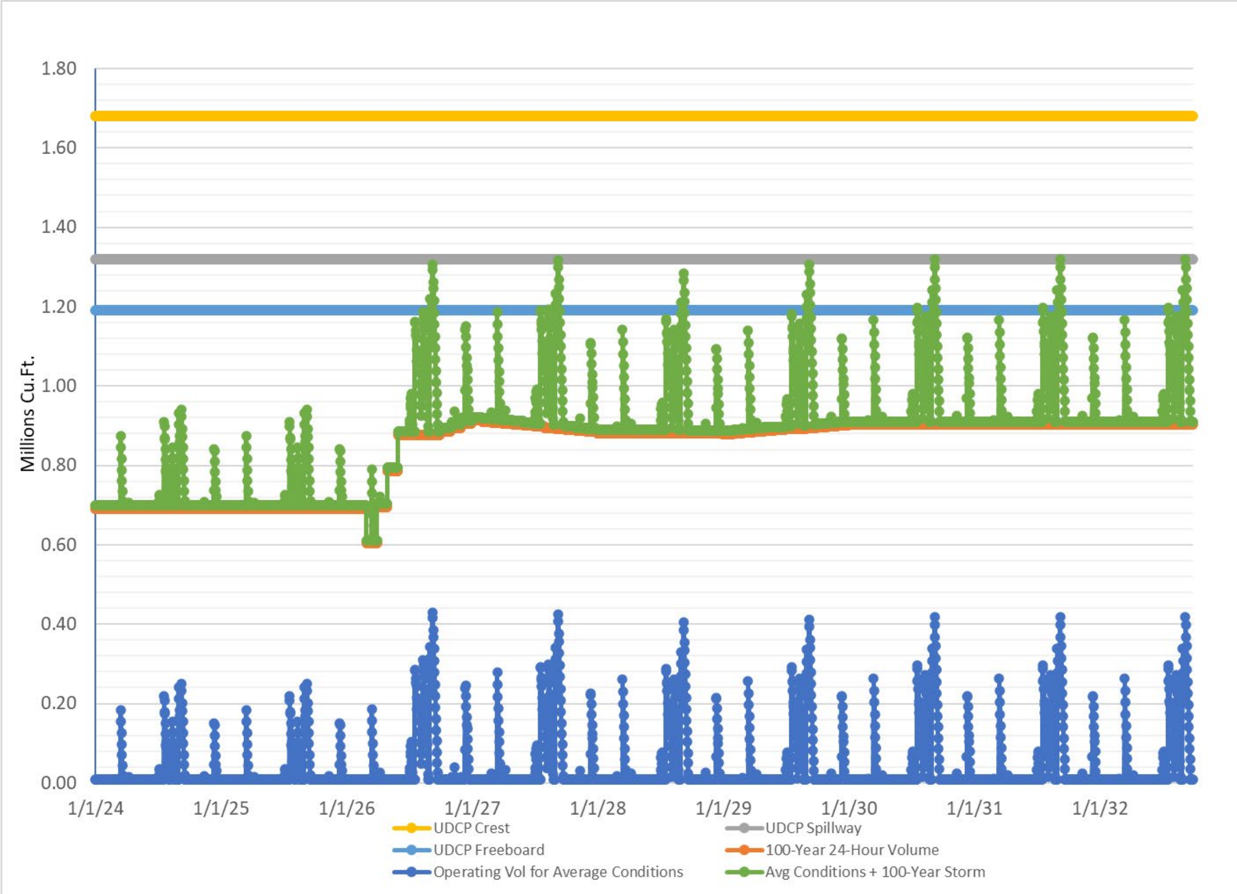
The model was run to identify required pumping in 2024 and 2025 necessary to maintain the level below the freeboard limit given average year conditions and the 100-year storm. Model runs indicate that at a UDCP pumping capacity of 65 gpm, adequate capacity would be maintained during these first two years of the model. Results from this model run are presented in **Figure 5.3**. As the figure indicates, while 65 gpm pumping capacity is adequate to control water levels through 2025, additional pumping capacity is necessary starting in 2026 due to impacts the expanded facility will have on water levels.

Figure 5.3. Average Precipitation and 100-Year, 24-Hour Storm with 65 gpm Pumping Capacity



The last assessment run using average conditions and the 100-year, 24-hour storm was an evaluation of the sensitivity of safe storage on pumping capacity. To understand the sensitivity of results to the modeled pumping capacity, the model was then run to determine the pumping rate required for water levels to approach but not exceed the spillway at any time. It was determined that with a pumping capacity of 140 gpm, water levels from average conditions plus the 100-year storm would just reach the spillway invert. **Figure 5.4** shows results for this model run. These results indicate that while a pumping capacity less than 400 gpm would not achieve the necessary freeboard, flow releases from the spillway would not be expected for minor variations in pumping.

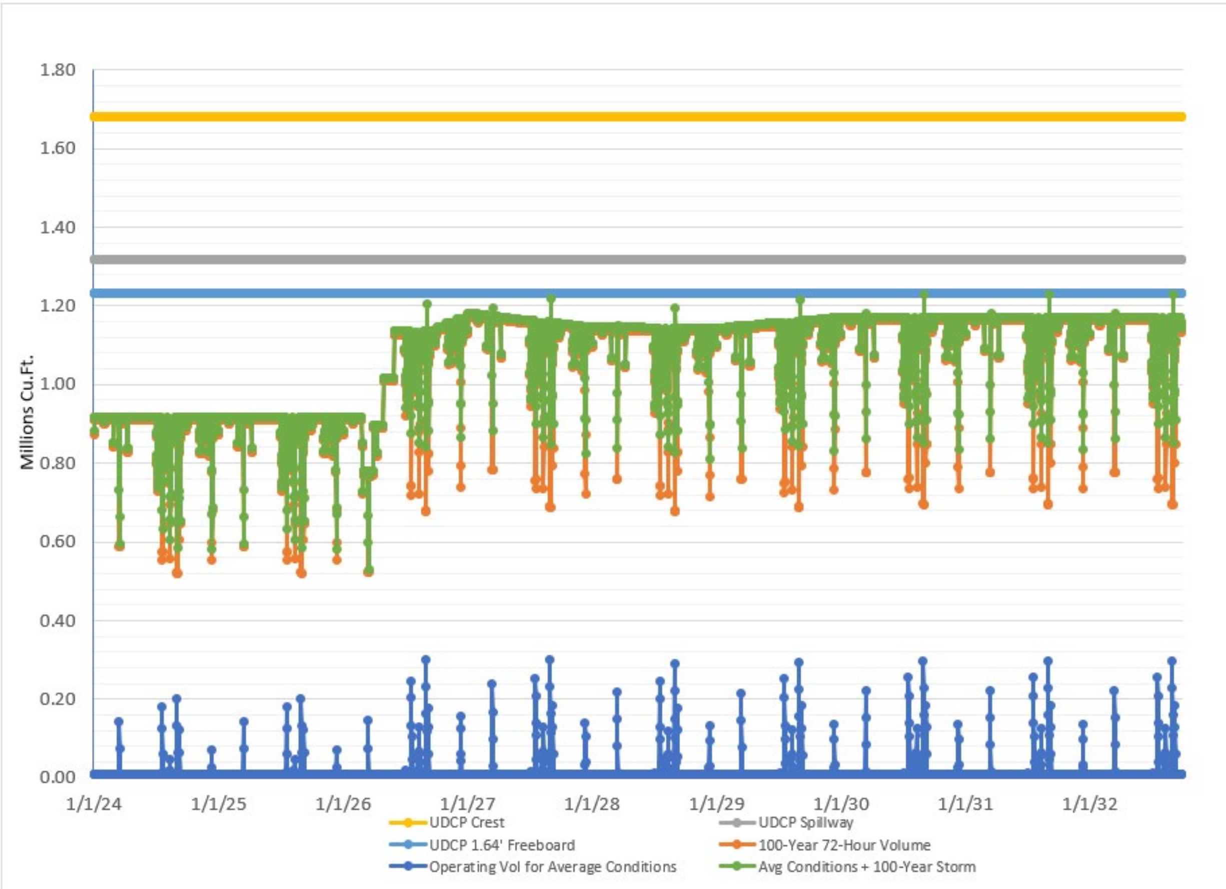
Figure 5.4. Average Precipitation and 100-Year, 24-Hour Storm with 140 gpm Pumping Capacity



5.3 UDCP Results – Average Precipitation Plus 100-year, 72-Hour Storm

The model was then run to evaluate response to the 100-year, 72-hour storm event. For conservatism and for model simplicity, depth of rainfall modeled for this evaluation on each day was the full 100-year, 72-hour storm depth of 6.54 inches minus the average daily precipitation from that day and the two preceding days. This is a conservative approach as in days with little to no preceding rainfall, the full 6.54 inches was assumed to occur in a 24-hour period rather than over three days. The model was run for average precipitation (2011 daily precipitation) and the 100-year, 72-hour storm event, the volume of which is added in a single day. Pumping capacities from the UDCP to water treatment were varied such that the additive volume of water stored in the UDCP for average precipitation and the 100-year storm volume were always maintained below the required 0.5 meter (1.64 feet) freeboard level. Similar to the evaluation for the 100-year, 24-hour storm, it was conservatively assumed that enhanced evaporation was not occurring at any time. It was determined that pumping capacity of 350 gpm from the UDCP to water treatment was required to meet this freeboard requirement. Results of the model run using 350 gpm pumping are shown on **Figure 5.5**. Given that greater pumping capacity is needed for the 24-hour event and two feet of freeboard, the 100-year 24-hour storm with 2-feet of freeboard was the controlling condition.

Figure 5.5. Average Precipitation and 100-Year, 72-Hour Storm with 350 gpm Pumping Capacity

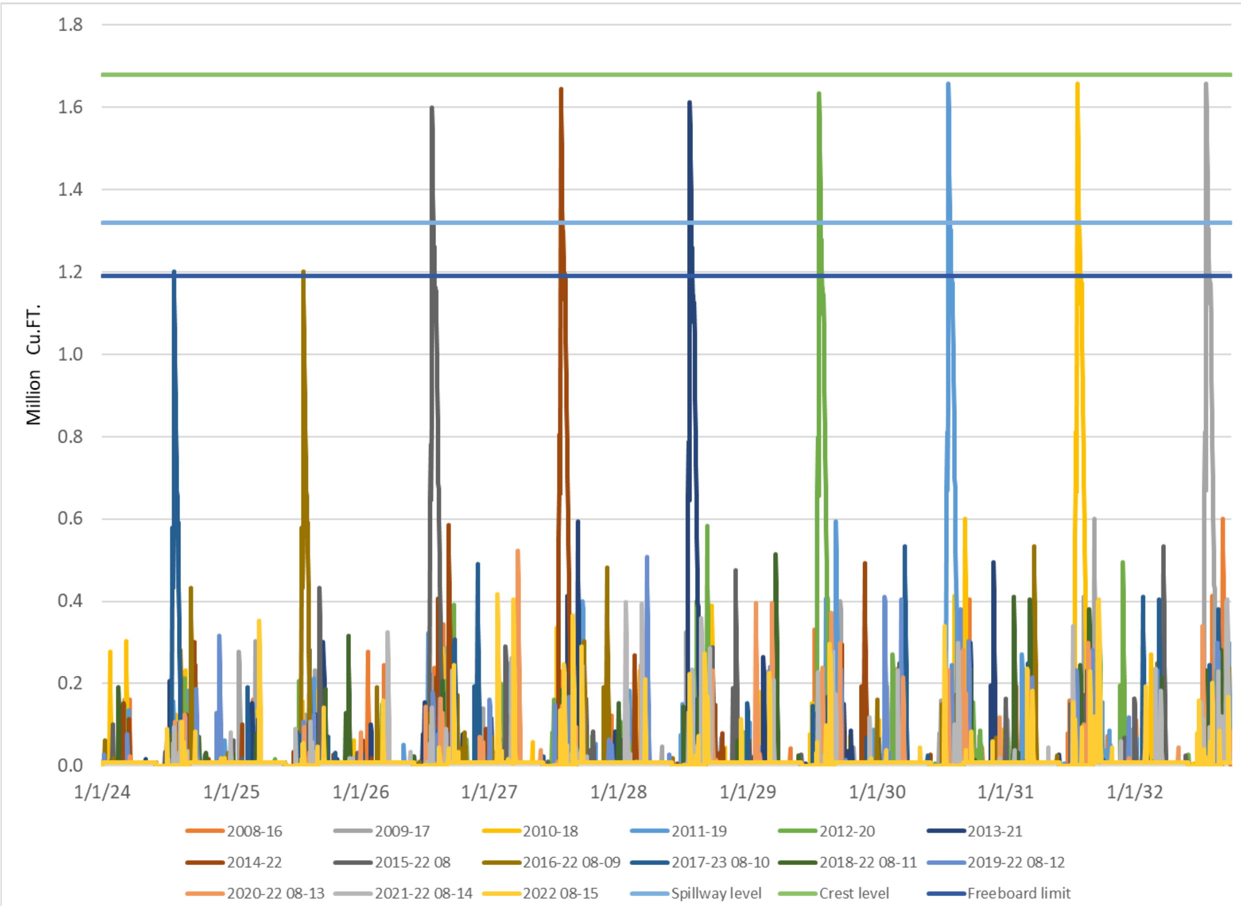


5.4 UDCP Results – Variable Precipitation Including 2017 Extreme Wet Condition

The model was then run using the variable annual precipitation including 2017. As discussed above, for this situation the model was run 15 times each with a different precipitation sequence in order to evaluate the system's response to variable precipitation conditions. For these runs, enhanced evaporation was assumed to occur in July, August and September with 50 gpm sent to three (3) evaporators 50% of the time.

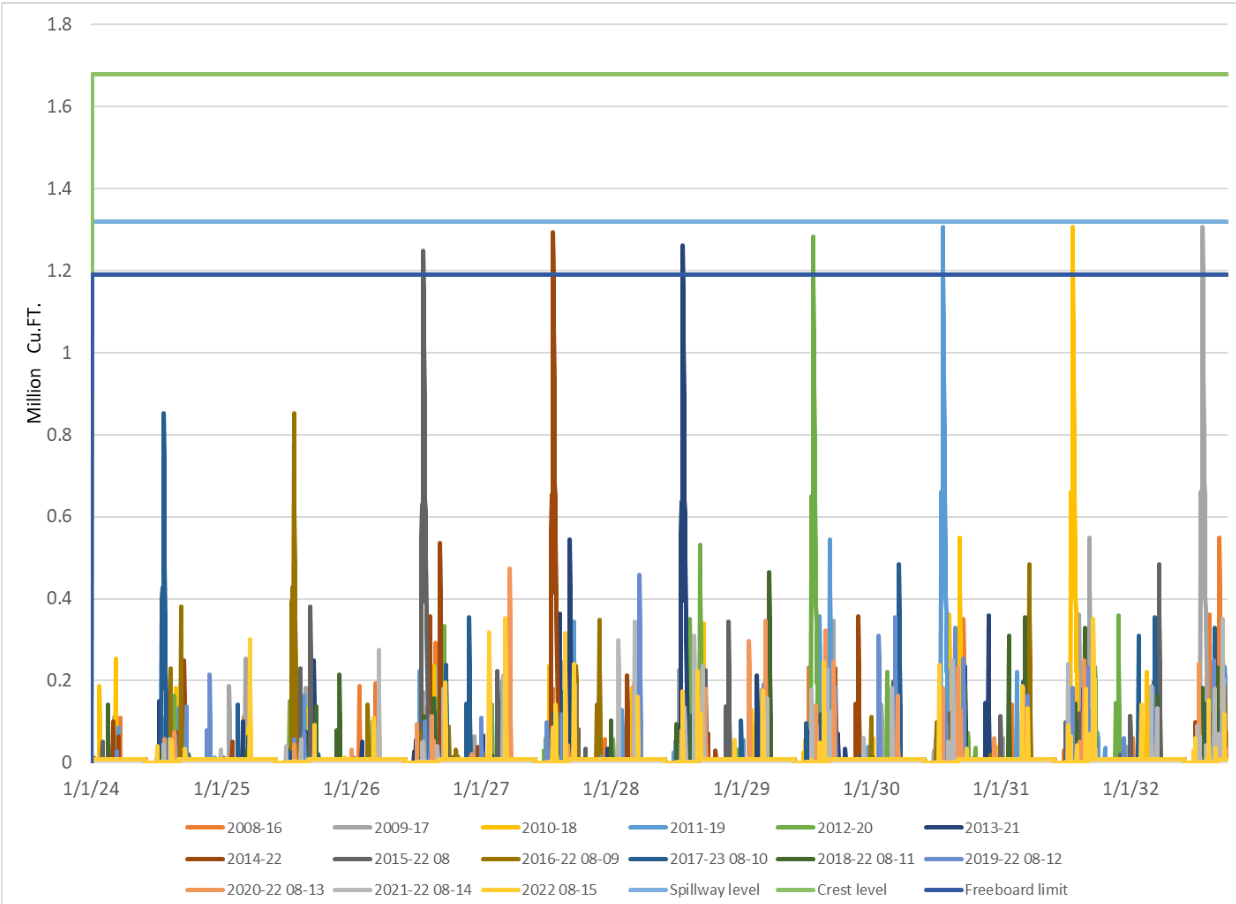
This variable year precipitation model was first run with a UDCP pumping capacity of 400 gpm defined above for average conditions plus the 100-year storm event. Results are presented in **Figure 5.6**. The different lines represent each of the 15 different precipitation runs modeled. The figure shows a single line exceeding the freeboard limit in 2024 and 2025 and a single line exceeding the spillway invert in 2026 – 2032. In all cases this single line is the 2017 precipitation sequence. This indicates that at 400 gpm pumping capacity, a precipitation event with an annual exceedance probability of 1 in 1,000 will result in activation of the emergency spillway and loss of contact water. As all other lines on the figure are well below the freeboard level, precipitation similar to any of the other past years would result in water levels being maintained well below the freeboard limit.

Figure 5.6. Variable Precipitation with 400 gpm Pumping Capacity



We then modified the modeled pumping rate to determine the pumping capacity that would be required to maintain water levels below the UDCP emergency spillway invert even for an extremely unlikely wet condition such as 2017. In the model, pumping capacities were increased until the water level in each year remained below the spillway. A pumping rate of 660 gpm was found to accomplish this goal. Results of the model run with a pumping capacity of 660 gpm are provided in **Figure 5.7**.

Figure 5.7. Variable Precipitation with 660 gpm Pumping Capacity



6.0 Summary

ERC completed a water balance analysis for the TSF and related facilities considering the proposed TSF1 expansion at the South32 Hermosa Project located near Patagonia, AZ. The evaluation predicted water levels in the UDCP using a daily model. Runs included average precipitation conditions plus the 100-year, 24-hour storm, the 100-year 72-hour storm and variable precipitation based on historic records. Precipitation from 2011 was selected to represent average conditions and a value of 5.22 inches of precipitation was used for the 100-year 24-hour event and 6.54 inches for the 100-year 72-hour storm. These short-duration events included an increase of 7% over the published NOAA estimate to account for potential climate change. The variable precipitation includes the extremely wet monsoon season of 2017 in which the largest daily precipitation was 4.56 inches and 12.39 inches of rainfall were recorded in a one-week period. For comparison the 24-hour 25-year, 50-year and 100-year storm events for the site are 3.93 inches, 4.40 inches and 4.88 inches, respectively (ERC 2017). The 30-day stretch of July 12 through August 10 in 2017 produced 18.1 inches of rainfall with peak totals having approximately a 1 in 1,000 year annual exceedance probability.

It was determined that a pumping capacity of 400 gpm is required to maintain water levels below the freeboard limit in the UDCP for average precipitation conditions plus the 100-year, 24-hour storm starting in 2026. In 2024 and 2025, the required pumping capacity is 65 gpm. These runs conservatively neglected any active evaporation. This was found to be more critical than the 100-year 72-hour event which required less (1.64 feet vs. 2 feet) freeboard below the spillway crest.

Running the model with the variable precipitation showed that with a pumping capacity of 400 gpm, water would be maintained well below the freeboard limits for all conditions except an extreme wet year such as 2017. A UDCP pumping capacity of 660 gpm would be required to maintain water levels below the spillway invert for all years of historical site precipitation data, given the amount of precipitation that occurred in the 2017 monsoon season.

7.0 References

Ecological Resources Consultants, Inc. (ERC). 2017. Arizona Mining Mine Site Climate Analysis. March 13.

Natural Resources Conservation Service (NRCS). Title 210, National Engineering Handbook, Second Edition, U.S. Dept. of Agriculture, Soil Conservation Service, 2021.

NewFields. 2023. *Hermosa Project, Tailings Storage Facility 1 (TSF1), Aquifer Protection Permit (APP) Significant Amendment, Best Available Demonstrated Control Technology (BADCT) Design Report.* NewFields Job No. 475.0014.035. Date TBD.

Appendix A – Areas by Month

Month	Natural Ground (run-on to External Detention Pond)	Geomem Area - External Detention Pond	Geomem Area - UDCP	Geomem Area - TSF	Protective Layer - TSF	Tailings / Rock Armor - TSF	Total Area
	(sf)	(sf)	(sf)	(sf)	(sf)	(sf)	(sf)
Jan-24	**867,571**	**134,699**	**80,760**	**270,330**	**178,876**	**760,832**	2,293,068
Feb-24	867,571	134,699	80,760	270,330	178,876	760,832	2,293,068
Mar-24	867,571	134,699	80,760	270,330	178,876	760,832	2,293,068
Apr-24	867,571	134,699	80,760	270,330	178,876	760,832	2,293,068
May-24	867,571	134,699	80,760	270,330	178,876	760,832	2,293,068
Jun-24	867,571	134,699	80,760	270,330	178,876	760,832	2,293,068
Jul-24	867,571	134,699	80,760	270,330	178,876	760,832	2,293,068
Aug-24	867,571	134,699	80,760	270,330	178,876	760,832	2,293,068
Sep-24	867,571	134,699	80,760	270,330	178,876	760,832	2,293,068
Oct-24	867,571	134,699	80,760	270,330	178,876	760,832	2,293,068
Nov-24	867,571	134,699	80,760	270,330	178,876	760,832	2,293,068
Dec-24	867,571	134,699	80,760	270,330	178,876	760,832	2,293,068
Jan-25	867,571	134,699	80,760	270,330	178,876	760,832	2,293,068
Feb-25	867,571	134,699	80,760	270,330	178,876	760,832	2,293,068
Mar-25	867,571	134,699	80,760	270,330	178,876	760,832	2,293,068
Apr-25	867,571	134,699	80,760	270,330	178,876	760,832	2,293,068
May-25	867,571	134,699	80,760	270,330	178,876	760,832	2,293,068
Jun-25	867,571	134,699	80,760	270,330	178,876	760,832	2,293,068
Jul-25	867,571	134,699	80,760	270,330	178,876	760,832	2,293,068
Aug-25	867,571	134,699	80,760	270,330	178,876	760,832	2,293,068
Sep-25	867,571	134,699	80,760	270,330	178,876	760,832	2,293,068
Oct-25	867,571	134,699	80,760	270,330	178,876	760,832	2,293,068
Nov-25	867,571	134,699	80,760	270,330	178,876	760,832	2,293,068
Dec-25	867,571	134,699	80,760	270,330	178,876	760,832	2,293,068
Jan-26	867,571	134,699	80,760	270,330	178,876	760,832	2,293,068
Feb-26	867,571	134,699	80,760	270,330	178,876	760,832	2,293,068
Mar-26	0	0	80,760	560,564	178,876	760,832	1,581,032
Apr-26	0	0	80,760	713,670	316,003	760,832	1,871,265
May-26	0	0	80,760	866,776	453,131	760,832	2,161,499
Jun-26	0	0	80,760	1,019,882	590,258	760,832	2,451,732
Jul-26	0	0	80,760	1,019,882	590,258	760,832	2,451,732
Aug-26	0	0	80,760	1,019,882	590,258	760,832	2,451,732
Sep-26	0	0	80,760	1,019,882	590,258	760,832	2,451,732
Oct-26	**0**	**0**	**80,760**	**934,636**	**525,628**	**910,708**	**2,451,732**

Nov-26	0	0	80,760	849,390	460,997	1,060,585	2,451,732
Dec-26	0	0	80,760	764,144	396,367	1,210,461	2,451,732
Jan-27	0	0	80,760	678,898	331,737	1,360,337	2,451,732
Feb-27	0	0	80,760	652,327	338,016	1,380,630	2,451,732
Mar-27	0	0	80,760	625,755	344,295	1,400,922	2,451,732
Apr-27	0	0	80,760	599,183	350,574	1,421,215	2,451,732
May-27	0	0	80,760	572,612	356,853	1,441,507	2,451,732
Jun-27	0	0	80,760	546,040	363,133	1,461,800	2,451,732
Jul-27	0	0	80,760	519,468	369,412	1,482,092	2,451,732
Aug-27	0	0	80,760	492,897	375,691	1,502,385	2,451,732
Sep-27	0	0	80,760	466,325	381,970	1,522,677	2,451,732
Oct-27	0	0	80,760	439,753	388,249	1,542,970	2,451,732
Nov-27	0	0	80,760	413,182	394,528	1,563,262	2,451,732
Dec-27	0	0	80,760	386,610	400,808	1,583,554	2,451,732
Jan-28	0	0	80,760	360,038	407,087	1,603,847	2,451,732
Feb-28	0	0	80,760	341,347	403,467	1,626,157	2,451,732
Mar-28	0	0	80,760	322,657	399,848	1,648,468	2,451,732
Apr-28	0	0	80,760	303,966	396,228	1,670,778	2,451,732
May-28	0	0	80,760	285,275	392,608	1,693,088	2,451,732
Jun-28	0	0	80,760	266,584	388,989	1,715,399	2,451,732
Jul-28	0	0	80,760	247,894	385,369	1,737,709	2,451,732
Aug-28	0	0	80,760	229,203	381,749	1,760,020	2,451,732
Sep-28	0	0	80,760	210,512	378,130	1,782,330	2,451,732
Oct-28	0	0	80,760	191,822	374,510	1,804,640	2,451,732
Nov-28	0	0	80,760	173,131	370,891	1,826,951	2,451,732
Dec-28	0	0	80,760	154,440	367,271	1,849,261	2,451,732
Jan-29	0	0	80,760	135,749	363,651	1,871,571	2,451,732
Feb-29	0	0	80,760	124,437	351,736	1,894,800	2,451,732
Mar-29	0	0	80,760	113,124	339,820	1,918,028	2,451,732
Apr-29	0	0	80,760	101,812	327,904	1,941,256	2,451,732
May-29	0	0	80,760	90,500	315,989	1,964,484	2,451,732
Jun-29	0	0	80,760	79,187	304,073	1,987,712	2,451,732
Jul-29	0	0	80,760	67,875	292,158	2,010,940	2,451,732
Aug-29	0	0	80,760	56,562	280,242	2,034,168	2,451,732
Sep-29	0	0	80,760	45,250	268,326	2,057,396	2,451,732
Oct-29	0	0	80,760	33,937	256,411	2,080,624	2,451,732
Nov-29	0	0	80,760	22,625	244,495	2,103,852	2,451,732
Dec-29	0	0	80,760	11,312	232,580	2,127,080	2,451,732
Jan-30	**0**	**0**	**80,760**	**0**	**220,664**	**2,150,308**	**2,451,732**
Feb-30	0	0	80,760	0	220,664	2,150,308	2,451,732

Mar-30	0	0	80,760	0	220,664	2,150,308	2,451,732
Apr-30	0	0	80,760	0	220,664	2,150,308	2,451,732
May-30	0	0	80,760	0	220,664	2,150,308	2,451,732
Jun-30	0	0	80,760	0	220,664	2,150,308	2,451,732
Jul-30	0	0	80,760	0	220,664	2,150,308	2,451,732
Aug-30	0	0	80,760	0	220,664	2,150,308	2,451,732
Sep-30	0	0	80,760	0	220,664	2,150,308	2,451,732
Oct-30	0	0	80,760	0	220,664	2,150,308	2,451,732
Nov-30	0	0	80,760	0	220,664	2,150,308	2,451,732
Dec-30	0	0	80,760	0	220,664	2,150,308	2,451,732
Jan-31	0	0	80,760	0	220,664	2,150,308	2,451,732
Feb-31	0	0	80,760	0	220,664	2,150,308	2,451,732
Mar-31	0	0	80,760	0	220,664	2,150,308	2,451,732
Apr-31	0	0	80,760	0	220,664	2,150,308	2,451,732
May-31	0	0	80,760	0	220,664	2,150,308	2,451,732
Jun-31	0	0	80,760	0	220,664	2,150,308	2,451,732
Jul-31	0	0	80,760	0	220,664	2,150,308	2,451,732
Aug-31	0	0	80,760	0	220,664	2,150,308	2,451,732
Sep-31	0	0	80,760	0	220,664	2,150,308	2,451,732
Oct-31	0	0	80,760	0	220,664	2,150,308	2,451,732
Nov-31	0	0	80,760	0	220,664	2,150,308	2,451,732
Dec-31	0	0	80,760	0	220,664	2,150,308	2,451,732
Jan-32	0	0	80,760	0	220,664	2,150,308	2,451,732
Feb-32	0	0	80,760	0	220,664	2,150,308	2,451,732
Mar-32	0	0	80,760	0	220,664	2,150,308	2,451,732
Apr-32	0	0	80,760	0	220,664	2,150,308	2,451,732
May-32	0	0	80,760	0	220,664	2,150,308	2,451,732
Jun-32	0	0	80,760	0	220,664	2,150,308	2,451,732
Jul-32	0	0	80,760	0	220,664	2,150,308	2,451,732
Aug-32	0	0	80,760	0	220,664	2,150,308	2,451,732
Sep-32	**0**	**0**	**80,760**	**0**	**220,664**	**2,150,308**	**2,451,732**

APPENDIX J

Operations, Maintenance, and Surveillance Plan

NewFields
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TECHNICAL MEMORANDUM

To: South32 Hermosa Inc.

From: Craig Thompson, P.E. – Senior Engineer

R. Michael Smith, P.E. – Project Principal

Project: Hermosa Project

Project No: 475.0014.035

Subject: Tailings Storage Facility 1 (TSF1) APP Significant Amendment – Operations, Maintenance, and Surveillance Plan

Date: October 2023

The purpose of this Technical Memorandum is to provide a summary of the Operations, Maintenance, and Surveillance (OMS) Plan in association with the Tailings Storage Facility 1 (TSF1) Aquifer Protection Permit (APP) Significant Amendment. A detailed TSF1 OMS Manual will be developed prior to the operation of TSF1. All inspection frequencies listed in the OMS Plan summary tables should be considered minimum frequencies.

TSF1 and Ancillary Facilities

Item	Area of focus	Inspection Type and Frequency
TSF Perimeter Road (Embankment)	Settlement	Operations staff to visually inspect monthly.
	Slides, depressions, misalignment, cracking, burrowing by animals, erosion, seepage	Operations staff to visually inspect monthly.
Tailings Slope	Settlement	Operations staff to visually inspect monthly.
	Slides, depressions, misalignment, cracking, burrowing by animals, erosion, seepage	Operations staff to visually inspect monthly.
Filtered Tailings Stack	Material Placement	Operations staff to track material placement volume in the TSF as well as verify construction quality assurance testing was performed on in-place material. In addition, operations staff to track stacking elevation, storage capacity utilized, and remaining available storage capacity. A histogram of material placement volume and storage capacity will be developed, updated, and maintained on site.

TSF1 and Ancillary Facilities (continued)

Item	Area to focus	Inspection Type and Frequency
Stormwater Diversion Channels	Internal and External Channels	Operations staff to visually inspect the channels monthly for any evidence of back cutting, erosion, or blockage of flow carrying capacity impacting the effectiveness of the channels. Any potential impacts to channel operation will be remediated immediately.
Instrumentation	Piezometers	Vibrating wire piezometers for the dry stack tailings will be monitored weekly by operations staff to determine if any phreatic surface development has occurred on the liner system that could impact performance of the TSF. A histogram of piezometer readings will be developed, updated, and maintained on site after each new reading.
Photographic Log	Embankment, perimeter road, stormwater diversion channels, tailings stacking and culvert	Operations staff will keep a quarterly photographic log of the upstream and downstream embankment slopes, perimeter road, stormwater diversion channels, tailings stacking and culverts. Whenever possible the photos will be taken from the same vantage points to allow relevant comparison of photos taken at different times in operational history.
Basin	Geomembrane	Operations staff to visually inspect geomembrane in the TSF basin as well as anchor trenches quarterly for damage or possible leakage areas. If geomembrane liner damage is noticed, repairs to the liner will be completed immediately with oversight and approval by a qualified quality assurance inspector.
Culverts	Flow Blockage	Operations staff to visually inspect culverts for any potential blockage monthly. If any blockage is found, it is to be immediately removed.
Sediment Control Structures	Sediment control ponds, sediment control logs, silt fencing and general slope controls	Operations staff to visually inspect sediment control elements for functionality daily. When functionality is compromised, repairs to and/or replacement of the sediment control elements will be completed as part of routine maintenance during operations. Maintenance may also include cleaning the structures out periodically.

Underdrain Collection Pond

Item	Area to focus	Inspection Type and Frequency[1]
Pond Embankment	Settlement	Operations staff to visually inspect monthly.
	Slides, depressions, misalignment, cracking, burrowing by animals, erosion, seepage	Operations staff to visually inspect monthly.
Spillway	Approach Channel and chute	Operations staff to visually inspect monthly to report condition of the spillway.
Downstream Channel Areas	Spillway outfall	Operations staff to visually inspect Spillway outfall monthly to check for any evidence of back cutting or other types of erosion that might impact the operational effectiveness of the spillway or that might impair outfall channel flow carrying capacity.
Pond perimeter	Rim area	Operations staff to check pond perimeter monthly for evidence of movement which could compromise the storage capacity or operational integrity of the pond. As required, vegetation, sediment or rock fall from the surrounding cut slopes will be removed to maintain flow carrying capacity in the stormwater diversion channel around the pond.
Site Security	Fencing	Fencing around the Underdrain Collection Pond will be checked monthly to ensure that breaches in the fence perimeter have not occurred.
Instrumentation	Piezometers	Vibrating wire piezometers for the pond embankment will be monitored weekly by operations staff for any phreatic surface that may develop in the embankment structure. A histogram of piezometer readings will be developed, updated, and maintained on site after each new reading.
	Settlement Monuments	Settlement monuments will be surveyed biannually or at any point when evidence of potential settlement is compelling. A histogram of settlement monument readings will be developed, updated, and maintained on site after each new reading.

Note: [1] Dam safety inspection to occur every 5 years by ADWR, Dam Safety Division or by the owner meeting the requirements in the Arizona Administrative Code Title 12 Chapter 15.

Underdrain Collection Pond (continued)

Item	Area to focus	Inspection Type and Frequency[1]
Photographic Log	Embankment, spillway, pond perimeter and cut slopes around the pond	Operations staff will keep a quarterly photographic log of the upstream and downstream embankment slopes, embankment crest, pond perimeter, spillway, entrance, chute, and outfall as well as the cut slopes around the Underdrain Collection Pond. Whenever possible the photos will be taken from the same vantage points to allow relevant comparison of photos taken at different times in operational history.
Pond	Water Level Readings	Water level readings will be taken in the pond weekly or otherwise when volume in the pond appears to be high, to monitor historic storage levels. Water level readings will allow for calculation of storage volume in the pond and available storage above the current pond surface to the spillway sill elevation. A histogram of active pond storage volume will be developed, updated, and maintained on site.
Pond	Geomembrane	Operations staff to visually inspect exposed geomembrane as well as anchor trenches monthly for damage or possible leakage areas. Inspection should be scheduled when the Underdrain Collection Pond level is low. Pay particular attention to all seams, liner penetrations, and connections to structures and to anchor trenches. If geomembrane liner damage is noticed, repairs to the liner will be completed immediately with oversight and approval by a qualified quality assurance inspector.
	Debris	Remove floating debris whenever observed.
Pumps	LCRS	Operations staff to inspect pumps daily and note leakages or any similar problems such as rapid increase or decrease in pond volumes. LCRS flow totalizer readings to be collected daily and compared to Alert Levels. If Alert Levels are exceeded refer to the actions specified in the Contingency Plan. Quarterly, staff should perform necessary maintenance on the pumps and pipes per manufacturer's recommendations.

Note: [1] Dam safety inspection to occur every 5 years by ADWR, Dam Safety Division or by the owner meeting the requirements in the Arizona Administrative Code Title 12 Chapter 15.

Operations staff will document changes in any conditions and will contact the design engineer regarding the changes immediately. Any corrective action will be accompanied by photos of the area of concern, design calculations supporting the corrective action (if appropriate), and a time frame to execute the action. A log book will be maintained as part of the TSF and Underdrain Collection Pond record and document all inspections and maintenance work. Each entry will show the date, description of activity performed and a signature by the person responsible for the data collection. Entries to include inspections, volumetric observations, maintenance, and instrument readings.

If you have questions or require additional information, please contact the undersigned.

Sincerely,

NewFields Mining Design & Technical Services

Craig M. Thompson
Senior Engineer

Reviewed by:

R. Michael Smith, P.E.
Principal

ATTACHMENT B

Materials Characterization

1860 E. River Rd., Ste 200
Tucson, AZ 85718

MEMORANDUM

To:	File
From:	Mark A. Williamson
Date:	December 6, 2023
Subject:	Characterization of Production Tailings

Summary

A variety of production tailings have been prepared using benchtop metallurgical processing. The tails span a range of lithologic types that are expected during actual mine production. Tailings have been characterized using industry-standard techniques to gauge their potential to produce acidic contact water, a metal release, or both.

The results indicate the following:

- In aggregate, tailings are non-acid producing. See Table 1.
- Synthetic Precipitation Leaching Procedure (SPLP) leach testing shows primarily that only antimony exceeds Arizona Water Quality Standards (AWQS.) See Table 2.
- Humidity cell testing produces results consistent with SPLP results, indicating that only antimony AWQS levels are exceeded. See Table 3.

Overall, metallurgical tailings can be considered chemically benign save for elevated antimony levels.

Approach

A variety of production tailings have been prepared using benchtop metallurgical processing. The tails span a range of lithologic types that are expected during actual mine production. Preparation of such tailings is ongoing. The present memo brings together the results of the geochemical characterization of materials to date.

Tailings have been characterized using industry-standard techniques to gauge their potential to produce acidic contact water, a metal release, or both. Data are provided below for

- Acid-base accounting (ABA; Table 2),
- NAG pH (Table 2),
- Synthetic Precipitation Leaching Procedure (SPLP; Table 3), and
- Humidity Cell Testing (HCT; Table 4).

Table 1 reports the samples tested, their sample names, the associated ore lithologies from which they were derived, and the test conducted on each.

Acid-Base Accounting

Acid-base accounting quantifies the net amounts of acid-generation potential (AP) and the neutralization potential (NP). AP is directly proportional to the mass of sulfide sulfur, which is generally presumed to occur as pyrite, FeS_2. Pyrite reacts with water and oxygen to produce a low-pH iron sulfate solution called Acid Rock Drainage (ARD). ARD may or may not contain a range of trace metals. NP is most directly associated with calcium carbonate ($CaCO_3$) minerals but can include some slowly reacting silicate minerals. Both AP and NP are expressed in $CaCO_3$ equivalent units, as tons $CaCO_3$/1000 tons of rock (parts per thousand).

Acid-base accounting (ABA) has been conducted using modified Sobek methods to determine the Acid Potential (AP) and the Neutralizing Potential (NP) of mine materials. For AP, sulfur within the rock and tailings mineral matrix was speciated to account for total sulfur, often not acid-generating sulfate sulfur, and potentially acid-generating sulfide sulfur. The calculated AP of materials has been based on total sulfur.

NAG pH

Net Acid Generating (NAG) testing simply combines a powdered sample of mine material (rock or tailings) with hydrogen peroxide to rapidly oxidized all exposed sulfide minerals, generate any associated acidity, and liberate any associated trace metals. Once released, these constituents react with any NP available to produce a final pH. This solution may also be analyzed to assess what trace metals may be released during field weathering, although the results are not regarded as closely correlated with ultimate contact water chemical quality because of the addition of hydrogen peroxide which is not present in the environment. NAG pH results are normally interpreted relative to a pH value of 4.5. Samples with a NAG pH that is greater than 4.5 are typically regarded as NPAG. Conversely, samples with a NAG pH below 4.5 are PAG. The lower the NAG pH the more likely the material is to produce ARD, and the higher the value the more benign.

Synthetic Precipitation Leaching Procedure

The Synthetic Precipitation Leaching Procedure (SPLP; US EPA Method 1312) is a batch (bottle roll) leach test that combines 1 part solid with 20 parts water. The combined water and solid are rolled at a specific rate for about 18 hours. The resulting leachate is analyzed for a range of chemical constituents, including pH, alkalinity, and sulfate, but also a range of regulated constituents (e.g., antimony, cadmium, arsenic). The test is used primarily to assess non-acid generating rock, as determined by ABA. It is the preferred method of ADEQ for assessing contact water quality.

Humidity Cell Testing

Humidity cell testing (ASTM 5744) is a multi-week column test in which the one-kilogram sample is exposed to three days of moist air, followed by three days of dry air, and is rinsed on the seventh day. This procedure supplies an excess of oxygen and water, ingredients required for the oxidation of sulfide minerals to produce acidity. Unlike the NAG test described above, HCT uses a coarser rock sample and uses naturally occurring oxygen rather than hydrogen peroxide. Any acidity produced reacts with any acid-neutralizing minerals presence. The test is normally conducted for a minimum of 26 weeks to assess the rate at which weathering reactions occur and helps to clarify the acid-generating potential of rock assessed as uncertain by ABA methods. It is also used to gauge of the chemical composition of contact water for impact assessment. Weekly leachates are analyzed for a range of chemical constituents (e.g., pH, alkalinity, calcium, sulfate, and iron). The leachate is also analyzed monthly for a range of regulated constituents (e.g., antimony, cadmium, arsenic).

Table 1. Sample descriptions.

Sample ID	Lithology	ABA	NAG pH	SPLP	HCT
CONCHA 1 MC 2021	Concha	X	X	X	
CONCHA 1 OSC	Concha	X	X	X	
CONCHA 2 MC 2022	Concha	X	X	X	
DEEPS MC 2021	Concha	X	X	X	
EPITAPH 1 COMP 3 2021	Epitaph	X	X	X	
EPITAPH 1 MC 2021	Epitaph	X	X	X	
EPITAPH 1 OSC	Epitaph	X	X	X	
EPITAPH 2 MC 2022	Epitaph	X	X	X	
HSV MC 2022	Hardshell Volcanics	X	X	X	
JHHZ MC MC 2022	Hardshell Volcanics	X	X	X	
OLD VOL MS 2022	Old Volcanics	X	X	X	
SCHERRER 1 MC 2021	Scherrer	X	X	X	
SCHERRER 1 OSC	Scherrer	X	X	X	
SCHERRER 2 MC 2022	Scherrer	X	X	X	
CONCHA 1	Concha	X	X	X	
EPITAPH	Epitaph	X	X	X	
CONCHA 2	Concha	X	X	X	
Cell 1	Concha				X
Cell 2	Scherrer				X
Cell 3	Epitaph				X
Cell 4	Concha				X
Cell 5	Scherrer				X
Cell 6	Epitaph				X

Table 2. Acid-base accounting for production tailings samples.

Sample ID	pH, Saturated Paste	NP[1]	NNP[1]	AP[1]	Sulfur Sulfide[2]	Sulfur Sulfate[2]		Sulfur Total[2]	NAG pH
CONCHA 1 MC 2021	7.5	76	-45.6	122	3.5	0.19		3.89	5.4
CONCHA 1 OSC	7.6	343	178	165	5.01	0.02		5.29	8.7
CONCHA 2 MC 2022	7.7	201	92.3	109	3.18	0.07		3.48	9
DEEPS MC 2021	8.1	346	279	67.2	1.84	0.25		2.15	10.4
EPITAPH 1 COMP 3 2021	8	12	-141	153	4.44	0.33		4.9	2.2
EPITAPH 1 MC 2021	8.3	288	185	103	2.52	0.71		3.31	10.6
EPITAPH 1 OSC	7.9	404	333	70.6	1.95	0.25		2.26	10.2
EPITAPH 2 MC 2022	8.1	571	554	16.6	0.52	0.1	U	0.53	10.9
HSV MC 2022	7.1	38	-331	369	10.7	0.4		11.8	2.4
JHHZ MC MC 2022	7.4	70	-133	203	5.12	1.18		6.5	2.5
OLD VOL MS 2022	7.8	298	-152	450	14.4	0.1	U	14.4	8.6
SCHERRER 1 MC 2021	7.9	286	134	152	4.08	0.58		4.86	9
SCHERRER 1 OSC	8.2	280	189	91.3	2.79	0.03		2.92	9.4
SCHERRER 2 MC 2022	7.9	379	264	115	2.62	0.97		3.67	10.7
CONCHA 1	8.7	271	136	135	3.81	0.37		4.31	9
EPITAPH	7.8	300	194	106	3.36	0.1	U	3.38	10.6
CONCHA 2	7.7	345	227	118	2.94	0.59		3.77	10.1

NOTE: NP = Acid Neutralizing Potential
AP = Acid Production Potential
NNP = Net Neutralizing Potential
U = undetected

[1] Units of tons $CaCO_3$/kton rock

[2] Units in %

Table 3. SPLP results for production tailings samples.

Sample ID	Sulfate	Barium	Calcium	Chromium	Copper	Magnesium	Nickel	Potassium	Sodium	Zinc	Antimony	Arsenic	Cadmium
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
CONCHA 1 MC 2021	21.7	0.035	16.4	< 0.05	< 0.05	2.53	<0.04	1.48	0.39	< 0.05	0.033	0.0037	0.000056
CONCHA 1 OSC	31.3	0.035	22.5	< 0.05	< 0.05	1.94	<0.04	0.56	0.36	< 0.05	0.0178	0.00076	0.000061
CONCHA 2 MC 2022	27	0.035	14.2	< 0.05	0.097	3.24	<0.04	1.75	0.51	0.02	0.0295	0.0022	0.000167
DEEPS MC 2021	14	0.035	13.9	< 0.05	< 0.05	1.13	<0.04	1.56	0.54	< 0.05	0.0064	0.001	0.00025
EPITAPH 1 COMP 3 2021	13.4	0.035	10.7	< 0.05	< 0.05	0.91	<0.04	2.78	<1	< 0.05	0.027	0.00078	<0.00025
EPITAPH 1 MC 2021	12.5	0.035	10.5	< 0.05	< 0.05	1.49	<0.04	2.27	<1	< 0.05	0.0232	0.00143	<0.00025
EPITAPH 1 OSC	19.4	0.0153	16.3	< 0.05	< 0.05	2.23	<0.04	1.16	0.92	< 0.05	0.0101	0.00174	<0.00025
EPITAPH 2 MC 2022	9.6	0.035	11.2	< 0.05	< 0.05	0.74	<0.04	0.69	<1	< 0.05	0.00159	0.00056	<0.00025
HSV MC 2022	31.9	0.0362	12	< 0.05	< 0.05	1.74	<0.04	1.77	<1	0.644	0.00331	0.001	0.00155
JHHZ MC MC 2022	21	0.035	12.7	< 0.05	< 0.05	1.57	<0.04	3.32	1.24	< 0.05	0.00823	0.001	<0.00025
OLD VOL MS 2022	28.9	0.035	21.4	< 0.05	< 0.05	1.72	<0.04	1.74	0.32	< 0.05	0.00902	0.001	<0.00025
SCHERRER 1 MC 2021	21.8	0.035	18.7	< 0.05	< 0.05	2.26	<0.04	1.29	0.41	< 0.05	0.0116	0.00089	<0.00025
SCHERRER 1 OSC	22.2	0.035	17.3	< 0.05	< 0.05	1.88	<0.04	1.45	<1	< 0.05	0.0268	0.00115	<0.00025
SCHERRER 2 MC 2022	14.7	0.035	14.3	< 0.05	< 0.05	0.98	<0.04	2.22	0.5	< 0.05	0.00192	0.00144	<0.00025
CONCHA 1	28.5	0.0135	22.8	< 0.05	< 0.05	2.77	<0.04	1.07	0.74	< 0.05	0.00679	0.00175	0.000078
EPITAPH	24.6	0.0208	16.2	< 0.05	< 0.05	2.83	<0.04	1.78	0.79	< 0.05	0.00444	0.00079	<0.00025
CONCHA 2	32.1	0.0128	21	< 0.05	< 0.05	1.62	<0.04	1.1	0.66	0.021	0.00509	0.00117	<0.00025

NOTE: Highlight = exceeds AWQS value.

Table 3 (cont.) SPLP results for production tailings samples.

Sample ID	Lead	Selenium	Silver	Thallium	Uranium	Beryllium	Mercury	Total Alkalinity	Conductivity	Chloride	Fluoride
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	μmho/cm	mg/L	mg/L
CONCHA 1 MC 2021	0.00373	0.00115	<0.0005	0.00012	0.00011	<0.00025	<0.001	35.5	118	1.69	<0.35
CONCHA 1 OSC	0.0049	0.00153	<0.0005	0.0001	0.00011	<0.00025	<0.001	49.9	142	2.45	0.35
CONCHA 2 MC 2022	0.00973	0.00148	<0.0005	0.00021	<0.0005	<0.00025	<0.001	30.2	117	1.69	0.17
DEEPS MC 2021	0.00251	0.00583	<0.0005	0.00015	0.0001	<0.00025	<0.001	28.5	90	1.38	0.55
EPITAPH 1 COMP 3 2021	0.00034	0.00218	<0.0005	<0.0005	<0.0005	<0.00025	<0.001	23.1	77	1.03	<0.35
EPITAPH 1 MC 2021	0.00076	0.00182	<0.0005	<0.0005	0.00018	<0.00025	<0.001	26.7	80	<2	0.25
EPITAPH 1 OSC	0.00215	0.00142	<0.0005	0.00021	0.00028	<0.00025	<0.001	34	114	1.67	0.61
EPITAPH 2 MC 2022	0.00372	0.0006	<0.0005	<0.0005	<0.0005	<0.00025	<0.001	21.8	69	2	0.42
HSV MC 2022	0.223	0.00027	<0.0005	0.00045	<0.0005	<0.00025	<0.001	13.3	108	1.19	<0.35
JHHZ MC MC 2022	0.00552	0.00031	<0.0005	<0.001	<0.0005	<0.00025	<0.001	27.1	103	1.09	0.32
OLD VOL MS 2022	0.0252	0.0023	<0.0005	<0.001	<0.0005	<0.00025	<0.001	36.9	139	1.93	0.18
SCHERRER 1 MC 2021	0.00413	0.00087	<0.0005	<0.001	<0.0005	<0.00025	<0.001	34.4	122	1.54	0.2
SCHERRER 1 OSC	0.00353	0.00152	<0.0005	0.00022	<0.0005	<0.00025	<0.001	30.6	115	1.46	0.42
SCHERRER 2 MC 2022	0.00154	0.00961	<0.0005	0.00075	<0.0005	<0.00025	<0.001	28.3	93	<2	0.62
CONCHA 1	0.00982	0.00048	<0.0005	<0.001	<0.0005	<0.00025	<0.001	28.5	153	<2	0.4
EPITAPH	0.00208	0.00095	<0.0005	0.00016	0.00033	<0.00025	<0.001	25	113	2.63	0.21
CONCHA 2	0.0117	0.00237	<0.0005	0.00035	0.00017	<0.00025	<0.001	22.3	129	1.12	0.44

NOTE: Highlight = exceeds AWQS value.

Table 4. Humidity cell results for production tailings.

Date	Week	pH	Cond.	Acidity	Alkalinity	Sulfate	Gross	Ra-226	Ra-228	TSS	Free	Ammonia	Nitrate	Nitrite
				(pH 8.3)			Alpha				CN	as N	as N	as N
			µmhos/cm	mgCaCO3/L	mgCaCO3/L	mg/L	pCi/L	pCi/L	pCi/L		mg/L	mg/L	mg/L	mg/L
CELL 1														
8-Apr-21	1	7.87	1159	5.5	70.1	555	<6.8	0.8	<2.2	< 6	< 0.005	< 0.1	< 0.6	< 0.3
15-Apr-21	2	8.38	201	#N/A	59.2	38	<1.6	0.3	<2.2	< 7	< 0.005	< 0.1	< 0.6	< 0.3
22-Apr-21	3	7.79	172	3.6	57.9	20	<1.9	<0.1	<2.2	< 3	< 0.005	< 0.1	< 0.6	< 0.3
29-Apr-21	4	7.87	150	2.7	39.9	26	3.0	0.3		< 120	< 0.005	< 0.1	< 0.6	< 0.3
6-May-21	5	7.82	173			30								
13-May-21	6	8.19	167	1.5	57	28	<1.9	<0.1	<2.2	2	< 0.005	< 0.1	< 0.6	< 0.3
20-May-21	7	7.93	148			21								
27-May-21	8	8.09	155	1.5	50.5	25				2	< 0.005	< 0.1	< 0.6	< 0.3
3-Jun-21	9	7.72	150			21								
10-Jun-21	10	8	151	1.5	49.6	23	<1.9	<0.1	<1.9	< 6	< 0.005	< 0.1	< 0.6	< 0.3
17-Jun-21	11	7.81	154			24								
24-Jun-21	12	8.44	151	#N/A	49.9	24				< 2	< 0.005	< 0.1	< 0.6	< 0.3
1-Jul-21	13	7.76	145			26								
8-Jul-21	14	7.75	152	3.3	43.7	25	<2.7	0.5	<2.2	< 2	< 0.005	< 0.1	< 0.6	< 0.3
15-Jul-21	15	7.87	153			26								
22-Jul-21	16	7.76	162	5.5	44.8	25				< 3	< 0.005	< 0.1	< 0.06	< 0.03
29-Jul-21	17	7.49	158			26								
5-Aug-21	18	7.69	160	5.2	46.7	24	<1.9	0.2	<2.2	< 3	< 0.005	< 0.1	< 0.6	< 0.3
12-Aug-21	19	7.67	150			22								
19-Aug-21	20	7.23	180	5.6	43.9	33								
26-Aug-21	21	7.89	161			23								
2-Sep-21	22	7.99	171	6.5	52.5	32	<1.6	<0.1	<2.2	< 6	< 0.005	< 0.1	< 0.6	< 0.3
9-Sep-21	23	7.94	171			29								

Date	Week	pH	Cond.	Acidity (pH 8.3)	Alkalinity	Sulfate	Gross Alpha	Ra-226	Ra-228	TSS	Free CN	Ammonia as N	Nitrate as N	Nitrite as N
			μmhos/cm	mgCaCO3/L	mgCaCO3/L	mg/L	pCi/L	pCi/L	pCi/L		mg/L	mg/L	mg/L	mg/L
16-Sep-21	24	8.02	162	1.6	48.5	25								
23-Sep-21	25	7.88	155			20								
30-Sep-21	26	8.04	151	1.6	48.2	15	<1.4	0.3	<2.2	< 3	< 0.005	< 0.1	< 0.6	< 0.3
7-Oct-21	27	8.01	161			23								
14-Oct-21	28	8	150	1.9	49.4	17								
21-Oct-21	29	8	145			14								
28-Oct-21	30	8.01	152	1.8	47.5	23	1.9	<0.1	<2.2	< 8	< 0.005	< 0.1	< 0.6	< 0.3
4-Nov-21	31	8.06	152			18								
11-Nov-21	32	8.08	145	1.2	50.3	16								
18-Nov-21	33	7.96	174			27								
25-Nov-21	34	8.05	157	1.3	50.1	18	1.1	0.1	<1.9	< 2	< 0.005	< 0.1	< 0.6	< 0.3
2-Dec-21	35	7.95	138			19								
9-Dec-21	36	7.34	172	2.8	45.8	31								
16-Dec-21	37	7.63	153			17								
23-Dec-21	38	8	164	1.8	50.9	24	2.2	<0.1	<5.4	< 3	< 0.05	< 0.1	< 0.6	< 0.3
30-Dec-21	39	7.48	158			19								
6-Jan-22	40	7.9	145	2.1	49.8	15								
CELL 2														
8-Apr-21	1	7.99	920	2	61.6	392	<8.6	0.8	<2.2	6	< 0.005	0.1	< 0.6	< 0.3
15-Apr-21	2	8.39	163	#N/A	48	28	1.6	0.3	<2.2	< 7	< 0.005	< 0.1	< 0.6	< 0.3
22-Apr-21	3	7.85	150	2.8	47.4	24	1.6	<0.1	<2.2	< 3	< 0.005	< 0.1	< 0.6	< 0.3
29-Apr-21	4	7.92	173	3.2	45.9	26	<1.9	0.2		6	< 0.005	< 0.1	< 0.6	< 0.3
6-May-21	5	7.88	152			22								
13-May-21	6	8.31	165	1.8	56.6	30	2.7	0.5	<2.2	< 2	< 0.005	< 0.1	< 0.6	< 0.3
20-May-21	7	8.06	150			22								

Date	Week	pH	Cond. µmhos/cm	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulfate mg/L	Gross Alpha pCi/L	Ra-226 pCi/L	Ra-228 pCi/L	TSS	Free CN mg/L	Ammonia as N mg/L	Nitrate as N mg/L	Nitrite as N mg/L
27-May-21	8	8.34	148	#N/A	52.5	20				2	< 0.005	< 0.1	< 0.6	< 0.3
3-Jun-21	9	8.07	147			22								
10-Jun-21	10	8	143	1.1	52.6	20	<1.6	<0.1	<1.9	< 6	< 0.005	< 0.1	< 0.6	< 0.3
17-Jun-21	11	8.04	148			24								
24-Jun-21	12	8.03	140	1.2	53.5	18				< 2	< 0.005	< 0.1	< 0.6	< 0.3
1-Jul-21	13	8	142			20								
8-Jul-21	14	7.78	147	2.8	47.8	21				< 2	< 0.005	< 0.1	< 0.6	< 0.3
15-Jul-21	15	7.94	147			18								
22-Jul-21	16	7.89	151	4.9	49.9	20	2.7	0.2	<2.2	3	< 0.005	< 0.1	< 0.06	< 0.03
29-Jul-21	17	7.95	150			20								
5-Aug-21	18	8.01	154	4.6	52.4	17	2.4	0.3	<2.2	< 3	< 0.005	< 0.1	< 0.6	< 0.3
12-Aug-21	19	7.94	146			18								
19-Aug-21	20	7.98	147	5.1	51.6	15								
26-Aug-21	21	8.04	153			19								
2-Sep-21	22	7.98	155	6.3	56.4	21	2.2	0.5	<2.2	< 6	< 0.005	< 0.1	< 0.6	< 0.3
9-Sep-21	23	8.01	161			19								
16-Sep-21	24	8.09	158	1.2	55.5	18								
23-Sep-21	25	7.99	150			14								
30-Sep-21	26	8.11	146	1.6	54.6	11	<1.1	0.2	<5.4	< 3	< 0.005	< 0.1	< 0.6	< 0.3
7-Oct-21	27	8.06	154			15								
14-Oct-21	28	8.09	161	1.7	57.1	16								
21-Oct-21	29	8.08	142			9								
28-Oct-21	30	8.07	167	1.8	58.9	20	3.0	<0.1	<2.2	< 8	< 0.005	< 0.1	< 0.6	< 0.3
4-Nov-21	31	8.1	156			17								
11-Nov-21	32	8.1	149	1.5	56.7	13								

Date	Week	pH	Cond.	Acidity (pH 8.3)	Alkalinity	Sulfate	Gross Alpha	Ra-226	Ra-228	TSS	Free CN	Ammonia as N	Nitrate as N	Nitrite as N
			µmhos/cm	mgCaCO3/L	mgCaCO3/L	mg/L	pCi/L	pCi/L	pCi/L		mg/L	mg/L	mg/L	mg/L
18-Nov-21	33	8.06	159			15								
25-Nov-21	34	8.13	150	0.9	57.6	12	1.4	0.5	<1.9	2	< 0.005	< 0.1	< 0.6	< 0.3
2-Dec-21	35	8.02	135			11								
9-Dec-21	36	8.05	149	2	57.1	14								
16-Dec-21	37	8.05	147			12								
23-Dec-21	38	8.08	149	1.2	58.1	11	1.1	<0.1	<2.2	< 3	< 0.05	< 0.1	< 0.6	< 0.3
30-Dec-21	39	8.01	148			12								
6-Jan-22	40	7.99	129	1.5	52.8	8								
CELL 3														
8-Apr-21	1	8.3	1089	#N/A	78.4	513	<9.2	0.3	<2.2	< 6	< 0.005	< 0.1	< 0.6	< 0.3
15-Apr-21	2	8.42	191	#N/A	56.8	26	<1.6	0.2	<2.2	< 7	< 0.005	< 0.1	< 0.6	< 0.3
22-Apr-21	3	7.87	167	3	53.2	26	<1.9	<0.1	<2.2	< 3	< 0.005	< 0.1	< 0.6	< 0.3
29-Apr-21	4	7.87	187	2.9	41.8	47	1.9	0.2		< 3	< 0.005	< 0.1	< 0.6	< 0.3
6-May-21	5	7.83	182			36								
13-May-21	6	8.27	197	1.7	56	47	1.9	0.3	2.2	2	< 0.005	< 0.1	< 0.6	< 0.3
20-May-21	7	8.03	172			31								
27-May-21	8	8.35	157	#N/A	51.7	27				< 3	< 0.005	< 0.1	< 0.6	< 0.3
3-Jun-21	9	8.03	151			27								
10-Jun-21	10	8	155	1.5	51.5	29	<1.9	0.1	1.9	< 6	< 0.005	< 0.1	< 0.6	< 0.3
17-Jun-21	11	8.01	162			30								
24-Jun-21	12	8.01	142	1.9	52.9	23				< 2	< 0.005	< 0.1	< 0.6	< 0.3
1-Jul-21	13	7.97	154			30								
8-Jul-21	14	7.77	156	2.9	46.3	24	<2.2	0.3	2.2	2	< 0.005	< 0.1	< 0.6	< 0.3
15-Jul-21	15	7.9	156			25								
22-Jul-21	16	7.88	157	5.1	47.3	25				2	0.005	< 0.1	< 0.06	< 0.03

Date	Week	pH	Cond.	Acidity (pH 8.3)	Alkalinity	Sulfate	Gross Alpha	Ra-226	Ra-228	TSS	Free CN	Ammonia as N	Nitrate as N	Nitrite as N
			µmhos/cm	mgCaCO3/L	mgCaCO3/L	mg/L	pCi/L	pCi/L	pCi/L		mg/L	mg/L	mg/L	mg/L
29-Jul-21	17	7.94	155			25								
5-Aug-21	18	7.97	148	4.6	46.2	21	<1.9	<0.1	<2.2	< 3	< 0.005	< 0.1	< 0.6	< 0.3
12-Aug-21	19	7.95	144			20								
19-Aug-21	20	7.98	158	5.1	48.5	21								
26-Aug-21	21	8.05	155			25								
2-Sep-21	22	7.98	148	6	50.6	21	2.2	0.2	2.2	< 6	< 0.005	< 0.1	< 0.6	< 0.3
9-Sep-21	23	8	149			21								
16-Sep-21	24	8.04	148	1.1	47.3	18								
23-Sep-21	25	7.98	153			14								
30-Sep-21	26	8.11	147	1.6	50.8	11	<1.4	<0.1	<2.2	< 3	< 0.005	< 0.1	< 0.6	< 0.3
7-Oct-21	27	8.06	145			15								
14-Oct-21	28	8.08	149	1.7	52	16								
21-Oct-21	29	8.06	143			13								
28-Oct-21	30	8.05	152	1.8	52.1	19	<1.6	<0.1	<2.2	< 8	< 0.005	< 0.1	< 0.6	< 0.3
4-Nov-21	31	8.11	137			12								
11-Nov-21	32	8.09	144	1.2	50.1	15								
18-Nov-21	33	8.06	157			18								
25-Nov-21	34	8.08	150	1.3	52.7	15	1.1	0.2	<1.9	2	< 0.005	< 0.1	< 0.6	< 0.3
2-Dec-21	35	7.98	89			8								
9-Dec-21	36	8.05	152	2	51.7	18								
16-Dec-21	37	8.04	144			15								
23-Dec-21	38	8.08	148	1.4	53.3	14	1.6	<0.1	<2.2	< 2	< 0.05	< 0.1	< 0.6	< 0.3
30-Dec-21	39	7.99	145			14								
6-Jan-22	40	7.97	139	1.4	51	12								
CELL 4														

Date	Week	pH	Cond.	Acidity (pH 8.3)	Alkalinity	Sulfate	Gross Alpha	Ra-226	Ra-228	TSS	Free CN	Ammonia as N	Nitrate as N	Nitrite as N
			µmhos/cm	mgCaCO3/L	mgCaCO3/L	mg/L	pCi/L	pCi/L	pCi/L		mg/L	mg/L	mg/L	mg/L
8-Apr-21	1	8.44	632	#N/A	89.9	222	6.8	0.8	2.2	< 6	< 0.005	< 0.1	< 0.6	< 0.3
15-Apr-21	2	8.38	226	#N/A	50.6	38	1.4	0.2	2.2	< 7	< 0.005	< 0.1	< 0.6	< 0.3
22-Apr-21	3	7.84	222	3.4	50.3	50	1.9	0.1	2.2	< 3	< 0.005	< 0.1	< 0.6	< 0.3
29-Apr-21	4	7.87	197	3.1	41.3	45	1.4	0.1		< 60	< 0.005	< 0.1	< 0.6	< 0.3
6-May-21	5	7.89	198			39								
13-May-21	6	8.25	195	1.9	56.5	45	2.2	0.2	2.2	< 2	< 0.005	< 0.1	< 0.6	< 0.3
20-May-21	7	8.12	115			11								
27-May-21	8	8.3	208	#N/A	50	60				< 3	< 0.005	< 0.1	< 0.6	< 0.3
3-Jun-21	9	8.1	168			33								
10-Jun-21	10	7.91	161	1.4	53	30	2.4	0.2	1.9	< 6	< 0.005	< 0.1	< 0.6	< 0.3
17-Jun-21	11	7.95	183			39								
24-Jun-21	12	7.99	168	2.5	52.7	27				< 2	< 0.005	< 0.1	< 0.6	< 0.3
1-Jul-21	13	7.92	164			33								
8-Jul-21	14	7.77	167	3.4	47.6	29	2.2	0.1	2.7	< 3	< 0.005	< 0.1	< 0.6	< 0.3
15-Jul-21	15	7.86	168			29								
22-Jul-21	16	7.86	164	5.3	50.3	24				< 2	< 0.005	< 0.1	< 0.06	< 0.03
29-Jul-21	17	7.92	172			29								
5-Aug-21	18	7.97	167	4.7	51.5	23	2.2	0.1	2.2	< 3	< 0.005	< 0.1	< 0.6	< 0.3
12-Aug-21	19	7.92	159			20								
19-Aug-21	20	7.93	188	5.6	52.5	32								
26-Aug-21	21	8	210			44								
2-Sep-21	22	7.92	191	7.1	56.2	40	2.2	0.3	2.2	< 6	< 0.005	< 0.1	< 0.6	< 0.3
9-Sep-21	23	7.98	183			34								
16-Sep-21	24	8.05	183	1.4	53.4	29								
23-Sep-21	25	8.02	171			19								

Date	Week	pH	Cond.	Acidity (pH 8.3)	Alkalinity	Sulfate	Gross Alpha	Ra-226	Ra-228	TSS	Free CN	Ammonia as N	Nitrate as N	Nitrite as N
			µmhos/cm	mgCaCO3/L	mgCaCO3/L	mg/L	pCi/L	pCi/L	pCi/L		mg/L	mg/L	mg/L	mg/L
30-Sep-21	26	8.11	175	1.6	54.6	22	1.6	0.2	2.2	< 3	< 0.005	< 0.1	< 0.6	< 0.3
7-Oct-21	27	8.03	170			23								
14-Oct-21	28	8.14	172	1.6	55.6	23								
21-Oct-21	29	8.05	157			18								
28-Oct-21	30	8.04	172	1.9	54.2	25	1.9	0.2	2.2	< 8	< 0.005	< 0.1	< 0.6	< 0.3
4-Nov-21	31	8.11	146			11								
11-Nov-21	32	8.09	165	1.3	53.5	19								
18-Nov-21	33	8.03	180			26								
25-Nov-21	34	8.07	175	1.4	55.4	23	1.1	0.1	1.9	2	< 0.005	< 0.1	< 0.6	< 0.3
2-Dec-21	35	7.96	129			19								
9-Dec-21	36	8.02	172	2.2	55.2	25								
16-Dec-21	37	7.99	173			25								
23-Dec-21	38	8.05	176	1.4	56.8	24	1.9	0.2	2.2	< 3	< 0.05	< 0.1	< 0.6	< 0.3
30-Dec-21	39	7.94	173			23								
6-Jan-22	40	8.01	155	1.5	54.9	18								
CELL 5														
8-Apr-21	1	8.41	624	#N/A	76.6	208	5.9	1.1	<1.9	8	< 0.005	< 0.1	< 0.6	< 0.3
15-Apr-21	2	8.43	158	#N/A	49.1	22	<1.4	0.3	<2.2	< 7	< 0.005	< 0.1	< 0.6	< 0.3
22-Apr-21	3	7.88	162	2.6	50.2	30	1.9	0.3	<2.2	< 3	< 0.005	< 0.1	< 0.6	< 0.3
29-Apr-21	4	7.89	163	3.2	42.8	27	3.5	0.3		< 3	< 0.005	< 0.1	< 0.6	< 0.3
6-May-21	5	7.89	159			28								
13-May-21	6	8.29	174	1.9	59	30	3.2	0.5	<2.2	2	< 0.005	< 0.1	< 0.6	< 0.3
20-May-21	7	8.09	161			26								
27-May-21	8	8.4	156	#N/A	55.1	24				< 2	< 0.005	< 0.1	< 0.6	< 0.3
3-Jun-21	9	8.16	152			21								

Date	Week	pH	Cond.	Acidity (pH 8.3)	Alkalinity	Sulfate	Gross Alpha	Ra-226	Ra-228	TSS	Free CN	Ammonia as N	Nitrate as N	Nitrite as N
			µmhos/cm	mgCaCO3/L	mgCaCO3/L	mg/L	pCi/L	pCi/L	pCi/L		mg/L	mg/L	mg/L	mg/L
10-Jun-21	10	8.04	150	1.1	55	22	1.6	<0.1	<1.9	< 6	< 0.005	< 0.1	< 0.6	< 0.3
17-Jun-21	11	8.09	157			26								
24-Jun-21	12	8.14	155	2	58.2	17				< 2	< 0.005	< 0.1	< 0.6	< 0.3
1-Jul-21	13	8.01	150			24								
8-Jul-21	14	7.81	152	3	50.9	22	2.2	0.2	<2.2	< 3	< 0.005	< 0.1	< 0.6	< 0.3
15-Jul-21	15	7.93	155			22								
22-Jul-21	16	7.89	142	4.8	49.4	15				2	< 0.005	< 0.1	< 0.06	< 0.03
29-Jul-21	17	7.99	144			17								
5-Aug-21	18	8.03	151	4.4	52.8	16	<1.6	0.5	<2.2	< 3	< 0.005	< 0.1	< 0.6	< 0.3
12-Aug-21	19	7.99	142			13								
19-Aug-21	20	8.03	145	5	53.4	11								
26-Aug-21	21	8.08	172			24								
2-Sep-21	22	8.01	157	6.3	58	21	2.7	0.5	<2.2	< 6	< 0.005	< 0.1	< 0.6	< 0.3
9-Sep-21	23	8.02	158			19								
16-Sep-21	24	8.08	153	1.2	54.7	17								
23-Sep-21	25	8.08	146			11								
30-Sep-21	26	8.11	149	1.6	54.6	13	1.9	0.2	<2.2	< 3	< 0.005	< 0.1	< 0.6	< 0.3
7-Oct-21	27	8.09	147			12								
14-Oct-21	28	8.09	142	1.6	55.4	11								
21-Oct-21	29	8.05	139			12								
28-Oct-21	30	8.08	140	1.5	54.2	12	1.6	0.2	<1.9	< 8	< 0.005	< 0.1	< 0.6	< 0.3
4-Nov-21	31	8.12	138			10								
11-Nov-21	32	8.12	137	1.1	52.9	13								
18-Nov-21	33	8.07	152			15								
25-Nov-21	34	8.1	148	1.2	56.3	12	2.7	<0.1	<1.9	< 2	< 0.005	< 0.1	< 0.6	< 0.3

Date	Week	pH	Cond.	Acidity (pH 8.3)	Alkalinity	Sulfate	Gross Alpha	Ra-226	Ra-228	TSS	Free CN	Ammonia as N	Nitrate as N	Nitrite as N
			µmhos/cm	mgCaCO3/L	mgCaCO3/L	mg/L	pCi/L	pCi/L	pCi/L		mg/L	mg/L	mg/L	mg/L
2-Dec-21	35	8	118			9								
9-Dec-21	36	8.05	135	1.9	54	10								
16-Dec-21	37	8.05	145			14								
23-Dec-21	38	8.09	149	1.2	57.2	12	2.7	0.2	<2.2	< 3	< 0.05	< 0.1	< 0.6	< 0.3
30-Dec-21	39	8.05	141			11								
6-Jan-22	40	8.03	134	1.3	54.6	9								
CELL 6														
8-Apr-21	1	8.33	525	#N/A	68.5	182	<3.8	0.5	<2.2	< 6	< 0.005	< 0.1	< 0.6	< 0.3
15-Apr-21	2	8.42	178	#N/A	52.2	25	1.4	0.3	<2.2	< 7	< 0.005	< 0.1	< 0.6	< 0.3
22-Apr-21	3	7.87	170	2.7	50.3	37	<1.4	0.2	<2.2	< 3	< 0.005	< 0.1	< 0.6	< 0.3
29-Apr-21	4	7.87	190	2.8	40.2	42	<1.6	0.3		113	< 0.005	< 0.1	< 0.6	< 0.3
6-May-21	5	7.87	193			45								
13-May-21	6	8.29	202	1.8	57.5	48	<1.6	0.3	<2.2	2	< 0.005	< 0.1	< 0.6	< 0.3
20-May-21	7	8.07	173			34								
27-May-21	8	8.39	167	#N/A	52.8	33				< 3	< 0.005	< 0.1	< 0.6	< 0.3
3-Jun-21	9	8.04	166			34								
10-Jun-21	10	7.95	179	1.6	54	35	<1.6	<0.1	<1.9	< 6	< 0.005	< 0.1	< 0.6	< 0.3
17-Jun-21	11	8.02	185			43								
24-Jun-21	12	8.06	174	2.3	54.7	32				3	< 0.005	< 0.1	< 0.6	< 0.3
1-Jul-21	13	7.98	160			28								
8-Jul-21	14	7.79	173	3	47.7	32				< 2	< 0.005	< 0.1	< 0.6	< 0.3
15-Jul-21	15	7.86	185			40								
22-Jul-21	16	7.87	187	5.3	51.2	33	3.0	0.5	<2.2	2	< 0.005	< 0.1	< 0.06	< 0.03
29-Jul-21	17	7.95	168			27								
5-Aug-21	18	8	169	4.4	52	24	<2.4	0.5	<2.2	< 3	< 0.005	< 0.1	< 0.6	< 0.3

Date	Week	pH	Cond.	Acidity (pH 8.3)	Alkalinity	Sulfate	Gross Alpha	Ra-226	Ra-228	TSS	Free CN	Ammonia as N	Nitrate as N	Nitrite as N
			µmhos/cm	mgCaCO3/L	mgCaCO3/L	mg/L	pCi/L	pCi/L	pCi/L		mg/L	mg/L	mg/L	mg/L
12-Aug-21	19	7.95	160			23								
19-Aug-21	20	7.97	167	5.3	52.5	22								
26-Aug-21	21	8.02	210			45								
2-Sep-21	22	7.96	196	6.7	56.8	34	2.2	0.5	<2.2	< 6	< 0.005	< 0.1	< 0.6	< 0.3
9-Sep-21	23	7.98	219			45								
16-Sep-21	24	8.07	190	1.3	56	33								
23-Sep-21	25	8.07	174			22								
30-Sep-21	26	8.11	182	1.6	56.4	25	<1.6	0.2	<2.4	< 3	< 0.005	< 0.1	< 0.6	< 0.3
7-Oct-21	27	8.06	180			24								
14-Oct-21	28	8.08	180	1.8	57.9	25								
21-Oct-21	29	8.07	168			20								
28-Oct-21	30	8.07	172	1.8	56.8	21	3.2	0.5	<1.9	< 8	< 0.005	< 0.1	< 0.6	< 0.3
4-Nov-21	31	8.13	164			17								
11-Nov-21	32	8.1	174	1.3	56.4	23								
18-Nov-21	33	8.06	199			30								
25-Nov-21	34	8.09	187	1.4	58.6	25	1.6	<0.1	<1.9	2	< 0.005	< 0.1	< 0.6	< 0.3
2-Dec-21	35	7.89	87			9								
9-Dec-21	36	8.03	177	2.1	57.2	25								
16-Dec-21	37	8.01	178			22								
23-Dec-21	38	8.07	181	1.4	59	21	1.4	<0.1	<2.2	< 2	< 0.05	< 0.1	< 0.6	< 0.3
30-Dec-21	39	7.98	167			21								
6-Jan-22	40	8.04	160	1.4	56.6	18								

Date	F	Sb	As	Ba	Be	B	Cd	Cr	Pb	Hg	Ni	Se	Tl	U
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	mg/L
8-Apr-21	1.32	0.0826	0.0028	0.026	< 0.000007	0.293	0.000714	< 0.00008	0.049	< 0.01	0.0029	0.004	0.00056	0.000367
15-Apr-21	1.43	0.108	0.0031	0.0222	< 0.000007	0.147	0.000138	0.00108	0.0335	< 0.01	< 0.0001	0.00167	0.000318	0.00017
22-Apr-21	1.31	0.0906	0.0032	0.0198	< 0.000007	0.071	0.000112	< 0.00008	0.0299	< 0.01	0.0002	0.00134	0.000228	0.000122
29-Apr-21	1.54	0.141	0.005	0.0359	< 0.000007	0.016	0.000057	0.00017	0.00943	< 0.01	0.0005	0.00093	0.000332	0.001594
13-May-21	1.26	0.074	0.003	0.0241	< 0.000007	0.025	0.000181	< 0.00008	0.0332	< 0.01	0.0002	0.00118	0.00014	0.000107
27-May-21	1.32	0.0764	0.0034	0.0274	< 0.000007	0.028	0.000212	< 0.00008	0.0371	< 0.01	0.0001	0.00137	0.000138	0.000113
10-Jun-21	1.17	0.0701	0.0036	0.0291	< 0.000007	0.022	0.00022	< 0.00008	0.0387	< 0.01	< 0.0001	0.00178	0.000134	0.000093
24-Jun-21	1.06	0.0587	0.0038	0.0272	< 0.000007	0.018	0.000165	0.00029	0.032	< 0.01	0.0002	0.0013	0.000096	0.000076
8-Jul-21	1.04	0.0587	0.0033	0.0248	< 0.000007	0.01	0.0002	< 0.00008	0.0306	< 0.01	0.0002	0.00138	0.000087	0.000079
22-Jul-21	0.92	0.0453	0.0029	0.0315	< 0.000007	0.011	0.000183	0.00013	0.0342	< 0.01	0.0004	0.00127	0.000101	0.000068
5-Aug-21	0.9	0.044	0.003	0.0377	< 0.000007	0.007	0.000166	< 0.00008	0.0324	< 0.01	0.0001	0.00123	0.000101	0.000077
2-Sep-21	0.85	0.067	0.0027	0.0338	< 0.000007	0.01	0.000183	< 0.00008	0.0323	< 0.01	< 0.0001	0.00141	0.000115	0.000094
30-Sep-21	0.74	0.0383	0.0031	0.0378	< 0.000007	0.01	0.00018	< 0.00008	0.0314	0.05	< 0.0001	0.00122	0.000087	0.00011
28-Oct-21	0.53	0.0334	0.0026	0.0339	< 0.000007	0.01	0.000174	0.00009	0.0261	< 0.01	0.0005	0.00147	0.000095	0.000131
25-Nov-21	0.54	0.0339	0.0031	0.0397	< 0.000007	0.006	0.000212	< 0.00008	0.0278	< 0.01	0.0002	0.00116	0.000083	0.000116
23-Dec-21	0.48	0.0313	0.0033	0.0386	< 0.000007	0.007	0.000198	< 0.00008	0.0211	< 0.01	0.0001	0.00111	0.000045	0.000104
CELL 2														
8-Apr-21	1.94	0.132	0.0043	0.0288	< 0.000007	0.128	0.000239	0.00009	0.0137	0.01	0.0034	0.00301	0.00173	0.00189
15-Apr-21	1.77	0.155	0.0066	0.0455	< 0.000007	0.047	0.000053	0.00107	0.00917	< 0.01	0.0005	0.00133	0.00056	0.00134
22-Apr-21	1.64	0.113	0.0053	0.0389	< 0.000007	0.021	0.00004	0.00037	0.0102	< 0.01	0.0008	0.00119	0.000383	0.00137
29-Apr-21	1.24	0.124	0.0031	0.0209	< 0.000007	0.059	0.000193	< 0.00008	0.0308	< 0.01	0.0002	0.00119	0.000213	0.000114
13-May-21	1.51	0.0772	0.0047	0.0438	< 0.000007	0.01	0.000051	< 0.00008	0.0105	< 0.01	0.0004	0.00084	0.000301	0.00182
27-May-21	1.5	0.0692	0.0051	0.0413	< 0.000007	0.01	0.000063	< 0.00008	0.0098	< 0.01	0.0005	0.00101	0.000294	0.00184
10-Jun-21	1.32	0.0581	0.005	0.0382	< 0.000007	0.008	0.000088	< 0.00008	0.0103	< 0.01	0.0003	0.00135	0.000261	0.00179

Date	F	Sb	As	Ba	Be	B	Cd	Cr	Pb	Hg	Ni	Se	Tl	U
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	mg/L
24-Jun-21	1.25	0.0517	0.0045	0.0385	< 0.000007	0.008	0.000057	0.00015	0.00988	< 0.01	0.0004	0.00083	0.000227	0.00179
8-Jul-21	1.25	0.051	0.0043	0.0333	< 0.000007	0.004	0.000062	< 0.00008	0.00951	< 0.01	0.0005	0.00103	0.000174	0.00183
22-Jul-21	1.14	0.0367	0.0036	0.0381	< 0.000007	0.006	0.000057	< 0.00008	0.011	< 0.01	0.0006	0.0008	0.00019	0.00161
5-Aug-21	1.12	0.0375	0.0039	0.0427	< 0.000007	< 0.002	0.000065	0.00043	0.0113	< 0.01	0.0004	0.00091	0.000186	0.00165
2-Sep-21	0.98	0.0589	0.0033	0.0347	< 0.000007	0.004	0.000069	< 0.00008	0.0104	< 0.01	0.0004	0.00097	0.000198	0.00179
30-Sep-21	0.83	0.036	0.0034	0.0361	< 0.000007	0.006	0.000056	< 0.00008	0.00897	0.03	< 0.0001	0.00087	0.000185	0.00181
28-Oct-21	0.62	0.0408	0.0026	0.0331	< 0.000007	0.005	0.000083	< 0.00008	0.00788	< 0.01	0.0006	0.00118	0.000188	0.00193
25-Nov-21	0.43	0.0371	0.0025	0.0282	< 0.000007	0.003	0.000083	< 0.00008	0.00699	< 0.01	0.0005	0.00065	0.000166	0.00167
23-Dec-21	0.32	0.0355	0.0026	0.0277	< 0.000007	0.004	0.000085	< 0.00008	0.00542	< 0.01	0.0004	0.00077	0.000105	0.00132
CELL 3														
8-Apr-21	1.81	0.0538	0.0056	0.0276	< 0.000007	0.45	0.000329	0.0001	0.00849	< 0.01	0.003	0.00291	0.00191	0.00171
15-Apr-21	1.87	0.0699	0.0086	0.0331	< 0.000007	0.199	0.000055	0.0006	0.0036	< 0.01	< 0.0001	0.00108	0.00077	0.00089
22-Apr-21	1.62	0.0603	0.0078	0.036	< 0.000007	0.101	0.000057	< 0.00008	0.00347	< 0.01	0.0007	0.00112	0.000507	0.000633
29-Apr-21	1.57	0.0802	0.0069	0.0402	< 0.000007	0.089	0.00005	0.00011	0.00409	< 0.01	0.0002	0.00092	0.000475	0.000608
13-May-21	1.6	0.0461	0.0068	0.0477	< 0.000007	0.04	0.000064	< 0.00008	0.00525	< 0.01	0.0002	0.00083	0.000395	0.000568
27-May-21	1.61	0.0487	0.0085	0.0491	< 0.000007	0.039	0.000062	< 0.00008	0.00457	< 0.01	0.0002	0.00101	0.000378	0.00059
10-Jun-21	1.57	0.0396	0.0083	0.0529	< 0.000007	0.028	0.000071	< 0.00008	0.00484	< 0.01	< 0.0001	0.00124	0.000348	0.000565
24-Jun-21	1.52	0.0377	0.0085	0.0543	< 0.000007	0.024	0.000061	0.00012	0.00415	< 0.01	0.0002	0.00081	0.000268	0.000559
8-Jul-21	1.53	0.0375	0.0078	0.0455	< 0.000007	0.015	0.000047	< 0.00008	0.00419	< 0.01	0.0002	0.00093	0.000237	0.00052
22-Jul-21	1.45	0.0257	0.0067	0.0489	< 0.000007	0.015	0.000038	< 0.00008	0.00396	< 0.01	0.0003	0.00091	0.000267	0.000428
5-Aug-21	1.39	0.0239	0.0068	0.0554	< 0.000007	0.01	0.000067	< 0.00008	0.00377	< 0.01	0.0001	0.00089	0.000275	0.000391
2-Sep-21	1.34	0.0362	0.0063	0.0386	< 0.000007	0.011	0.000048	< 0.00008	0.00294	< 0.01	< 0.0001	0.00099	0.000238	0.000467
30-Sep-21	1.28	0.0226	0.0066	0.0405	< 0.000007	0.012	0.000053	< 0.00008	0.00214	< 0.01	< 0.0001	0.00097	0.000186	0.000525
28-Oct-21	1.29	0.023	0.0057	0.0345	< 0.000007	0.01	0.000059	0.00025	0.00204	< 0.01	0.0001	0.00063	0.000193	0.000523
25-Nov-21	1.25	0.0217	0.0066	0.0345	0.000007	0.008	0.00005	< 0.00008	0.00141	< 0.01	0.0001	0.00079	0.000184	0.00049

Date	F	Sb	As	Ba	Be	B	Cd	Cr	Pb	Hg	Ni	Se	Tl	U
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	mg/L
23-Dec-21	1.21	0.0218	0.008	0.0409	< 0.000007	0.008	0.000047	< 0.00008	0.00105	< 0.01	0.0001	0.00088	0.000096	0.000434
CELL 4														
8-Apr-21	1.38	0.108	0.004	0.016	< 0.000007	0.362	0.000369	< 0.00008	0.0254	< 0.01	0.0029	0.00267	0.000573	0.00157
15-Apr-21	1.47	0.117	0.0042	0.0196	< 0.000007	0.178	0.000245	0.00036	0.0176	< 0.01	0.0005	0.00195	0.000403	0.000302
22-Apr-21	1.31	0.0863	0.0035	0.0213	< 0.000007	0.094	0.000249	< 0.00008	0.0168	< 0.01	0.0005	0.00157	0.000313	0.000211
29-Apr-21	1.26	0.114	0.0032	0.02	< 0.000007	0.071	0.000266	0.00014	0.0152	< 0.01	0.0005	0.0013	0.000264	0.000171
13-May-21	1.41	0.0642	0.0032	0.0256	< 0.000007	0.033	0.000199	< 0.00008	0.0225	< 0.01	0.0003	0.00128	0.000208	0.000142
27-May-21	1.4	0.0615	0.0033	0.0349	< 0.000007	0.031	0.000344	< 0.00008	0.0277	< 0.01	0.0005	0.00146	0.000251	0.000147
10-Jun-21	1.24	0.0543	0.0035	0.0297	< 0.000007	0.023	0.000234	< 0.00008	0.0286	< 0.01	0.0002	0.00162	0.000212	0.000129
24-Jun-21	1.16	0.0508	0.0032	0.0361	< 0.000007	0.019	0.000242	< 0.00008	0.0291	< 0.01	0.0003	0.00129	0.000161	0.000137
8-Jul-21	1.21	0.0518	0.0046	0.0253	< 0.000007	0.004	0.00006	< 0.00008	0.0118	< 0.01	0.0004	0.00133	0.000209	0.00226
22-Jul-21	1.05	0.0359	0.0028	0.0362	< 0.000007	0.012	0.000215	< 0.00008	0.0282	0.04	0.0004	0.00125	0.000165	0.000123
5-Aug-21	1.12	0.0374	0.003	0.0458	< 0.000007	0.009	0.000232	0.00008	0.0298	< 0.01	0.0003	0.00126	0.000174	0.000134
2-Sep-21	1.12	0.0545	0.0023	0.0472	< 0.000007	0.011	0.000277	< 0.00008	0.0259	< 0.01	0.0002	0.00141	0.000191	0.000162
30-Sep-21	1	0.0317	0.0026	0.0536	< 0.000007	0.009	0.000253	< 0.00008	0.0232	< 0.01	< 0.0001	0.00131	0.000161	0.000173
28-Oct-21	0.95	0.0332	0.0034	0.0444	< 0.000007	0.009	0.00025	< 0.00008	0.0174	< 0.01	0.0004	0.00144	0.000153	0.000193
25-Nov-21	0.72	0.0296	0.0027	0.0473	< 0.000007	0.007	0.000202	0.00014	0.0165	< 0.01	0.0004	0.00108	0.000145	0.00019
23-Dec-21	0.73	0.029	0.0029	0.0508	< 0.000007	0.007	0.000246	< 0.00008	0.0133	< 0.01	0.0002	0.00127	0.00009	0.000181
CELL 5														
8-Apr-21	1.75	0.21	0.0067	0.0295	< 0.000007	0.121	0.000092	< 0.00008	0.0128	< 0.01	0.0037	0.00199	0.00103	0.00292
15-Apr-21	1.65	0.18	0.0078	0.0369	< 0.000007	0.045	0.000083	0.0004	0.0105	< 0.01	0.0004	0.00162	0.000523	0.00186
22-Apr-21	1.42	0.115	0.0068	0.0319	< 0.000007	0.019	0.000045	< 0.00008	0.00922	< 0.01	0.0005	0.00173	0.000372	0.00186
29-Apr-21	1.42	0.137	0.0066	0.0293	< 0.000007	0.013	0.000051	< 0.00008	0.0108	< 0.01	0.0005	0.00128	0.000384	0.00222
13-May-21	1.34	0.0738	0.0068	0.0345	< 0.000007	0.008	0.000082	< 0.00008	0.0111	< 0.01	0.0006	0.00123	0.00034	0.00232
27-May-21	1.46	0.0653	0.0062	0.0333	< 0.000007	0.007	0.000069	< 0.00008	0.0114	< 0.01	0.0006	0.00128	0.000316	0.00229

Date	F	Sb	As	Ba	Be	B	Cd	Cr	Pb	Hg	Ni	Se	Tl	U
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	mg/L
10-Jun-21	1.28	0.0547	0.0055	0.0306	< 0.000007	0.006	0.000074	< 0.00008	0.0125	< 0.01	0.0005	0.00145	0.000321	0.00239
24-Jun-21	1.18	0.0486	0.005	0.0315	< 0.000007	0.004	0.000171	0.00017	0.0121	< 0.01	0.0006	0.00123	0.00025	0.0024
8-Jul-21	1.28	0.05	0.0028	0.0306	< 0.000007	0.013	0.000226	< 0.00008	0.0277	< 0.01	0.0003	0.00133	0.000146	0.000143
22-Jul-21	0.89	0.031	0.0041	0.0247	< 0.000007	0.004	0.000044	0.00014	0.013	< 0.01	0.0007	0.00118	0.000222	0.00137
29-Jul-21														
5-Aug-21	1.03	0.0349	0.0045	0.0308	< 0.000007	< 0.002	0.000069	< 0.00008	0.014	< 0.01	0.0004	0.00125	0.000242	0.00223
2-Sep-21	0.93	0.0618	0.0041	0.0261	< 0.000007	0.003	0.000057	< 0.00008	0.0147	< 0.01	0.0004	0.00132	0.000232	0.00227
30-Sep-21	0.75	0.0356	0.0035	0.0283	< 0.000007	0.004	0.00007	< 0.00008	0.0132	< 0.01	< 0.0001	0.00127	0.000218	0.0022
28-Oct-21	0.58	0.0357	0.0037	0.0203	0.000012	< 0.002	0.000052	0.00012	0.0107	< 0.01	0.0004	0.00114	0.000194	0.00186
25-Nov-21	0.47	0.0396	0.0036	0.0214	< 0.000007	0.002	0.000055	< 0.00008	0.0109	< 0.01	0.0004	0.00145	0.000199	0.00185
23-Dec-21	0.44	0.0403	0.0035	0.0224	< 0.000007	0.003	0.000074	0.00033	0.00932	< 0.01	0.0004	0.00145	0.000145	0.00169
CELL 6														
8-Apr-21	1.87	0.0708	0.0077	0.0322	< 0.000007	0.4	0.00016	< 0.00008	0.011	0.02	0.0013	0.00215	0.000982	0.000774
15-Apr-21	1.84	0.0894	0.0102	0.0546	< 0.000007	0.191	0.000097	0.00034	0.0105	< 0.01	0.0004	0.00127	0.000594	0.000515
22-Apr-21	1.55	0.0722	0.009	0.0619	< 0.000007	0.099	0.000073	< 0.00008	0.0103	< 0.01	0.0008	0.00123	0.000458	0.000416
29-Apr-21	1.57	0.0894	0.0079	0.0627	< 0.000007	0.08	0.000097	< 0.00008	0.0122	< 0.01	0.0005	0.00117	0.000414	0.00038
13-May-21	1.5	0.0558	0.0074	0.0757	< 0.000007	0.038	0.000118	< 0.00008	0.0161	< 0.01	0.0005	0.00109	0.00037	0.00037
27-May-21	1.67	0.0574	0.0085	0.082	< 0.000007	0.037	0.00017	< 0.00008	0.0174	< 0.01	0.0005	0.00138	0.000364	0.000397
10-Jun-21	1.51	0.0484	0.0079	0.0869	< 0.000007	0.026	0.000157	< 0.00008	0.0185	< 0.01	0.0004	0.00162	0.000349	0.000395
24-Jun-21	1.37	0.0414	0.0066	0.0913	< 0.000007	0.019	0.000126	0.00015	0.0171	< 0.01	0.0005	0.00126	0.000286	0.000373
8-Jul-21	1.4	0.0402	0.0072	0.0718	< 0.000007	0.014	0.000126	< 0.00008	0.0139	< 0.01	0.0006	0.00126	0.000212	0.000361
22-Jul-21	1.34	0.0304	0.0054	0.09	< 0.000007	0.013	0.000131	< 0.00008	0.0156	< 0.01	0.0005	0.00122	0.000256	0.00032
5-Aug-21	1.36	0.0286	0.0065	0.0913	< 0.000007	0.01	0.000137	< 0.00008	0.0134	< 0.01	0.0003	0.00127	0.000256	0.00034
2-Sep-21	1.3	0.0432	0.0046	0.096	< 0.000007	0.011	0.000143	< 0.00008	0.0121	< 0.01	0.0003	0.00126	0.000281	0.000427
30-Sep-21	1.31	0.0245	0.0044	0.0994	< 0.000007	0.01	0.000135	< 0.00008	0.0101	< 0.01	< 0.0001	0.00124	0.000246	0.000469

Date	F	Sb	As	Ba	Be	B	Cd	Cr	Pb	Hg	Ni	Se	Tl	U
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	mg/L
28-Oct-21	1.28	0.0261	0.0048	0.0815	0.000007	0.008	0.000117	< 0.00008	0.00776	< 0.01	0.0003	0.00115	0.000248	0.000537
25-Nov-21	1.21	0.0231	0.0042	0.0829	< 0.000007	0.007	0.000163	0.00014	0.00746	< 0.01	0.0004	0.00094	0.000224	0.000506
23-Dec-21	1.19	0.0222	0.0045	0.0804	< 0.000007	0.007	0.000124	< 0.00008	0.00511	< 0.01	0.0003	0.00112	0.000154	0.000444

NOTE: Highlight = exceeds AWQS value.

ATTACHMENT C

Memorandum:
Standardized Reclamation Cost Estimator (SRCE)
And
CFO Letter

1860 East River Road, Suite 200
Tucson, AZ 85718
USA

T +1 520 485 1300

south32.net

December 05, 2023

Via Electronic Mail
Arizona Department of Environmental Quality
Attention: Mr. Vimal Chauhan, Groundwater Protection
1110 West Washington Street
Phoenix, Arizona 85007
Email: chauhan.vimal@azdeq.gov

Re: Aquifer Protection Program (APP) Permit Significant Amendment No. P-512235, Financial Statement

Dear Mr. Chauhan:

This letter is provided under the Arizona Administrative Code (A.A.C.) R18-9-A203(B)(1) in support of the application by South32 Hermosa, Inc. for a significant amendment to APP No. P-512235.

The amendment will authorize the expansion of the existing tailings storage facility (TSF) on South32 Hermosa's private property. Estimated costs for construction, closure, and post-closure are provided in the application.

South32 Hermosa Inc., using its own assets or those provided by its parent company, has sufficient resources to construct the expansion and is financially capable of meeting the costs described in A.A.C. R18-9-A201(B)(5). Closure and post-closure costs for the existing TSF are covered by a bond. The increased closure and post-closure costs associated with the expansion will be provided either by an increased bond, or by an alternative mechanism allowed under A.A.C. R18-9-A203(C)(2)-(8). The mechanism will be provided once estimated closure and post-closure costs are approved by the Arizona Department of Environmental Quality (ADEQ).

Please contact Brent Musslewhite (brent.musslewhite@south32.net) if you have any questions, concerns, or require additional information.

South32 Hermosa Inc.,

Sandy Sibenalar

Sandy Sibenalar
Chief Financial Officer

December 8, 2023

South32 Hermosa Inc.
1860 East River Road
Tucson, Arizona 85718

Attention: Mr. Brent Musslewhite

Re: Standardized Reclamation Cost Estimator for the Hermosa Project Tailings Storage Facility 1 (TSF1) Significant Amendment

NewFields has prepared this letter in response to a request from South32 Hermosa Inc. (South32) to update the 2020 Standardized Reclamation Cost Estimator (SRCE) model developed for the Hermosa Lined TSF Design Amendment. The update includes the Tailings Storage Facility 1 (TSF1) design which is being submitted to the Arizona Department of Environmental Quality (ADEQ) as a proposed Aquifer Protection Permit (APP) significant amendment. The attached NewFields' technical memorandum titled "Tailings Storage Facility 1 (TSF1) Standardized Reclamation Cost Estimator (SRCE) Update" dated December 8th, 2023 includes a description of the SRCE model development as well as the SRCE model results. The description is presented in Sections 1 through 8, the SRCE model outputs are presented in Attachment A, various closure cost summary tables in Attachment B, and a set of Figures are presented after the attachments to illustrate the inputs utilized for the model.

The engineer of record, Craig M Thompson, has directed the work of the development of the SRCE model described herein. Please reference the attached NewFields' technical memorandum for SRCE model details and results.

Sincerely,

Registered Professional Engineer (Civil)
CERTIFICATE NO.
63431
CRAIG M.
THOMPSON
12/8/23
Date Signed
ARIZONA, U.S.A.
EXPIRES 3/31/26

Reviewed by:

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TECHNICAL MEMORANDUM

To: South32 Hermosa Inc.

From: R. Michael Smith, P.E. – Project Principal and
Craig M. Thompson, P.E. – Project Manager

Project: Hermosa Project

Subject: Tailings Storage Facility 1 (TSF1) Standardized Reclamation Cost Estimator (SRCE) Update

Date: December 8, 2023

1. INTRODUCTION

NewFields has performed an update to the 2020 Standardized Reclamation Cost Estimator (SRCE) model developed for the Hermosa Project (NewFields, 2020b). The 2020 SRCE model was submitted to and approved by Arizona Department of Environmental Quality (ADEQ) Aquifer Protection Permit (APP) program as part of the Hermosa Lined TSF Design Amendment (NewFields, 2020c). The purpose of the update is to re-calculate closure costs associated with the proposed Tailings Storage Facility 1 (TSF1) expansion (NewFields, 2023).

The 2023 SRCE model update was performed using the "Issued for Tender" TSF1 Design Drawings and is being submitted to ADEQ as part of a significant amendment application. The SRCE model is software that was developed as a collaborative effort between the Nevada Division of Environmental Protection (NDEP) Bureau of Mining Regulation and Reclamation (BMRR), the US Department of Interior Bureau of Land Management (BLM) and the Nevada Mining Association (NvMA). The SRCE model was developed by these agencies to provide a template for the calculation of mine site reclamation costs in an effort to provide consistent, complete, and accurate estimates. ADEQ recommends (but does not require) that applicants use the SRCE model to estimate closure costs as can be seen on the "Individual Aquifer Protection Permit Closure and Post-Closure Plan/Strategy and Cost Estimate Checklist" (p. 1) (available at https://static.azdeq.gov/forms/app_cost_est_checklist_mining_indust.pdf).

To date, the materials relocated onto the existing lined TSF were placed as a dry stack following engineering specifications and controls (i.e., moisture and density controls). The materials included historic tailings piles, exploration decline development (waste) rock, water treatment plant 1 (WTP1) filter cake, core cutting solids, and construction potentially acid generating (PAG) rock. As part of the transition to an active mining project, the proposed TSF1 will store additional materials including waste rock from exploration and future mine development, WTP1 and WTP2 filter cake, core cutting solids, drill cuttings, assay rejects, sediments from stormwater BMPS, sediments from vehicle and equipment wash sumps, and filtered tailings. All materials placed within TSF1 will also be placed as a dry stack material following required engineering specifications and controls. The SRCE model does not include a specific reclamation section for dry stack tailings storage facilities. Therefore, the "Waste Rock Dumps" section of the SRCE model was used because reclamation elements in the SRCE model for a waste dump are comparable to those that are required for a dry stack TSF.

NewFields prepared the SRCE model for the elements identified as APP discharging facilities in the current permit amendment. The following facilities were included in the model:

- Existing Water Treatment Plant 1 (WTP1).
- Existing Underdrain Collection Pond.
- Proposed expanded TSF1.
- Existing Water Treatment Plant 2 (WTP2).

Model inputs were developed based on existing aerial topography (collected in March 2020 and April 2023), as-built data from the Voluntary Remediation Program (VRP) Tailings Storage Facility (TSF) construction (NewFields, 2020a), and the proposed TSF1 Design (NewFields, 2023). A general site arrangement can be referenced in Figure 1 and details of the various facilities can be referenced in Figure 2 through Figure 6. Conceptual closure design drawings for TSF1, created to show the closure strategy, can be referenced in the Drawings section of the TSF1 Design Report (NewFields, 2023). The conceptual closure design drawings are A600 through A615.

The reclamation cost was calculated using SRCE version 1.4.1 (Build 017b revised May 16, 2019), which was downloaded from the NDEP-BMRR website and approved for use by the State of Nevada as of August 1, 2012. The SRCE model outputs are provided as Attachment A, and the assumptions used to develop the SRCE model are summarized in the following sections.

2. CLOSURE STRATEGY

An applicant for an APP or a significant permit amendment must identify a closure strategy, A.R.S. 49-243(A)(8) & 49-243(N)(2). The closure strategy for the APP facilities listed in Section 1 is presented below, with estimated costs following the description of the closure strategy.

The closure strategy includes capping the dry stack TSF with 1 to 2 feet of reseeded growth media underlain by a capillary break created by the armoring berms placed on the exterior slopes during operation. The side slopes of the final TSF will have a 3H:1V compound slope with 2.5H:1V open slopes broken every 25 ft in vertical elevation rise by a 12.5 ft wide bench. The compound slope configuration will aid in reducing meteoric water runoff velocities, thereby reducing the propensity for erosion of the closure cap on the sides of the TSF. During operations, the top of the TSF will be graded to form a swale that flows to an outfall (stormwater diversion channel) along the haul road. The stormwater diversion channel adjacent to the haul road will convey flows from the top of the TSF to the base. Similar to operations, flows at closure will be collected from the top of the reclaimed TSF in the swale, directed to an outfall along the haul road, and conveyed from the top of the TSF to the base of the TSF. Flows reporting to the base of the TSF from this outfall and from the TSF slope areas will be collected in a closure channel (located inside of the TSF perimeter berm) and conveyed around the TSF base where they will be directed, via the TSF spillway, to a permanent stormwater diversion channel.

It should be noted that meteoric flow collecting in the closure channel will be separated from the underdrain system by a low permeability soil layer which will serve to minimize infiltration into the underdrain system. Surface water flow reporting to the closure surface will exit TSF1 on both the western and eastern sides of the facility. The western and eastern spillways will utilize culverts to pass flow under the site access roads while the mine is in operation (referred to as active closure). When the site moves to a passive (post) closure phase, the culverts that pass beneath the access road adjacent to TSF1 will be removed and replaced with riprap armored open channel spillways.

It is expected that the post closure underdrain flows from the TSF will be minimal because the closure cap will minimize infiltration and little water is expected to be entrained within the tailings mass at closure. This expectation of very low underdrain flow post closure is supported by actual dry season (non-monsoonal) flows that are currently being observed for the existing VRP TSF that are less than 1 gallon per minute (after a month of no precipitation). It should be noted that the observed flows at the existing VRP TSF are representative of a facility without a closure cap in place. Underdrain flows should be reduced even further once a closure cap is in place. The underdrain flows will continue to be collected and transmitted to active water treatment systems. Active water treatment will remain in-place until a passive treatment system can be proven to effectively address post closure contact water chemistry and/or flows and a passive treatment system can be installed in the Underdrain Collection Pond area. Maintaining active treatment post closure will allow the engineer to evaluate post closure underdrain water chemistry and expected flow rate ranges to effectively design a passive treatment system.

The closure strategy for siting a passive treatment system remains unchanged from the approved closure strategy for the VRP project. The approach is to reduce the UDCP size post closure (lower the embankment elevation) and fill the remaining pond storage area with a passive treatment substrate that effectively addresses the remaining underflow water chemistry. The underflow will be directed to the bottom of the substrate, in the passive treatment system, using a modified outfall system from the TSF. The outfall system will be designed and constructed once post closure flow rates are known. The specific mix of substrate, if required, will be developed through observation of pilot scale passive treatment cells during the post closure period. Results of the pilot scale testing, post closure effluent chemistry variability, and flow rate variability will form the design basis for the permanent passive treatment system. Until an effective passive treatment approach can be demonstrated, active treatment of underdrain flows will continue. Other options (i.e., passive closure through evaporation) will also be evaluated but the previously approved closure strategy described above was used in the SRCE model.

The following actions are being taken during operations to facilitate future closure:

- During operations, the TSF dry stack side slopes are constructed to the final closure configuration which is a composite 3H:1V slope. Minimal grading will be required to transition from operations to closure.
- During construction, growth media material will be removed from the TSF footprint and stockpiled adjacent to the TSF for placement of the closure cap.
- The UDCP is planned to be converted to a passive treatment system for treatment of post closure underflow from the TSF. The TSF will be constructed so that all percolation through the stack will be collected in an underdrain system and conveyed to these areas via gravity. This will minimize pumping and construction effort required during closure.
- The water treatment plants required during active operations will be utilized for active treatment until a passive treatment system can be established.

Post closure will require maintenance of the closure cap until a vegetated surface can be established. The closure surface will be monitored, inspected, and repaired, as needed, to address water and wind erosion. In addition to the closure cap, the access roads, stormwater diversion channels and Underdrain Collection Pond areas will also be monitored, inspected, and repaired, as needed.

If January Adit ground water is not pumped down in post closure, the water level will rise over time. Once the water level returns to the January Adit surface elevation, it would begin to discharge on the surface. As part of the closure strategy, a concrete bulkhead will be constructed in the January Adit and an injection grouting program will be performed in competent rock around the adit. It is assumed injection grouting would be performed in concentric circles with radii of 10 ft, 20 ft, and 30 ft. The injection grouting holes are assumed to be drilled at 10 ft intervals around the circumference of each circle. The concrete bulkhead in conjunction with the injection grouting is the conceptual closure strategy to prevent a discharge from the January Adit after the water levels return during post closure. If the January Adit plug does not prevent discharging at closure, flow from the January Adit mine workings would be treated at the passive treatment system established in the repurposed Underdrain Collection Pond as a backup contingency.

For more detailed descriptions regarding the various components of the closure strategy and assumptions, calculations, quantities and/or unit rate development, refer to Section 6 of this Technical Memorandum.

3. WATER TREATMENT PLANT 1 (WTP1)

Cost associated with the closure of WTP1 is calculated based on the following data and assumptions:

- Treatment of contact water reporting to the Underdrain Collection Pond (existing facility) is performed at WTP1. Water collected in the UDCP may also be pumped to WTP2 for treatment (in lieu of WTP1). For the SRCE model, WTP1 was assumed to treat all contact water from the UDCP due to the amount of actual cost data acquired over the years of treating UDCP water at WTP1.
  - Treatment duration: Estimated to be a total of 7 years based on the assumption of 5 years of active treatment at which time a passive treatment system will be constructed. An additional 2 years of active treatment will be continued while the passive treatment system is established.
  - Treatment cost: Estimated by South32 based on current treatment costs experienced to date. Historic WTP1 cost data was selected because it will most accurately model actual future treatment costs.
  - Treatment quantity: Contact water reporting to the Underdrain Collection Pond is estimated based on assumed drain down flowrates through the TSF stacking as well as estimated infiltration through the closure cap. All other meteoric precipitation is assumed to be directed from the facility as non-contact runoff or lost through evaporation.
  - All treated water at WTP1 must utilized within the operation (i.e., dust suppression) or pumped to WTP2 for discharge.
- There is no cost associated with turning the WTP1 off as part of the APP closure strategy. Costs, such as building demolition, associated with closure of the WTP1 are not part of this APP SRCE model. Financial assurance for this element of reclamation is under the jurisdiction of the Arizona State Mine Inspector.

Additional details regarding WTP1 closure costs can be referenced in the “Other User” and “User 9” printouts from the SRCE model (Attachment A) and Section 6.33 of this technical memo.

4. UNDERDRAIN COLLECTION POND AND TSF

Closure of the Underdrain Collection Pond and TSF are estimated by the SRCE model and described in Section 2 (Closure Strategy) as well as in detail in the remaining sections of this report. Additionally, figures showing the various closure tasks can be referenced in the attached Figures 1 through 6.

5. WATER TREATMENT PLANT 2 (WTP2)

There is no cost associated with closure of WTP2 because the APP closure strategy is to simply stop discharges from the facility. WTP2 will be evaluated for use to treat TSF draindown after closure but for the purposes of the SRCE model, the cost to treat TSF draindown is already captured under WTP1. Costs, such as decommissioning and building demolition, associated with closure of the WTP2 are not part of this APP SRCE model. Financial assurance for these elements of reclamation is under the jurisdiction of the Arizona State Mine Inspector.

6. SRCE MODEL SECTIONS

The following sections summarize the inputs and outputs for the SRCE model. Detailed information for each section can be referenced in the SRCE model printouts in Attachment A.

6.1 Cost Summary

The Cost Summary compiles labor, equipment, material, and total cost for the following:

- A. Earthwork/Recontouring
- B. Revegetation/Stabilization
- C. Detoxification/Water Treatment/Disposal of Wastes
- D. Structure, Equipment and Facility Removal, and Misc
- E. Monitoring
- F. Construction Management and Support
- Indirect Costs

Please note, the cost associated with the Underdrain Collection Pond conversion to a passive treatment system is included under the “Earthworks/Recontouring” section of the Cost Summary and supporting documentation can be referenced on the “User 11” and “Other User” printouts in Attachment A. In addition, mobilization and demobilization costs are included under the “Earthworks/Recontouring” section of the Cost Summary and the supporting documentation can be referenced on the “User 1” printout in Attachment A. WTP1 treatment costs are included under the “Detoxification/Water Treatment/Disposal of Wastes” section of the Cost Summary and supporting documentation can be referenced on the “User 9” and “Other User” printouts in Attachment A.

All indirect costs (i.e., engineering, design and construction plan, contingency, etc.) utilize the default values provided in the SRCE model. The indirect cost percentages can be referenced in the administrative cost rates table shown in the cost summary printout. In general, these percentages are determined from a variable rate scale based on the total reclamation cost.

6.2 Other User

The other user section is utilized to define the following costs and quantities:

- Riprap (D_{50}=6in, D_{50}=12in, D_{50}=18in and D_{50}=24in) and Grouted Riprap (D_{50}=12in)
  - Additional information regarding the riprap unit rate development including labor, equipment and material costs can be referenced on the “User 5” printout in the SRCE model (Attachment A) and Section 6.29 of this memo.
  - In general, the riprap quantities are based on closure stormwater diversion channel lengths measured in AutoCAD multiplied by the riprap cross sectional area. The closure stormwater diversion channel stationing and typical cross section can be referenced in Figure 2 and Figure 5, respectively.
  - Additional riprap quantities are based on construction of the closure emergency spillways as well as the additional revetement along the existing stormwater diversion channel and access road in preparation for passive closure. The riprap areas shown in plan view and typical cross sections can be referenced in Figure 6.
- 36-inch and 42-inch diameter CPe culverts
  - Additional information regarding the culvert unit rate development including labor, equipment and material costs can be referenced on the “User 6” printout in the SRCE model (Attachment A) and Section 6.30 of this memo.
  - The quantities are based on culvert length measured in AutoCAD multiplied by the cross-sectional areas for the various materials. The culvert location and typical cross section can be referenced in Figure 2 and Figure 5, respectively.
- 10 oz/yd^2 non-woven geotextile
  - Additional information regarding the geotextile unit rate development including labor, equipment and material costs can be referenced on the “User 7” printout in the SRCE model (Attachment A) and Section 6.31 of this memo.
  - In general, the geotextile quantity is based on closure stormwater diversion channel lengths measured in AutoCAD multiplied by the geotextile cross sectional length. The closure stormwater diversion channel stationing and typical cross section can be referenced in Figure 2 and Figure 5, respectively.
  - Additional geotextile quantities are based on construction of the closure emergency spillways as well as the additional revetement along the existing stormwater diversion channel and access road in preparation for passive closure. The passive closure geotextile areas and typical cross sections can be referenced in Figure 6.
- Bentonite (for Low Permeability Soil Layer amendment)
  - Additional information regarding the bentonite amendment unit rate development including labor, equipment and material cost can be referenced on the “User 8” printout in the SRCE model (Attachment A) and Section 6.32 of this memo.
  - The quantity of bentonite was determined using 4% of the low permeability soil layer dry weight.

- Water Treatment Plant 1
  - Additional information regarding development of the costs associated with the operation of WTP1 can be referenced on the "User 9" printout in the SRCE model (Attachment A) and Section 6.33 of this memo.
- The January Adit Plug
  - Additional information regarding the January Adit Plug cost can be referenced on the "User 10" printout in the SRCE model (Attachment A) and Section 6.34 of this memo.
- Passive Treatment System
  - Additional information regarding the cost associated with the conversion of the Underdrain Collection Pond to a passive treatment system can be referenced on the "User 11" printout in the SRCE model (Attachment A) and Section 6.35 of this memo.
- Remove 36-inch and 42-inch diameter CPe Culverts
  - Additional information regarding the cost for removal of the 36-inch and 42-inch diameter CPe Culverts at passive closure can be referenced on the "User 12" printout in the SRCE model (Attachment A) and Section 6.36 of this memo.
- Bridge
  - Additional information regarding the cost to construct a bridge at passive closure can be referenced on the "User 13" printout in the SRCE model (Attachment A) and Section 6.37 of this memo.

6.3 Exploration

Exploration is not part of this APP SRCE model. Financial assurance for this element of reclamation is under the jurisdiction of the Arizona State Mine Inspector.

6.4 Exploration Roads and Pads

Exploration roads and pads are not part of this APP SRCE model. Financial assurance for this element of reclamation is under the jurisdiction of the Arizona State Mine Inspector.

6.5 Waste Rock Dumps (used as surrogate for dry stack TSF)

The SRCE waste rock dump section is utilized to model the reclamation costs for the dry stack TSF due to the TSF stacking geometry and placement method of the contained materials (historic and filtered tailings with low moisture content, waste rock from mine development, construction cut determined to be PAG, and miscellaneous other materials) being most representative of a waste rock dump. During operations, the materials within the dry stack TSF are placed as a mechanically compacted earthen material and designed with a composite slope arrangement (open slopes and benches) to break up continuous slope lengths and thereby reduce sheet flow velocities with the intent to minimize the initiation and/or propagation of surface erosion.

The stacked material geometry is an overall 3H:1V slope comprised of 25 vertical feet 2.5H:1V slopes with 12.5-foot-wide benches every 25 vertical feet. Within the 25 vertical foot 2.5H:1V slope are five 1.5H:1V open slopes each 5 vertical feet high with a 5-foot-wide bench. During closure, the 1.5H:1V slopes with corresponding benches will be re-graded to create one continuous 25 vertical foot open slope. Slopes requiring re-grading and a cross section of the closure stacking configuration can be referenced in Figure 2.

The flat areas will be ripped, and the slopes and top will be covered with 1 to 2 feet of growth media material and revegetated. The SRCE model assumes 2 feet to calculate the closure quantity. Growth media material at closure will be borrowed from the Growth Media Storage Area. The Growth Media Storage Area location can be referenced in Figure 1.

It is important to note, the TSF embankment downstream slope was hydroseeded during construction and the TSF embankment upstream slope is geomembrane lined. The TSF embankment crest reclamation costs are included under Section 6.8, “Roads”.

All waste rock dump inputs, such as bench lengths, footprint area and haul distance/slope are calculated using AutoCAD Civil 3d.

6.6 Heap Leach Pads

No heap leach pads are planned as part of this project.

6.7 Tailings

The tailings section in SRCE is configured for conventional slurry tailings facilities. The dry stack TSF geometry and placement method is representative of a waste rock dump. Refer to Section 6.5, Waste Rock Dumps, for reclamation cost of the dry stack TSF.

6.8 Roads

The TSF Perimeter Road and TSF Haul Road are included in the road section of the SRCE model. The TSF Perimeter Road will have the safety berms removed (both sides), and the road will be ripped and revegetated. The TSF Haul Road will have the safety berm removed, ripped, covered with 1 to 2 feet of growth media (2 ft assumed in the SRCE model), fertilized and revegetated. The TSF Perimeter Road and TSF Haul Road locations can be referenced in Figure 2 and the road dimensions and lengths can be referenced in the SRCE printouts. All other site roads are not included in this APP SRCE model as they are not associated with APP regulated facilities. Financial assurance for these roads and any future site roads not associated with APP facilities are under the jurisdiction of the Arizona State Mine Inspector.

All road inputs, such as length, width and haul distance/slope are calculated using AutoCAD Civil 3d. Please note, the TSF Haul Road growth media and revegetation reclamation costs are included as part of the "Waste Rock Dumps" growth media and revegetation costs since they exist within the same footprint.

6.9 Pits

No pits are planned as part of this project.

6.10 Quarries and Borrow Pits

The quarries and borrow pits section in SRCE was utilized to capture the cost associated with revegetation of the Growth Media Storage Area after the growth media is removed. All inputs such as final (regarded) footprint are calculated using AutoCAD Civil 3d.

6.11 Underground Openings

Underground openings are not part of this APP SRCE model. Financial assurance for this element of reclamation is under the jurisdiction of the Arizona State Mine Inspector.

6.12 Material Hauling

Engineered fill is planned to be excavated, loaded, hauled to the TSF, and compacted to create positive drainage for stormwater runoff in the closure stormwater diversion channel. Similarly, low permeability soil layer material is planned to be screened, loaded, and then hauled to the closure stormwater diversion channel and compacted. Meteoric flow collecting in the closure stormwater diversion channel will be separated from the underdrain by a low permeability soil layer to minimize infiltration of the surface flows into the underdrain system.

The closure stormwater diversion channel location can be referenced in Figure 1. The engineered fill and low permeability soil layer material volume, haul distance and haul slope can be referenced in the SRCE printouts. All material haulage inputs, such as road lengths and slopes are calculated using AutoCAD Civil 3d.

6.13 Building and Foundation Demolition

Building and foundation demolition are not part of this APP SRCE model. Financial assurance for this element of reclamation is under the jurisdiction of the Arizona State Mine Inspector.

6.14 Other Demolition and Equipment Removal

Other demolition and equipment removal are not part of this APP SRCE model. Financial assurance for this element of reclamation is under the jurisdiction of the Arizona State Mine Inspector.

6.15 Sediment and Drainage Control

Closure stormwater diversion channels will be constructed at the base of TSF1 to collect and convey stormwater runoff within the TSF1 footprint to the permanent stormwater diversion channel via the TSF1 closure spillways. The closure stormwater diversion channel, including the TSF1 spillways, can be referenced in plan view in Figure 2. The reclamation costs associated with the closure stormwater diversion channel and TSF spillway are included as follows:

Closure Stormwater Diversion Channel – See Figures 2 (plan view) and 5 (typical section):

- Riprap revetment: Included in “other users” section. Riprap was included in the other users because SRCE does not have built in riprap sizes that are specific to this project (i.e., D_{50}=6in, D_{50}=12in, D_{50}=18in, and D_{50}=24in).
- Geotextile: Included in “other users” section. Geotextile was included in the other users because SRCE does not have a built in geotextile cost.
- Engineered Fill and Low Permeability Soil Layer: Included in “Material Hauling” section.

TSF1 Closure Spillways – See Figure 2:

- Riprap revetment: Included in “other users” section. Riprap was included in the other users because SRCE does not have built in riprap sizes that are specific to this project.
- Geotextile: Included in “other users” section. Geotextile was included in the other users because SRCE does not have a built-in geotextile cost.
- 36-inch and 42-inch diameter CPe culverts installation (active closure only): Included in “other users” section.
- Low Permeability Soil Layer: Included in “Material Hauling” section.
- 36-and 42inch diameter CPe culverts removal (passive closure only): Included in “misc. costs” section.
- Spillway excavation: Included in “Sediment & Drainage Control” section.

The diversion channel length, depth, bottom width, and slope can be referenced in the SRCE printouts. All sediment and drainage control inputs are calculated using AutoCAD Civil 3d.

Removal of existing sediment ponds/basins are not part of this APP SRCE model. Financial assurance for this element of reclamation is under the jurisdiction of the Arizona State Mine Inspector.

6.16 Ponds

During closure, the Underdrain Collection Pond is planned to be converted to a passive treatment system. A plan view of the Underdrain Collection Pond can be referenced in Figure 3 and description can be referenced in Section 2 titled Closure Strategy. The costs to convert the Underdrain Collection Pond to a passive treatment system were estimated by CPE Consultants. Detailed closure costs associated with the passive treatment system can be referenced on the "User 11" printout in the SRCE model and Section 6.35 of this memo.

6.17 Landfills

No on-site landfills are currently planned as part of this project.

6.18 Yards

Yards are not part of this APP SRCE model. Financial assurance for this element of reclamation is under the jurisdiction of the Arizona State Mine Inspector.

6.19 Waste Disposal

Waste disposal accounts for a 30 cubic yard dumpster per month to handle solid waste generated during closure construction. The quantity of solid waste is an assumed value. The dumpster rental is assumed to be required during the months of active reclamation construction.

6.20 Well Abandonment

Well abandonment cost accounts for the Point of Compliance (POC) monitoring well abandonment (referred to as MW-3). The well location can be referenced in Figure 1. All well abandonment inputs are provided by Clear Creek Associates based on the MW-3 as-built condition.

6.21 Misc Costs

The miscellaneous costs include the removal of the TSF1 spillway culverts. All inputs, such as culvert length are calculated using AutoCAD Civil 3d. Removal of other miscellaneous site culverts and buried pipes is not part of this APP SRCE model. Financial assurance for this element of reclamation is under the jurisdiction of the Arizona State Mine Inspector.

6.22 Reclamation Monitoring and Maintenance

Reclamation monitoring and maintenance cost assumes that 25 percent of the area will require revegetation maintenance (reseeding) and 10 percent of the volume will require erosion maintenance. It also assumes that reclamation monitoring will be performed by a field geologist/engineer using the following inputs:

- 5 hours/day of field work, 2 hours/day of reporting, and 3 hours/day of driving.
- 12 days per year of reclamation monitoring (once per month).

- 30 years of reclamation monitoring.
- Assuming that a local firm performs reclamation monitoring work (no flights included).

Water and rock sample analysis assumes one sample will be collected from the POC on a semi-annual basis for thirty years and tested per the parameters shown in the “User 4” printout (see ACZ Laboratories Inc quote for actual cost of the POC monitoring tests). The reclamation monitoring cost also includes 8 hours for collection and 2 hours for reporting for a field geologist/engineer per sample obtained. The POC location can be referenced in Figure 1 as MW-3.

6.23 Construction Management and Road Maintenance

Based on hours and the specified equipment fleet produced from the SRCE model, it is anticipated that active reclamation construction will require approximately six months of construction management. A construction manager as well as equipment for road maintenance are included for reclamation construction utilizing the following assumptions:

- 6-month duration (covers anticipated construction schedule).
- 160 hours per month.
- 1 temporary office rental.
- 2 toilet rentals.
- A medium size water truck for the duration of anticipated construction (road maintenance) is assumed to work 160 hours per month.
- A medium size grader for the duration of anticipated construction (road maintenance) is assumed to work 160 hours per month.

After active reclamation construction is complete, monitoring and maintenance is assumed utilizing the following assumptions:

- A medium size water truck and grader (road maintenance) is assumed to be required semiannually for a duration of 7 years (totaling 14 “durations”).
- Each “duration” would require 16 hours to perform maintenance activities.
- A mobilization/demobilization is included for all 14 occurrences for both the water truck and grader.

6.24 Labor Rates, Equipment Costs, Material Costs and Misc. Unit Costs

Historical contractor time and material costs for construction performed on site were provided by South32 for the creation of site-specific contractor labor and equipment rates. Although South32 has a comprehensive list of site-specific contractor labor and equipment rates, it does not address every labor category and piece of equipment in the SRCE model. Where site-specific data was unavailable, the standard SRCE model rate for the Southern Nevada region was utilized. The Southern Nevada region was selected as the most representative due to the geographic proximity to the project.

The SRCE model was run with two cost basis categories: site-specific labor and equipment rates and the standard SRCE labor and equipment rates for the Southern Nevada region. The site-specific information resulted in a similar but lower reclamation cost (less than 1% difference). To be conservative, the standard SRCE Southern Nevada labor and equipment rates were used to populate the reclamation cost. The standard SRCE Southern Nevada rates are provided by NDEP (SRCE_Cost_Data_File_1_12_Std_2023.xlsm) last updated August 1, 2023.

Generally, the standard SRCE model rates for Southern Nevada were also used for material and miscellaneous unit costs. However, site material rates for seed mix and water quality analysis were utilized to represent actual site costs.

6.25 User 1

The mobilization/demobilization cost estimate for the equipment fleet anticipated to perform closure construction is included under “User 1.” The costs were manually input into the “Cost Summary” sheet under the “Earthwork/Recontouring” section. The required equipment was obtained from the SRCE model which can also be referenced in the “User 2” printout.

6.26 User 2

The closure construction equipment fleet and corresponding projected hours for the various work items were obtained from the SRCE model and collated in the “User 2” printout. Based on the summation of hours for each equipment fleet, an assumed construction timeline was determined. The construction management and road maintenance durations were set based on this assumed construction timeline. In addition, the equipment fleets shown in this spreadsheet were utilized as an input into the mobilization/demobilization cost estimate that is provided in the “User 1” printout (Attachment A).

6.27 User 3

A quote for the proposed seed mix was provided by Arizona Revegetation & Monitoring Co. in July 2022 and can be referenced in the “User 3” printout (Attachment A). The seed mix is specified as “User Mix 1” is the SRCE model.

6.28 User 4

A quote for the water sample analysis under the monitoring section was provided by South32 from ACZ Laboratories Inc in September 2023 and can be referenced in the “User 4” printout (Attachment A).

6.29 User 5

A cost was developed by NewFields to estimate production and placement cost for the following riprap sizes:

- Riprap D_{50} = 6 inch
- Riprap D_{50} = 12 inch
- Riprap D_{50} = 18 inch
- Riprap D_{50} = 24 inch
- Grouted Riprap D_{50} = 12 inch

The following information and assumptions were utilized to develop the unit rate:

- Construction performed by a third-party contractor.
- Labor and equipment rates utilized from SRCE model.
- Overbuild and wastage of 15%.

The supply cost of riprap was estimated assuming the riprap would be produced from the existing material located at the non-PAG waste rock stockpiles by passing the material over bar screens. It was assumed that a percentage of the material passed over the screen would be usable product and the remainder would be waste. The estimated usable vs waste product varied for each riprap D_{50} size. The installation cost was estimated assuming the material would be loaded with a hydraulic loader, hauled with an articulated truck fleet, end dumped in the bottom of the channel and spread with a large excavator at a rate of 30 to 175 cy/hr. The installation rate was dependent on riprap size with the largest riprap having the slowest installation rate.

The riprap quantity was calculated by multiplying AutoCAD riprap lengths and the riprap cross sectional area. The detailed development of the unit rates including material, labor and equipment/operating cost can be referenced in the "User 5" printout (Attachment A).

6.30 User 6

A cost was developed by NewFields to estimate a cost per linear foot for the 36-inch and the 42-inch diameter culverts at the closure TSF spillway inclusive of the culvert supply and installation cost. The installation cost also includes the excavation of the trench, supply and installation of pipe bedding and pipe backfill as a cost per liner foot of culvert. The following information was utilized to develop the unit rate:

- Construction performed by a third-party contractor.
- Labor and equipment rates utilized from SRCE model.
- 36-inch diameter CPe pipe supply cost: $60.36/ft including freight and tax (based on quote provided by ISCO February 2023).

- 42-inch diameter CPe pipe supply cost: \$111.30/ft including freight and tax (based on quote provided by ISCO February 2023).
- Pipe bedding supply cost: \$18.99/ton.
- Pipe backfill supply cost: material was assumed to be the material that was excavated from the trench and screened over a bar screen.

The culvert quantity was calculated using an AutoCAD length measurement. The detailed development of the unit rate including material, labor and equipment/operating cost can be referenced in the "User 6" printout (Attachment A).

6.31 User 7

A cost was developed by NewFields to estimate the supply and installation cost of 10 oz/yd^2 non-woven geotextile. The following information was utilized to develop the unit rate:

- Construction performed by a third-party contractor.
- Labor and equipment rates utilized from SRCE model.
- Supply cost was developed using quote from Agru America (\$0.19/sf) provided July 2023.
- The cost includes an allowance for a sales tax of 6.6% and for freight from the supplier's facility to the site.
- The installation cost was developed based on historic information and input from Agru at an assumed average placement rate of approximately 2,000 square feet per hour.

Detailed development of the unit rate including material supply and delivery costs as well as labor and equipment rates can be referenced in the "User 7" printout (Attachment A).

6.32 User 8

A cost was developed by NewFields to estimate the supply and use of bentonite as an amendment to the low permeability soil layer. The total unit cost includes material supply and transportation to the project site as well as processing the bentonite into the low permeability soil. The following information was utilized to develop the unit rate:

- Construction performed by a third-party contractor.
- Labor and equipment rates utilized from SRCE model.
- Costs for supply and delivery of bentonite (\$445.46/ton) were based on a quote received from Western Geosystems in July 2023.
- Installation costs based on historical site data provided by South32 for equipment and labor rates (Wirtgen spreader and tractor with disc).
- Placement rate assumed to be approximately 10 tons/hour.

Detailed development of the unit rate including material supply and delivery costs as well as labor and equipment rates for processing can be referenced in the “User 8” printout (Attachment A).

6.33 User 9

A cost was developed by NewFields to estimate the operational cost of WTP1 upon closure. The operating cost includes labor and material costs based on current WTP1 operating costs to date. Water collected in the UDCP can also be treated at WTP2, but WTP1 was selected to estimate operational costs because of the level of actual cost data acquired over the years of treating water collected in the UDCP at WTP1. The following information was used to develop the labor and material costs:

- Current labor and operational costs provided by South32 based on an approximate 120 gallon per minute treatment rate.
  - Current labor cost are all-inclusive actual costs to operate WTP1.
  - Closure labor cost is calculated as a factor of the current labor cost based on projected operational hours.
    - Years 1 and 2 of closure remain at 100% of current labor costs. Labor costs are reduced when TSF and January Adit Plug closure construction has been completed. Closure construction is assumed to take 2 years from design to completion of construction.
    - In Years 3 through 7 of closure, the closure labor cost accounts for operation 8 hours per day and 5 days per week which equates to ~23.8% of the current hours. Based on projected treatment quantities of water, 40 hours per week of operation is a conservative estimate.
  - Current material costs (i.e., utilities, spares, chemicals, etc.) were summed up and utilized to develop a dollar per gallon basis.
  - Closure material costs utilized the current material dollar per gallon cost.
- The operating duration of WTP1 once closure activities commence is an assumed 7 years.
  - The first two years provide time to finalize design and construct the TSF and January Adit closure system.
  - At year five the Underdrain Collection Pond will be converted to a passive treatment system.
  - Active treatment will continue until year seven providing time for the passive treatment system to be established.

Water reporting to WTP1 was assumed to be from the following:

- January Adit will be pumped and treated for the first two years of closure until the January Adit plug can be installed.
  - January Adit is assumed to be pumped at 20 gallons per minute based on current treatment rates provided by South32.

  - This assumption is conservative because mine dewatering activities are projected to dry the January Adit.
- Precipitation over the TSF is assumed to be collected and conveyed to the Underdrain Collection Pond for the first two years of closure until the TSF closure can be final designed and constructed. From the Underdrain Collection Pond, the water will be pumped to WTP1 for treatment.
  - It is conservatively assumed that 100% of the annual precipitation over the TSF is collected and conveyed to the Underdrain Collection Pond and then pumped to WTP1 (no evaporation).
- Precipitation over the Underdrain Collection Pond is assumed to be collected for the first five years of closure until the Underdrain Collection Pond can be converted to a passive treatment system. From the Underdrain Collection Pond, the water will be pumped to WTP1 for treatment.
  - It is conservatively assumed that 100% of the annual precipitation is collected and pumped to WTP1 (no evaporation).
- Draindown from the TSF to the Underdrain Collection Pond at a rate of approximately 4.25 gallons per minute after closure.
  - The draindown was calculated based on maximum stacking volume (~8.0 million cubic yards), average in place density (108 pounds per cubic foot), average in place moisture content (14.4%), assumed residual moisture content (12.0%) of the stacked material and draindown duration (30 years).
- Infiltration through the TSF closure cover is assumed to be a value of 2% of the average annual rainfall at site. All infiltration will report to the Underdrain Collection Pond.
- Laboratory sample analysis costs have been included for quarterly ($2,847/quarter) and annual ($7,033/year) sample analysis for a duration of 7 years which is the same duration that the WTP1 will be operating). This laboratory sample analysis cost is for monitoring of discharge from WTP1.

Detailed development of the WTP1 operational treatment cost can be referenced in the “User 9” printout (Attachment A).

6.34 User 10

A high level cost estimate was developed by NewFields to estimate the reclamation cost of a January Adit Plug. As currently envisioned, the construction of the January Adit plug would involve the following:

- Excavate area around the January Adit/Shaft to create access and required space for construction of the adit plug. Excavation area is assumed to be approximately 80ft by 80ft of flat area at the rough current ground elevation. This working platform will be the flat surface where excavation to the competent bedrock will occur. Excavation cut slopes are assumed to be 1.5H:1V daylights (horizontal:vertical).

- Once competent bedrock is exposed, historic backfill, placed in the January Adit/Shaft, will be removed to a depth of approximately 30ft to allow placement of a concrete bulkhead in the adit/shaft.
- Construct a concrete bulkhead in the January Adit/Shaft.
  - Assume concrete bulkhead to be 15ft by 15ft by 30ft (depth).
- Backfill bulkhead excavation in preparation for injection grouting.
- Perform an injection grouting campaign using the following assumptions:
  - An inner injection grouting ring with a 10 ft radius and holes at 10 ft spacing.
  - An intermediate injection grouting ring with a 20 ft radius and holes at 10 ft spacing.
  - An outer injection grouting ring with a 30 ft radius and holes at 10 ft spacing.
  - Assume one confirmatory hole is drilled for each injection grouting hole to check degree of injection grouting translation laterally.
  - Assume half of the confirmatory holes require injection grouting.
  - Assume competent bedrock is located 30 ft below ground surface.
  - Assume injection grouting is performed for 20 vertical ft in the competent bedrock.
- Based on historical site data, drilling mobilization and demobilization is approximately $10,000 and drilling cost would be approximately $175 per foot. Assumed 50 ft of drill depth per injection grouting hole.
- Injection grouting cost is assumed at $310 per hour with each hole needing active grouting time of 15 hours. Grouting time/cost includes grout plant elements, injection grout nipple installation and packer testing of the grout holes prior to grouting.
- An additional 10% contingency was applied to cover uncertainties and unknowns.

Development of the January Adit Plug cost can be referenced in the "User 10" printout (Attachment A).

6.35 User 11

The reclamation cost estimate associated with the conversion of the existing Underdrain Collection Pond to a passive treatment system was generated by CPE Consultants. It is currently anticipated that active treatment will continue for approximately 5 years at which time the passive treatment system will be implemented. An additional 2 years of active treatment will be continued while the passive treatment system is established. The passive treatment system costs considered the following:

- Construction Capital Costs
  - Site improvement work including mobilization/demobilization, grading, equipment, and piping.

- Biochemical Reactor (BCR) Cells
- Aerobic Polishing Wetland
- Manganese Removal Bed (MRB)

Details of the reclamation costs can be referenced on the "User 11" printout (Attachment A). Please note, the passive treatment system cost is the same as the previously approved 2020 SRCE model except the costs have been escalated to Q2 2023 using the Bureau of Reclamation construction indexes composite trend data.

6.36 User 12

Quantities and associated costs (as required) were calculated to estimate the construction capital costs associated with the following items to prepare TSF1 for passive closure (considering 2090 climate change projections):

- Existing stormwater diversion channel riprap extension
  - Extend riprap (grouted) up the eastern slope of the existing stormwater diversion channel as well as on the eastern slope of the existing Access Road.
  - Quantity inputs were calculated using AutoCAD Civil 3D.
  - Detailed information can be referenced in plan view and Section G in Figure 6.
  - Cost captured in "Other User" printouts from the SRCE model (Attachment A).
- UDCP stormwater diversion channel (crest raise)
  - Raise eastern UDCP crest 1.5 feet with Engineered Fill.
  - Quantity inputs were calculated using AutoCAD Civil 3D.
  - Detailed information can be referenced in plan view and Section K in Figure 6.
  - Cost captured in "Material Hauling" printouts from the SRCE model (Attachment A).
- TSF Perimeter Road (Embankment) Raise
  - Raise TSF Perimeter Road (Embankment) 2 feet including Engineered Fill, riprap, and geotextile.
  - Quantity inputs were calculated using AutoCAD Civil 3D.
  - Detailed information can be referenced in plan view and Section H in Figure 6.
  - Cost captured in "Material Hauling" printouts from the SRCE model (Attachment A).
- Access Road Raise
  - Raise Access Road with Engineered Fill east of the TSF1 Closure Spillway.
  - Quantity inputs were calculated using AutoCAD Civil 3D.
  - Detailed information can be referenced in plan view and Section J in Figure 6.
  - Cost captured in "Material Hauling" printouts from the SRCE model (Attachment A).
- Remove culverts in TSF1 Spillway section

  - Detailed information can be referenced in plan view and Section J in Figure 6.
  - Cost captured in “Misc Cost” printouts from the SRCE model (Attachment A).
- Construct permanent TSF1 Closure Spillway (West)
  - Consists of cut, riprap (12 inch D_{50} grouted), geotextile, and low permeability soil layer.
  - Quantity inputs were calculated using AutoCAD Civil 3D.
  - Detailed information can be referenced in plan view in Figure 4.
  - Cost captured in “Sediment & Drainage Control” (cut), “Other User” (riprap and geotextile), and “Material Hauling” (low permeability soil layer) printouts from the SRCE model (Attachment A).
- Construct permanent TSF1 Closure Spillway (East)
  - Consists of cut, riprap (12 inch D_{50}), and geotextile
  - Quantity inputs were calculated using AutoCAD Civil 3D.
  - Detailed information can be referenced in plan view in Figure 4.
  - Cost captured in “Sediment & Drainage Control” (cut) and “Other User” (riprap and geotextile) printouts from the SRCE model (Attachment A).

6.37 User 13

A construction capital cost was developed to estimate the supply and installation cost of the Access Road Bridge during passive closure. The construction capital cost was generated using actual engineering, supply, and installation costs incurred by South32 for the existing Growth Media Storage Area bridge constructed onsite in July 2022. The following parameters were used to estimate the future Access Road Bridge cost:

- Existing Growth Media Storage Area Bridge span is approximately 46 feet. Engineering, supply, and installation cost was $621,922 in 3Q22 resulting in approximately $13,520 per foot of span.
- Construction capital cost was escalated to 3Q23 using the United States Bureau of Reclamation Construction Cost Trends resulting in a 2.9% increase.
- A future Access Road Bridge is assumed to have a similar design and installation procedure as the existing Growth Media Storage Area bridge. The future bridge will span the TSF1 Closure Spillway requiring an approximate 90 foot span.
- Installation was assumed to be allocated as 50% labor and 50% equipment.
- Access Road Bridge can be referenced in plan view and Section J in Figure 6.
- Cost captured in “Other User” printouts from the SRCE model (Attachment A).

Development of the lump sum rate including engineering, material supply, and installation cost can be referenced in the “User 13” printout (Attachment A).

7. CONCLUSIONS

NewFields has completed an update to the approved 2020 SRCE model (version 1.4.1) developed for the Hermosa Project. The purpose of the update is to re-calculate reclamation/closure costs to include the TSF1 expanded footprint which is being submitted to ADEQ as part of a proposed significant APP amendment. Assumptions used to complete the 2023 SRCE model are summarized in the above sections. Model inputs were derived from existing aerial topography, as-built data from the VRP TSF construction, and the TSF1 design work. The model includes the following facilities:

- Existing WTP1.
- Existing Underdrain Collection Pond.
- Proposed TSF1 expansion.
- Existing WTP2.

All SRCE model outputs can be referenced in Attachment A. The reclamation cost estimate calculated using SRCE increased from $13,920,872 (2020 SRCE) to $24,657,909 (2023 SRCE). The calculated closure costs increase was mainly a function of a larger TSF footprint as well as the escalation of labor, equipment, and material costs which occurred between 2020 to 2023.

The SRCE model does not distinguish costs between closure and post-closure. Tables detailing closure and post-closure costs can be referenced in Attachment B. Closure and post-closure costs were separated as follows:

Closure activities:

- Construction cost to close TSF1.
- Construction cost of the January Adit plug.
- Construction cost of the Underdrain Collection Pond passive treatment system.
- Indirect costs associated with the closure construction activities (i.e., engineering, design and construction, contingency, insurance, bond, contractor profit, and contract administration).

Post-closure activities:

- Cost for reclamation monitoring and maintenance such as revegetation and erosion maintenance, reclamation and water quality monitoring, and mobilization/demobilization associated with these activities.
- Cost to operate WTP1 until passive treatment system is constructed and functional.
- Underdrain Collection Pond passive treatment system maintenance tasks.
- Indirect costs associated with the post-closure activities (i.e., engineering, design and construction, contingency, insurance, bond, contractor profit, and contract administration)

8. REFERENCES

NewFields Mining Design & Technical Services, (2020a), Hermosa Project Tailings and Potentially Acid Generating (PAG) Material, Remediation, Placement and Storage Project Tailings Storage Facility (TSF) Interim Record of Construction Report, dated April 6, 2020.

NewFields Mining Design & Technical Services, (2020b), Hermosa Lined TSF Design Amendment, Standardized Reclamation Cost Estimator (SRCE), dated August 12, 2020.

NewFields Mining Design & Technical Services, (2020c), Hermosa Lined TSF Design Amendment Aquifer Protection Permit (APP) Best Available Demonstrated Control Technology (BADCT) Design, dated August 13, 2020.

NewFields Mining Design & Technical Services, (2023), Hermosa Project Tailings Storage Facility 1 (TSF1) Aquifer Protection Permit (APP) Best Available Demonstrated Control Technology (BADCT) Design, dated December 8, 2023.

ATTACHMENT A

Enter Data Below in Green and Blue Spaces

STANDARDIZED RECLAMATION COST ESTIMATOR

Version 1.4.1
Build 017b (Revised 16 May 2019)

Approved for use in Nevada, August 1, 2012

COST DATA FILE INFORMATION

File Name:	0014.035 SRCE Model sNV.S32.xlsm		
Cost Data File:	SRCE_Cost_data-USR_1_12_S32_230801.xlsm		
Cost Data Date:	August 1, 2023		
Cost Data Basis:	User Data	Data Cost Units:	Imperial
Author/Source:	NewFields		

PROJECT INFORMATION

Property/Mine Name:	Hermosa Project	Property Code:	
Project Name:	Tailings Storage Facility 1 (TSF1)		
Date of Submittal:	October 2023	Average Altitude:	5000 ft.
Select One:	○ Notice or Sm Exploration Plan; ○ Lg Exploration Plan; ● Mine Operation		
Select One:	● Private Land; ○ Public or Public/Private		
Cost Estimate Type:	Surety		
Cost Basis Category:	Southern Nevada		
	Clark, Esmeralda, Lincoln and Nye Counties		
Cost Basis Description:			

Closure Cost Estimate
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roject Name: Tailings Storage Facility 1 (TSF1)
Project Date: October 2023
0014.035 SRCE Model sNV.S32.xlsm
Reclamation Plan

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	Description
User Sheet 1	MOBILIZATION AND DEMOBILIZATION
User Sheet 2	EQUIPMENT UTILIZATION
User Sheet 3	SEED MIXTURE
User Sheet 4	WATER SAMPLE ANALYSIS
User Sheet 5	RIPRAP - PROCESS AND PLACE
User Sheet 6	SPILLWAY CULVERTS (ACTIVE CLOSURE)
User Sheet 7	GEOTEXTILE - SUPPLY AND INSTALL (ACTIVE CLOSURE)
User Sheet 8	BENTONITE AMENDMENT - SUPPLY AND PROCESS

Closure Cost Estimate
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Closure Cost Estimate
Cost Summary

Project Name: Tailings Storage Facility 1 (TSF1)
Project Date: October 2023
Model Version: Version 1.4.1
File Name: 0014.035 SRCE Model sNV.S32.xlsm

A. Earthwork/Recontouring	Labor (1)	Equipment (2)	Materials	Total
Exploration	$0	$0	$0	$0
Exploration Roads & Drill Pads	$0	$0	$0	$0
Roads	$760	$2,224	$0	$2,984
Well Abandonment	$744	$641	$4	$1,389
Pits	$0	$0	N/A	$0
Quarries & Borrow Areas	$380	$1,113	$0	$1,493
Underground Openings	$0	$0	$0	$0
Process Ponds	$0	$0	$0	$0
Heaps	$0	$0	$0	$0
Waste Rock Dumps	$171,300	$426,472	$0	$597,772
Landfills	$0	$0	$0	$0
Tailings	$0	$0	$0	$0
Foundation & Buildings Areas	$0	$0	$0	$0
Yards, Etc.	$0	$0	$0	$0
Drainage & Sediment Control	$1,424	$2,415	$0	$3,839
Generic Material Hauling	$98,453	$183,588	$0	$282,041
Other User Costs (from Other User sheet)	$1,185,467	$1,576,366	$6,440,012	$9,201,844
Other**				$0
Subtotal	**$1,458,527**	**$2,192,819**	**$6,440,016**	**$10,091,362**
Mob/Demob if included in Other User sheet	$0	$0	$0	$0
Mob/Demob		$58,390		$58,390
Subtotal "A"	**$1,458,527**	**$2,251,209**	**$6,440,016**	**$10,149,752**

B. Revegetation/Stabilization	Labor (1)	Equipment (2)	Materials	Total
Exploration	$0	$0	$0	$0
Exploration Roads & Drill Pads	$0	$0	$0	$0
Roads	$796	$455	$10,660	$11,911
Well Abandonment				N/A
Pits	$0	$0	$0	$0
Quarries & Borrow Areas	$889	$508	$13,208	$14,605
Underground Openings				N/A
Process Ponds	$0	$0	$0	$0
Heaps	$0	$0	$0	$0
Waste Rock Dumps	$18,272	$14,867	$140,556	$173,695
Landfills	$0	$0	$0	$0
Tailings	$0	$0	$0	$0
Foundation & Buildings Areas	$0	$0	$0	$0
Yards, Etc.	$0	$0	$0	$0
Drainage & Sediment Control	$0	$0	$0	$0
Generic Material Hauling	$0	$0	$0	$0
Other User Costs (from Other User sheet)	$0	$0	$0	$0
Other**				$0
Subtotal "B"	**$19,957**	**$15,830**	**$164,424**	**$200,211**

C. Detoxification/Water Treatment/Disposal of Wastes**	Labor (1)	Equipment (2)	Materials	Total
Process Ponds/Sludge				$0
Heaps				$0
Dumps (Waste & Landfill)				$0
Tailings				$0
Surplus Water Disposal				$0
Monitoring				$0
Miscellaneous				$0
Solid Waste - On Site	$0	$0	N/A	$0
Solid Waste - Off Site				$7,308
Hazardous Materials				$0
Hydrocarbon Contaminated Soils	$0	$0	$0	$0
Other User Costs (from Other User sheet)	$0	$0	$5,338,646	$5,338,646
Other**				$0
Subtotal "C"	**$0**	**$0**	**$5,338,646**	**$5,345,954**

D. Structure, Equipment and Facility Removal, and Misc.	Labor (1)	Equipment (2)	Materials	Total
Foundation & Buildings Areas	$0	$0	$0	$0
Other Demolition	$0	$0	$0	$0
Equipment Removal	$0	$0	$0	$0
Fence Removal	$0	$0		$0
Fence Installation	$0	$0	$0	$0
Culvert Removal	$51,139	$15,618	N/A	$66,757
Pipe Removal	$0	$0	N/A	$0
Powerline Removal	$0			$0
Transformer Removal	$0			$0
Rip-rap, rock lining, gabions	$0	$0	$0	$0
Other Misc. Costs	$0	$0	$0	$0
Other User Costs (from Other User sheet)	$469,590	$469,590	$312,657	$1,251,837
Other**				$0
Subtotal "D"	**$520,729**	**$485,208**	**$312,657**	**$1,318,594**

E. Monitoring	Labor (1)	Equipment (2)	Materials	Total
Reclamation Monitoring and Maintenance	$505,817	$106,230	$42,043	$654,090
Ground and Surface Water Monitoring	$86,494	$25,126	$42,007	$153,627
Other User Costs (from Other User sheet)	$0	$0	$0	$0
Subtotal "E"	**$592,311**	**$131,356**	**$84,050**	**$807,717**

F. Construction Management & Support	Labor	Equipment (2)	Materials	Total
Construction Management	$144,211	$27,946	N/A	$172,157
Construction Support	$0	$19,031	$0	$19,031
Road Maintenance	$199,042	$294,224	$0	$493,266
Other User Costs (from Other User sheet)	$0	$0	$0	$0
Other**				$0
Subtotal "F"	**$343,253**	**$341,201**	**$0**	**$684,454**

Subtotal Operational & Maintenance Costs	Labor (1)	Equipment (2)	Materials (3)	Total
Subtotal A through F	**$2,934,777**	**$3,224,804**	**$12,339,793**	**$18,506,682**

** Other Operator supplied costs - additional documentation required.

Closure Cost Estimate
Cost Summary

Project Name: Tailings Storage Facility 1 (TSF1)
Project Date: October 2023
Model Version: Version 1.4.1
File Name: 0014.035 SRCE Model sNV.S32.xlsm

Indirect Costs		Include?	Total
1. Engineering, Design and Construction (ED&C) Plan (7)			$1,110,401
2. Contingency (8)			$1,110,401
3. Insurance (9)	$44,022		$44,022
4. Performance Bond (10)			$555,200
5. Contractor Profit (11)			$1,850,668
6. Contract Administration (12)			$1,480,535
7. Government Indirect Cost (13)			N/A
Subtotal Add-On Costs			**$6,151,227**
Total Indirect Costs as % of Direct Cost			33%
GRAND TOTAL			**$24,657,909**

Administrative Cost Rates (%)	Cost Ranges for Indirect Cost Percentages				
	<=	<=	<=	>	
1. Engineering, Design and Construction (ED&C) Plan (7)	$1,000,000	$25,000,000		$25,000,000	Small Plan
Variable Rate	8%	6%		4%	0%
	<=	<=	<=	>	
2. Contingency (8)	$500,000	$5,000,000	$50,000,000	$50,000,000	Small Plan
Variable Rate	10%	8%	6%	4%	0%
3. Insurance (9)	1.5%	of labor costs			
4. Bond (10)	3.0%	of the O&M costs if O&M costs are >$100,000			
5. Contractor Profit (11)	10%	of the O&M costs			
	<=	<=	<=	>	
6. Contract Administration (12)	$1,000,000	$25,000,000		$25,000,000	
Variable Rate	10%	8%		6%	
0	21%	of contract administration			

RECLAMATION COST ESTIMATION SUMMARY SHEET FOOTNOTES

1. Federal construction contracts require Davis-Bacon wage rates for contracts over $2,000. Wage rate estimates may include base pay, payroll loading,
2. The reclamation cost estimate must include the estimated plugging cost of at least one drill hole for each active drill rig in the project area. Where the
3. Miscellaneous items should be itemized on accompanying worksheets.
4. Fluid management should be calculated only when mineral processing activities are involved. Fluid management represents the costs of maintaining proper
5. Handling of hazardous materials includes the cost of decontaminating, neutralizing, disposing, treating and/or isolating all hazardous materials used, produced,
6. Any mitigation measures required in the Plan of Operations must be included in the reclamation cost estimate. Mitigation may include measures to avoid,
7. Engineering, design and construction (ED&C) plans are often necessary to provide details on the reclamation needed to contract for the required work. To
8. A contingency cost is included in the reclamation cost estimation to cover unforeseen cost elements. Calculate the contingency cost as a percentage of the
9. Insurance premiums are calculated at 1.5% of the total labor costs. Enter the premium amount if liability insurance is not included in the itemized unit costs.
10. Federal construction contracts exceeding $100,000 require both a performance and a payment bond (Miller Act, 40 USC 270et seq.). Each bond premium is
11. For Federal construction contracts, use 10% of estimated O&M cost for the contractor's profit.
12. To estimate the contract administration cost, use 6 to 10% of the operational and maintenance (O&M) cost. Calculate the contract administration cost as a
13. Government indirect cost rate is 21% of the contract administration costs.

Closure Cost Estimate
Other User

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety Cost Basis: Southern Nevada

Other Cost Items Calculated Elsewhere

	Description (required)	ID Code	Facility Type	Quantity	Units	Total Capital Cost $	Material Unit Cost $	Labor Unit Cost $	Equipment/ Operating Unit Cost $	Cost Type (select)	Total Cost $	Comments
1	Riprap (D50=6in)		RipRap	1,939	cy	$27	$0.00	$12.00	$14.85	A. Earthwork	$52,093	
2	Riprap (D50=12in)		RipRap	6,025	cy	$41	$0.00	$18.22	$22.44	A. Earthwork	$245,002	
3	Riprap (D50=18in)		RipRap	9,208	cy	$105	$0.00	$42.43	$62.12	A. Earthwork	$962,806	
4	Riprap (D50=24in)		RipRap	4,626	cy	$181	$0.00	$73.25	$108.05	A. Earthwork	$838,842	
5	Grouted Riprap (D50=12in)		RipRap	4,697	cy	$131	$76.65	$26.94	$27.26	A. Earthwork	$614,669	
6	36" Dia. Cpe Culvert (2 culverts)		Culverts	1,101	ft	$92	$60.36	$14.02	$17.65	A. Earthwork	$101,416	
7	42" Dia. Cpe Culvert (3 culverts)		Culverts	82	ft	$143	$111.30	$14.02	$17.65	A. Earthwork	$11,867	
8	10 oz/yd2 non-woven geotextile		Surface Channels	516,595	sf	$1	$0.19	$0.31	$0.26	A. Earthwork	$396,923	Non-woven geotextile is placed under riprap in closure stormwater diversion channel.
9	Bentonite (for Low Permeability Soil Layer Amendment)		Surface Channels	11,935	tons	$30	$23.58	$1.52	$4.59	A. Earthwork	$354,439	Bentonite is amended into Low Permeability Soil Layer.
10	Water Treatment Plant 1		Water Treatment - Contac	1	ls	$5,338,646				C. Water Management	$5,338,646	
11	January Adit Plug		UG Mine - Openings Horiz	1	ls	$1,800,000				A. Earthwork	$1,800,000	
12	Passive Treatment System		H2O Treat Sys Constr - Pa	1	ls	$3,823,787				A. Earthwork	$3,823,787	
13	Passive Closure Bridge		Site Facilities	1	ls		$312,656.91	$469,589.90	$469,589.90	D. Facility & Equipment	$1,251,837	
						$10,963,183	$1,128,132	$1,655,057	$2,045,956		$15,792,327	

Notes: Capital cost is lump sum (i.e. not multiplied by the quantity).
Material, Labor and Equipment/Operating costs are unit costs (i.e. multiplied by the quantity).

1. For riprap cost information refer to "User 5"
2. For 36" and 42" Dia CPE Culvert cost information refer to "User 6"
3. For 10 oz/yd2 non-woven geotextile cost information refer to "User 7"
4. For Bentonite cost information refer to "User 8"
5. For Water Treatment Plant 1 cost information refer to "User 9"
6. For January Adit Plug cost information refer to "User 10" and Passive Treatment System cost information refer to "User 11"
7. For Passive Closure elements refer to "User 12"

Closure Cost Estimate
Reclamation Quantities

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Data Cost File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety   Cost Basis: Southern Nevada

Reclamation Quantity Summary

												Unit Costs					
	Description	Total Regrade or Haul Volume cy	Total Regrade or Haul Cost $	Total Cover Volume cy	Cover Placement Cost $	Total Growth Media Volume cy	Growth Media Placement Cost $	Total Surface Area acres	Total Scarify Cost $	Total Revetation Cost $	TOTALS $	Regrade Unit Cost $/CY	Material Haul or Backfill Unit Cost $/CY	Cover Unit Cost $/CY	Growth Media Unit Cost $/CY	Scarify Unit Cost $/CY	Area Unit Cost $/acre
1	Waste Rock Dumps	14,542	$ 2,612		$ -	174,434	$ 591,055	54.06	$ 4,105	$ 173,695	$ 771,467	$0.18	N/A		$3.39	$75.93	$14,270.57
2	Tailings Impoundments		$ -		$ -		$ -		$ -	$ -	$ -		N/A				
3	Heap Leach Pads		$ -		$ -		$ -		$ -	$ -	$ -		N/A				
5	Open Pits		$ -							$ -	$ -		N/A				
4	Quarries & Borrow Pits		$ -		$ -		$ -	5.08	$ 1,493	$ 14,605	$ 16,098		N/A			$293.90	$3,168.90
6	Roads	2,051	$ 1,492				$ -	5.09	$ 1,492	$ 11,911	$ 14,895	$0.73	N/A			$293.12	$2,926.33
7	Landfills		$ -		$ -		$ -		$ -	$ -	$ -		N/A				
8	Buildings				$ -		$ -		$ -	$ -	$ -		N/A				
9	Yards		$ -		$ -		$ -		$ -	$ -	$ -		N/A				
10	Ponds		$ -				$ -	1.9		$ -	$ -	N/A					$0.00
11	Exploration Roads		$ -				$ -		$ -	$ -	$ -		N/A				
12	Exploration Trenches		$ -							$ -	$ -		N/A				
13	Diversion Ditches		$ 3,839					1		$ -	$ 3,839		N/A				$3,839.00
14	Sediment Ponds		$ -				$ -		$ -	$ -	$ -						
15	Generic Haulage/Backfill	58,838	$ 282,041		$ -		$ -	0.7	$ -	$ -	$ 282,041	N/A	$4.79			$0.00	#########
16	Adit/Decline Backfilling1		$ -								$ -	N/A					
17	Shaft Backfilling		$ -								$ -	N/A					
	TOTALS	75,431	$ 289,984	-	$ -	174,434	$ 591,055	67.83	$ 7,090	$ 200,211	$ 1,088,340						
	Average Costs	per CY	$3.84	per CY		per CY	$3.39	per acre	$104.53	$28.24	$16,045	per acre					

Closure Cost Estimate
Exploration

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety Cost Basis: Southern Nevada

Exploration - Cost Summary	Labor	Equipment	Materials	Totals
Hole Abandonment Costs	$0	$0	$0	$0
Trench Backfilling Costs	$0	$0		$0
Subtotal Earthworks	**$0**	**$0**	**$0**	**$0**
Trench Revegetation Costs	$0	$0	$0	$0
TOTALS	**$0**	**$0**	**$0**	**$0**

Exploration Drillhole Abandonment - User Input

Facility Description			Hole Plugging							
	Description (required)	ID Code	Hole Type (select)	Diameter in	Total Number of Holes	Max Holes Open at One Time	Casing to Remove ft	Average Depth of Hole[1] ft bgs	Depth to Water ft bgs	Hole Plug Method (select)

Notes:
1. If core holes are pre-drilled, use length of hole below pre-drilled length
2. If Top Plug is selected, assumes maximum 1/2hr laborer time to place plug and backfill with cuttings/soil (including move-to/set up time).

Exploration Trenches - User Input

Facility Description			Trench Parameters					Backfill			Revegetation		
	Description (required)	ID Code	Trench Length ft	Trench Depth ft	Trench Bottom Width ft	Trench Sideslope Angle degrees	Additional Hrs for Walk-in [1] hr	Backfill Material (select)	Cut Material Type (select)	Backfilling Fleet (select)	Seed Mix (select)	Mulch (select)	Fertilizer (select)

Notes:
1. Include one-way hours necessary to walk equipment in from drop-off point to work area
2. Material Types are used for density correction based on material densities in Caterpillar Performance Handbook material density table

Exploration Drillhole Abandonment

	Description (required)	Vol/foot of depth ft3	Hole Plugging Material [1]	Total Grout Volume [2] cy	Total Cuttings Volume cy	Total Top Seal Volume [3,4] cy	Total Drillhole Abandon. Hours [6,7] hrs	Casing Removal Labor Cost [5] $	Casing Removal Equipment Cost $	Plugging Labor Cost $	Plugging Equipment Cost $	Plugging Material Cost $	Top Seal Material Cost [2,3] $	Total Cost [6,7] $
								$0	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**

Notes:

1. Assumes grout backfill from bottom of hole to 50' (15.24m) above static water level, up to 10' (3m) from top of hole
2. Assumes 25% loss to formation for grout backfill
3. If "Top Plug" hole plug method is used, assumes physical plug installed without backfill, grout or cement. Not available option for Nevada projects
4. Assumes top 20' (6 m) of hole is plugged with cement if "Grout Only", "Backfill + Grout", or "Cement Plug" hole plug method are chosen.
5. Assumes that a) casing is not cemented entire length, b) does not include temporary surface casing
6. Assumes minimum 1 hr per hole for abandonment (excluding move-to and casing removal)
7. Assumes fixed hours per hole for setup & tear-down and moving between holes (see Productivty Sheet) per drill hole (includes rig time if grouting required, labor crew only if cuttings backfill only)

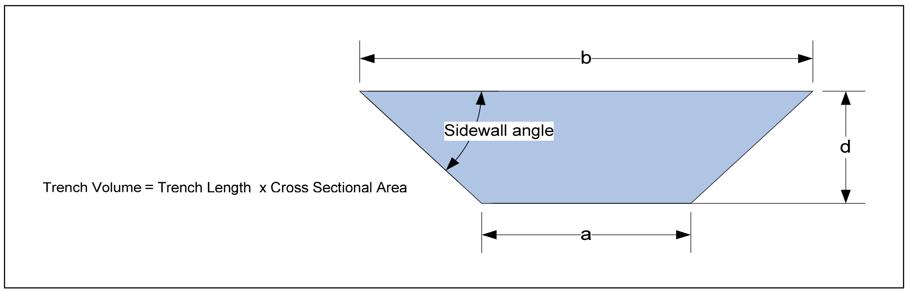
Closure Cost Estimate
Exploration

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety   Cost Basis: Southern Nevada

Exploration - Cost Summary	Labor	Equipment	Materials	Totals
Hole Abandonment Costs	$0	$0	$0	$0
Trench Backfilling Costs	$0	$0		$0
Subtotal Earthworks	**$0**	**$0**	**$0**	**$0**
Trench Revegetation Costs	$0	$0	$0	$0
TOTALS	**$0**	**$0**	**$0**	**$0**

Exploration Trenches - Calculations

Exploration Trench Volume Calculation



Dozing & Ripping/Scarifying Calculations

Dozing: Dozing distance = 1/2 trench length or 400 ft (max push) whichever is less
Assumes flat push (grade correction factor = 1)

Revegetation: 10 ft added to trench width to account for revegetation under spoil pile

Exploration Trenches - Backfill/Regrading Costs

Productivity = Dozer Productivity x Grade Correction x Density Correction x Operator (0.75) x Material x Visibility x Job Efficiency (0.83)

	Description (required)	Trench Backfill Volume	Dozer Push Distance	Equipment Productivity	Dozing Material	Density Correction	Backfilling Fleet	Corrected Hourly Productivity	Total Dozer Hours	Trench Backfill Labor Cost	Trench Backfill Equipment Cost	Total Trench Backfill Cost
		LCY (BCY+30%)	ft	yd3/hr				yd3/hr	hr	$	$	$
										$0	**$0**	**$0**

Exploration Trenches - Revegetation Costs

	Description (required)	Surface Area	Revegetation Labor Cost	Revegetation Equipment Cost	Revgetation Material Cost	Total Revegetation Cost
		acres	$	$	$	$
			$0	**$0**	**$0**	**$0**

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety   Cost Basis: Southern Nevada

Exploration Roads & Pads - Cost Summary	Labor	Equipment	Materials	Totals
Grading Costs	$0	$0	N/A	$0
Cover Placement Cost	$0	$0	N/A	$0
Ripping/Scarifying Cost	$0	$0	N/A	$0
Subtotal Earthworks	**$0**	**$0**		**$0**
Revegetation Cost	$0	$0	$0	$0
TOTALS	**$0**	**$0**	**$0**	**$0**

Exploration Roads & Pads - User Input

You must fill in ALL green cells and relevant blue cells in this section for each road

	Facility Description		Physical (1) - MANDATORY										User Overrides		Growth Media		
	Description (required)	ID Code	Underlying Ground Slope % grade	Ungraded Slope _H:1V	Cut Slope degrees	Road + Drill Pad Length ft	Road Width ft	Number of Drill Pads	Individual Sump Volume cy	Drill Pad Width ft	Drill Pad Length ft	Slope Replacement Percent %	Regrade Volume (if calculated elsewhere) cy	Disturbed Area (if calculated elsewhere) acres	Growth Media Thickness in	Distance to Growth Media Stockpile ft	Slope from Road to Stockpile % grade

Notes:
1. All Physical parameters must be input even if manual overrides for volume or area are used.
2. Slope replacement refers to the percentage of cut volumn replaced during regrading.
3. If Slope from facility to borrow source is >20, downhill travel time may be underestimated due to limitation of uphill travel time curves and downhill speed tables from CAT Handbook (see Productivty Sheet)
4. Sump volume will be applied to all roads on slopes <20%. On slopes >20% pad width (i.e. cut volume) should be adequate to account for sump volume.

Exploration Roads & Pads - User Input (cont.)

You must fill in ALL green cells and relevant blue cells in this section for each road

		Grading				Growth Media				Revegetation				
	Description (required)	Regrade Material Condition (select)	Cut Material Type (select)	Recontouring Equipment Fleet (select)	Additional Hrs for Walk-in (1)	Growth Media Material Type (select)	Growth Media Placement Equipment Fleet (select)	Maximum Fleet Size (user override)	Additional Hrs for Walk-in (1)	Seed Mix (select)	Mulch (select)	Fertilizer (select)	Scarifying/ Ripping? (select)	Ripping Fleet (select)

Notes:
1. Include one-way hours necessary to walk equipment in from drop-off point to work area
2. Material Types are used for density correction based on material densities in Caterpillar Performance Handbook material density table

Exploration Roads & Pads - Calculations

Regrading Volume and Footprint Volume

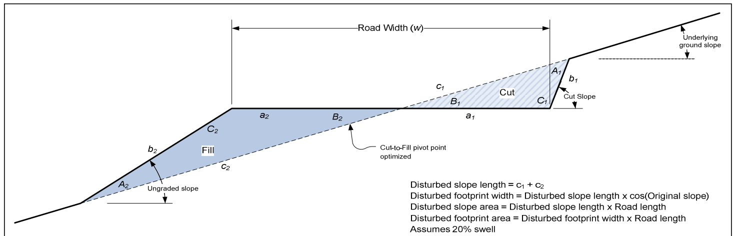


Figure 1 - Regrading Volume Calculation

Will not allow dozer for slopes greater than 30%
For dozer regrading push distance = road width
Assumes dozer push is uphill
Assumes minimum push distance of 100 ft

Swell Factor: 1.2

Ripping/Scarifying Calculations

Minimum 1 hr ripping/scarifying time per area
Number of passes = Final slope length ÷ Grader width
Travel distance = Number of passes x Road length
Total hours = (Travel distance ÷ Grader productivity) + (Number of passes x Grader maneuver time)
For dozer regrading assumes push distance = 3 x road width

Revegetation Calculations

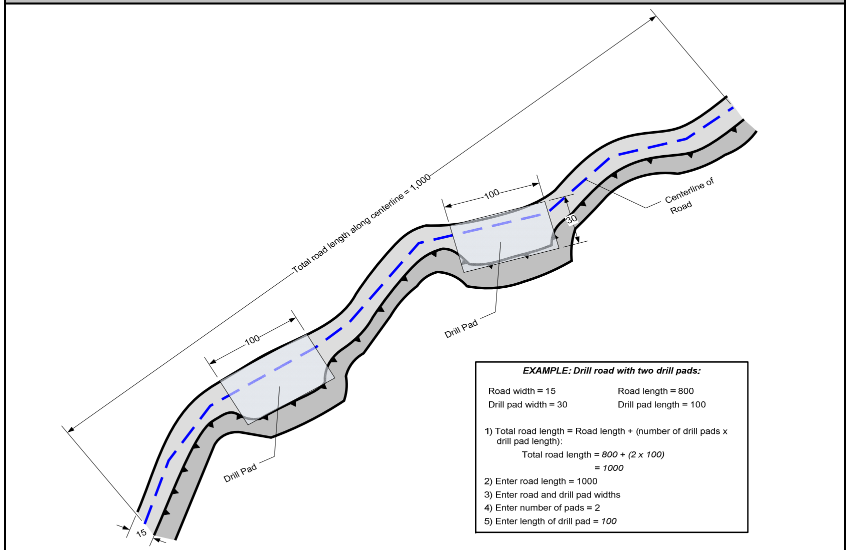
Minimum of 1 acre crew time per area

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety   Cost Basis: Southern Nevada

Exploration Roads & Pads - Cost Summary

	Labor	Equipment	Materials	Totals
Grading Costs	$0	$0	N/A	$0
Cover Placement Cost	$0	$0	N/A	$0
Ripping/Scarifying Cost	$0	$0	N/A	$0
Subtotal Earthworks	**$0**	**$0**		**$0**
Revegetation Cost	$0	$0	$0	$0
TOTALS	**$0**	**$0**	**$0**	**$0**

Inputting Exploration Roads and Drill Pads



Exploration Roads & Pads - Regrading Costs

	Description (required)	Total Road Length ft	Total Drill Pad Length ft	Regrading Volume cy	Recontouring Fleet	Equipment Productivity cy/hr	Total Equipment Hours [(1)] hr	Total Labor Cost $	Total Equipment Cost $	Total Regrading Cost $
								$0	**$0**	**$0**

(1) Includes walk-in time based on distance and travel speed (see Productivity sheet for speeds)

Exploration Roads & Pads - Growth Media Costs

	Description (required)	Growth Media Volume cy	Growth Media Replacement Fleet	Fleet Productivity LCY/hr	Number of Trucks/ Scrapers	Total Fleet Hours	Total Labor Cost $	Total Equipment Cost $	Total Growth Media Cost $
							$0	**$0**	**$0**

Exploration Roads & Pads - Scarifying/Revegetation Costs

	Description (required)	Surface Area acres	Ripping/ Scarifying Fleet	Ripping Hours hrs	Ripping Labor Costs $	Ripping Equipment Cost $	Total Ripping Costs $	Revegetation Labor Cost $	Revegetation Equipment Cost $	Revgetation Material Cost $	Total Revegetation Cost $
					$0	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**

Closure Cost Estimate
Waste Rock Dumps

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety Cost Basis: Southern Nevada

Waste Rock Dumps - Cost Summary

	Labor	Equipment	Materials	Totals
Grading Costs	$665	$1,947	N/A	$2,612
Cover Placement Cost	$0	$0	N/A	$0
Topsoil Placement Cost	$169,589	$421,466	N/A	$591,055
Ripping/Scarifying Cost	$1,046	$3,059	N/A	$4,105
Subtotal Earthworks	**$171,300**	**$426,472**	**$0**	**$597,772**
Revegetation Cost	$18,272	$14,867	$140,556	$173,695
TOTALS	**$189,572**	**$441,339**	**$140,556**	**$771,467**

Waste Rock Dumps - User Input

You must fill in ALL green cells in this section for each dump, lift or dump category

	Facility Description			Physical - MANDATORY									Cover				Growth Media			
	Description (required)	ID Code	Type	Underlying Ground Slope % Grade	Ungraded Slope _H:1V	Final Slope _H:1V	Final Top Slope % Grade	Lift (dump) Height ft	Mid-Bench Length ft	Average Flat Area Long Dimension (ripping distance) ft	Final (Regraded) Dump Footprint acres	Regrade Volume (1) (if calculated elsewhere) cy	Cover Thickness Slopes in	Cover Thickness Flat Areas in	Distance from Cover Borrow ft	Slope from Dump to Cover Borrow % grade	Slope Growth Media Thickness in	Flat Area Growth Media Thickness in	Distance from Growth Media Stockpile ft	Slope from Dump to Stockpile % grade
1	TSF1	N/A	Waste Rock Dump	0.0	1.5	2.5	0.0	5	130,876	909	51.42						24.0	24.0	6,195	-3.7

Notes:
1. All Physical parameters must be input even if manual overrides for volume or area are used.
2. If Slope from facility to borrow source is >20, downhill travel time may be underestimated due to limitation of uphill travel time curves and downhill speed tables from CAT Handbook (see Productivty Sheet)

3. The mid-bench length, ripping distance and final dump footprint were calculated using AutoCAD.
4. The Haul Distance from Growth Media Stockpile was calculated using AutoCAD.

Waste Rock Dumps - User Input (cont.)

You must fill in ALL green cells and relevant blue cells in this section for each dump, lift or dump category

		Grading				Cover		Growth Media		Revegetation								
	Description (required)	Regrading Material Condition (select)	Regrading Material Type (select)	Regrading Equipment Fleet (select)	Slot/Side-by-Side (select)	Cover Material Type (select)	Cover Placement Equipment Fleet (select)	Growth Media Material Type (select)	Growth Media Equipment Fleet (select)	Seed Mix Slopes (select)	Seed Mix Flat Areas (select)	Mulch Slopes (select)	Mulch Flat Areas (select)	Fertilizer Slopes (select)	Fertilizer Flat Areas (select)	Slope Scarify/ Rip? (select)	Flat Area Scarify/ Rip? (select)	Scarify/ Ripping Fleet (select)
1	TSF1	1	Clay - Dry	Med	No	Topsoil	Med Truck	Topsoil	Med Truck	User Mix 1	User Mix 1	None	None	Chemical	Chemical	No	Yes	Med Dozer

Notes:
1. Material Types are used for density correction based on material densities in Caterpillar Performance Handbook material density table

Waste Rock Dumps - Calculations

Regrading Volume Calculation

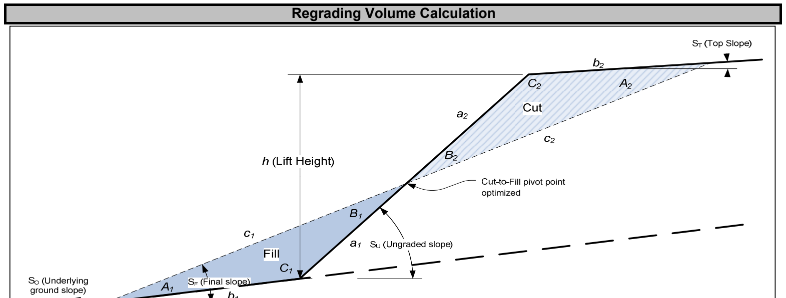


Figure 1 - Regrace Volume Calculation

Final Slope Area and Footprint Area Calculations

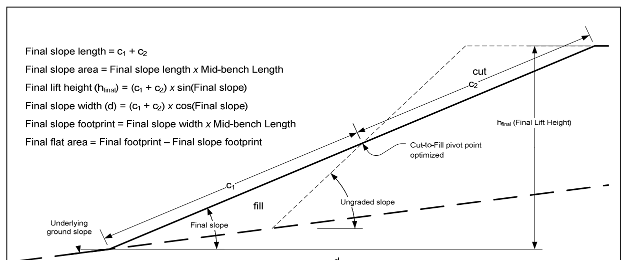


Figure 3 - Final Slope Area and Footprint Area Calculation

Closure Cost Estimate
Waste Rock Dumps

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety   Cost Basis: Southern Nevada

Waste Rock Dumps - Cost Summary

	Labor	Equipment	Materials	Totals
Grading Costs	$665	$1,947	N/A	$2,612
Cover Placement Cost	$0	$0	N/A	$0
Topsoil Placement Cost	$169,589	$421,466	N/A	$591,055
Ripping/Scarifying Cost	$1,046	$3,059	N/A	$4,105
Subtotal Earthworks	**$171,300**	**$426,472**	**$0**	**$597,772**
Revegetation Cost	$18,272	$14,867	$140,556	$173,695
TOTALS	**$189,572**	**$441,339**	**$140,556**	**$771,467**

Regrading Push Distance Calculation

dozing distance: based on 2/3 final cut slope + 2/3 final fill slope (minimum = 50 ft)

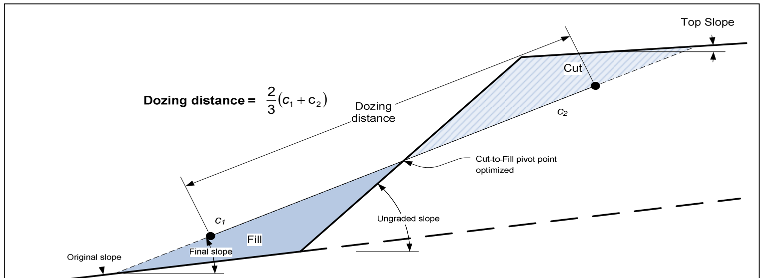


Figure 2 - Dozing Distance Calculation

Ripping/Scarifying Calculations

Minimum 1 hr ripping/scarifying time per dump

Slopes:
Number of passes = Final slope length ÷ Grader width
Travel distance = Number of passes x Mid-bench length
Total hours = (Travel distance ÷ Grader productivity) + (Number of passes x Grader maneuver time)
Minimum 1 hr

Flat Areas:
Flat area width = Final flat area ÷ Average long dimensions
Number of passes = Flat area width ÷ Grader width
Travel distance = Number of passes x Average long dimensions
Total hours = (Travel distance ÷ Grader productivity) + (Number of passes x Grader maneuver time)

Revegetation: Minimum 1 acre revegetation crew time per area

Waste Rock Dumps - Regrading Costs

Productivity = Dozer Productivity x Grade Correction x Density Correction x Operator (0.75) x Material x Visibility x Job Efficiency (0.83) x (Slot/Side-by-Side) x (Altitude Deration)

	Description (required)	Regrading Volume cy	Dozing Distance (see above) ft	Regrading Fleet	Uncorrected Dozer Productivity cy/hr	Grade Correction	Dozing Material	Density Correction	Side-by-Side or Slot Dozing	Total Hourly Productivity cy/hr	Total Dozer Hours hr	Total Labor Cost $	Total Equipment Cost $	Total Regrading Cost $
1	**TSF1**	14,542	50	D9R	2,251	1.6	1.0	0.92	1.0	2,063	7	$665	$1,947	$2,612
		14,542									7	**$665**	**$1,947**	**$2,612**

Waste Rock Dumps - Cover and Growth Media Costs

		Cover (lower layer)								Growth Media Placement							
	Description (required)	Cover Volume cy	Cover Replacement Fleet	Fleet Productivity LCY/hr	Number of Trucks/ Scrapers	Total Fleet Hours	Cover Labor Cost $	Cover Equipment Cost $	Total Cover Cost $	Growth Media Volume cy	Growth Media Replacement Fleet	Fleet Productivity BCY/hr	Number of Trucks/ Scrapers	Total Fleet Hours	Total Labor Cost $	Total Equipment Cost $	Total Growth Media Cost $
1	**TSF1**						$0	$0	$0	174,434	740/988G/D8R	573	5	304	$169,589	$421,466	$591,055
							$0	**$0**	**$0**	174,434				304	**$169,589**	**$421,466**	**$591,055**

Waste Rock Dumps - Scarifying/Revegetation Costs

	Description (required)	Slope Area acres	Flat Area acres	Total Surface Area acres	Final Slope Length ft	Flat Area Long Dimension ft	Ripping/ Scarifying Fleet	Slope Scarifying/ Ripping Hours hrs	Flat Area Scarifying/ Ripping Hours hrs	Scarifying/ Ripping Labor Costs $	Scarifying/ Ripping Equipment Cost $	Total Scarifying/ Ripping Costs $	Revegetation Labor Cost $	Revegetation Equipment Cost $	Revgetation Material Cost $	Total Revegetation Cost $
1	**TSF1**	39.06	15.00	54.06	13	909	D9R		11	$1,046	$3,059	$4,105	$18,272	$14,867	$140,556	$173,695
		39.06	15.00	54.06					11	**$1,046**	**$3,059**	**$4,105**	**$18,272**	**$14,867**	**$140,556**	**$173,695**

Notes: 1) Minimum total ripping hours = 1 (i.e. If total ripping hrs (slope + flat) < 1, then one hour of fleet time is assumed, regardless of acres shown in in scarifying table.)
2) Assumes 50min/hr equipment availability

Closure Cost Estimate
Heap Leach

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety   Cost Basis: Southern Nevada

Heap Leach Pads - Cost Summary

	Labor	Equipment	Materials	Totals
Drain Installation	$0	$0	$0	$0
Grading Costs	$0	$0	N/A	$0
Cover Placement Cost	$0	$0	N/A	$0
Topsoil Placement Cost	$0	$0	N/A	$0
Ripping/Scarifying Cost	$0	$0	N/A	$0
Subtotal Earthworks	**$0**	**$0**	**$0**	**$0**
Revegetation Cost	$0	$0	$0	$0
TOTALS	**$0**	**$0**	**$0**	**$0**

Heap Leach Pads - User Input

You must fill in ALL green cells and relevant blue cells in this section for each heap, lift or heap category

Facility Description				Physical (1) - MANDATORY									Cover				Growth Media			
	Description (required)	ID Code	Type	Underlying Ground Slope % grade	Ungraded Slope _H:1V	Final Slope _H:1V	Final Top Slope % grade	Lift (heap) Height ft	Mid-Bench Length ft	Average Flat Area Long Dimension (ripping distance) ft	Final (Regraded) Heap Footprint acres	Regrade Volume (if calculated elsewhere) cy	Cover Thickness Slopes in	Cover Thickness Flat Areas in	Distance from Cover Borrow ft	Slope from Heap to Cover Borrow % grade	Slope Growth Media Thickness in	Flat Area Growth Media Thickness in	Distance from Growth Material Stockpile ft	Slope from Heap to Stockpile % grade

Notes:
1. All Physical parameters must be input even if manual overrides for volume or area are used.
2. If Slope from facility to borrow source is >20, downhill travel time may be underestimated due to limitation of uphill travel time curves and downhill speed tables from CAT Handbook (see Productivty Sheet)

Heap Leach Pads - User Input (cont.)

You must fill in ALL green cells and relevant blue cells in this section for each heap, lift or heap category

		Grading				Cover		Growth Media		Revegetation								
	Description (required)	Regrading Material Condition (select)	Regrading Material Type (select)	Regrading Equipment Fleet (select)	Slot/ Side-by-Side (select)	Cover Material Type (select)	Cover Placement Equipment Fleet (select)	Growth Media Material Type (select)	Growth Media Equipment Fleet (select)	Seed Mix Slopes (select)	Seed Mix Flat Areas (select)	Mulch Slopes (select)	Mulch Flat Areas (select)	Fertilizer Slopes (select)	Fertilizer Flat Areas (select)	Slope Scarify/ Rip? (select)	Flat Area Scarify/ Rip? (select)	Scarifying/ Ripping Fleet (select)

Notes:
1. Material Types are used for density correction based on material densities in Caterpillar Performance Handbook material density table

Heap Leach Pads - User Input (cont.)

		Solution Collection Ditch Fill							Piping			
	Description (required)	Collection Ditch Length ft	Collection Ditch Top Width ft	Collection Ditch Depth ft	Volume (if calculated elsewhere) cy	Distance from Borrow ft	Slope to Borrow % grade	Drain Rock Equipment Fleet (select)	Solid Pipe Length ft	Solid Pipe Type (select)	Drainage Pipe Length ft	Drainage Pipe Type (select)

Notes:

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety   Cost Basis: Southern Nevada

Heap Leach Pads - Cost Summary

	Labor	Equipment	Materials	Totals
Drain Installation	$0	$0	$0	$0
Grading Costs	$0	$0	N/A	$0
Cover Placement Cost	$0	$0	N/A	$0
Topsoil Placement Cost	$0	$0	N/A	$0
Ripping/Scarifying Cost	$0	$0	N/A	$0
Subtotal Earthworks	**$0**	**$0**	**$0**	**$0**
Revegetation Cost	$0	$0	$0	$0
TOTALS	**$0**	**$0**	**$0**	**$0**

Heap Leach Pads - Calculations

Regrading Volume Calculation

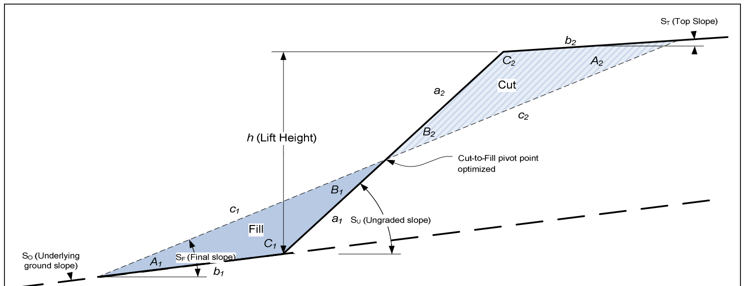


Figure 1 - Regrading Volume Calculation

Regrading Push Distance Calculation

dozing distance: based on 2/3 final cut slope + 2/3 final fill slope (minimum = 50 ft)

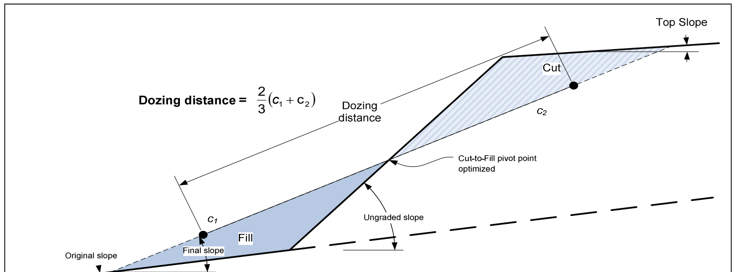


Figure 2 - Dozing Distance Calculation

Ripping/Scarifying Calculations

Minimum 1 hr ripping/scarifying per area

Slopes:
Number of passes = Final slope length ÷ Grader width
Travel distance = Number of passes x Mid-bench length
Total hours = (Travel distance ÷ Grader productivity) + (Number of passes x Grader maneuver time)

Flat Areas:
Flat area width = Final flat area ÷ Average long dimensions
Number of passes = Flat area width ÷ Grader width
Travel distance = Number of passes x Average long dimensions
Total hours = (Travel distance ÷ Grader productivity) + (Number of passes x Grader maneuver time)

Revegetation: Minimum 1 acre revegetation crew time per area

Final Slope Area and Footprint Area Calculations

Final slope length = $c_1 + c_2$
Final slope area = Final slope length *x* Mid-bench Length
Final lift height (h_{final}) = ($c_1 + c_2$) *x* sin(Final slope)
Final slope width (d) = ($c_1 + c_2$) *x* cos(Final slope)
Final slope footprint = Final slope width *x* Mid-bench Length
Final flat area = Final footprint – Final slope footprint

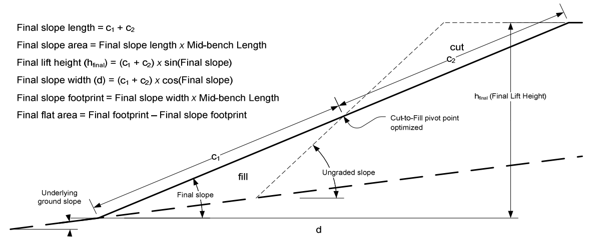


Figure 3 - Final Slope Area and Footprint Area Calculation

Solution Collection Ditch Calculations

Use when existing heap material is not suitable drain rock
Assume to be constructed in existing solution channels
Assume 2H:1V ditch sideslopes
Drain rock assumed to be Gravel - Dry at 2,550 lb/cy (1,510 kg/m3) from CAT Handbook 35th Ed.

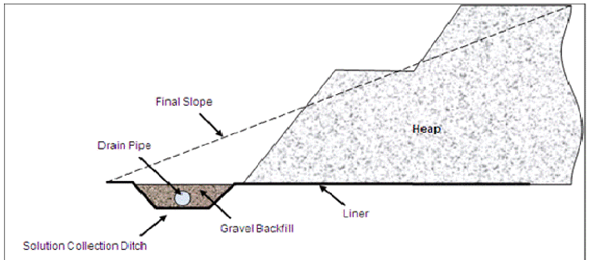


Figure 4 – Drainage Ditch Construction

Closure Cost Estimate
Heap Leach

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety Cost Basis: Southern Nevada

Heap Leach Pads - Cost Summary

	Labor	Equipment	Materials	Totals
Drain Installation	$0	$0	$0	$0
Grading Costs	$0	$0	N/A	$0
Cover Placement Cost	$0	$0	N/A	$0
Topsoil Placement Cost	$0	$0	N/A	$0
Ripping/Scarifying Cost	$0	$0	N/A	$0
Subtotal Earthworks	**$0**	**$0**	**$0**	**$0**
Revegetation Cost	$0	$0	$0	$0
TOTALS	**$0**	**$0**	**$0**	**$0**

Heap Leach Pad - Drainage Channel Fill & Drainage Pipe Installation

	Drain Rock Placement								Drainpipe Installation				
Description (required)	Drain Rock Volume cy	Drain Rock Fleet	Fleet Productivity LCY/hr	Number of Trucks/ Scrapers	Total Fleet Hours hrs	Drainage Labor Cost $	Drainage Equipment Cost $	Total Drainage Cost $	Piping Crew Hours hrs	Piping Labor Cost $	Piping Equipment Cost $	Piping Material Cost $	Total Pipe Installation Cost $
					0	$0	$0	$0		$0	$0	$0	$0

Heap Leach Pad - Regrading Costs

Productivity = Dozer Productivity x Grade Correction x Density Correction x Operator (0.75) x Material x Visibility x Job Efficiency (0.83) x (Slot/Side-by-Side) x (Altitude Deration)

Description (required)	Regrading Volume cy	Dozing Distance (see above) ft	Regrading Fleet	Uncorrected Dozer Productivity cy/hr	Grade Correction	Dozing Material	Density Correction	Side-by-Side or Slot Dozing	Total Hourly Productivity cy/hr	Total Dozer Hours hr	Total Labor Cost $	Total Equipment Cost $	Total Regrading Cost $
											$0	$0	$0

Heap Leach Pad - Cover and Growth Media Costs

	Cover (lower layer)								Growth Media Placement							
Description (required)	Cover Volume cy	Cover Replacement Fleet	Fleet Productivity LCY/hr	Number of Trucks/ Scrapers	Total Fleet Hours	Cover Labor Cost $	Cover Equipment Cost $	Total Cover Cost $	Growth Media Volume cy	Growth Media Replacement Fleet	Fleet Productivity BCY/hr	Number of Trucks/ Scrapers	Total Fleet Hours	Total Labor Cost $	Total Equipment Cost $	Total Growth Media Cost $
						$0	$0	$0						$0	$0	$0

Heap Leach Pad - Scarifying/Revegetation Costs

Description (required)	Slope Area acres	Flat Area acres	Total Surface Area acres	Final Slope Length ft	Flat Area Long Dimension ft	Ripping/ Scarifying Fleet	Slope Scarifying/ Ripping Hours hrs	Flat Area Scarifying/ Ripping Hours hrs	Scarifying/ Ripping Labor Costs $	Scarifying/ Ripping Equipment Cost $	Total Scarifying/ Ripping Costs $	Revegetation Labor Cost $	Revegetation Equipment Cost $	Revgetation Material Cost $	Total Revegetation Cost $
									$0	$0	$0	$0	$0	$0	$0

1) Minimum total ripping hours = 1 (i.e. If total ripping hrs (slope + flat) < 1, then one hour of fleet time is assumed, regardless of acres shown in in scarifying table.)

Bond Calculation
Tailings

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety   Cost Basis: Southern Nevada

Tailings - Cost Summary	Labor	Equipment	Materials	Totals
Embankment Regrading Cost	$0	$0	N/A	$0
Tailings Surface Grading Cost	$0	$0	N/A	$0
Cover Placement Cost	$0	$0	N/A	$0
Topsoil Placement Cost	$0	$0	N/A	$0
Ripping/Scarifying Cost	$0	$0	N/A	$0
Subtotal Earthworks	**$0**	**$0**	**$0**	**$0**
Revegetation Cost	$0	$0	$0	$0
TOTALS	**$0**	**$0**	**$0**	**$0**

Tailings - User Input
You must fill in ALL green cells and relevant blue cells in this section for each tailings impoundment

	Facility Description		Physical - MANDATORY								Cover				Growth Media			
	Description (required)	ID Code	Underlying Ground Slope % Grade	Ungraded Slope _H:1V	Final (Regraded) Embankment Slope _H:1V	Final Embankment Height ft	Final Tailings Surface Area acres	Mid-Embankment or Ripping Length ft	Embankment Regrade Volume (if calculated elsewhere) cy	Surface Regrade Volume (calculated elsewhere) cy	Embankment Cover Thickness in	Tailings Surface Cover Thickness in	Distance from Cover Borrow ft	Slope from Tailings to Borrow % grade	Embankment Growth Media Thickness in	Tailings Surface Growth Media Thickness in	Distance from Growth Material Stockpile ft	Slope from Tailings to Stockpile % grade

Notes:
1. All Physical parameters must be input even if manual overrides for volume or area are used.
2. If Slope from facility to borrow source is >20, downhill travel time may be underestimated due to limitation of uphill travel time curves and downhill speed tables from CAT Handbook (see Productivty Sheet)

Tailings - User Input (cont.)
You must fill in ALL green cells and relevant blue cells in this section for each tailings impoundment

		Grading				Cover		Growth Media		Revegetation								
	Description (required)	Regrading Material Condition (select)	Embankment Material Type (select)	Regrading Equipment Fleet (select)	Slot/Side-by-Side (select)	Cover Material Type (select)	Cover Placement Equipment Fleet (select)	Growth Media Material Type (select)	Growth Media Equipment Fleet (select)	Seed Mix Embankment Slope (select)	Seed Mix Tailings Surface (select)	Mulch Embankment Slopes (select)	Mulch Tailings Surface (select)	Fertilizer Embankment Slopes (select)	Fertilizer Tailing Surface (select)	Embankment Slope Scarify/ Rip? (select)	Tailings Surface Scarify/ Rip? (select)	Scarifying/ Ripping Fleet (select)

Notes:
1. Material Types are used for density correction based on material densities in Caterpillar Performance Handbook material density table

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety Cost Basis: Southern Nevada

Tailings - Cost Summary

	Labor	Equipment	Materials	Totals
Embankment Regrading Cost	$0	$0	N/A	$0
Tailings Surface Grading Cost	$0	$0	N/A	$0
Cover Placement Cost	$0	$0	N/A	$0
Topsoil Placement Cost	$0	$0	N/A	$0
Ripping/Scarifying Cost	$0	$0	N/A	$0
Subtotal Earthworks	**$0**	**$0**	**$0**	**$0**
Revegetation Cost	$0	$0	$0	$0
TOTALS	**$0**	**$0**	**$0**	**$0**

Tailings - Calculations

Surface Area Calculations

Top Surface Area provided by user

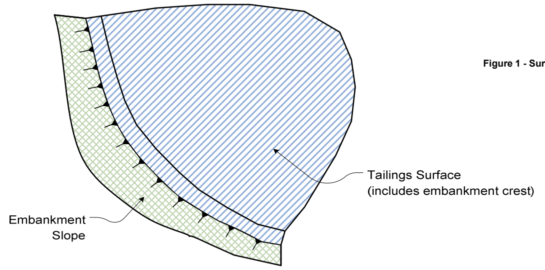


Figure 1 - Surface Areas

Final Slope Area and Footprint Area Calculations

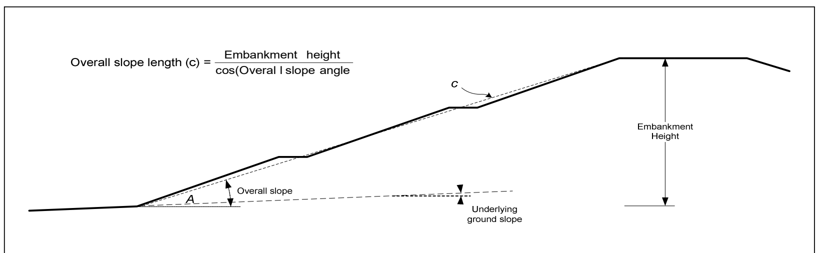


Figure 2 - Final Slope Area and Footprint Area Calculation

Grading Calculations

Grading assumed on impoundment surface only, not embankment
Average push distance assumed to be 2/3 of the 600 feet maximum from Catepillar Handbook or 400 feet
Material assumed to be loose stockile (1.2 productivity factor)
Dozing density correction based on dry sand = 2300/2400 = 0.96
Slope assumed to be 0 to 5% (1.0 productivity factor)

Ripping/Scarifying/Revegetation Calculation

Minimum 1 hr ripping/scarifying per area
Minimum 1 acre revegetation crew time per area

Regrading Volume Calculation

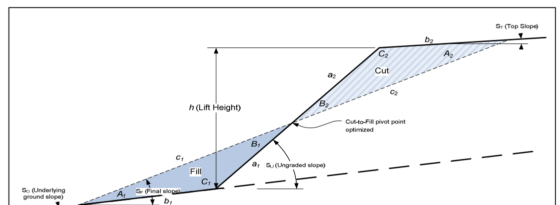


Figure 1 - Regrading Volume Calculation

Regrading Push Distance Calculation

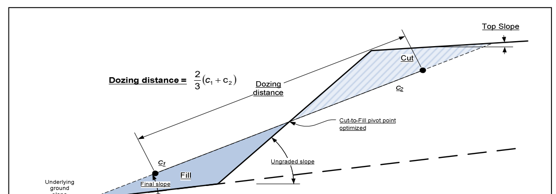


Figure 2 - Dozing Distance Calculation

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety Cost Basis: Southern Nevada

Tailings - Cost Summary

	Labor	Equipment	Materials	Totals
Embankment Regrading Cost	$0	$0	N/A	$0
Tailings Surface Grading Cost	$0	$0	N/A	$0
Cover Placement Cost	$0	$0	N/A	$0
Topsoil Placement Cost	$0	$0	N/A	$0
Ripping/Scarifying Cost	$0	$0	N/A	$0
Subtotal Earthworks	**$0**	**$0**	**$0**	**$0**
Revegetation Cost	$0	$0	$0	$0
TOTALS	**$0**	**$0**	**$0**	**$0**

Tailings - Embankment Regrading Costs

Productivity = Dozer Productivity x Grade Correction x Density Correction x Operator (0.75) x Material x Visibility x Job Efficiency (0.83) x (Slot/Side-by-Side) x (Altitude Deration)

	Description (required)	Regrading Volume cy	Dozing Distance (see above) ft	Regrading Fleet	Uncorrected Dozer Productivity cy/hr	Grade Correction	Dozing Material Condition	Density Correction	Side-by-Side or Slot Dozing	Total Hourly Productivity cy/hr	Total Dozer Hours hr	Total Labor Cost $	Total Equipment Cost $	Total Regrading Cost $
												$0	**$0**	**$0**

Tailings - Surface Regrading Costs

Productivity = Dozer Productivity x Grade Correction x Density Correction x Operator (0.75) x Material x Visibility x Job Efficiency (0.83) x (Slot/Side-by-Side) x (Altitude Deration)

	Description (required)	Regrading Volume cy	Dozing Distance (see above) ft	Regrading Fleet	Uncorrected Dozer Productivity cy/hr	Grade Correction	Density Correction	Dozing Material	Side-by-Side or Slot Dozing	Total Hourly Productivity cy/hr	Total Dozer Hours hr	Total Labor Cost $	Total Equipment Cost $	Total Regrading Cost $
												$0	**$0**	**$0**

Tailings - Cover and Growth Media Costs

		Cover Placement								Growth Media Placement							
	Description (required)	Cover Volume cy	Cover Placement Fleet	Cover Fleet Productivity LCY/hr	Number of Trucks/ Scrapers	Total Fleet Hours	Total Labor Cost $	Total Equipment Cost $	Total Cover Placement Cost $	Growth Media Volume cy	Growth Media Placement Fleet	Growth Media Fleet Productivity LCY/hr	Number of Trucks/ Scrapers	Total Fleet Hours	Total Labor Cost $	Total Equipment Cost $	Total Growth Media Cost $
							$0	**$0**	**$0**						**$0**	**$0**	**$0**

Tailings - Scarifying/Revegetation Costs

	Description (required)	Embankment Slope Area acres	Tailings Surface Area acres	Total Surface Area acres	Final Slope Length ft	Ripping/ Scarifying Fleet	Slope Scarifying/ Ripping Hours hrs	Flat Area Scarifying/ Ripping Hours hrs	Scarifying/ Ripping Labor Cost $	Scarifying/ Ripping Equipment Cost $	Total Scarifying/ Ripping Cost $	Revegetation Labor Cost $	Revegetation Equipment Cost $	Revgetation Material Cost $	Total Revegetation Cost $
									$0	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**

Closure Cost Estimate
Roads

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety   Cost Basis: Southern Nevada

Roads - Cost Summary

	Labor	Equipment	Materials	Totals
Grading Costs	$380	$1,112	N/A	$1,492
Cover Placement Cost	$0	$0	N/A	$0
Ripping/Scarifying Cost	$380	$1,112	N/A	$1,492
Subtotal Earthworks	**$760**	**$2,224**		**$2,984**
Revegetation Cost	$796	$455	$10,660	$11,911
TOTALS	**$1,556**	**$2,679**	**$10,660**	**$14,895**

Roads - User Input — **You must fill in ALL green cells and relevant blue cells in this section for each road**

	Facility Description			Physical (1) - MANDATORY						User Overrides		Growth Media		
	Description (required)	ID Code	Type	Underlying Ground Slope % grade	Ungraded Slope _H:1V	Cut Slope degrees	Road Width ft	Road Length ft	Slope Replacement Percent %	Regrade Volume (if calculated elsewhere) cy	Disturbed Area (if calculated elsewhere) acres	Growth Media Thickness in	Haul Distance from Growth Media Stockpile ft	Slope from Road to Stockpile % grade
1	**TSF Perimeter Road (1 way)**		**Access Road**				**16.0**	**1,505**				**0.0**	**1,700**	**3%**
2	**TSF Perimeter Road (2 way)**		**Access Road**				**36.0**	**4,300**				**0.0**	**3,350**	**-2%**
3	**TSF Haul Road**		**Haul Road**				**36.0**	**1,200**				**0.0**	**5,330**	**-2%**

Notes:
1. All Physical parameters must be input even if manual overrides for volume or area are used.
2. If Slope from facility to borrow source is >20, downhill travel time may be underestimated due to limitation of uphill travel time curves and downhill speed tables from CAT Handbook (see Productivty Sheet)
3. Because the work required for building roads with a dozer is similar to that required to regrade a road with a dozer, this sheet could be used to provide a rough estimate of road construction costs if a dozer is selected as the grading fleet.
4. **The TSF Perimeter Road and TSF Haul Road lengths were calculated using AutoCAD.**
5. **TSF Haul Road growth media and revegetation is incorporated as part of the "Waste Rock Dumps" section.**

Roads - User Input (cont.)

		Haul Road Safety Berms				
	Description (required)	Berm Length ft	Berm Height ft	Berm Base Width ft	Berm Sideslope Angle _H:1V	Number of Berms (2) (1 or 2 sides)
1	**TSF Perimeter Road (1 way)**	**1,505.0**	**1.5**	**4.5**	**1.5**	**2**
2	**TSF Perimeter Road (2 way)**	**4,300.0**	**1.5**	**4.5**	**1.5**	**2**
3	**TSF Haul Road**	**1,200.0**	**3.0**	**9.0**	**1.5**	**1**

(2) Enter 1 if berm on only one side of road, 2 if both sides of road are bermed.

Roads - User Input (cont.) — **You must fill in ALL green cells and relevant blue cells in this section for each road**

		Grading				Growth Media			Revegetation				
	Description (required)	Regrading Material Condition (select)	Regrading Material Type (select)	Regrading Equipment Fleet (select)	No. of Excavators if grade >30% (select)	Growth Media Material Type (select)	Cover Placement Equipment Fleet (select)	Maximum Fleet Size (user override)	Seed Mix (select)	Mulch (select)	Fertilizer (select)	Scarifying/ Ripping? (select)	Ripping Fleet (select)
1	**TSF Perimeter Road (1 way)**	**1**	**Clay - Dry**	**Med Dozer**		**Topsoil**	**Med Truck**		**User Mix 1**	**None**	**Chemical**	**Yes**	**Med Dozer**
2	**TSF Perimeter Road (2 way)**	**1**	**Clay - Dry**	**Med Dozer**		**Topsoil**	**Med Truck**		**User Mix 1**	**None**	**Chemical**	**Yes**	**Med Dozer**
3	**TSF Haul Road**	**1**	**Clay - Dry**	**Med Dozer**		**Topsoil**	**Med Truck**		**None**	**None**	**None**	**Yes**	**Med Dozer**

Notes:
1. Material Types are used for density correction based on material densities in Caterpillar Performance Handbook material density table
2. If original slope >30% only excavators are allowed.

Closure Cost Estimate
Roads

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety **Cost Basis: Southern Nevada**

Roads - Cost Summary

	Labor	Equipment	Materials	Totals
Grading Costs	$380	$1,112	N/A	$1,492
Cover Placement Cost	$0	$0	N/A	$0
Ripping/Scarifying Cost	$380	$1,112	N/A	$1,492
Subtotal Earthworks	**$760**	**$2,224**		**$2,984**
Revegetation Cost	$796	$455	$10,660	$11,911
TOTALS	**$1,556**	**$2,679**	**$10,660**	**$14,895**

Roads - Calculations

Regrading Volume and Footprint Volume

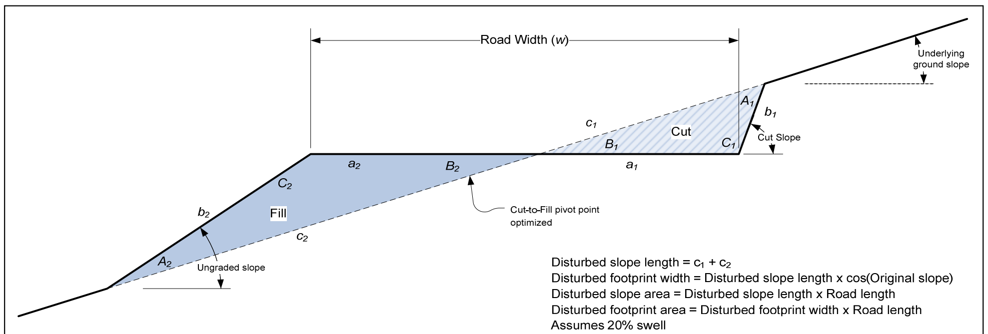


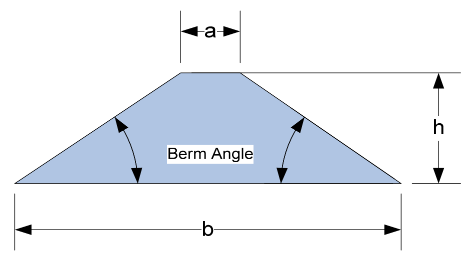
Figure 1 - Regrading Volume Calculation

Will not allow dozer for slopes greater than 30%
For dozer regrading push distance = road width
Assumes dozer push is uphill
Assumes minimum push distance of 100 ft

Safety Berm Volume Calculation

Cross Sectional Area $= \frac{(a+b)}{2} \times h$

Berm Volume = Berm Length x Cross Sectional Area x No. Sides



Total berm volume doubled if both sides of road are bermed.
If length of berm on each side of road is different, input total length of both berms and input 1 for number of sides

Ripping/Scarifying Calculations

Minimum 1 hr ripping/scarifying time per area
Number of passes = Final slope length ÷ Grader width
Travel distance = Number of passes x Road length
Total hours = (Travel distance ÷ Grader productivity) + (Number of passes x Grader maneuver time)
For dozer regrading assumes push distance = 3 x road width

Revegetation Calculations

Minimum of 1 acre crew time per area

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety   Cost Basis: Southern Nevada

Roads - Cost Summary

	Labor	Equipment	Materials	Totals
Grading Costs	$380	$1,112	N/A	$1,492
Cover Placement Cost	$0	$0	N/A	$0
Ripping/Scarifying Cost	$380	$1,112	N/A	$1,492
Subtotal Earthworks	**$760**	**$2,224**		**$2,984**
Revegetation Cost	$796	$455	$10,660	$11,911
TOTALS	**$1,556**	**$2,679**	**$10,660**	**$14,895**

Roads - Regrading Costs

	Description (required)	Regrading Volume cy	Recontouring Fleet	Fleet Productivity cy/hr	Total Fleet Hours hr	Total Labor Cost $	Total Equipment Cost $	Total Regrading Cost $
1	**TSF Perimeter Road (1 way)**	376	D9R	672	1	$95	$278	$373
2	**TSF Perimeter Road (2 way)**	1,075	D9R	672	2	$190	$556	$746
3	**TSF Haul Road**	600	D9R	672	1	$95	$278	$373
		2,051			4	**$380**	**$1,112**	**$1,492**

Roads - Growth Media Costs

	Description (required)	Growth Media Volume cy	Growth Media Replacement Fleet	Fleet Productivity LCY/hr	Number of Trucks/ Scrapers	Total Fleet Hours	Total Labor Cost $	Total Equipment Cost $	Total Growth Media Cost $
1	**TSF Perimeter Road (1 way)**						$0	$0	$0
2	**TSF Perimeter Road (2 way)**						$0	$0	$0
3	**TSF Haul Road**						$0	$0	$0
							$0	**$0**	**$0**

Roads - Scarifying/Revegetation Costs

	Description (required)	Total Surface Area acres	Final Slope Length ft	Ripping/ Scarifying Fleet	Ripping Hours hrs	Ripping Labor Costs $	Ripping Equipment Cost $	Total Ripping Costs $	Revegetation Labor Cost $	Revegetation Equipment Cost $	Revgetation Material Cost $	Total Revegetation Cost $
1	**TSF Perimeter Road (1 way)**	0.55	16.0	D9R	1	$95	$278	$373	$175	$100	$1,430	$1,705
2	**TSF Perimeter Road (2 way)**	3.55	36.0	D9R	2	$190	$556	$746	$621	$355	$9,230	$10,206
3	**TSF Haul Road**	0.99	36.0	D9R	1	$95	$278	$373	$0	$0	$0	$0
		5.09			4	**$380**	**$1,112**	**$1,492**	**$796**	**$455**	**$10,660**	**$11,911**

Closure Cost Estimate
Pits

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety **Cost Basis: Southern Nevada**

Pits - Cost Summary

	Labor	Equipment	Materials	Totals
Safety Berm Construction Cost	$0	$0	N/A	$0
Safety Berm Revegetation Cost	$0	$0	$0	$0
TOTALS	**$0**	**$0**	**$0**	**$0**

Pits - User Input

Facility Description				Pit Berms					Berm Construction		Excavate or Doze	Hauling (if selected method)				Revegetation		
	Description (required)	ID Code	Type	Berm (or Highwall) Length ft	Berm Height ft	Berm Base Width ft	Berm Sideslope Angle _H:1V	Volume (if calculated elsewhere) cy	Construction Method (select)	Berm Material Type (select)	Berm Construction Equipment Fleet (select)	Berm Hauling Fleet (select)	Distance to Borrow Source ft	Slope to Borrow Source % grade	Maximum Fleet Size (user override)	Seed Mix (select)	Mulch (select)	Fertilizer (select)

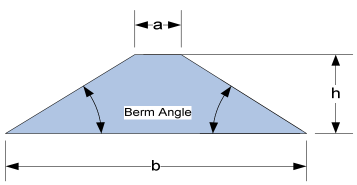
Notes:
1. All Physical parameters must be input even if manual overrides for volume or area are used.
2. If Slope from facility to borrow source is >20, downhill travel time may be underestimated due to limitation of uphill travel time curves and downhill speed tables from CAT Handbook (see Productivty Sheet)
3. Material Types are used for density correction based on material densities in Caterpillar Performance Handbook material density table

Pits - Calculations

Safety Berm Volume Calculation

$$\text{Cross Sectional Area} = \frac{(a+b)}{2} \times h$$

Berm Volume = Berm Length x Cross Sectional Area



Dozer productivity assumes push distance of: 100 feet

Dozer:
Length x (Berm Base Width + Dozer Push Distance) - accounts for disturbance created in borrow area

Excavator:
Length x (Berm Base Width + (2 x Excavator Track Width) - accounts for disturbance created in borrow area

Haul & Place:
Length x Berm Base Width - if necessary use Yards sheet to account for disturbance created in borrow area

Revegetation Calculations

Minimum 1 acre revegetation crew time per area

Pits - Safety Berm Construction Costs

		Safety Berm							
	Description (required)	Safety Berm Volume cy	Selected Fleet	Number of Trucks/ Scrapers	Corrected Fleet Productivity cy/hr	Total Hours	Safety Berm Labor Cost $	Safety Berm Equipment Cost $	Total Safety Berm Cost $
							$0	$0	$0

Pits - Safety Berms - Revegetation Costs

	Description (required)	Flat Area acres	Revegetation Labor Cost $	Revegetation Equipment Cost $	Revgetation Material Cost $	Total Revegetation Cost $
			$0	$0	$0	$0

Closure Cost Estimate
Quarries & Borrow Pits

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety **Cost Basis: Southern Nevada**

Waste Rock Dumps - Cost Summary	Labor	Equipment	Materials	Totals
Grading Costs	$0	$0	N/A	$0
Cover Placement Cost	$0	$0	N/A	$0
Topsoil Placement Cost	$0	$0	N/A	$0
Ripping/Scarifying Cost	$380	$1,113	N/A	$1,493
Safety Berm Construction Cost	$0	$0	N/A	$0
Subtotal Earthwork	**$380**	**$1,113**	**$0**	**$1,493**
Revegetation Cost	$889	$508	$13,208	$14,605
Safety Berm Revegetation Cost	$0	$0	$0	$0
	$889	**$508**	**$13,208**	**$14,605**
TOTALS	**$1,269**	**$1,621**	**$13,208**	**$16,098**

Quarries & Borrow Pits - User Input

You must fill in ALL green cells in this section for each dump, lift or dump category

	Facility Description			Physical - MANDATORY									Cover				Growth Media			
	Description (required)	ID Code	Type	Underlying Ground Slope % Grade	Ungraded Slope _H:1V	Final Slope _H:1V	Final Top Slope % Grade	Bench or Highwall Height ft	Mid-Bench Length ft	Average Flat Area Long Dimension (ripping distance) ft	Final (Regraded) Footprint acres	Regrade Volume (1) (if calculated elsewhere) cy	Cover Thickness Slopes in	Cover Thickness Flat Areas in	Distance from Cover Borrow ft	Slope from Dump to Cover Borrow % grade	Slope Growth Media Thickness in	Flat Area Growth Media Thickness in	Distance from Growth Media Stockpile ft	Slope from Dump to Stockpile % grade
1	Growth Media Storage Area		Quarry	20.0	3.0	3.0	0.0	100	700	150	4.61	0	0.0	0.0	0	0.0	0.0	0.0	0	0.0

Notes:
1. All Physical parameters must be input even if manual overrides for volume or area are used.
2. If Slope from facility to borrow source is >20, downhill travel time may be underestimated due to limitation of uphill travel time curves and downhill speed tables from CAT Handbook (see Productivty Sheet)
3. Growth Media Storage Area to be revegetated after growth media is moved to the TSF.
4. The Growth Media Stockpile final footprint area was calculated using AutoCAD Civil 3D.

Quarries & Borrow Pits - User Input (cont.)

You must fill in ALL green cells and relevant blue cells in this section for each dump, lift or dump category

		Grading				Cover		Growth Media		Revegetation								
	Description (required)	Regrading Material Condition (select)	Regrading Material Type (select)	Regrading Equipment Fleet (select)	Slot/Side-by-Side (select)	Cover Material Type (select)	Cover Placement Equipment Fleet (select)	Growth Media Material Type (select)	Growth Media Equipment Fleet (select)	Seed Mix Slopes (select)	Seed Mix Flat Areas (select)	Mulch Slopes (select)	Mulch Flat Areas (select)	Fertilizer Slopes (select)	Fertilizer Flat Areas (select)	Slope Scarify/ Rip? (select)	Flat Area Scarify/ Rip? (select)	Scarify/ Ripping Fleet (select)
1	Growth Media Storage Area	1	Clay - Dry	Med	No	Topsoil	Med Truck	Topsoil	Med Truck	User Mix 1	User Mix 1	None	None	Chemical	Chemical	Yes	Yes	Med Dozer

Notes:
1. Material Types are used for density correction based on material densities in Caterpillar Performance Handbook material density table

Quarries & Borrow Pits - User Input (cont.)

	Facility Description	Highwall Berms					Berm Construction		Excavate or Doze	Hauling (if selected method)				Revegetation		
	Description (required)	Berm (or Highwall) Length ft	Berm Height ft	Berm Base Width ft	Berm Sideslope Angle _H:1V	Volume (if calculated elsewhere) cy	Construction Method (select)	Berm Material Type (select)	Berm Construction Equipment Fleet (select)	Berm Hauling Fleet (select)	Distance to Borrow Source ft	Slope to Borrow Source % grade	Maximum Fleet Size (user override)	Seed Mix (select)	Mulch (select)	Fertilizer (select)
1	Growth Media Storage Area															

Notes:
1. All Physical parameters must be input even if manual overrides for volume or area are used.
2. If Slope from facility to borrow source is >20, downhill travel time may be underestimated due to limitation of uphill travel time curves and downhill speed tables from CAT Handbook (see Productivty Sheet)
3. Material Types are used for density correction based on material densities in Caterpillar Performance Handbook material density table

Closure Cost Estimate
Quarries & Borrow Pits

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety Cost Basis: Southern Nevada

Waste Rock Dumps - Cost Summary	Labor	Equipment	Materials	Totals
Grading Costs	$0	$0	N/A	$0
Cover Placement Cost	$0	$0	N/A	$0
Topsoil Placement Cost	$0	$0	N/A	$0
Ripping/Scarifying Cost	$380	$1,113	N/A	$1,493
Safety Berm Construction Cost	$0	$0	N/A	$0
Subtotal Earthwork	**$380**	**$1,113**	**$0**	**$1,493**
Revegetation Cost	$889	$508	$13,208	$14,605
Safety Berm Revegetation Cost	$0	$0	$0	$0
	$889	**$508**	**$13,208**	**$14,605**
TOTALS	**$1,269**	**$1,621**	**$13,208**	**$16,098**

Quarries & Borrow Pits - Calculations

Regrading Volume Calculation

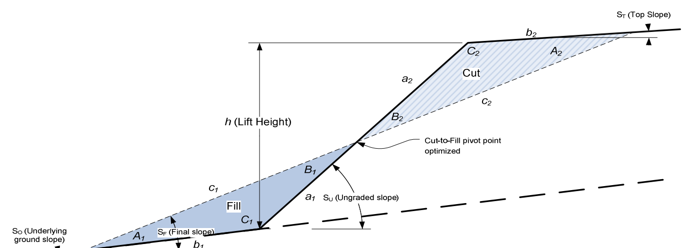


Figure 1 - Regrade Volume Calculation

Final Slope Area and Footprint Area Calculations

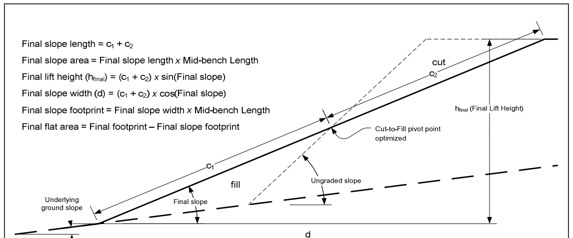


Figure 3 - Final Slope Area and Footprint Area Calculation

Regrading Push Distance Calculation

dozing distance: based on 2/3 final cut slope + 2/3 final fill slope (minimum = 50 ft)

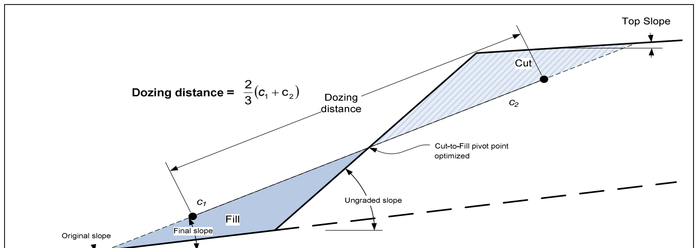


Figure 2 - Dozing Distance Calculation

Ripping/Scarifying Calculations

Minimum 1 hr ripping/scarifying time per dump

Slopes:
Number of passes = Final slope length ÷ Grader width
Travel distance = Number of passes x Mid-bench length
Total hours = (Travel distance ÷ Grader productivity) + (Number of passes x Grader maneuver time)
Minimum 1 hr

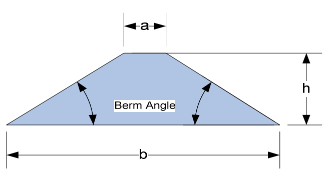
Flat Areas:
Flat area width = Final flat area ÷ Average long dimensions
Number of passes = Flat area width ÷ Grader width
Travel distance = Number of passes x Average long dimensions
Total hours = (Travel distance ÷ Grader productivity) + (Number of passes x Grader maneuver time)

Revegetation: Minimum 1 acre revegetation crew time per area

Safety Berm Volume Calculation

$$\text{Cross Sectional Area} = \frac{(a+b)}{2} \times h$$

Berm Volume = Berm Length x Cross Sectional Area



Dozer productivity assumes push distance of:

100	feet

Dozer:
Length x (Berm Base Width + Dozer Push Distance) - accounts for disturbance created in borrow area

Excavator:
Length x (Berm Base Width + (2 x Excavator Track Width) - accounts for disturbance created in borrow area

Haul & Place:
Length x Berm Base Width - if necessary use Yards sheet to account for disturbance created in borrow area

Closure Cost Estimate
Quarries & Borrow Pits

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Waste Rock Dumps - Cost Summary	Labor	Equipment	Materials	Totals
Grading Costs	$0	$0	N/A	$0
Cover Placement Cost	$0	$0	N/A	$0
Topsoil Placement Cost	$0	$0	N/A	$0
Ripping/Scarifying Cost	$380	$1,113	N/A	$1,493
Safety Berm Construction Cost	$0	$0	N/A	$0
Subtotal Earthwork	**$380**	**$1,113**	**$0**	**$1,493**
Revegetation Cost	$889	$508	$13,208	$14,605
Safety Berm Revegetation Cost	$0	$0	$0	$0
	$889	**$508**	**$13,208**	**$14,605**
TOTALS	**$1,269**	**$1,621**	**$13,208**	**$16,098**

Quarries & Borrow Pits - Regrading Costs

Productivity = Dozer Productivity x Grade Correction x Density Correction x Operator (0.75) x Material x Visibility x Job Efficiency (0.83) x (Slot/Side-by-Side) x (Altitude Deration)

	Description (required)	Regrading Volume cy	Dozing Distance (see above) ft	Regrading Fleet	Uncorrected Dozer Productivity cy/hr	Grade Correction	Dozing Material	Density Correction	Side-by-Side or Slot Dozing	Total Hourly Productivity cy/hr	Total Dozer Hours hr	Total Labor Cost $	Total Equipment Cost $	Total Regrading Cost $
1	**Growth Media Storage Area**	0		D9R								$0	$0	$0
												$0	**$0**	**$0**

Quarries & Borrow Pits - Cover and Growth Media Costs

		Cover (lower layer)								Growth Media Placement							
	Description (required)	Cover Volume cy	Cover Replacement Fleet	Fleet Productivity LCY/hr	Number of Trucks/ Scrapers	Total Fleet Hours	Cover Labor Cost $	Cover Equipment Cost $	Total Cover Cost $	Growth Media Volume cy	Growth Media Replacement Fleet	Fleet Productivity BCY/hr	Number of Trucks/ Scrapers	Total Fleet Hours	Total Labor Cost $	Total Equipment Cost $	Total Growth Media Cost $
1	**Growth Media Storage Area**	0					$0	$0	$0	0					$0	$0	$0
							$0	**$0**	**$0**						**$0**	**$0**	**$0**

Quarries & Borrow Pits - Scarifying/Revegetation Costs

	Description (required)	Slope Area acres	Flat Area acres	Total Surface Area acres	Final Slope Length ft	Flat Area Long Dimension ft	Ripping/ Scarifying Fleet	Slope Scarifying/ Ripping Hours hrs	Flat Area Scarifying/ Ripping Hours hrs	Scarifying/ Ripping Labor Costs $	Scarifying/ Ripping Equipment Cost $	Total Scarifying/ Ripping Costs $	Revegetation Labor Cost $	Revegetation Equipment Cost $	Revgetation Material Cost $	Total Revegetation Cost $
1	**Growth Media Storage Area**	5.08		5.08	316	150	D9R	4	0	$380	$1,113	$1,493	$889	$508	$13,208	$14,605
		5.08		5.08				4		**$380**	**$1,113**	**$1,493**	**$889**	**$508**	**$13,208**	**$14,605**

Notes: 1) Minimum total ripping hours = 1 (i.e. If total ripping hrs (slope + flat) < 1, then one hour of fleet time is assumed, regardless of acres shown in in scarifying table.)
2) Assumes 50min/hr equipment availability

Quarries & Borrow Pits - Safety Berm Construction Costs

		Safety Berm							
	Description (required)	Safety Berm Volume cy	Selected Fleet	Number of Trucks/ Scrapers	Corrected Fleet Productivity cy/hr	Total Hours	Safety Berm Labor Cost $	Safety Berm Equipment Cost $	Total Safety Berm Cost $
1	**Growth Media Storage Area**						$0	$0	$0
							$0	**$0**	**$0**

Quarries & Borrow Pits - Safety Berms - Revegetation Costs

	Description (required)	Flat Area acres	Revegetation Labor Cost $	Revegetation Equipment Cost $	Revgetation Material Cost $	Total Revegetation Cost $
1	**Growth Media Storage Area**	0.00	$0	$0	$0	$0
			$0	**$0**	**$0**	**$0**

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Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety Cost Basis: Southern Nevada

Underground Openings Cost Summary

	Labor	Equipment	Materials	Totals
Adits, Portals & Declines Plugging	$0	$0	$0	$0
Shaft Backfill/Cover	$0	$0	N/A	$0
Shaft Capping	$0	$0	$0	$0
TOTALS	**$0**	**$0**	**$0**	**$0**

Adits, Portals & Declines - User Input

Facility Description			Physical Characteristics				Backfill Material			
	Description (required)	ID Code	Height ft	Width ft	Backfill/ Plug Type	Distance to Bulkhead ft	Backfill Material Condition (select)	Backfill Material Type (select)	Distance to Backfill Borrow ft	Slope from Adit to Borrow Area % grade

Notes: 1) Foam (adit) option is for smaller openings that can be plugged with simple forms and a 5 ft thick plug.
2) Foam (production) option is for larger production openings (declines, etc.) and requires larger form construction and minimum 10 ft thick plug.
3) All foam plugs include minimum 15ft of backfill from opening to plug.
4) Bat gate option is for small openings and the material cost is the same for any size opening.
5) Backfilling assumes that small dozer will push material from nearby stockpile or dump
6) Material Types are used for density correction based on material densities in Caterpillar Performance Handbook material density table

Shaft Openings - User Input

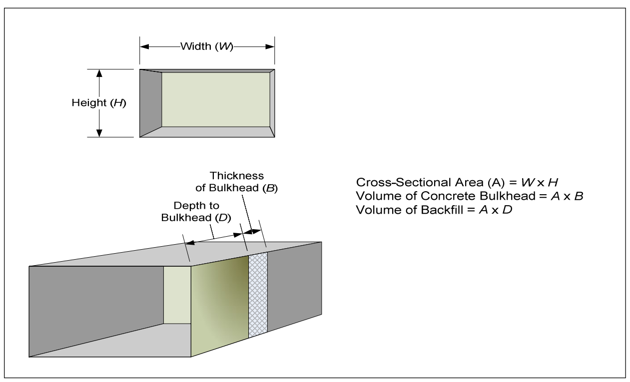
You must fill in ALL green cells and relevant blue cells in this section for each shaft

Facility Description			Physical Characteristics			Backfill or Foundation Cover					
	Description (required)	ID Code	Diameter ft	Shaft Depth (for backfill method) ft	Backfill/ Plug Type (select)	Backfill Material Type (select)	Cover/ Backfill Fleet (select)	Thickness (if not complete backfill) ft	Distance to Backfill Borrow ft	Slope from Shaft to Borrow Area % grade	Maximum Fleet Size (user override)

Notes:
1. If Slope from facility to borrow source is >20, downhill travel time may be underestimated due to limitation of uphill travel time curves and downhill speed tables from CAT Handbook (see Productivty Sheet)
2. Material Types are used for density correction based on material densities in Caterpillar Performance Handbook material density table

Underground Openings - Calculations

Adits, Declines and Portals - Volume Calculations



Concrete Cover/Bulkhead Volume Calculation

Using Means Heavy Construction Cost Data (2004)
Estimage cover/bulkhead thickness
Assumes that all concrete works are reinforced
Productivity for crew from Means Heavy Construction Cost Data (2004) adjusted for supervision (addressed in Misc. Costs) and Davis-Bacon Wage Rates
Assumes 18 in thick slab

Backfill Calculations

Uses 1 large and 1 small dozer for adit backfill
Assumes max 400 foot push
Assumes average operator and 50 min/hr availability

Uses truck & loader load, haul place fleets for shafts
Concrete cap will be 1.5 feet thick, reinforced, structurally supported.
If concrete cap is used, assume 10 feet of rock backfill on top of cap.
Assumes that all concrete works are reinforced
If backfill is used, assume overfill by 5 feet
Carpenter rate incl Fringe: 1 per hour

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
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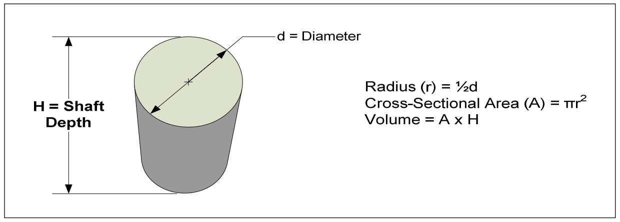
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety   Cost Basis: Southern Nevada

Underground Openings Cost Summary	Labor	Equipment	Materials	Totals
Adits, Portals & Declines Plugging	$0	$0	$0	$0
Shaft Backfill/Cover	$0	$0	N/A	$0
Shaft Capping	$0	$0	$0	$0
TOTALS	**$0**	**$0**	**$0**	**$0**

Shaft Volume Calculations



Adits, Portals & Declines Plugging

Uses RS Means Heavy Construction Cost Data for bulkhead production rate, material costs and crews

							Bulkhead Construction				Backfill or Foam (1)				Bat Gate or Culvert (2,3,4)				Total Costs			
	Description (required)	Bulkhead Volume cy	Backfill (rock) Volume cy	Backfill Equipment Fleet	Backfill Productivity LCY/hr	Backfill Hours	Total Labor Cost $	Total Equipment Cost $	Total Material Cost $	Total Bulkhead Cost $	Total Labor Cost $	Total Equipment Cost $	Material (Foam) Cost $	Total Backfill Cost $	Total Labor Cost $	Total Equipment Cost $	Total Material Cost $	Total Bat Gate Cost $	Total Labor Cost $	Total Equipment Cost $	Total Material Cost $	Total Plugging Costs $
							$0	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**

Notes:
1) Foam costs include 1 hour move to and setup + 1 hr. minimum crew time
2) Assumes 1 hr walk-in/walk-out time for equipment
3) Batgate assumes 8 hr install time each
4) Bat culvert backfill costs based on one 8-hr day (i.e. backfilling hours = 8 hrs).

Shaft Plugging

		Cover/Cap										Backfill/Cover		
	Description (required)	Cover Area ft2	Backfill or Cover Volume cy	Backfill Equipment Fleet	Number of Trucks	Backfill Productivity LCY/hr	Backfill Hours	Total Labor Cost $	Total Equipment Cost $	Total Material Cost $	Total Shaft Cap Cost $	Total Labor Cost $	Total Equipment Cost $	Total Backfill Cost $
								$0	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety Cost Basis: Southern Nevada

Generic Material Hauling - Cost Summary

	Labor	Equipment	Materials	Totals
Hauling/Crush/Screen/Compact	$98,453	$183,588	N/A	$282,041
Cover Placement Cost	$0	$0	N/A	$0
Topsoil Placement Cost	$0	$0	N/A	$0
Ripping/Scarifying Cost	$0	$0	N/A	$0
Subtotal Earthworks	**$98,453**	**$183,588**	**$0**	**$282,041**
Revegetation Cost	$0	$0	$0	$0
TOTALS	**$98,453**	**$183,588**	**$0**	**$282,041**

Generic Material Hauling - User Input

	Facility Description			Physical		Hauled Material			Crushing & Screening					Cover			Growth Media		
	Description (required)	ID Code	Type	Final Surface Area acres	Average Ripping Distance ft	Material Volume Required cy	Distance from Borrow Source (1) ft	Slope to Borrow Source % grade	Crush Material	Screen Material	Loss to Crushing/ Screening %	Distance to Placement Location (2) ft	Slope to Placement % grade	Cover Thickness in	Distance to Cover Borrow ft	Slope to Borrow % grade	Growth Media Thickness in	Distance to Growth Material Stockpile ft	Slope to Stockpile % grade
1	Engineered Fill (Closure Stormwater Diversion Channel)		Surface Channels			48,800	3,570	3.8	No	No									
2	Engineered Fill (UDCP Raise Passive Closure)		Ponds			236	4,266	6.9	No	No									
3	Engineered Fill (TSF Raise Passive Closure)		Waste Rock Dump			200	5,782	3.7	No	No									
4	Engineered Fill (Access Road Raise Passive Closure)		Access Road			1,857	3,802	6.7	No	No									
5	Low Permeability Soil Layer (Closure Stormwater Diversion Channel)		Surface Channels			7,073	3,000	2.0	Yes	Yes	75%	3,570	3.8						
6	Low Permeability Soil Layer (West Spillway- Active)		Surface Channels			320	3,000	2.0	Yes	Yes	75%	3,614	6.0						
7	Low Permeability Soil Layer (West Spillway- Passive)		Surface Channels			353	3,000	2.0	Yes	Yes	75%	3,614	6.0						

Notes:
1. Input distance to crusher if material to be crushed
2. Input distance from crusher to placement if material to be crushed
3. If Slope from facility to borrow source is >20, downhill travel time may be underestimated due to limitation of uphill travel time curves and downhill speed tables from CAT Handbook (see Productivty Sheet)
4. **The Engineered Fill and Low Permeability Soil Layer haul and placement distances were calculated using AutoCAD Civil 3D.**
5. **The Engineered Fill is assumed to be sourced from the Non-PAG Waste Rock Stockpiles and the Low Permeability Soil Layer sourced from a borrow no more than 3,000 ft away.**
6. **Processing of material is assumed to occur at the Non-PAG Waste Rock Stockpile location.**

Generic Material Hauling - User Input (cont.)

		Hauling Material				Cover			Growth Media			Revegetation				
	Description (required)	Haul Material Type (select)	Material Hauling Fleet (select)	Each Fleet Size (from/to crusher) (user override)	Compact After Placement?	Cover Material Type (select)	Cover Placement Equipment Fleet (select)	Maximum Fleet Size (user override)	Growth Media Material Type (select)	Growth Media Equipment Fleet (select)	Maximum Fleet Size (user override)	Seed Mix (select)	Mulch Type (select)	Fertilizer Type (select)	Scarify/ Rip? (select)	Scarifying/ Ripping Fleet (select)
1	Engineered Fill (Closure Stormwater Diversion Channel)	Clay - Dry	Med Truck		Yes	Topsoil	Med Truck		Topsoil	Med Truck		None	None	None	No	Med Dozer
2	Engineered Fill (UDCP Raise Passive Closure)	Clay - Dry	Med Truck		Yes	Topsoil	Med Truck		Topsoil	Med Truck		None	None	None	No	Med Dozer
3	Engineered Fill (TSF Raise Passive Closure)	Clay - Dry	Med Truck		Yes	Topsoil	Med Truck		Topsoil	Med Truck		None	None	None	No	Med Dozer
4	Engineered Fill (Access Road Raise Passive Closure)	Clay - Dry	Med Truck		Yes	Topsoil	Med Truck		Topsoil	Med Truck		None	None	None	No	Med Dozer
5	Low Permeability Soil Layer (Closure Stormwater Diversion	Clay - Dry	Med Truck		Yes	Topsoil	Med Truck		Topsoil	Med Truck		None	None	None	No	Med Dozer
6	Low Permeability Soil Layer (West Spillway- Active)	Clay - Dry	Med Truck		Yes	Topsoil	Med Truck		Topsoil	Med Truck		None	None	None	No	Med Dozer
7	Low Permeability Soil Layer (West Spillway- Passive)	Clay - Dry	Med Truck		Yes	Topsoil	Med Truck		Topsoil	Med Truck		None	None	None	No	Med Dozer

Notes:
1. Material Types are used for density correction based on material densities in Caterpillar Performance Handbook material density table

Generic Material Hauling - Load, Haul, Place and Grade

		Material Haulage								Crush and/or Compact			
	Description (required)	Material Volume to Crusher cy	Final Material Volume cy	Material Haulage Fleet	Fleet Productivity LCY/hr	Number of Trucks/ Scrapers	Total Fleet Hours	Hauling Labor Cost $	Hauling Equipment Cost $	Total Crush/ Screen Cost $	Compact Labor Cost $	Compact Equipment Cost $	Total Load/Haul/ Place Cost $
1	Engineered Fill (Closure Stormwater Diversion Channel)	48,800	48,800	740/988G/D8R	565	3	86	$35,305	$87,686	$0	$24,888	$4,880	$152,759
2	Engineered Fill (UDCP Raise Passive Closure)	236	236	740/988G/D8R	496	3	1	$411	$1,020	$0	$120	$24	$1,575
3	Engineered Fill (TSF Raise Passive Closure)	200	200	740/988G/D8R	456	3	1	$411	$1,020	$0	$102	$20	$1,553
4	Engineered Fill (Access Road Raise Passive Closure)	1,857	1,857	740/988G/D8R	523	3	4	$1,642	$4,078	$0	$947	$186	$6,853
5	Low Permeability Soil Layer (Closure Stormwater Diversion	28,291	7,073	740/988G/D8R	418	5	68	$27,832	$69,097	$7,073	$3,607	$707	$108,316
6	Low Permeability Soil Layer (West Spillway- Active)	1,280	320	740/988G/D8R	418	5	3	$1,422	$3,529	$320	$163	$32	$5,466
7	Low Permeability Soil Layer (West Spillway- Passive)	1,410	353	740/988G/D8R	418	5	3	$1,422	$3,529	$353	$180	$35	$5,519
		82,074	58,838				166	**$68,445**	**$169,959**	**$7,745**	**$30,008**	**$5,884**	**$282,041**

Notes: Final Material Volume includes allowance for additional material hauled to crushing/screening plant based on Loss to Crushing/Screening input above.

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
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File Name: 0014.035 SRCE Model sNV.S32.xlsm
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Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety Cost Basis: Southern Nevada

Generic Material Hauling - Cost Summary

	Labor	Equipment	Materials	Totals
Hauling/Crush/Screen/Compact	$98,453	$183,588	N/A	$282,041
Cover Placement Cost	$0	$0	N/A	$0
Topsoil Placement Cost	$0	$0	N/A	$0
Ripping/Scarifying Cost	$0	$0	N/A	$0
Subtotal Earthworks	**$98,453**	**$183,588**	**$0**	**$282,041**
Revegetation Cost	$0	$0	$0	$0
TOTALS	**$98,453**	**$183,588**	**$0**	**$282,041**

Generic Material Hauling - Cover and Growth Media Costs

		Cover Placement								Growth Media Placement							
	Description (required)	Cover Volume cy	Cover Placement Fleet	Cover Fleet Productivity LCY/hr	Number of Trucks/ Scrapers	Total Fleet Hours	Total Labor Cost $	Total Equipment Cost $	Total Cover Placement Cost $	Growth Media Volume cy	Growth Media Placement Fleet	Growth Media Fleet Productivity LCY/hr	Number of Trucks/ Scrapers	Total Fleet Hours	Total Labor Cost $	Total Equipment Cost $	Total Growth Media Cost $
1	**Engineered Fill (Closure Stormwater Diversion Channel)**						$0	$0	$0	0					$0	$0	$0
2	**Engineered Fill (UDCP Raise Passive Closure)**						$0	$0	$0	0					$0	$0	$0
3	**Engineered Fill (TSF Raise Passive Closure)**						$0	$0	$0	0					$0	$0	$0
4	**Engineered Fill (Access Road Raise Passive Closure)**						$0	$0	$0	0					$0	$0	$0
5	**Low Permeability Soil Layer (Closure Stormwater Diversion**						$0	$0	$0	0					$0	$0	$0
6	**Low Permeability Soil Layer (West Spillway- Active)**						$0	$0	$0	0					$0	$0	$0
7	**Low Permeability Soil Layer (West Spillway- Passive)**						$0	$0	$0	0					$0	$0	$0
							$0	**$0**	**$0**						**$0**	**$0**	**$0**

Generic Material Hauling - Scarifying/Revegetation Costs

	Description (required)	Total Surface Area acres	Ripping/ Scarifying Fleet	Scarifying/ Ripping Hours hrs	Scarifying/ Ripping Labor Cost $	Scarifying/ Ripping Equipment Cost $	Total Scarifying/ Ripping Cost $	Revegetation Labor Cost $	Revegetation Equipment Cost $	Revgetation Material Cost $	Total Revegetation Cost $
1	**Engineered Fill (Closure Stormwater Diversion Channel)**	0.10	D9R		$0	$0	$0	$0	$0	$0	$0
2	**Engineered Fill (UDCP Raise Passive Closure)**	0.10	D9R		$0	$0	$0	$0	$0	$0	$0
3	**Engineered Fill (TSF Raise Passive Closure)**	0.10	D9R		$0	$0	$0	$0	$0	$0	$0
4	**Engineered Fill (Access Road Raise Passive Closure)**	0.10	D9R		$0	$0	$0	$0	$0	$0	$0
5	**Low Permeability Soil Layer (Closure Stormwater Diversion**	0.10	D9R		$0	$0	$0	$0	$0	$0	$0
6	**Low Permeability Soil Layer (West Spillway- Active)**	0.10	D9R		$0	$0	$0	$0	$0	$0	$0
7	**Low Permeability Soil Layer (West Spillway- Passive)**	0.10	D9R		$0	$0	$0	$0	$0	$0	$0
		0.70			**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**

Closure Cost Estimate
Foundations & Buildings

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety Cost Basis: Southern Nevada

Buildings & Foundation Demolition Cost Summary	Labor	Equipment	Materials	Totals
Building Demolition Cost	$0	$0	N/A	$0
Wall Demolition Cost	$0	$0	N/A	$0
Slab Demolition	$0	$0	N/A	$0
Subtotal Demolition	**$0**	**$0**	**$0**	**$0**
Cover Placement Cost	$0	$0	N/A	$0
Growth Media Placement Cost	$0	$0	N/A	$0
Ripping/Scarifying Cost	$0	$0	N/A	$0
Subtotal Earthworks	**$0**	**$0**	**$0**	**$0**
Revegetation Cost	$0	$0	$0	$0
TOTALS	**$0**	**$0**	**$0**	**$0**

Buildings & Foundation - User Input

You must fill in ALL green cells and relevant blue cells in this section for each building or facility

Facility Description			Physical - MANDATORY									Foundation Cover (1)			Growth Media (1) (entire footprint)		
Description (required)	ID Code	Type	Length ft	Width ft	Eve Height ft	Slab Thickness in	Foundation Wall Thickness in	Foundation Wall Height ft	Average Flat Area Long Dimension (ripping distance) ft	Building Area Footprint (including surrounding facilities) acres		Foundation Cover Thickness in	Distance from Foundation Cover Borrow Area ft	Slope from Facility to Borrow Area % grade	Growth Media Thickness in	Distance from Growth Media Stockpile ft	Slope from Facility to Stockpile % grade

Notes:
1. Foundation cover only calculated to cover slab. Growth media estimated over entire footprint area
2. If Slope from facility to borrow source is >20, downhill travel time may be underestimated due to limitation of uphill travel time curves and downhill speed tables from CAT Handbook (see Productivty Sheet)

Buildings & Foundation - User Input (cont.)

You must fill in ALL green cells and relevant blue cells in this section for each building or facility

	Construction Materials		Slab Demolition		Foundation Cover			Growth Media			Revegetation				
Description (required)	Building Type (select)	Foundation Wall Type (select)	Slab Demo Method (select)	Slab Breaking Equipment Fleet (select)	Cover Material Type (select)	Cover Placement Equipment Fleet (select)	Maximum Fleet Size (user override)	Growth Media Material Type (select)	Growth Media Placement Equipment Fleet (select)	Maximum Fleet Size (user override)	Seed Mix (select)	Mulch (select)	Fertilizer (select)	Scarify/ Rip? (select)	Ripping Fleet (select)

Notes:
1. Material Types are used for density correction based on material densities in Caterpillar Performance Handbook material density table

Buildings & Foundation - Calculations

Building Volume Calculations

Using Means Heavy Construction Cost Data (2004) calculates cubic feet from building dimensions
Estimage slab thickness and wall thickness if not known
Assumes that all concrete slabs are reinforced
Productivity for crew from Means Heavy Construction Cost Data (2004) adjusted for supervision
(addressed in Misc. Costs) and Davis-Bacon Wage Rates
Demolition costs do not include hauling or disposing if debris - Use Waste Disposal module

Slab Demolition Calculations

Minimum 1 hr excavator time for slab demolition

Cover Volume Calculation

Foundation area x cover thickness
If "Bury in Place" is selected as slab demolition method, cover thickness is adjusted such that
total cover (cover + growth media) equals value entered in "Minimum thickness of cover over unbroken slab" cell above

Ripping/Scarifying Calculations

Flat area width = Final flat area ÷ Average long dimensions
Number of passes = Flat area width ÷ Grader width
Travel distance = Number of passes x Average long dimensions
Total hours = (Travel distance ÷ Grader productivity) + (Number of passes x Grader maneuver time)

Revegetation

Minimum 1 acre revegetation crew time per area

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Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety Cost Basis: Southern Nevada

Buildings & Foundation Demolition Cost Summary

	Labor	Equipment	Materials	Totals
Building Demolition Cost	$0	$0	N/A	$0
Wall Demolition Cost	$0	$0	N/A	$0
Slab Demolition	$0	$0	N/A	$0
Subtotal Demolition	**$0**	**$0**	**$0**	**$0**
Cover Placement Cost	$0	$0	N/A	$0
Growth Media Placement Cost	$0	$0	N/A	$0
Ripping/Scarifying Cost	$0	$0	N/A	$0
Subtotal Earthworks	**$0**	**$0**	**$0**	**$0**
Revegetation Cost	$0	$0	$0	$0
TOTALS	**$0**	**$0**	**$0**	**$0**

Building & Foundation Demolition Costs

Uses RS Means Heavy Construction Cost Data for building and wall demolition cost calculations. Uses CAT Handbook for slab breaking production.

								Building Demolition			Wall Demolition			Slab Demolition			Total Costs		
	Description (required)	Building Footprint (slab area) sqft	Building Volume cu ft	Wall Length ft	Wall Area sq ft	Slab Demolition Fleet	Slab Volume cy	Total Labor Cost $	Total Equipment Cost $	Total Building Demolition Cost $	Total Labor Cost $	Total Equipment Cost $	Total Wall Demolition Cost $	Total Labor Cost $	Total Equipment Cost $	Total Slab Breaking Cost $	Total Labor Cost $	Total Equipment Cost $	Total Demolition Costs $
								$0	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**

Building & Foundation - Foundation Cover and Growth Media Costs

		Foundation Cover								Growth Media								Total Cover & Growth Media Costs		
	Description (required)	Cover Volume cy	Cover Repacement Fleet	Fleet Productivity LCY/hr	Number of Trucks/ Scrapers	Total Fleet Hours	Total Labor Cost $	Total Equipment Cost $	Total Cover Cost $	Growth Media Volume cy	Growth Media Repacement Fleet	Fleet Productivity LCY/hr	Number of Trucks/ Scrapers	Total Fleet Hours	Total Labor Cost $	Total Equipment Cost $	Total Growth Media Cost $	Total Labor Cost $	Total Equipment Cost $	Total Costs $
							$0	**$0**	**$0**						**$0**	**$0**	**$0**	**$0**	**$0**	**$0**

Building & Foundation - Scarifying/Revegetation Costs

					Scarifying/Ripping			Revegetation				Total Scarify & Revegation Costs			
	Description (required)	Flat Area acres	Ripping/ Scarifying Fleet	Scarifying/ Ripping Hours hrs	Scarifying/ Ripping Labor Costs $	Scarifying/ Ripping Equipment Cost $	Total Scarifying/ Ripping Costs $	Revegetation Labor Cost $	Revegetation Equipment Cost $	Revgetation Material Cost $	Total Revegetation Cost $	Total Labor Cost $	Total Equipment Cost $	Total Material Cost $	Total Costs $
					$0	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**

Closure Cost Estimate
Other Demo & Equip Removal

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety Cost Basis: Southern Nevada

Other Demoltion and Equipment Removal - Cost Summary	Labor	Equipment	Materials	Totals
Other Demolition	$0	$0	$0	$0
Equipment Removal	$0	$0	$0	$0
TOTALS	**$0**	**$0**	**$0**	**$0**

Other Demolition

Facility Description									
	Description (required)	ID Code	Type	Quantity	Units	Labor Unit Cost $	Equipment Unit Cost $	Material Unit Cost $	Total Cost $
						$0	**$0**	**$0**	

Notes:

Equipment & Material Removal

Facility Description									
	Description (required)	ID Code	Type	Quantity	Units	Labor Unit Cost ($)	Equipment Unit Cost ($)	Material Unit Cost ($)	Total Cost ($)
						$0	**$0**	**$0**	

Notes:

Closure Cost Estimate
Sediment & Drainage Control

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety Cost Basis: Southern Nevada

Drainage Control - Cost Summary	Labor	Equipment	Materials	Totals
Diversion Ditch Construction	$1,424	$2,415	N/A	$3,839
Diversion Ditch Liner	$0	$0	$0	$0
Diversion Ditch Rip-Rap	$0	$0	$0	$0
Sed Pond Construct/Regrade	$0	$0	N/A	$0
Liner Installation	$0	$0	$0	$0
Sed Pond Cover	$0	$0	N/A	$0
Ripping/Scarifying Cost	$0	$0	N/A	$0
Subtotal Earthworks	**$1,424**	**$2,415**	**$0**	**$3,839**
Diversion Ditch Revegetation	$0	$0	$0	$0
Sediment Pond Revegetation	$0	$0	$0	$0
Subtotal Revegetation	**$0**	**$0**	**$0**	**$0**
TOTALS	**$1,424**	**$2,415**	**$0**	**$3,839**

Diversion Ditches - User Input

			Diversions Ditches							Revegetation			Liner and Rip-Rap Installation			
	Description (required)	ID Code	Diversion Length ft	Diversion Depth ft	Ditch Bottom Width ft	Ditch Sideslope Angle _H:1V	Excavate Volume (if calculated elsewhere) cy	Excavating Material Condition (select)	Excavating Equipment Fleet (select)	Seed Mix (select)	Mulch (select)	Fertilizer (select)	Liner Area S.Y.	Liner Type (select)	Rip-Rap Area S.Y.	Rip-Rap Type (select type)
1	**West Closure Spillway - Active Closure**		**100**	**5.0**	**15.0**	**2.5**	**2,200**	**1**	**Medium**	**None**	**None**	**None**	**0**		**0**	
2	**West Closure Spillway - Passive Closure**		**80**	**5.0**	**15.0**	**2.5**		**1**	**Medium**	**None**	**None**	**None**	**0**		**0**	
3	**East Closure Spillway - Passive Closure**		**1100**	**4.0**	**12.0**	**2.5**		**1**	**Medium**	**None**	**None**	**None**	**0**		**0**	

Notes:
1. The Closure Stormwater Diversion Channel (Spillway) excavated volume was calculated using AutoCAD Civil 3d as-built and design surfaces.
2. See the "Other User" tab for spillway riprap revetment cost (Riprap (D50=12in)).

Sediment/Evaporation Pond Construction/Removal - User Input

			Sediment Ponds								Growth Media		
	Description (required)	ID Code	Pond Width ft	Pond/Berm Length ft	Berm Height ft	Crest Width ft	Sideslope Angle _H:1V	Final Area (if calculated elsewhere) acres	Regrade Volume (if calculated elsewhere) cy	Cover Volume (if calculated elsewhere) cy	Growth Media Thickness in	Distance from Growth Media Stockpile ft	Slope from Pond to Borrow % grade

Notes:
1. All Physical parameters must be input even if manual overrides for volume or area are used.
2. If Slope from facility to borrow source is >20, downhill travel time may be underestimated due to limitation of uphill travel time curves and downhill speed tables from CAT Handbook (see Productivty Sheet)
3. Material Types are used for density correction based on material densities in Caterpillar Performance Handbook material density table

Sediment/Evaporation Pond Construction/Removal - User Input (cont.)

		Sediment Ponds				Growth Media			Revegetation			Ripping/Scarifying	
	Description (required)	Excavating Material Condition (select)	Material Type (select)	Excavating Equipment Fleet (select)	Liner Type (select)	Growth Media Material Type (select)	Growth Media Placement Equipment Fleet (select)	Maximum Fleet Size (user override)	Seed Mix (select)	Mulch (select)	Fertilizer (select)	Scarify/ Rip? (select)	Scarify/ Ripping Fleet (select)

Notes:
1. Material Types are used for density correction based on material densities in Caterpillar Performance Handbook material density table

Closure Cost Estimate
Sediment & Drainage Control

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety   Cost Basis: Southern Nevada

Drainage Control - Cost Summary	Labor	Equipment	Materials	Totals
Diversion Ditch Construction	$1,424	$2,415	N/A	$3,839
Diversion Ditch Liner	$0	$0	$0	$0
Diversion Ditch Rip-Rap	$0	$0	$0	$0
Sed Pond Construct/Regrade	$0	$0	N/A	$0
Liner Installation	$0	$0	$0	$0
Sed Pond Cover	$0	$0	N/A	$0
Ripping/Scarifying Cost	$0	$0	N/A	$0
Subtotal Earthworks	**$1,424**	**$2,415**	**$0**	**$3,839**
Diversion Ditch Revegetation	$0	$0	$0	$0
Sediment Pond Revegetation	$0	$0	$0	$0
Subtotal Revegetation	**$0**	**$0**	**$0**	**$0**
TOTALS	**$1,424**	**$2,415**	**$0**	**$3,839**

Drainage Control - Calculations

Diversion Ditch Volume Calculation

$$\text{Cross Sectional Area} = \frac{(a+b)}{2} \times d$$

Ditch Volume = Ditch Length x Cross Sectional Area

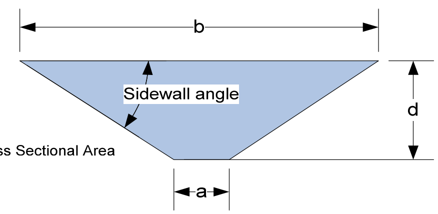
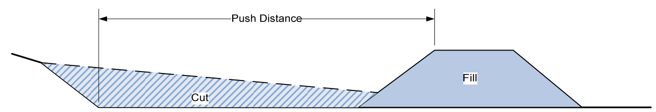


Figure 1 - Ditch Volume Calculation

1) Assume 20% swell for excavations
2) Assumes heavy duty trenching bucket is used

Sediment/Evaporation Pond Construction Calculation



Cut = Fill
Push distance = pond width up to 2/3 max push distance (400 ft)

Figure 2 - Sediment Ponds

1) Assume balanced cut-to-fill for berm construction
2) Include cost for liner, if required.
3) Include line items for removal, if necessary.
4) Assume 20% swell for excavations
5) Minimum 1 hr ripping/scarifying per area
6) Minimum 1 acre revegetation crew time per area

Diversion Ditches - Excavation Costs

	Description (required)	Diversion Ditch Volume LCY	Diversion Ditch Equipment	Corrected Excavator Productivity LCY/hr	Total Hours	Diversion Ditch Labor Cost $	Diversion Ditch Equipment Cost $	Total Diversion Ditch Cost $	Liner Installation: Total Labor Cost $	Liner Installation: Total Equipment Cost $	Liner Installation: Total Material Cost $	Liner Installation: Total Liner Cost $	Rip-Rap Installation: Labor Cost $	Rip-Rap Installation: Equipment Cost $	Rip-Rap Installation: Material Cost $	Rip-Rap Installation: Total Cost $
1	**West Closure Spillway - Active Closure**	2,640	345B	480	5	$475	$805	$1,280	$0	$0	$0	$0	$0	$0	$0	$0
2	**West Closure Spillway - Passive Closure**	489	345B	480	1	$95	$161	$256	$0	$0	$0	$0	$0	$0	$0	$0
3	**East Closure Spillway - Passive Closure**	4,302	345B	480	9	$854	$1,449	$2,303	$0	$0	$0	$0	$0	$0	$0	$0
		7,431			15	**$1,424**	**$2,415**	**$3,839**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**

Notes: LCM assumes 20% swell from ditch volume

Closure Cost Estimate
Sediment & Drainage Control

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety Cost Basis: Southern Nevada

Drainage Control - Cost Summary

	Labor	Equipment	Materials	Totals
Diversion Ditch Construction	$1,424	$2,415	N/A	$3,839
Diversion Ditch Liner	$0	$0	$0	$0
Diversion Ditch Rip-Rap	$0	$0	$0	$0
Sed Pond Construct/Regrade	$0	$0	N/A	$0
Liner Installation	$0	$0	$0	$0
Sed Pond Cover	$0	$0	N/A	$0
Ripping/Scarifying Cost	$0	$0	N/A	$0
Subtotal Earthworks	**$1,424**	**$2,415**	**$0**	**$3,839**
Diversion Ditch Revegetation	$0	$0	$0	$0
Sediment Pond Revegetation	$0	$0	$0	$0
Subtotal Revegetation	**$0**	**$0**	**$0**	**$0**
TOTALS	**$1,424**	**$2,415**	**$0**	**$3,839**

Diversion Ditches - Revegetation Costs

	Description (required)	Surface Area acres	Revegetation Labor Cost $	Revegetation Equipment Cost $	Revgetation Material Cost $	Total Revegetation Cost $
1	**West Closure Spillway - Active Closure**	0.10	$0	$0	$0	$0
2	**West Closure Spillway - Passive Closure**	0.10	$0	$0	$0	$0
3	**East Closure Spillway - Passive Closure**	0.80	$0	$0	$0	$0
		1.00	**$0**	**$0**	**$0**	**$0**

Sediment/Evaporation Ponds - Construction/Regrading Costs

Productivity = Dozer Productivity x Grade Correction x Density Correction x Operator (0.75) x Material x Visibility x Job Efficiency (0.83)

	Description (required)	Regrading Volume cy	Sed/Evap Pond Equipment	Dozing Distance (see above) ft	Uncorrected Dozer Productivity LCY/hr	Grade Correction	Density Correction	Excavating Material	Corrected Productivity LCY/hr	Total Dozer Hours hr	Earthwork: Total Labor Cost $	Earthwork: Total Equipment Cost $	Earthwork: Total Constr/ Regrading Cost $	Liner: Total Labor Cost $	Liner: Total Equipment Cost $	Liner: Total Material Cost $	Liner: Total Liner Cost $
											$0	$0	$0	$0	$0	$0	$0

Sediment/Evaporation Ponds - Growth Media Costs

	Description (required)	Growth Media: Growth Media Volume cy	Growth Media Fleet	Fleet Productivity LCY/hr	Number of Trucks/ Scrapers	Total Fleet Hours	Total Labor Cost $	Total Equipment Cost $	Total Cover Placement Cost $
							$0	$0	$0

Sediment/Evaporation Ponds - Revegetation Costs

	Description (required)	Surface Area acres	Long Ripping Distance ft	Ripping/ Scarifying Fleet	Scarifying/ Ripping Hours hrs	Scarifying/ Ripping Labor Costs $	Scarifying/ Ripping Equipment Cost $	Total Scarifying/ Ripping Costs $	Revegetation Labor Cost $	Revegetation Equipment Cost $	Revgetation Material Cost $	Total Revegetation Cost $
					0	$0	$0	$0	$0	$0	$0	$0

Closure Cost Estimate
Process Ponds

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety   Cost Basis: Southern Nevada

Process Ponds - Cost Summary

	Labor	Equipment	Materials	Totals
Backfilling Costs	$0	$0	N/A	$0
Growth Media Placement Costs	$0	$0	N/A	$0
Liner Cutting & Folding Costs	$0	$0	N/A	$0
Subtotal Earthworks	**$0**	**$0**	**$0**	**$0**
Revegetation Costs	$0	$0	$0	$0
TOTALS	**$0**	**$0**	**$0**	**$0**

Process Ponds - User Input   **You must fill in ALL green cells and relevant blue cells in this section for each pond**

	Facility Description		Pond Dimensions (1)					Backfill - (If trucks are used) (1)				Growth Media		
	Description (required)	**ID Code**	**Pond Length** ft	**Pond Width** ft	**Pond Depth** ft	**Pond Sideslope Angle** _H:1V	**Disturbed Area (if calculated elsewhere)** acres	**Percent Backfill** (100% if blank)	**Distance from Backfill Borrow** ft	**Slope from Facility to Borrow Area** % grade	**Pond Volume (if calculated elsewhere)** cy	**Growth Media Thickness** in	**Distance from Growth Media Stockpile** ft	**Slope from Facility to Stockpile** % grade
1	**Underdrain Collection Pond**		**352**	**229**	**50.5**	**2.0**	**1.86**				**0**	**0**		

Notes:
1. All Physical parameters must be input even if manual overrides for volume or area are used.
2. If Slope from facility to borrow source is >20, downhill travel time may be underestimated due to limitation of uphill travel time curves and downhill speed tables from CAT Handbook (see Productivty Sheet)
3. The Underdrain Collection Pond will be converted to a passive treatment system. See "User 11" for details.

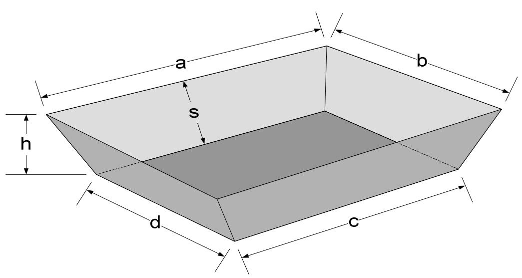
Process Ponds - User Input (cont.)

		Liner	Backfill			Growth Media			Revegetation		
	Description (required)	**Crew Cut & Fold Time** (2) hrs	**Backfill Material Type** (select)	**Backfill Equipment Fleet** (select)	**Maximum Fleet Size** (user override)	**Growth Media Material Type** (select)	**Growth Media Placement Equipment Fleet** (select)	**Maximum Fleet Size** (user override)	**Seed Mix** (select)	**Mulch** (select)	**Fertilizer** (select)
1	**Underdrain Collection Pond**	**0.0**	**Clay - Dry**	**Med Truck**		**Topsoil**	**Med Truck**		**None**	**None**	**None**

Notes:
1. Material Types are used for density correction based on material densities in Caterpillar Performance Handbook material density table
(2) Pond liner removal crew (2Clab + excavator) = 2 General Laborers + 325C Excavator

Process Ponds - Calculations

Pond Volume Calculation



Area and Volume of the Frustrum of a Pyramid

$$\text{Surface Area} = ab + cd + (a+b+c+d) \times \frac{s}{2}$$

$$\text{Volume} = \frac{h\,(ab + cd + \sqrt{abcd}\,)}{3}$$

Revegetation Calculations

Minimum 1 acre revegetation crew time per area

Closure Cost Estimate
Process Ponds

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety Cost Basis: Southern Nevada

Process Ponds - Cost Summary

	Labor	Equipment	Materials	Totals
Backfilling Costs	$0	$0	N/A	$0
Growth Media Placement Costs	$0	$0	N/A	$0
Liner Cutting & Folding Costs	$0	$0	N/A	$0
Subtotal Earthworks	**$0**	**$0**	**$0**	**$0**
Revegetation Costs	$0	$0	$0	$0
TOTALS	**$0**	**$0**	**$0**	**$0**

Process Ponds - Liner Cutting and Folding

	Description (required)	Crew Hours hrs	Total Labor Cost $	Total Equipment Cost $	Total Liner Removal Cost $
1	**Underdrain Collection Pond**	0	$0	$0	$0
			$0	**$0**	**$0**

Process Ponds - Backfill and Growth Media Costs

		Pond Backfill								Growth Media							
	Description (required)	Backfill Volume cy	Backfill Fleet	Fleet Productivity LCY/hr	Number of Trucks/ Scrapers	Total Fleet Hours hrs	Total Labor Cost $	Total Equipment Cost $	Total Backfill Cost $	Growth Media Volume cy	Growth Media Fleet	Fleet Productivity LCY/hr	Number of Trucks/ Scrapers	Total Fleet Hours	Total Labor Cost $	Total Equipment Cost $	Total Growth Media Cost $
1	**Underdrain Collection Pond**	0					$0	$0	$0						$0	$0	$0
							$0	**$0**	**$0**						**$0**	**$0**	**$0**

Process Ponds - Revegetation Costs

	Description (required)	Surface Area acres	Revegetation Labor Cost $	Revegetation Equipment Cost $	Revgetation Material Cost $	Total Revegetation Cost $
1	**Underdrain Collection Pond**	1.90	$0	$0	$0	$0
		1.90	**$0**	**$0**	**$0**	**$0**

Closure Cost Estimate
Landfills

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety Cost Basis: Southern Nevada

Landfills - Cost Summary

	Labor	Equipment	Materials	Totals
Grading Costs	$0	$0	N/A	$0
Cover Placement Cost	$0	$0	N/A	$0
Topsoil Placement Cost	$0	$0	N/A	$0
Ripping/Scarifying Cost	$0	$0	N/A	$0
Subtotal Earthworks	**$0**	**$0**	**$0**	**$0**
Revegetation Cost	$0	$0	$0	$0
TOTALS	**$0**	**$0**	**$0**	**$0**

Landfills - User Input

You must fill in ALL green cells and relevant blue cells in this section for each landfill

Facility Description			Physical (1)			Cover			Growth Media		
	Description (required)	ID Code	Final Landfill Footprint acres	Average Long Dimension (ripping distance) ft	Regrade Volume (calculated elsewhere) cy	Cover Thickness in	Distance from Cover Borrow ft	Slope from Landfill to Cover Borrow % grade	Growth Media Thickness in	Distance from Growth Media Stockpile ft	Slope from Landfill to Stockpile % grade

Notes:
1. All Physical parameters must be input even if manual overrides for volume or area are used.
2. If Slope from facility to borrow source is >20, downhill travel time may be underestimated due to limitation of uphill travel time curves and downhill speed tables from CAT Handbook (see Productivty Sheet)

Landfills - User Input (cont.)

You must fill in ALL green cells and relevant blue cells in this section for each landfill

		Grading				Cover			Growth Media			Revegetation				
	Description (required)	Regrading Material Condition (select)	Regrading Material Type (select)	Regrading Equipment Fleet (select)	Slot/ Side-by-Side (select)	Cover Material Type (select)	Cover Placement Equipment Fleet (select)	Maximum Fleet Size (user override)	Growth Media Material Type (select)	Growth Media Equipment Fleet (select)	Maximum Fleet Size (user override)	Seed Mix (select)	Mulch Type (select)	Fertilizer (select)	Scarify/ Rip? (select)	Scarifying/ Ripping Fleet (select)

Notes:
1. Material Types are used for density correction based on material densities in Caterpillar Performance Handbook material density table

Landfills - Calculations

Dozing, Ripping/Scarifying & Revegetation Calculations

Dozing: Dozing distance = 2/3 of the 600 feet maximum from Catepillar Handbook or 400 feet
Assumes flat push (grade correction factor = 1)
Minimum 1 hr per area

Ripping: Flat area width = Final flat area ÷ Average long dimensions
Number of passes = Flat area width ÷ Grader width
Travel distance = Number of passes x Average long dimensions
Total hours = (Travel distance ÷ Grader productivity) + (Number of passes x Grader maneuver time)
Minimum 1 hr per area

Revegetation: Minimum 1 acre revegetation crew time per area

Landfills - Regrading Costs

Productivity = Dozer Productivity x Density Correction x Operator (0.75) x Material x Visibility x Job Efficiency (0.83) x (Slot/Side-by-Side)

	Description (required)	Regrading Volume cy	Dozing Distance (see above) ft	Regrading Fleet	Uncorrected Dozer Productivity cy/hr	Dozing Material	Density Correction	Side-by-Side or Slot Dozing	Total Hourly Productivity LCY/hr	Total Dozer Hours hr	Total Labor Cost $	Total Equipment Cost $	Total Regrading Cost $
											$0	$0	$0

Landfills - Cover and Growth Media Costs

		Cover Placement								Growth Media Placement							
	Description (required)	Cover Volume ft	Cover Replacement Fleet	Fleet Productivity LCY/hr	Number of Trucks/ Scrapers	Total Fleet Hours	Cover Labor Cost $	Cover Equipment Cost $	Total Cover Cost $	Growth Media Volume ft	Growth Media Replacement Fleet	Fleet Productivity LCY/hr	Number of Trucks/ Scrapers	Total Fleet Hours	Total Labor Cost $	Total Equipment Cost $	Total Growth Media Cost $
							$0	$0	$0						$0	$0	$0

Landfills - Scarifying/Revegetation Costs

	Description (required)	Surface Area acres	Long Dimension ft	Ripping/ Scarifying Fleet	Scarifying/ Ripping Hours hrs	Scarifying/ Ripping Labor Costs $	Scarifying/ Ripping Equipment Cost $	Total Scarifying/ Ripping Costs $	Revegetation Labor Cost $	Revegetation Equipment Cost $	Revgetation Material Cost $	Total Revegetation Cost $
						$0	$0	$0	$0	$0	$0	$0

Closure Cost Estimate
Yards, Etc.

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety **Cost Basis: Southern Nevada**

Yards, Etc. - Cost Summary				
	Labor	Equipment	Materials	Totals
Regrading Cost	$0	$0	N/A	$0
Cover Placement Cost	$0	$0	N/A	$0
Growth Media Placement Cost	$0	$0	N/A	$0
Ripping/Scarifying Cost	$0	$0	N/A	$0
Subtotal Earthworks	**$0**	**$0**		**$0**
Revegetation Cost	$0	$0	$0	$0
TOTALS	**$0**	**$0**	**$0**	**$0**

Yards, Etc. - User Input

You must fill in ALL green cells and relevant blue cells in this section for each building or facility

Facility Description				Physical			Cover			Growth Media		
	Description (required)	ID Code	Type	Area acres	Average Flat Area Long Dimension (ripping distance) ft	Regrade Volume (calculated elsewhere) cy	Cover Thickness in	Distance from Cover Borrow Area ft	Slope from Facility to Borrow Area % grade	Growth Media Thickness in	Distance from Growth Media Stockpile ft	Slope from Facility to Stockpile % grade

Notes:
1. All Physical parameters must be input even if manual overrides for volume or area are used.
2. If Slope from facility to borrow source is >20, downhill travel time may be underestimated due to limitation of uphill travel time curves and downhill speed tables from CAT Handbook (see Productivty Sheet)

Yards, Etc. - User Input (cont.)

You must fill in ALL green cells and relevant blue cells in this section for each building or facility

		Grading			Cover			Growth Media			Revegetation				
	Description (required)	Regrading Material Condition (select)	Regrading Material Type (select)	Regrading Equipment Fleet (select)	Cover Material Type (select)	Cover Placement Equipment Fleet (select)	Maximum Fleet Size (user override)	Growth Media Material Type (select)	Growth Media Equipment Fleet (select)	Maximum Fleet Size (user override)	Seed Mix (select)	Mulch (select)	Fertilizer (select)	Scarify/ Rip? (select)	Ripping Fleet (select)

Notes:
1. Material Types are used for density correction based on material densities in Caterpillar Performance Handbook material density table

Yards, Etc. - Calculations

Grading Calculations

Average push distance assumed to be 2/3 of the 600 feet maximum from Catepillar Handbook or 400 feet
Material assumed to be loose stockile (1.2 productivity factor)
Slope assumed to be 0 to 5% (1.0 productivity factor)

Cover Volume Calculation

Yard area x cover thickness

Ripping/Scarifying Calculations

Flat area width = Final flat area ÷ Average long dimensions
Number of passes = Flat area width ÷ Grader width
Travel distance = Number of passes x Average long dimensions
Total hours = (Travel distance ÷ Grader productivity) + (Number of passes x Grader maneuver time)
Minimum 1 hr ripping/scarifying per area

Revegetation

Minimum 1 acre revegetation crew time per area

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety Cost Basis: Southern Nevada

Yards, Etc. - Cost Summary

	Labor	Equipment	Materials	Totals
Regrading Cost	$0	$0	N/A	$0
Cover Placement Cost	$0	$0	N/A	$0
Growth Media Placement Cost	$0	$0	N/A	$0
Ripping/Scarifying Cost	$0	$0	N/A	$0
Subtotal Earthworks	**$0**	**$0**		**$0**
Revegetation Cost	$0	$0	$0	$0
TOTALS	**$0**	**$0**	**$0**	**$0**

Yards, Etc. - Regrading Costs

Productivity = Dozer Productivity x Grade Correction x Density Correction x Operator (0.75) x Material x Visibility x Job Efficiency (0.83) x (Slot/Side-by-Side)

	Description (required)	Regrading Volume cy	Dozing Distance (see above) ft	Regrading Fleet	Uncorrected Dozer Productivity cy/hr	Grade Correction	Dozing Material	Density Correction	Total Hourly Productivity cy/hr	Total Dozer Hours hr	Total Labor Cost $	Total Equipment Cost $	Total Regrading Cost $
											$0	$0	$0

Yards, Etc. - Cover and Growth Media Costs

		Cover								Growth Media							
	Description (required)	Cover Volume cy	Topsoil Repacement Fleet	Fleet Productivity LCY/hr	Number of Trucks/ Scrapers	Total Fleet Hours	Total Labor Cost $	Total Equipment Cost $	Total Cover Cost $	Growth Media Volume cy	Growth Media Fleet	Fleet Productivity LCY/hr	Number of Trucks/ Scrapers	Total Fleet Hours	Total Labor Cost $	Total Equipment Cost $	Total Growth Media Cost $
							$0	$0	$0						$0	$0	$0

Yards, Etc. - Scarifying/Revegetation Costs

	Description (required)	Surface Area acres	Area Long Dimension ft	Ripping/ Scarifying Fleet	Scarifying/ Ripping Hours hrs	Scarifying/ Ripping Labor Costs $	Scarifying/ Ripping Equipment Cost $	Total Scarifying/ Ripping Costs $	Revegetation Labor Cost $	Revegetation Equipment Cost $	Revgetation Material Cost $	Total Revegetation Cost $
						$0	$0	$0	$0	$0	$0	$0

Closure Cost Estimate
Waste Disposal

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety   Cost Basis: Southern Nevada

Waste Disposal - Cost Summary	Labor	Equipment	Fees	Totals
Solid Waste - On Site	$0	$0	N/A	$0
Solid Waste - Off Site				$7,308
Hazardous Materials				$0
Hydrocarbon Contaminated Soils	$0	$0	$0	$0
TOTALS	**$0**	**$0**	**$0**	**$7,308**

Waste Disposal - User Input - Solid Waste

						Landfill (Bulk) Disposal			Dumpster
	Description (required)	ID Code	Waste Type (select)	Disposal Method (select)	Quantity cy	Distance to Landfill ft	Slope to Landfill % grade	Number of Trucks (user override)	Months Dumpster Rental months
1	Dumpster for Waste during Reclamation		Waste Mgmt & Disposal	Dumpster	180				6

Notes:
1. All Physical parameters must be input even if manual overrides for volume or area are used.
2. If Slope from facility to borrow source is >20, downhill travel time may be underestimated due to limitation of uphill travel time curves and downhill speed tables from CAT Handbook (see Productivty Sheet)

3. A 30 cubic yard dumpster was assumed to be utilized for the duration of active reclamation construction.

Waste Disposal - User Input - Hazardous Materials

	Description (required)	ID Code	Waste Type (select)	Container Type (select)	Vacuum Truck Size (select)	Liquid Quantity gallons	Soild Quantity cy	One Way Travel Distance to Disposal Site mi	One Way Travel Time to Disposal Site hr

Notes:
1. Use Other Demo & Equip Removal Sheet for tank removal

Waste Disposal - User Input - Hydrocarbon Contaminated Soils

	Description (required)	ID Code	Waste Type (select)	Disposal Method (select)	Quantity cy	Travel Distance to Offsite Disposal mi

Notes:
1. Use Yards or Landfills Sheets for bioremediation facility reclamation

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
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Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety **Cost Basis: Southern Nevada**

Waste Disposal - Cost Summary

	Labor	Equipment	Fees	Totals
Solid Waste - On Site	$0	$0	N/A	$0
Solid Waste - Off Site				$7,308
Hazardous Materials				$0
Hydrocarbon Contaminated Soils	$0	$0	$0	$0
TOTALS	**$0**	**$0**	**$0**	**$7,308**

Waste Disposal - Assumptions & Calculations

Solid Waste Disposal

Off site disposal assumes use of average rolloff dumpster [30 cy (m3), 10 ton (tonne)]
On site disposal assumes use of small loader/truck fleet for haulage
Average density for on site disposal = 2,600 lb/cy (1,540 kg/m3)
For on site disposal only 1 truck is required unless total truck hours > 8, only 2 trucks unless total truck hours are > 16

Hazardous Materials Disposal

Assumes all hazardous materials are known
Enter EITHER solid or liquid quantity each line.
If container type = 55 gallon (200 liter) drum then solid waste hauling costs apply
Average density for solids assumed to be 2,600 lb/cy (1,540 kg/m3)
Vacuum truck sizes: small = 2,200 gal (~8,300 litres), large = 5,000 gal (~19,000 litres)
Vacuum truck on site for 4 hours for each load

Hydrocarbon Contaminated Soils Disposal

Assumes all hazardous materials are known
On site disposal assumes biopad treatment
Exavation productivity =45 cy./hr (35 m3/hr) (Means Heavy Construction, 2006: 02315-424-0360)

Waste Disposal - Solid Waste Disposal

	Description (required)	Waste Volume cy	Number of Off Site Dumpster Loads	Landfill Fleet Equipment	Landfill Fleet Productivity LCY/hr	Number of Trucks	Total Fleet Hours	Total Dumpster Cost $	Total Labor Cost $	Total Equipment Cost $	Total Waste Disposal Cost $
1	**Dumpster for Waste during Reclamation**	180	6					$7,308	$0	$0	$0
		180						**$7,308**	**$0**	**$0**	**$0**

Waste Disposal - Hazardous Materials Disposal

	Description (required)	Liquid Waste Volume gallons	Solid Waste Volume cy	Number of Truck Loads	Tons of Waste Tons	Pick-up Fees $	Transport Fees $	Disposal Fees $	Total Hazardous Material Cost $
						$0	**$0**	**$0**	**$0**

Waste Disposal - Hydrocarbon Contaminated Soils

	Description (required)	Quantity cy	Disposal Equipment Fleet	Total Fleet Hours	Treatment Cost $	Transport Fees $	Disposal Fees $	Total Labor Cost $	Total Equipment Cost $	Total Waste Disposal Cost $
					$0	**$0**	**$0**	**$0**	**$0**	**$0**

Closure Cost Estimate
Well Abandonment

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety Cost Basis: Southern Nevada

Well Abandonment

	Labor	Equipment	Materials	Totals
Production, Dewatering, Infiltration Wells	$0	$0	$0	$0
Monitoring Wells	$744	$641	$4	$1,389
TOTALS	**$744**	**$641**	**$4**	**$1,389**

Production, Dewatering and Infiltration Well Closure

	Description (required)	ID Code	Number of Holes	Casing Diam in	Average Depth(1) ft bgs	Depth to First Water ft bgs	Original Static Water Level ft bgs	Top of Slotted Casing(2) ft bgs	Blank Casing Below Top of Screen(2) ft	Type of Pump (if any) (select)	Depth to Pump ft bgs	Hole Plug Method (select)	Casing Volume per ft cf	Perforation Length(3,4) ft	Grout Volume per Hole(4,5) cy	Cement Volume per Hole(6) cy	Inert Media Volume per Hole(7) cy	Pump Removal Labor Cost $	Pump Removal Equip Cost $	Perf Labor Cost $	Perf Equip Cost(8) $	Grout + Cement Labor Cost(9) $	Grout + Cement Equip Cost(9) $	Grout + Cement Material Cost $	Inert Media Labor Cost(10) $	Inert Media Equip Cost(9) $	Total Cost $
																		$0	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**

(1) For previously abandoned holes enter "0" for depth
(2) Wells abandoned per Nevada Administrative Code (NAC 534.420). Hole grouted and perforated from bottom to 50 feet (15.24m) above the top of the screen, or first water encountered or original static water level, depending on vertical hydraulic gradient and well construction parameters. Inert media (cuttings or alluvium) used from top of grout to top seal.
(3) Perforation length = amount of blank casing below first water (for confined aquifers) or predicted recovered water table (unconfined aquifers) + 50 feet (15.24m) of blank casing above water table
(4) Assumes 50' (15.24m) sanitary seal at top of hole. Therefore, perforation and grouting only required to bottom of sanitary seal.
(5) Assumes 100% loss to formation for grout (abandonite) for screened and perforated sections.
(6) Assumes 20' (6m) top seal of cement in casing only. See note 4.
(7) Inert material is cuttings or alluvium sourced locally.
(8) Includes perforation tool wear cost/ft of perforation (see Productivty Sheet).
(9) See Productivity Sheet for hourly production. Minimum 1 hr per hole + fixed hours per hole for move and setup. If no perforation required, use standard drill rig.
(10) See Productivity Sheet for hourly production. Minimum 1 hr per hole.

Notes:

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety   Cost Basis: Southern Nevada

Well Abandonment

	Labor	Equipment	Materials	Totals
Production, Dewatering, Infiltration Wells	$0	$0	$0	$0
Monitoring Wells	$744	$641	$4	$1,389
TOTALS	**$744**	**$641**	**$4**	**$1,389**

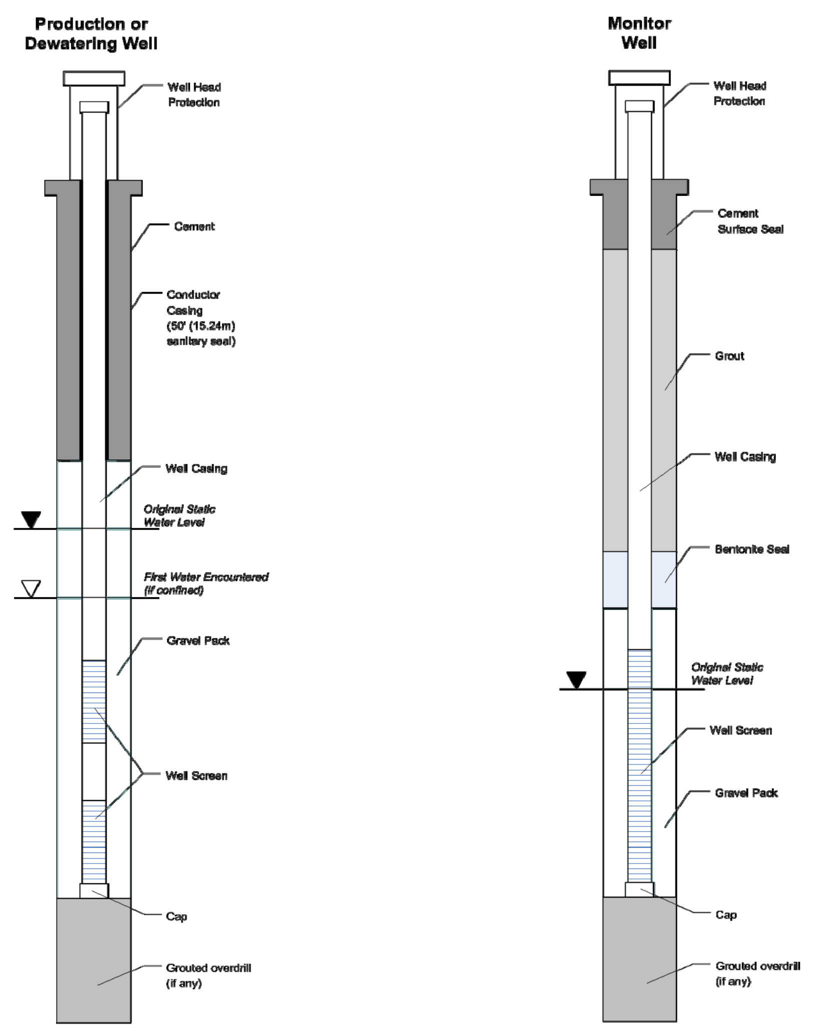
Monitoring Well Closure

	Description (required)	ID Code	Number of Holes	Casing Diam in	Average Depth ft bgs	Top of Screen(1) ft bgs	Hole Plug Method (select)	Casing Volume per ft ft3	Grout Volume/ Well(2,3) cy	Cement Volume per Hole(4) cy	Inert Backfill Volume per Hole(5) cy	Total Grouting Hours/ Hole hr	Total Inert Media Hours/ Hole hr	Grout + Cement Labor Cost(6) $	Grout + Cement Equip Cost(6) $	Grout + Cement Material Cost $	Inert Material Labor Cost(7) $	Inert Material Equip Cost(7) $	Total Cost $
1	POC Well		1	2.0	86	18	Grout Only	0.020	0.06	0.02		3.2		$744	$641	$4	$0	$0	$1,389
														$744	**$641**	**$4**	**$0**	**$0**	**$1,389**

Wells abandoned per NAC 534.420 with bentonite grout placed to 50 feet above the top of the screen (see note 1).
(1) Assumes top of screen is at or above the static water level (in unconfined aquifers) or the depth of first water encountered (in confined aquifers).
(2) Assumes 25% loss to formation for grouting
(3) Grouting only required to 50' (15.24m) above the top of screen because monitor wells are constructed with a seal in the annular space.
(4) Assumes top 20' (6m) plugged with cement.
(5) Assumes hole plugged with inert material (cuttings or alluvium) above grout up to cement surface plug.
(6) See Productivity Sheet for hourly production. Minimum 1 hr per hole + fixed hours per hole for move and setup (see Productivty Sheet).
(7) See Productivity Sheet for hourly production. Minimum 1 hr per hole.

Notes:

Well Construction



Closure Cost Estimate
Misc. Costs

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety **Cost Basis: Southern Nevada**

Miscellaneous Cost Summary

	Labor	Equipment	Materials	Totals
Fence Removal	$0	$0	N/A	$0
Fence Installation	$0	$0	$0	$0
Culvert & Buried Pipe Removal	$51,139	$15,618	N/A	$66,757
Surface Pipe Removal	$0	$0	N/A	$0
Power Lines	$0	N/A	N/A	$0
Substations/Transformers	$0	N/A	N/A	$0
Rip-rap, rock lining, gabions	$0	$0	$0	$0
Other Costs	$0	$0	$0	$0
TOTALS	**$51,139**	**$15,618**	**$0**	**$66,757**

Fence Removal

You must fill in ALL green and blue cells

	Description (required)	ID Code	Length ft	Type (select type)	Costs: Labor Cost $	Equipment Cost $	Total Cost $
					$0	**$0**	**$0**

Notes:

Fence Installation

You must fill in ALL green and blue cells

	Description (required)	ID Code	Input: Length ft	Type (select type)	Costs: Labor Cost $	Equipment Cost $	Material Cost ($)	Total Cost $
					$0	**$0**	**$0**	**$0**

Notes:

Culvert & Buried Pipe Removal

You must fill in ALL green and blue cells

	Description (required)	ID Code	Input: Length ft	Type (select type)	Location (select)	Costs: Labor Cost $	Equipment Cost $	Total Cost $
1	**Remove 36" Diameter Culvert - Passive Treatment**	**36**	**2202**	**36 in (1m) Diameter**		$46,000	$14,049	$60,049
2	**Remove 42" Diameter Culvert - Passive Treatment**	**42**	**246**	**36 in (1m) Diameter**		$5,139	$1,569	$6,708
						$51,139	**$15,618**	**$66,757**

Notes:

Closure Cost Estimate
Misc. Costs

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety Cost Basis: Southern Nevada

Miscellaneous Cost Summary

	Labor	Equipment	Materials	Totals
Fence Removal	$0	$0	N/A	$0
Fence Installation	$0	$0	$0	$0
Culvert & Buried Pipe Removal	$51,139	$15,618	N/A	$66,757
Surface Pipe Removal	$0	$0	N/A	$0
Power Lines	$0	N/A	N/A	$0
Substations/Transformers	$0	N/A	N/A	$0
Rip-rap, rock lining, gabions	$0	$0	$0	$0
Other Costs	$0	$0	$0	$0
TOTALS	**$51,139**	**$15,618**	**$0**	**$66,757**

Surface Pipe Removal

You must fill in ALL green and blue cells

			Input			Costs		
	Description (required)	ID Code	Length ft	Type (select type)	Location (select)	Labor Cost $	Equipment Cost $	Total Cost $
						$0	**$0**	**$0**

Notes:

Power Line and Substation Removal

You must fill in ALL green and blue cells

			Input				Costs			Cost Breakdown	
	Description (required)	ID Code	Power Line Length miles	Power Line Type (select)	Number of Substations #	Location (select)	Power Line Removal $	Substation Removal $	Total Cost $	Labor Cost $	Equipment Cost $
							$0	**$0**	**$0**	**$0**	**$0**

Notes: If substation owned by operator, use Other Demo & Equipment Removal sheet
User may need to add line items in Foundations & Buildings for substation slab demolition and fence removal
Labor/Equipment costs assume approximately 80% of cost are equipment and 20% are labor related costs

Rip-Rap & Rock Lining

You must fill in ALL green and blue cells

			Input		Costs			
	Description (required)	ID Code	Area S.Y.	Type (select type)	Labor Cost $	Equipment Cost $	Material Cost $	Total Cost $
					$0	**$0**	**$0**	**$0**

Notes:

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety Cost Basis: Southern Nevada

Reclamation Monitoring & Maintenance - Cost Summary

	Labor	Equipment	Lab & Materials	Totals
Revegetation Maintenance	$5,732	$4,663	$42,043	$52,438
Erosion Maintenance	$14,783	$44,349	N/A	$59,132
Reclamation Monitoring	$485,302	$57,218	N/A	$542,520
Subtotal Reclamation Monitoring	**$505,817**	**$106,230**	**$42,043**	**$654,090**
Water Quality Monitoring	$86,494	$25,126	$42,007	$153,627
TOTAL MONITORING	**$592,311**	**$131,356**	**$84,050**	**$807,717**

Reclamation Maintenance

Description	Total Revegetation Surface Area (1,2) acres	% Area Requiring Reseeding	Seed Mix (select)	Area Requiring Reseeding acres	Seed $/acres	Labor $/acres	Equipment $/acres	Totals $
Revegetation Maintenance	68	**25%**	**User Mix 1**	17.0	$2,479.32	$338.00	$275.00	
Labor								$5,732
Equipment								$4,663
Materials								$42,043
Cost/Acre								$3,092
							Subtotal	**$52,438**

Notes: 1) Surface area is NOT the same as footprint disturbance area typically used for permitting purposes.

	Total Volume Growth Media cy	% Volume Requiring Maintenance	Average Growth Media Placement Cost $/CY	Volume Requiring Replacement cy		Labor (assume: 25%) $/acres	Equipment (assume: 75%) $/acres	Total $
Erosion Maintenance	174,434	**10%**	$3.39	17,443		$14,783.00	$44,349.00	$59,132

Notes:

Reclamation Monitoring

Description	Hrs/Day	Days/Year	Number of Years	Rate $/hr	
Field Work					
Field Geologist/Engineer	**5**	**12**	**30**	$192.58	$346,644
Range Scientist				$152.23	$0
Reporting					
Field Geologist/Engineer	**2**	**12**	**30**	$192.58	$138,658
Range Scientist				$152.23	$0
				Subtotal	**$485,302**
Travel					
	Hrs/Trip hr	Trips/Year	Years	Truck Cost $/hr	
Travel	**3**	**12**	**30**	$52.98	$57,218
				Subtotal	**$57,218**
				Total Reclamation Monitoring	**$542,520**

Notes: **Reclamation monitoring assumes local firm performs the work.**

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety Cost Basis: Southern Nevada

Reclamation Monitoring & Maintenance - Cost Summary

	Labor	Equipment	Lab & Materials	Totals
Revegetation Maintenance	$5,732	$4,663	$42,043	$52,438
Erosion Maintenance	$14,783	$44,349	N/A	$59,132
Reclamation Monitoring	$485,302	$57,218	N/A	$542,520
Subtotal Reclamation Monitoring	**$505,817**	**$106,230**	**$42,043**	**$654,090**
Water Quality Monitoring	$86,494	$25,126	$42,007	$153,627
TOTAL MONITORING	**$592,311**	**$131,356**	**$84,050**	**$807,717**

Water and Rock Sample Analysis

Description	Samples #	Events/Year	No. Years	First Sample Year closure year (1-100)	No. of Samplers	Days/Event	Hrs/Day	Analysis Cost $/sample	Supplies $/sample	Lab Cost $	Material Cost $	Equipment Cost $	Labor Cost $	Cost $	Comments
ACZ Laboratory Hermosa	**1**	**2**	**30**	**1**	**1**	**1**	**8**	$691.44	$8.69	$41,486	$521	$13,973	$63,384	$119,364	**Quote received for cost of required testing is shown in User 4**
														$0	
														$0	
														$0	
														$0	
														$0	
														$0	
														$0	
														$0	
														$0	
														$0	
														$0	
														$0	
														$0	
														$0	
														$0	
									$41,486.00	$521.00	$13,972.80	$63,384.00		
												Subtotal Sampling Costs		**$119,364**	

Notes: Sampling labor cost = No. Samplers x Years x Events/year x Days/event x Hour/Day x Labor Rate
Sampling equipment costs include 1 pickup truck for every two samplers

Ground & Surface Water Monitoring

Pump Costs

Description	No. of units		Years		Cost $
Pump (purchased)	**1**	Replacement period (yrs):	**10**	3717.89	$11,154
				Subtotal Field Work	**$11,154**

Notes: Replacement period = frequency of pump replacement

Reporting

Description	Hrs/Event	Rate $/hr	Cost $
Field Geologist/Engineer	**2**	$192.58	$23,110
		Subtotal Reporting	**$23,110**

Notes:

Closure Cost Estimate
Constr. Mgmt

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety Cost Basis: Southern Nevada

Construction Management & Road Maintenance - Cost Summary	Labor	Equipment	Materials	Totals
Construction Management	$144,211	$27,946	N/A	$172,157
Construction Support		$19,031		$19,031
Road Maintenance	$199,042	$294,224	$0	$493,266
TOTAL CONSTRUCTION MANAGEMENT	**$343,253**	**$341,201**	**$0**	**$684,454**

Construction Management

Construction Management Staff

Description	Duration mo.	Hours/ Month hr.	Number of Supervisors	Supervisor Rate $/hr	Labor Cost $	Equipment Cost[1] $	Totals $
Active Reclamation	6	160	1	$150.22	$144,211	$27,946	$172,157
Monitoring & Maintenance					$0	$0	$0
				Total Staff	**$144,211**	**$27,946**	**$172,157**

Construction Management Support

Description	Duration mo.	Number of Units		Rental Rate $/mo	Generator Cost $/mo	Equipment Cost[1] $	Totals $
Temporary Office Rental	6	1		$203	$2,507	$16,261	$16,261
Temporary Toilets	6	2		$231		$2,770	$2,770
					Total Support	**$19,031**	**$19,031**

Notes: Office rental assumes only 1 generator required for every 4 trailers

Total Construction Management **$191,188**

Road Maintenance

Description	Fleet Size (select)	Number	Duration mo.	Hours/ Month hr.	Labor Cost $	Equipment Cost $	Totals $
Active Reclamation							
Water Truck	Medium	1	6	160	$70,723	$77,107	$147,830
Grader	Medium	1	6	160	$90,662	$161,453	$252,115
Monitoring & Maintenance							
Water Truck	Medium	1	14	16	$16,502	$17,992	$34,494
Grader	Medium	1	14	16	$21,155	$37,672	$58,827
Description	**Gallons/ Day**	**Days/ Month**	**Duration** mo.	**Cost/ Gallon** $			**Totals** $
Water Fees							
Water Fees							$0
				Total Project Maintenance	**$199,042**	**$294,224**	**$493,266**

Notes: 1) Supervisor equipment = pickup truck
2) Monitoring and maintenance assumes the following: Water truck and grader required semi-annually for a duration of 7 years (14 "durations"). Each "duration" would require 16 hours to perform maintenance work.

Closure Cost Estimate
Labor Rates

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
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Cost Estimate Type: Surety **Cost Basis: Southern Nevada**

Color Code Key	
User Input - Direct Input	Direct Input
User Input - Pull Down List	Pull Down Selection
Program Constant (can override)	Alternate Input
Program Calculated Value	Locked Cell - Formula or Reference

ZONE ADJUSTMENTS		
Cost Basis/Project Region	Southern Nevada	Clark, Esmeralda, Lincoln and Nye Counties
Power Equipment Operators	0-20 miles	$0.00
Truck Drivers	0-30 miles	$0.00
Laborers	0-30 miles	$0.00
INDIRECT COSTS		
Unemployment (%)	6.00%	
Retirement/SS/Medicare (%)	7.65%	
Workman's Compensation (%)	8.90%	
Other Indirects		
State Payroll Tax (13),(15),(17),(1	2.70%	
Total Other Indirects	**2.70%**	

HOURLY LABOR RATE TABLE										
EQUIPMENT TYPE (1) OR JOB DESCRIPTION	**Labor Group**	**Base Rate** ($/hr)	**Zone Adjustment** ($/hr)	**Hourly Wage** ($/hr)	**Fringe** ($/hr)	**Retirement/ Medicare** ($/hr)	**Unemployment Insurance** ($/hr)	**Workman's Compensation** ($/hr)	**Other Indirect Costs** ($/hr)	**Total** ($/hr)
Equipment Operators ($/hr) (2)										
Bulldozers										
D6R	Group 8A	$51.27	$0.00	$51.27	$30.85	$3.08	$3.92	$4.56	$1.38	$95.07
D6R w/ Winch					$30.85					
D7R	Group 8A	$51.27	$0.00	$51.27	$30.85	$3.08	$3.92	$4.56	$1.38	$95.07
D8R	Group 8A	$51.27	$0.00	$51.27	$30.85	$3.08	$3.92	$4.56	$1.38	$95.07
D9R	Group 8A	$51.27	$0.00	$51.27	$30.85	$3.08	$3.92	$4.56	$1.38	$95.07
D10R	Group 8A	$51.27	$0.00	$51.27	$30.85	$3.08	$3.92	$4.56	$1.38	$95.07
D11R	Group 8A	$51.27	$0.00	$51.27	$30.85	$3.08	$3.92	$4.56	$1.38	$95.07
Wheeled Dozers										
824G					$30.85					
834G					$30.85					
844					$30.85					
854G					$30.85					
Motor Graders										
120H	Group 10	$50.77	$0.00	$50.77	$30.85	$3.05	$3.88	$4.52	$1.37	$94.44
14G/H	Group 10	$50.77	$0.00	$50.77	$30.85	$3.05	$3.88	$4.52	$1.37	$94.44
16G/H	Group 10	$50.77	$0.00	$50.77	$30.85	$3.05	$3.88	$4.52	$1.37	$94.44
24M					$30.85					
Track Excavators										
312C	Group 12A	$51.14	$0.00	$51.14	$30.85	$3.07	$3.91	$4.55	$1.38	$94.90
320C	Group 12A	$51.14	$0.00	$51.14	$30.85	$3.07	$3.91	$4.55	$1.38	$94.90
325C	Group 12A	$51.14	$0.00	$51.14	$30.85	$3.07	$3.91	$4.55	$1.38	$94.90
330C	Group 12A	$51.14	$0.00	$51.14	$30.85	$3.07	$3.91	$4.55	$1.38	$94.90
345B	Group 12A	$51.14	$0.00	$51.14	$30.85	$3.07	$3.91	$4.55	$1.38	$94.90
365BL					$30.85					
385BL	Group 12A	$51.14	$0.00	$51.14	$30.85	$3.07	$3.91	$4.55	$1.38	$94.90
Scrapers										
631G	Group 8A	$51.27	$0.00	$51.27	$30.85	$3.08	$3.92	$4.56	$1.38	$95.07
637G	Group 8A	$51.27	$0.00	$51.27	$30.85	$3.08	$3.92	$4.56	$1.38	$95.07
Wheeled Loaders										
924G	Group 8A	$51.27	$0.00	$51.27	$30.85	$3.08	$3.92	$4.56	$1.38	$95.07
928G	Group 8A	$51.27	$0.00	$51.27	$30.85	$3.08	$3.92	$4.56	$1.38	$95.07
950G	Group 8A	$51.27	$0.00	$51.27	$30.85	$3.08	$3.92	$4.56	$1.38	$95.07
966G	Group 8A	$51.27	$0.00	$51.27	$30.85	$3.08	$3.92	$4.56	$1.38	$95.07
972G	Group 8A	$51.27	$0.00	$51.27	$30.85	$3.08	$3.92	$4.56	$1.38	$95.07
980G	Group 8A	$51.27	$0.00	$51.27	$30.85	$3.08	$3.92	$4.56	$1.38	$95.07
988G	Group 10	$50.77	$0.00	$50.77	$30.85	$3.05	$3.88	$4.52	$1.37	$94.44
990					$30.85					
992G	Group 10	$50.77	$0.00	$50.77	$30.85	$3.05	$3.88	$4.52	$1.37	$94.44
994D					$30.85					
L2350					$30.85					
Shovels										
PC2000					$30.85					
PC3000					$30.85					
PC4000					$30.85					
PC5500					$30.85					
PC8000					$30.85					
Hydraulic Hammers										
H-120 (fits 325)										
H-160 (fits 345)										
H-180 (fits 365/385)										
Demolition Shears										
S340 (fits 322/325/330)										
S365 (fits 330/345)										
S390 (fits 365/385)										
Demolition Grapples										
G315 (fits 322/325)										
G320 (fits 325/330)										
G330 (fits 345/365)										

Closure Cost Estimate
Labor Rates

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
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Color Code Key	
User Input - Direct Input	**Direct Input**
User Input - Pull Down List	**Pull Down Selection**
Program Constant (can override)	**Alternate Input**
Program Calculated Value	**Locked Cell - Formula or Reference**

ZONE ADJUSTMENTS

Cost Basis/Project Region	**Southern Nevada**	Clark, Esmeralda, Lincoln and Nye Counties
Power Equipment Operators	**0-20 miles**	$0.00
Truck Drivers	**0-30 miles**	$0.00
Laborers	**0-30 miles**	$0.00

INDIRECT COSTS

Unemployment (%)	6.00%
Retirement/SS/Medicare (%)	7.65%
Workman's Compensation (%)	8.90%

Other Indirects

State Payroll Tax (13),(15),(17),(1	2.70%
Total Other Indirects	**2.70%**

HOURLY LABOR RATE TABLE

Other Equipment

420D 4WD Backhoe	Group 12A	$51.27	$0.00	$51.27	$30.85	$3.08	$3.92	$4.56	$1.38	$95.07
428D 4WD Backhoe	Group 12A	$51.27	$0.00	$51.27	$30.85	$3.08	$3.92	$4.56	$1.38	$95.07
CS533E Vibratory Roller	Group 12A	$51.27	$0.00	$51.27	$30.85	$3.08	$3.92	$4.56	$1.38	$95.07
CS633E Vibratory Roller					$30.85					
CP533E Sheepsfoot Compactor					$30.85					
CP633E Sheepsfoot Compactor					$30.85					
Light Truck - 1.5 Ton					$30.85					
Supervisor's Truck					$30.85					
Flatbed Truck					$30.85					
Air Compressor + tools	Group 1	$49.89	$0.00	$49.89	$30.85	$2.99	$3.82	$4.44	$1.35	$91.99
Welding Equipment	Group 8A	$51.27	$0.00	$51.27	$30.85	$3.08	$3.92	$4.56	$1.38	$93.68
Heavy Duty Drill Rig	Group 1	$49.89	$0.00	$49.89	$30.85	$2.99	$3.82	$4.44	$1.35	$91.99
Pump (plugging) Drill Rig	Group 1	$49.89	$0.00	$49.89	$30.85	$2.99	$3.82	$4.44	$1.35	$91.99
Concrete Pump					$30.85					
Gas Engine Vibrator	Group 8A	$51.27	$0.00	$51.27	$30.85	$3.08	$3.92	$4.56	$1.38	$95.07
Generator 5KW					$30.85					
HDEP Welder (pipe or liner)					$30.85					
5 Ton Crane	Group 8A	$51.27	$0.00	$51.27	$30.85	$3.08	$3.92	$4.56	$1.38	$95.07
20 Ton Crane	Group 8A	$51.27	$0.00	$51.27	$30.85	$3.08	$3.92	$4.56	$1.38	$95.07
50 Ton Crane	Group 8A	$51.27	$0.00	$51.27	$30.85	$3.08	$3.92	$4.56	$1.38	$95.07
120 Ton Crane					$30.85					

NOTES:

(1) Equipment Type:	Catepillar model or equivalent, LeTourneau
(2) Equipment Operator Source:	D-B NV20230012 5/12/2023
(3) Zone Basis:	From Las Vegas City Hall

Truck Drivers ($/hr) (4)

725		$39.99	$0.00	$39.99	$23.58	$2.40	$3.06	$3.56	$1.08	$73.67
730		$39.99	$0.00	$39.99	$23.58	$2.40	$3.06	$3.56	$1.08	$73.67
735		$39.99	$0.00	$39.99	$23.58	$2.40	$3.06	$3.56	$1.08	$73.67
740		$39.99	$0.00	$39.99	$23.58	$2.40	$3.06	$3.56	$1.08	$73.67
769D		$39.99	$0.00	$39.99	$23.58	$2.40	$3.06	$3.56	$1.08	$73.67
773E					$23.58					
777D		$39.99	$0.00	$39.99	$23.58	$2.40	$3.06	$3.56	$1.08	$73.67
785C					$23.58					
793C					$23.58					
797B					$23.58					
613E (5,000 gal) Water Wagon		$39.99	$0.00	$39.99	$23.58	$2.40	$3.06	$3.56	$1.08	$73.67
621E (8,000 gal) Water Wagon		$39.99	$0.00	$39.99	$23.58	$2.40	$3.06	$3.56	$1.08	$73.67
777D Water Truck					$23.58					
785C Water Truck					$23.58					
Dump Truck (10-12 yd3)		$39.99	$0.00	$39.99	$23.58	$2.40	$3.06	$3.56	$1.08	$73.67

NOTES:

(4) Truck Driver Source:	D-B NV20230012 5/12/2023
(5) Zone Basis:	From Las Vegas City Hall

Closure Cost Estimate
Labor Rates

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety **Cost Basis: Southern Nevada**

Color Code Key	
User Input - Direct Input	Direct Input
User Input - Pull Down List	Pull Down Selection
Program Constant (can override)	Alternate Input
Program Calculated Value	Locked Cell - Formula or Reference

ZONE ADJUSTMENTS		
Cost Basis/Project Region	Southern Nevada	Clark, Esmeralda, Lincoln and Nye Counties
Power Equipment Operators	0-20 miles	$0.00
Truck Drivers	0-30 miles	$0.00
Laborers	0-30 miles	$0.00

INDIRECT COSTS	
Unemployment (%)	6.00%
Retirement/SS/Medicare (%)	7.65%
Workman's Compensation (%)	8.90%
Other Indirects	
State Payroll Tax (13),(15),(17),(1	2.70%
Total Other Indirects	**2.70%**

HOURLY LABOR RATE TABLE

Laborers ($/hr) (6,7)										
General Laborer	Group 1	$31.00	$0.00	$31.00	$31.16	$1.86	$2.37	$2.76	$0.84	$69.99
Skilled Laborer	Group 2	$31.21	$0.00	$31.21	$31.16	$1.87	$2.39	$2.78	$0.84	$70.25
Driller's Helper	Group 2	$31.21	$0.00	$31.21	$31.16	$1.87	$2.39	$2.78	$0.84	$70.25
Rodmen (reinforcing concrete)	Group 2	$31.21	$0.00	$31.21	$31.16	$1.87	$2.39	$2.78	$0.84	$70.25
Cement finisher	Group 2	$31.21	$0.00	$31.21	$31.16	$1.87	$2.39	$2.78	$0.84	$70.25
Carpenter		$44.54	$0.00	$44.54	$23.28	$2.67	$3.41	$3.96	$1.20	$79.07

NOTES:

(6) Laborer Source:	D-B LABO0872-015 7/2/2021
(7) Carpenter Source:	D-B CARP1977-003 7/1/2021
(8) Zone Basis:	From Las Vegas City Hall

Project Management and Technical Labor ($/hr) (9)										
Project Manager		$95.06		$95.06	$31.16	$5.70	$7.27	$8.46	$2.57	$150.22
Foreman		$88.31		$88.31	$31.16	$5.30	$6.76	$7.86	$2.38	$141.77
Field Geologist/Engineer		$128.88		$128.88	$31.16	$7.73	$9.86	$11.47	$3.48	$192.58
Field Tech/Sampler		$80.55		$80.55	$31.16	$4.83	$6.16	$7.17	$2.17	$132.05
Range Scientist		$96.66		$96.66	$31.16	$5.80	$7.39	$8.60	$2.61	$152.23
Senior Planning Engineer					$31.16					
Project Engineer					$31.16					
Mechanic/Fitter					$31.16					
					$31.16					
					$31.16					
					$31.16					
					$31.16					

NOTES:

(9) Project Manager:	R.S.Means 2023 Q2 (01 31 1320 0200 Total Incl.O&P-10%) Adjusted for Elko, NV
(9) Foreman Source:	R.S.Means 2023 Q2 (01 31 1320 0200 Total Incl.O&P-10%) Adjusted for Elko, NV
(9) Techical Labor Source:	WSP 2023 Adjusted for Zone,Tax and Ins.
Other Labor Source:	
Other Labor Source:	
†Additional User Markups (These are added by the user to the base rate to account for site-specific conditions or corporate requirements)	

Closure Cost Estimate
Equipment Costs

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Monthly Rental Basis: 160 hrs month

EQUIPMENT RENTAL RATE TABLE

EQUIPMENT TYPE (1)	Monthly Owner/Rental Rate	Equipment Hourly Rate	Fuel/Lube/ Wear	Total Rate
Bulldozers				
D6R	$11,500.00	$71.88	$39.22	$111.09
D6R w/ Winch			$24.44	$24.44
D7R	$12,900.00	$80.63	$44.11	$124.73
D8R	$24,500.00	$153.13	$59.03	$212.16
D9R	$31,000.00	$193.75	$84.38	$278.13
D10R	$44,500.00	$278.13	$108.13	$386.26
D11R	$58,439.01	$365.24	$164.82	$530.06
Wheeled Dozers				
824G			$42.03	$42.03
834G			$49.27	$49.27
844			$58.65	$58.65
854G			$74.29	$74.29
Motor Graders				
120H	$12,000.00	$75.00	$41.98	$116.98
14G/H	$17,000.00	$106.25	$61.93	$168.18
16G/H	$16,500.00	$103.13	$78.42	$181.54
24M			$60.61	$60.61
Track Excavators				
312C	$6,450.00	$40.31	$17.03	$57.34
320C	$8,000.00	$50.00	$29.88	$79.88
325C	$9,500.00	$59.38	$37.98	$97.35
330C	$13,000.00	$81.25	$46.17	$127.42
345B	$16,500.00	$103.13	$57.92	$161.04
365BL			$51.61	$51.61
385BL	$25,000.00	$156.25	$91.45	$247.70
Scrapers				
631G	$25,000.00	$156.25	$98.26	$254.51
637G	$34,668.91	$216.68	$150.06	$366.74
Wheeled Loaders				
924G	$5,600.00	$35.00	$25.46	$60.46
928G	$6,750.00	$42.19	$29.59	$71.77
950G	$8,600.00	$53.75	$39.59	$93.34
966G	$12,500.00	$78.13	$52.97	$131.09
972G	$16,000.00	$100.00	$59.05	$159.05
980G	$16,000.00	$100.00	$66.85	$166.85
988G	$25,970.00	$162.31	$94.93	$257.24
990			$66.47	$66.47
992G	$69,500.00	$434.38	$177.96	$612.34
994D			$140.76	$140.76
L2350			$258.06	$258.06
Shovels				
PC2000			$144.67	$144.67
PC3000			$195.50	$195.50
PC4000			$273.70	$273.70
PC5500			$465.29	$465.29
PC8000			$582.59	$582.59
Hydraulic Hammers				
H-120 (fits 325)	$10,500.00	$65.63	$5.76	$71.39
H-160 (fits 345)	$12,500.00	$78.13	$6.48	$84.61
H-180 (fits 365/385)	$16,000.00	$100.00	$9.14	$109.14
Demolition Shears				
S340 (fits 322/325/330)				$0.00
S365 (fits 330/345)				$0.00
S390 (fits 365/385)				$0.00
Demolition Grapples				
G315 (fits 322/325)				$0.00
G320 (fits 325/330)				$0.00
G330 (fits 345/365)				$0.00
Other Equipment				
420D 4WD Backhoe	$3,200.00	$20.00	$21.77	$41.77
428D 4WD Backhoe	$4,350.00	$27.19	$21.62	$48.81
CS533E Vibratory Roller	$2,948.00	$18.43	$14.66	$33.09
CS633E Vibratory Roller			$18.57	$18.57
CP533E Sheepsfoot Compactor			$14.66	$14.66
CP633E Sheepsfoot Compactor			$18.57	$18.57
Light Truck - 1.5 Ton	$7,475.60	$46.72	$6.26	$52.98
Supervisor's Truck	$3,968.80	$24.81	$4.30	$29.11
Flatbed Truck	$7,475.60	$46.72	$20.54	$67.26
Air Compressor + tools	$5,272.96	$32.96	$3.91	$36.87
Welding Equipment	$3,036.00	$18.98	$7.82	$26.80
Heavy Duty Drill Rig	$25,806.00	$161.29	$46.92	$208.21
Pump (plugging) Drill Rig	$25,806.00	$161.29	$39.10	$200.39
Concrete Pump	$17,072.00	$106.70	$39.10	$145.80
Gas Engine Vibrator	$612.04	$3.83	$3.91	$7.74
Generator 5KW	$1,568.16	$9.80	$5.87	$15.67
HDEP Welder (pipe or liner)	$6,864.00	$42.90	$7.82	$50.72
5 Ton Crane	$8,025.60	$50.16	$11.73	$61.89
20 Ton Crane	$46,970.00	$293.56	$15.64	$309.20
50 Ton Crane	$46,970.00	$293.56	$18.38	$311.94
120 Ton Crane			$20.33	$20.33
Trucks				
725	$17,500.00	$109.38	$53.97	$163.35
730	$17,500.00	$109.38	$55.93	$165.30
735	$17,500.00	$109.38	$68.50	$177.87
740	$17,500.00	$109.38	$74.03	$183.40
769D	$32,500.00	$203.13	$54.30	$257.43
773E	$39,750.00	$248.44	$78.40	$326.84
777D	$63,000.00	$393.75	$103.28	$497.03
785C			$94.82	$94.82
793C			$163.24	$163.24
797B			$229.71	$229.71
613E (5,000 gal) Water Wagon	$7,312.50	$45.70	$34.61	$80.32
621E (8,000 gal) Water Wagon	$12,375.00	$77.34	$57.98	$135.33
777D Water Truck			$65.49	$65.49
785C Water Truck			$94.82	$94.82
Dump Truck (10-12 yd^3)	$16,346.00	$102.16	$21.65	$123.81

NOTES:

(1) Power Equipment Source:	
(2) Power Equipment Type:	Catepillar model or equivalent, LeTourneau loader, Komatsu shovels
(3) Drilling Equipment Source:	
(4) Other Equipment Source:	
(5) Drill rig includes support (pipe) truck	

Closure Cost Estimate
Equipment Costs

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm

FUEL, LUBE AND WEAR CALCULATIONS

EQUIPMENT TYPE	PM Cost Per Hour (1)	Under carriage or Tires (2)	G.E.T Consumption (3)	Fuel Use Rate gal/hr (4)	Cost@ 3.91/gal	Total Hourly Equipment Cost
Bulldozers						
D6R	$8.80		$5.98	6.25	$24.44	$39.22
D6R w/ Winch				6.25	$24.44	$24.44
D7R	$8.80		$5.98	7.50	$29.33	$44.11
D8R	$9.29		$11.62	9.75	$38.12	$59.03
D9R	$10.59		$18.07	14.25	$55.72	$84.38
D10R	$12.46		$25.29	18.00	$70.38	$108.13
D11R	$19.60		$41.60	26.50	$103.62	$164.82
Wheeled Dozers						
824G		$0.00		10.75	$42.03	$42.03
834G		$0.00		12.60	$49.27	$49.27
844		$0.00		15.00	$58.65	$58.65
854G		$0.00		19.00	$74.29	$74.29
Motor Graders						
120H	$5.35	$8.55	$12.44	4.00	$15.64	$41.98
14G/H	$6.67	$12.86	$17.97	6.25	$24.44	$61.93
16G/H	$6.97	$17.57	$24.55	7.50	$29.33	$78.42
24M				15.50	$60.61	$60.61
Track Excavators						
312C	$5.03		$4.65	1.88	$7.35	$17.03
320C	$5.36		$5.36	4.90	$19.16	$29.88
325C	$5.40		$6.77	6.60	$25.81	$37.98
330C	$6.66		$7.45	8.20	$32.06	$46.17
345B	$8.84		$7.63	10.60	$41.45	$57.92
365BL				13.20	$51.61	$51.61
385BL	$7.41		$15.61	17.50	$68.43	$91.45
Scrapers						
631G	$8.93	$20.90	$9.78	15.00	$58.65	$98.26
637G	$20.14	$20.90	$16.16	23.75	$92.86	$150.06
Wheeled Loaders						
924G	$4.44	$4.94	$5.33	2.75	$10.75	$25.46
928G	$4.44	$4.94	$6.52	3.50	$13.69	$29.59
950G	$5.94	$8.09	$9.92	4.00	$15.64	$39.59
966G	$6.19	$11.84	$12.45	5.75	$22.48	$52.97
972G	$7.00	$11.84	$15.77	6.25	$24.44	$59.05
980G	$7.00	$14.76	$15.77	7.50	$29.33	$66.85
988G	$13.12	$17.60	$16.90	12.10	$47.31	$94.93
990				17.00	$66.47	$66.47
992G	$14.52	$34.71	$38.80	23.00	$89.93	$177.96
994D				36.00	$140.76	$140.76
L2350				66.00	$258.06	$258.06
Shovels						
PC2000				37.00	$144.67	$144.67
PC3000				50.00	$195.50	$195.50
PC4000				70.00	$273.70	$273.70
PC5500				119.00	$465.29	$465.29
PC8000				149.00	$582.59	$582.59
Hydraulic Hammers						
H-120 (fits 325)	N/A		$5.76			$5.76
H-160 (fits 345)	N/A		$6.48			$6.48
H-180 (fits 365/385)	N/A		$9.14			$9.14
Demolition Shears						
S340 (fits 322/325/330)	N/A					$0.00
S365 (fits 330/345)	N/A					$0.00
S390 (fits 365/385)	N/A					$0.00
Demolition Grapples						
G315 (fits 322/325)	N/A					$0.00
G320 (fits 325/330)	N/A					$0.00
G330 (fits 345/365)	N/A					$0.00
Other Equipment						
420D 4WD Backhoe	$4.95	$0.95	$4.14	3.00	$11.73	$21.77
428D 4WD Backhoe	$4.68	$0.95	$4.26	3.00	$11.73	$21.62
CS533E Vibratory Roller			N/A	3.75	$14.66	$14.66
CS633E Vibratory Roller			N/A	4.75	$18.57	$18.57
CP533E Sheepsfoot Compactor			N/A	3.75	$14.66	$14.66
CP633E Sheepsfoot Compactor			N/A	4.75	$18.57	$18.57
Light Truck - 1.5 Ton		$0.39	N/A	1.50	$5.87	$6.26
Supervisor's Truck		$0.39	N/A	1.00	$3.91	$4.30
Flatbed Truck		$2.16	N/A	4.70	$18.38	$20.54
Air Compressor + tools			N/A	1.00	$3.91	$3.91
Welding Equipment			N/A	2.00	$7.82	$7.82
Heavy Duty Drill Rig			N/A	12.00	$46.92	$46.92
Pump (plugging) Drill Rig			N/A	10.00	$39.10	$39.10
Concrete Pump			N/A	10.00	$39.10	$39.10
Gas Engine Vibrator			N/A	1.00	$3.91	$3.91
Generator 5KW			N/A	1.50	$5.87	$5.87
HDEP Welder (pipe or liner)			N/A	2.00	$7.82	$7.82
5 Ton Crane			N/A	3.00	$11.73	$11.73
20 Ton Crane			N/A	4.00	$15.64	$15.64
50 Ton Crane			N/A	4.70	$18.38	$18.38
120 Ton Crane			N/A	5.20	$20.33	$20.33
Trucks						
725	$9.84	$22.05	$3.71	4.70	$18.38	$53.97
730	$9.84	$22.05	$3.71	5.20	$20.33	$55.93
735	$9.84	$26.21	$3.71	7.35	$28.74	$68.50
740	$9.84	$31.74	$3.71	7.35	$28.74	$74.03
769D	$7.29	$6.70	$4.15	9.25	$36.17	$54.30
773E	$9.02	$18.78	$4.66	11.75	$45.94	$78.40
777D	$12.91	$19.68	$5.20	16.75	$65.49	$103.28
785C				24.25	$94.82	$94.82
793C				41.75	$163.24	$163.24
797B				58.75	$229.71	$229.71
613E (5,000 gal) Water Wagon	$5.90	$5.25		6.00	$23.46	$34.61
621E (8,000 gal) Water Wagon	$8.35	$7.60		10.75	$42.03	$57.98
777D Water Truck				16.75	$65.49	$65.49
785C Water Truck				24.25	$94.82	$94.82
Dump Truck (10-12 yd3) (5)	N/A	$1.32	N/A	5.20	$20.33	$21.65

Notes:

(1) PM Source:	Cashman Equipment Company (July 2023) unless noted
(2) Undercarriage Source:	Purcell Tire Quote: 2023
(3) G.E.T. Source:	Cashman Equipment Company (July 2023) unless noted
(4) Fuel Use Source:	Caterpillar Handbook, Edition 35, Ch. 20; or estimated average for smaller vehicles
(5) Dump Truck Oper. Cost Source:	Means Heavy Construction (2008)

Closure Cost Estimate
Equipment Costs

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm

TIRE COST TABLES

Equipment	Tire Size	# of Tires Per Piece of Equipment	Cost Per Tire	Tire Cost (1)(2)	Life Expectency Hours (Low/Zone A) (3)	Tire Cost per Hour
Bulldozers						
D6R			N/A			
D6R w/ Winch			N/A			
D7R			N/A			
D8R			N/A			
D9R			N/A			
D10R			N/A			
D11R			N/A			
Wheeled Dozers						
824G	29.5R25	4		$0.00	3,500	$0.00
834G	35/65-R33	4		$0.00	3,500	$0.00
844	45/65-R39	4		$0.00	3,500	$0.00
854G	45/65-R45	4		$0.00	3,500	$0.00
Motor Graders						
120H	13PR24	6	$4,989.00	$29,934.00	3,500	$8.55
14G/H	20.5R25	6	$7,499.00	$44,994.00	3,500	$12.86
16G/H	23.5R25	6	$10,250.00	$61,500.00	3,500	$17.57
24M	23.5R25	6		$0.00	3,500	
Track Excavators						
312C			N/A			
320C			N/A			
325C			N/A			
330C			N/A			
345B			N/A			
365BL			N/A			
385BL			N/A			
Scrapers						
631G	37.25R35	4	$20,900.00	$83,600.00	4,000	$20.90
637G	37.25R35	4	$20,900.00	$83,600.00	4,000	$20.90
Wheeled Loaders						
924G	17.5R25	4	$5,560.00	$22,240.00	4,500	$4.94
928G	17.5R25	4	$5,560.00	$22,240.00	4,500	$4.94
950G	26.5R25	4	$9,100.00	$36,400.00	4,500	$8.09
966G	26.5R25	4	$13,325.00	$53,300.00	4,500	$11.84
972G	26.5R25	4	$13,325.00	$53,300.00	4,500	$11.84
980G	29.5R25	4	$16,600.00	$66,400.00	4,500	$14.76
988G	35/65-33	4	$19,800.00	$79,200.00	4,500	$17.60
990	41.25/70-39	4		$0.00	4,500	
992G	45/65R45	4	$39,050.00	$156,200.00	4,500	$34.71
994D	55/85R57	4		$0.00	4,500	
L2350	55/85R57	4		$0.00	4,500	
Shovels						
PC2000			N/A			
PC3000			N/A			
PC4000			N/A			
PC5500			N/A			
PC8000			N/A			
Hydraulic Hammers						
H-120 (fits 325)			N/A			
H-160 (fits 345)			N/A			
H-180 (fits 365/385)			N/A			
Demolition Shears						
S340 (fits 322/325/330)			N/A			
S365 (fits 330/345)			N/A			
S390 (fits 365/385)			N/A			
Demolition Grapples						
G315 (fits 322/325)			N/A			
G320 (fits 325/330)			N/A			
G330 (fits 345/365)			N/A			
Other Equipment						
420D 4WD Backhoe	340/80R18-19.5LR24	2	$1,429.00	$2,858.00	3,000	$0.95
428D 4WD Backhoe	340/80R18-16.9R28	2	$1,429.00	$2,858.00	3,000	$0.95
CS533E Vibratory Roller			N/A			
CS633E Vibratory Roller			N/A			
CP533E Sheepsfoot Compactor			N/A			
CP633E Sheepsfoot Compactor			N/A			
Light Truck - 1.5 Ton		4	295	$1,180.00	3,000	$0.39
Supervisor's Truck		4	295	$1,180.00	3,000	$0.39
Flatbed Truck		22	295	$6,490.00	3,000	$2.16
Air Compressor + tools			N/A			
Welding Equipment			N/A			
Heavy Duty Drill Rig		4		$0.00	3,000	
Pump (plugging) Drill Rig		4		$0.00	3,000	
Concrete Pump			N/A			
Gas Engine Vibrator			N/A			
Generator 5KW			N/A			
HDEP Welder (pipe or liner)			N/A			
5 Ton Crane		4		$0.00	3,000	
20 Ton Crane		4		$0.00	3,000	
50 Ton Crane		6		$0.00	3,000	
120 Ton Crane		6		$0.00	3,000	
Trucks						
725	23.5R25	6	$7,349.00	$44,094.00	2,000	$22.05
730	23.5R25	6	$7,349.00	$44,094.00	2,000	$22.05
735	26.5R25	6	$8,736.00	$52,416.00	2,000	$26.21
740	29.5R25	6	$10,580.00	$63,480.00	2,000	$31.74
769D	18.00R33	6	$6,695.00	$40,170.00	6,000	$6.70
773E	24.00R35	6	$15,649.00	$93,894.00	5,000	$18.78
777D	27.00R49	6	$16,400.00	$98,400.00	5,000	$19.68
785C	33.00R51	6		$0.00	4,000	
793C	40.00R57	6		$0.00	4,000	
797B	40.00R57	6		$0.00	4,000	
613E (5,000 gal) Water Wagon	23.5R25	6	$5,250.00	$31,500.00	6,000	$5.25
621E (8,000 gal) Water Wagon	33.25R29	6	$10,130.00	$60,780.00	8,000	$7.60
777D Water Truck	27.00R49	6		$0.00	5,000	
785C Water Truck	33.00R51	6		$0.00	4,000	
Dump Truck (10-12 yd3)		10	$790.00	$7,900.00	6,000	$1.32

Notes:

(1) Unit Cost Basis:	Cost per set
(2) Cost Basis:	Total cost for all required tires.
(3) Tire Cost Source:	Purcell Tire Quote: 2023
(4) Tire Wear Source:	Caterpillar Handbook, Ewdition 35; Ch 20

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety   Cost Basis: Southern Nevada

Revegetation Materials

Seed Mixes

Seed Mix	Description		Cost/Acre
None			
Mix 1	Basins		$302.50
Mix 2	Low Hills		$332.75
Mix 3	Uplands		$363.00
Mix 4	Riparian or Custom		$393.25
User Mix 1	**Hermosa Project**		**$2,479.32**
User Mix 2			
User Mix 3			
User Mix 4			
	Cost/lb	**lbs/Acre**	**Cost/Acre**
User Mix 5 (from Seed Mix sheet)	$0.00	$25.97	$0.00
Notes:	**User Mix 1: Seed mix price ($/acre) provided by South32 Hermosa Inc. based on historical price paid on site for seed mix.**		

Mulch

Item	Cost/lb	lbs/Acre	Cost/Acre
None			
Straw Mulch	$0.24		
Hydro Mulch	$0.39		
Timber Mulch			
Notes:	Granite Seed $780 per Ton in 50 lb bag Wood (Hydro) Mulch (2023)		
	Included in User Mix 1		

Amendments

Item	Cost/lb	lbs/Acre	Cost/Acre
None			
Organic Matter	$0.80		$0.00
Treated Sludge			
Chemical	$0.73	**165**	$120.68
Notes:	Western Nevada Supply $36.57 per 50 lb. bag 15-15-15 (2023)		
	Assumed 165 lbs per acre for chemical amendments.		

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
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Cost Estimate Type: Surety **Cost Basis: Southern Nevada**

Well Abandonment Materials

Description	Cost/50lb bag	Units	Cost/unit*
Cement	$8.11	cy	$38.63
Grout (Low Grade Bentonite)	$11.92	cy	$56.76
Inert Material/Cuttings		cy	
		cy	
		cy	

(1) Jentech Drilling Supply quote (2023) Type I,II Cement at $15.25 per 94 lb. bag
(2) Jentech Drilling Supply (2023) 3/8 in. Chunk Bentonite Hole Plug at $11.92 per 50 lb. bag (5.75 cf/bag at 43 ga

* Assumes 1 bag mixes with water to make 0.21 y3 or 0.16 m3 of grout/cement slurry.

Monitoring Costs

Description	Units	Cost/unit
Monitor Well Pump	ea.	$3,717.89
Sampling Supplies	ea.	$8.69
Water Analysis (Profile I) (1)	ea.	$513.00
Leach Test (MWMP) w/ analysis	ea.	$626.00
ABA + S speciation	ea.	$210.00
WAD Cyanide in water	ea.	$82.00
Water Analysis (Profile II) (1)	ea.	$585.00
	ea.	
	ea.	
	ea.	
	ea.	
	ea.	
	ea.	
	ea.	
	ea.	
	ea.	
	ea.	
ACZ Laboratory Hermosa	**ea.**	**$691.44**

(1) WET Lab, Reno, Nevada (2023)
Well pump and Sample supply costs adjusted to 2023.

Fuel, Etc.

Description	Units	Cost/unit
Off-road Diesel - delivered (1)	$/gal	$3.910
Pickup Truck Mileage	$/mi	$0.655
Electical Power	$/kWh	$0.111

(1) Source: Oil Price Infomration Service , average annual cost including freight to Nevada (2023).
Source: Federal Government Vehicle Allowance Rate
Source: NV Energy (2023) $0.11062

Closure Cost Estimate
Material Costs

Revegetation Method				
Slopes				
Disturbance Type	**Seed Application Method**	**Labor** Cost/Acre	**Equipment** Cost/Acre	**Total** Cost/Acre
Waste Rock Dumps	**Hydroseeding**	$338.00	$275.00	$613.00
Heap Leach	**Mechanical Broadcast**	$175.00	$100.00	$275.00
Tailings	**Hand Broadcast**	$175.00	$100.00	$275.00
Quarries & Borrow Pits	**Mechanical Broadcast**	$175.00	$100.00	$275.00
Flat Areas and Undifferentiated				
Disturbance Type	**Seed Application Method**	**Labor** Cost/Acre	**Equipment** Cost/Acre	**Total** Cost/Acre
Exploration Trenches	**Mechanical Broadcast**	$175.00	$100.00	$275.00
Exploration Roads	**Mechanical Broadcast**	$175.00	$100.00	$275.00
Waste Rock Dumps	**Hydroseeding**	$338.00	$275.00	$613.00
Heap Leach	**Mechanical Broadcast**	$175.00	$100.00	$275.00
Tailings	**Mechanical Broadcast**	$175.00	$100.00	$275.00
Quarries & Borrow Pits	**Mechanical Broadcast**	$175.00	$100.00	$275.00
Roads	**Mechanical Broadcast**	$175.00	$100.00	$275.00
Pits	**Mechanical Broadcast**	$175.00	$100.00	$275.00
Haul Material	**Mechanical Broadcast**	$175.00	$100.00	$275.00
Foundations & Buildings	**Mechanical Broadcast**	$175.00	$100.00	$275.00
Sediment & Drainge Control	**Mechanical Broadcast**	$175.00	$100.00	$275.00
Process Ponds	**Mechanical Broadcast**	$175.00	$100.00	$275.00
Landfills	**Mechanical Broadcast**	$175.00	$100.00	$275.00
Yards, Etc.	**Mechanical Broadcast**	$175.00	$100.00	$275.00
Revegetation Maintenance	**Hydroseeding**	$338.00	$275.00	$613.00

Closure Cost Estimate
Misc. Unit Costs

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
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Cost Estimate Type: Surety Cost Basis: Southern Nevada

Revegetation

	Means Number	Unit	Crew	Daily Output	Daily Output User	Materials	Labor	Equipment	Total	Notes
Seeding - Broadcast Hand (1)		acres					$175.00	$100.00	$275.00	
Seeding - Broadcast Mechanical (1)		acres					$175.00	$100.00	$275.00	
Seeding - Drill (1)		acres		365			$175.00	$175.00	$350.00	
Seeding - Hydroseeding (1)				365			$338.00	$275.00	$613.00	
Shrub Planting - bare root 6-10 in (150- 250mm) (2)	02910-400-0561	ea.	1 Clab	365					$0.00	
Tree Planting - bare root 11-16 in (270- 400mm) (3)	02910-400-0562	ea.	1 Clab	260					$0.00	
Cactus Planting (4)		ea.	1 Clab						$0.00	
NOTES:										
(1) Seeding Source:	Source: Kelley Erosion Control (2023).									
(2) Shrub Source:										
(3) Tree Source:										
(4) Cactus Source:										

Building and Wall Demolition

Hourly productivity rates and crew composition from Means Heavy Construction 2005 Edition by permission of R.S.Means/Reed Construction Data .
All equipment, labor and material unit costs are from Labor Costs, Equipment Costs and Material Costs spreadsheets

	Means Number	Unit	Crew	Daily Output	Daily Output User	Labor	Equipment	Premium	Total	Notes
Building Demolition										
Lg. steel	02220-110-0012	C.F.	B-8	21500		$0.23	$0.23		$0.46	
Lg. concrete	02220-110-0050	C.F.	B-8	15300		$0.32	$0.33		$0.65	
Lg. masonry	02220-110-0080	C.F.	B-8	20100		$0.25	$0.25		$0.50	
Lg. mixed	02220-110-0100	C.F.	B-8	20100		$0.25	$0.25		$0.50	
Sm. steel	02220-110-0500	C.F.	B-3	14800		$0.28	$0.17		$0.45	
Sm. concrete	02220-110-0600	C.F.	B-3	11300		$0.37	$0.23		$0.60	
Sm. masonry	02220-110-0650	C.F.	B-3	14800		$0.28	$0.17		$0.45	
Sm. wood	02220-110-0700	C.F.	B-3	14800		$0.28	$0.17		$0.45	
Wall Demolition										
Block 4 in (100 mm) thick	02220-130-2000	S.F.	1 Clab	180		$3.11	$0.00	20%	$3.73	
Block 6 in (150 mm) thick	02220-130-2040	S.F.	1 Clab	170		$3.29	$0.00	20%	$3.95	
Block 8 in (200 mm) thick	02220-130-2080	S.F.	1 Clab	150		$3.73	$0.00	20%	$4.48	
Block 12 in (300 mm) thick	02220-130-2100	S.F.	1 Clab	150		$3.73	$0.00	20%	$4.48	
Conc 6 in (150 mm) thick	02220-130-2400	S.F.	B-9	160		$25.69	$1.84	10%	$30.28	
Conc 8 in (200 mm) thick	02220-130-2420	S.F.	B-9	140		$29.36	$2.11	10%	$34.62	
Conc 10 in (250 mm) thick	02220-130-2440	S.F.	B-9	120		$34.25	$2.46	10%	$40.38	
Conc 12 in (300 mm) thick	02220-130-2500	S.F.	B-9	100		$41.10	$2.95	10%	$48.46	

Waste Disposal

Unit rates from Means Heavy Construction 2006 Edition by permission of R.S.Means/Reed Construction Data .

	Means Number	Unit	Crew	Daily Output	Materials	Labor	Equipment		Total	Notes
Rubbish Handling										
Dumpster delivery (average for all sizes)	02220-350-0910	ea.			$55.00				$55.00	
Haul (average for all sizes)	02220-350-0920	ea.			$172.00				$172.00	
Rent per month (average for all sizes)	02220-350-0940	ea.			$58.50				$58.50	
Disposal fee per ton (tonne) (average for all sizes)	02220-350-0950	ton			$64.00				$64.00	
NOTES:										
Dumpster Cost Source	R.S. Means Heavy Construction (2023 Q2).									
Dumpster Disposal Fee Source:	R.S. Means Heavy Construction (2023 Q2).									
Hazardous Material Handling - Solids (+ Liquids in drums)										
Pickup fees 55 gal (200 L). drums	02110-300-1100	ea.			$244.00				$244.00	
Bulk material (average)	02110-300-1220/1230	ton			$396.50				$396.50	
Transport - truck load (80 drums, 25 cy (m3), 18 tons)	02110-300-1260/1270	mile			$5.72				$5.72	
Dump site solid disposal fee	02110-300-6000/6020	ton			$281.00				$281.00	
NOTES:										
Solid Handling Cost Source	R.S. Means Heavy Construction (2023 Q2).									
Solid Disposal Fee Source:	2023 Q2 R.S. Means Heavy Const. ave. 02 81									
Hazardous Material Handling - Liquids										
Vacuum Truck Pickup (2200 gal/8300 L)	02110-300-3110	hr.			$142.00				$142.00	
Vacuum Truck Pickup (5000 gal/19000 L)	02110-300-3120	hr.			$207.00				$207.00	
Dump site liquid disposal fee	02110-300-6000/6020	ton			$281.00				$281.00	
NOTES:										
Liquid Handling Cost Source	R.S. Means Heavy Construction (2023 Q2).									
Liquid Disposal Fee Source:	2023 Q2 R.S. Means Heavy Const. ave. 02 81									
Hydrocarbon Contaminated Soils (HCS)										
Insitu Biotreatment	02115-200-2020/2021	C.Y.			$19.10				$19.10	
HCS disposal fee	02115-200-2050/2055	C.Y.			$271.50				$271.50	
NOTES:										
Insitu Treatement Cost Source	2023 Q2 R.S. Means Heavy Const., ave. 02 65									
HCS Disposal Fee Source:	2023 Q2 R.S. Means Heavy Const., ave. 02 65									

Concrete Structure Installation

Weekly dumpster rental rates from Means Heavy Construction 2005 Edition with permission by R.S.Means/Reed Construction Data .
Weekly dumpster rental rates include haul to off-site disposal site and disposal fees

	Means Number	Unit	Crew	Daily Output	Materials	Labor	Equipment	Premium	Total	Notes
Reinforced Concrete Bulkheads and Shaft Covers										
Grade walls - 15 in (400mm) thick, 8 ft (2.5m) high	03310-240-4300	C.Y.	C-14D	80.02	$202.00	$201.03	$18.26		$421.29	includes reinforcing
Grade walls - 15 in (400mm) thick, 12 ft (3.7m) high	03310-240-4350	C.Y.	C-14D	26.2	$202.00	$613.99	$55.77		$871.76	includes reinforcing
Elevated conc, 1-way beam & slab - 15ft (4.6m) span	03310-240-2700	C.Y.	C-14B	20.59	$420.00	$801.73	$70.97		$1,292.70	includes reinforcing
Elevated conc, 1-way beam & slab - 25ft (7.5m) span	03310-240-2750	C.Y.	C-14B	28.36	$385.00	$582.07	$51.52		$1,018.59	includes reinforcing
Bat Gate/Foam Plug Installation										
Bat Gate (5)		ea.			$4,490.14					materials $/ea. Installed
Culvert Gate (5)		ea.			$8,980.28					materials $/ea. Installed
Adit Foam Plug (6)		ea./C.Y.			$449.01					materials $/cy placed
Production Opening Foam Plug (6)		ea./C.Y.			$449.01					materials $/cy placed
NOTES:										
(5) Bat Gate Source:	NV BLM, 2/2006: 8 hr + 1hr mob/demob + 1hr setup per gate (adjusted to 2023)									
(6) Foam Plug Source:	NV BLM, 2/2006: 8 hr+ 1hr mob/demob + 1hr setup per adit; 16 hrs per production opening (adjusted to 2023)									

Closure Cost Estimate
Misc. Unit Costs

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety Cost Basis: Southern Nevada

Misc. Linear Projects

Hourly productivity rates and crew composition from Means Heavy Construction 2005 Edition by permission of R.S.Means/Reed Construction Data .
All equipment, labor and material unit costs are from Labor Costs, Equipment Costs and Material Costs spreadsheets

	Means Number	Unit	Crew	Daily Output	Materials	Labor	Equipment	Premium	Total	Notes
Fencing Installation										
Barbed 3-strand	02820-170-1650	L.F.	B-80A	760	$0.54	$2.21	$0.56		$3.31	
Barbed 4-strand	extrapolated	L.F.	B-80A	570	$0.72	$2.95	$0.74		$4.41	
Barbed 5-strand	02820-130-0920	L.F.	B-80A	456	$0.90	$3.68	$0.93		$5.51	
Chain link 8-10ft (2.5-3m) Install	02820-130-0920	L.F.	B-80C	180	$43.00	$9.33	$2.35		$54.68	
Wood stockade fence 6 ft (2 m) high - Install	02820-510-1240	L.F.	B-80C	150	$15.70	$11.20	$2.83		$29.73	
	user	L.F.							$0.00	
	user	L.F.							$0.00	
	user	L.F.							$0.00	
	user	L.F.							$0.00	
Fencing Removal										
Barbed 3-strand Removal	02220-220-1600	L.F.	2 Clab	430		$2.60	$0.99		$3.59	
Barbed 4-strand Removal	extrapolated	L.F.	2 Clab	355		$3.15	$1.19		$4.34	
Barbed 5-strand Removal	02220-220-1650	L.F.	2 Clab	280		$4.00	$1.51		$5.51	
Chain link 8-10 ft (2.5-3 m) Removal	02220-220-1700	L.F.	B-6	445		$4.23	$1.29		$5.52	
Wood, all types 4-6 ft ("1.5-2 m) high - Removal	02220-220-1775	L.F.	2 Clab	430		$2.60	$0.99		$3.59	
	user	L.F.								
	user	L.F.							$0.00	
	user	L.F.							$0.00	
	user	L.F.							$0.00	
Culvert Removal										
12 in (300 mm) Diameter	02220-220-2900	L.F.	B-6	175		$10.75	$3.28		$14.03	
18 in (450 mm) Diameter	02220-220-2930	L.F.	B-6	150		$12.54	$3.83		$16.37	
24 in (600 mm) Diameter	02220-220-2960	L.F.	B-6	120		$15.67	$4.78		$20.45	
36 in (1m) Diameter	02220-220-3000	L.F.	B-6	90		$20.89	$6.38		$27.27	
Pipeline Removal										
0.75 in (20mm) - 4 in (100 mm) diameter	02220-381-1600	L.F.	B-20	700		$3.22	$0.61		$3.83	
6 in (150 mm) - 8 in (200 mm)	02220-381-1700	L.F.	B-20	500		$4.51	$0.85		$5.36	
10 in (250 mm) - 18 in (450 mm)	02220-381-1800	L.F.	B-20	300		$7.52	$1.41		$8.93	
20 in (500 mm) - 36 in (1 m)	02220-381-1900	L.F.	B-20	200		$11.28	$2.12		$13.40	
Pipe and Drainpipe Installation										
Water 4in (100mm) 40ft (12m) length, welded HDPE	02510-760-0100	L.F.	B-22A	400	$1.11	$8.01	$5.72		$14.84	
Water 6in (150mm) 40ft (12m) length, welded HDPE	02510-760-0200	L.F.	B-22A	380	$2.39	$8.43	$6.02		$16.84	
Water 12in (300mm) 40ft (12m) length, welded HDPE	02510-760-0500	L.F.	B-22A	260		$12.32	$8.80		$21.12	
Drain 4in (100mm) perforated PVC	02620-630-2100	L.F.	B-14	315	$4.18	$13.13	$2.41		$19.72	
Drain 6in (150mm) perforated PVC	02620-630-2110	L.F.	B-14	300	$9.90	$13.78	$2.53		$26.21	
Drain 4in (100mm) corrugated, perf or plain	02620-660-0040	L.F.	2 Clab	1200	$1.76	$0.93	$0.35		$3.04	
Drain 6in (150mm) corrugated., perf or plain	02620-660-0060	L.F.	2 Clab	900	$4.57	$1.24	$0.47		$6.28	
Drain Rock Preparation										
Crushing		C.Y.							$0.50	
Screening		C.Y.							$0.50	
TOTAL									$1.00	

Misc.

	Means Number	Unit	Crew	Daily Output	Materials	Labor	Equipment	Premium	Total	Notes
Backhoe work	02210-700-0120	C.Y.	B-11M	28		$27.16	$11.93		$39.09	
Powerline and Transformer Removal										
Single Pole		mile							$62,404.92	
Double Pole		mile							$71,319.91	
Transformer (9)		ea.							$78,663.08	

NOTES:

(7) Single Pole Source:	NV Energy estimate (2009) Adjusted to 2023
(8) Double Pole Source:	NV Energy estimate (2009) Adjusted to 2023
(9) Transformer Source:	NV Energy estimate (2018) adjusted to 2023

Erosion and Sedimentation Control

Hourly productivity rates and crew composition from Means Heavy Construction 2005 Edition by permission of R.S.Means/Reed Construction Data .
All equipment, labor and material unit costs are from Labor Costs, Equipment Costs and Material Costs spreadsheets

	Means Number	Unit	Crew	Daily Output	Materials	Labor	Equipment	Premium	Total	Notes
Rip-Rap & Rock Lining										
Rip-Rap 3/8 to 1/4 CY (m3) pieces, grouted	02370-450-0110	S.Y.	B-13	80	$16.95	$51.68	$30.92		$99.55	assumes on-site source of rip-rap
Rip-Rap 18 in (450 mm) min thick, no grout	02370-450-0200	S.Y.	B-13	53	$3.61	$78.01	$46.67		$128.29	assumes on-site source of rip-rap
Gabions, 6 in (150 mm) deep	02370-450-0400	S.Y.	B-13	200	$4.28	$20.67	$12.37		$37.32	assumes on-site source rock fill for gabions
Gabions, 9 in (250 mm) deep	02370-450-0500	S.Y.	B-13	163	$7.50	$25.36	$15.18		$48.04	assumes on-site source rock fill for gabions
Gabions, 12 in (300 mm) deep	02370-450-0200	S.Y.	B-13	153	$8.50	$27.02	$16.17		$51.69	assumes on-site source rock fill for gabions
Gabions, 18 in (450 mm) deep	02370-450-0200	S.Y.	B-13	102	$16.95	$40.53	$24.25		$81.73	assumes on-site source rock fill for gabions
Gabions, 36 in (1m) deep	02370-450-0200	S.Y.	B-13	60	$21.00	$68.91	$41.23		$131.14	assumes on-site source rock fill for gabions
HDEP Liner Installation										
Finish grading large area	2310-100-0100	S.F.	B-11L	18000		$0.07	$0.07		$0.14	
Compaction-riding, vibrating roller - 12in (300mm) lifts	2315-310-5100	C.Y.	B-10Y	2600		$0.51	$0.10		$0.61	
60 mil HDPE	2660-610-0010	S.F.	3 Skwk	1600	$1.01	$1.53	$0.46		$3.00	
80 mil HDPE	user	S.F.	3 Skwk	149		$16.42	$4.97		$21.39	
40 mil VLDPE	user	S.F.	3 Skwk	150		$16.31	$4.93		$21.24	
	user	S.F.	3 Skwk	149		$16.42	$4.97		$21.39	
	user	S.F.	3 Skwk	149		$16.42	$4.97		$21.39	

Construction Management Support

	Means Number	Unit	Crew	Daily Output	Materials	Labor	Equipment	Premium	Total	Notes
Office Trailer, Furnished, no hook-ups	0150-500-0250	mo.			$203.00				$203.00	
Toilet Portable, chemical	1590-400-6410	mo.			$230.80				$230.80	
TOTAL					$433.80				$433.80	

Pump and Casing Removal

Pump Type	Measurement	Unit				Labor	Equipment		Total	Notes
Pump Removal										
Submersible	ft to pump	L.F.				$14.32	$35.18		$49.50	
Line Shaft	ft to pump	L.F.				$14.32	$35.18		$49.50	

NOTES:

(10) Pump Removal Source:	Boart Longyear Quote: 2023

Closure Cost Estimate
Seed Mixture

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety Cost Basis: Southern Nevada

Seed Mixture

Common Name	Scientific Name	Species Number of Seeds / lb	Species % in Mix	PLS/acre	Cost/Lb	Cost/Acre
Grasses						
Ephraim Crested Wheatgrass	*Agropyron Cristatum var. Ephraim*					
Thickspike Wheatgrass	*Agropyron dasystrachyum*	154,000	4.40	1.24		
Bluebunch Wheatgrass	*Agropyron spicatum*	117,000	23.42	8.65		
Great Basin Wildrye	*Elymus cinereus*	95,000	8.15	6.18		
Big Bluegrass	*Poa ampla*	917,000	13.11	0.62		
Indian Ricegrass	*Oryzopsis hymenoides*	188,000	5.38	1.24		
Sandberg Bluegrass	*Poa secunda*	925,000	13.23	0.62		
Forbs						
Blue Flax				0.62		
Small Burnet	*Sanguisorba minor*	55,000	1.57	1.24		
Forage Kochia	*Kochia prostrata var. Immigrant*	407,700	2.33	0.25		
Palmer Penstemon	*Penstemon palmeri*	610,000	3.49	0.25		
Shrubs						
Fourwing Saltbush	*Atriplex canescens*	52,000	5.95	1.85		
Antelope Bitterbrush	*Purshia tridentate*	15,000	0.43	2.47		
Winterfat	*Eurotia lanata*	111,000	1.59	0.62		
Wyoming Big Sagebrush	*Artemesia tridentata wyomingensis*	2,500,000	7.15	0.12		
Total				$25.97		$0.00

Source:

Notes:

Closure Cost Estimate
User 1

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety   Cost Basis: Southern Nevada

MOBILIZATION AND DEMOBILIZATION

	Miles from equipment rental yard to project, one way (9)								75
Hermosa Project Tailings Storage Facility 1 (TSF1)						Hours travel time @ 55 MPH			1.36
Equipment	Mobilization $/hour (1)	$ Flat Rate load & unload (2)	$/hour Deadhead (empty return cost (3)	Disassembly and assembly (4)	Permit cost $ (5)	Pilot car costs	# of units	One Way Mob Cost	Total Mob and Demob Cost
Bulldozers									
D6R	$ 123	$ 123	$ 123	$ -	$ -	$ -		$ -	$ -
D7R	$ 160	$ 160	$ 160	$ -	$ 25	$ 162		$ -	$ -
D8R	$ 187	$ 187	$ 187	$ -	$ 25	$ 324	1	$ 911	$ 1,821
D9R	$ 187	$ 187	$ 187	$ -	$ 25	$ 324	1	$ 911	$ 1,821
D10R	$ 187	$ 187	$ 187	$ 80,441	$ 25	$ 486		$ -	$ -
D11R (two transports) (7)	$ 187	$ 187	$ 187	$ 171,334	$ 25	$ 486		$ -	$ -
Motor Graders									
14G/H	$ 123	$ 123	$ 123	$ -	$ -	$ -	15	$ 5,522	$ 11,044
16G/H	$ 160	$ 160	$ 160	$ -	$ 25	$ 162		$ -	$ -
Track Excavators									
320C	$ 160	$ 160	$ 160	$ -	$ -	$ -		$ -	$ -
325C	$ 160	$ 160	$ 160	$ -	$ -	$ -		$ -	$ -
345B	$ 187	$ 187	$ 187	$ -	$ 25	$ 324	1	$ 911	$ 1,821
385BL	$ 187	$ 187	$ 187	$ 56,657	$ 25	$ 324		$ -	$ -
Scrapers									
631G	$ 187	$ 187	$ 187	$ -	$ 25	$ 324		$ -	$ -
637G PP	$ 187	$ 187	$ 187	$ -	$ 25	$ 324		$ -	$ -
Wheeled Loaders									
928G	$ 123	$ 123	$ 123	$ -	$ -	$ -		$ -	$ -
966G	$ 123	$ 123	$ 123	$ -	$ -	$ -	2	$ 736	$ 1,472
972G	$ 160	$ 160	$ 160	$ -	$ -	$ -		$ -	$ -
988G	$ 160	$ 160	$ 160	$ -	$ 25	$ 162	2	$ 1,332	$ 2,663
992G (two transports) (7)	$ 187	$ 187	$ 187	$ 93,620	$ 25	$ 324		$ -	$ -
Hydraulic Hammers									
H-120 (fits 325) no charge, mobilize with machine	$ -	$ -	$ -	$ -	$ -	$ -		$ -	$ -
H-160 (fits 345) no charge, mobilize with machine	$ -	$ -	$ -	$ -	$ -	$ -		$ -	$ -
H-180 (fits 365/385) no charge, mobilize with machine	$ -	$ -	$ -	$ -	$ -	$ -		$ -	$ -
Other Equipment									
420D 4WD Backhoe	$ 123	$ 123	$ 123	$ -	$ -	$ -		$ -	$ -
CS533E Vibratory Roller	$ 123	$ 123	$ 123	$ -	$ -	$ -	1	$ 368	$ 736
Light Truck - 1.5 Ton	$ 84	$ 84	$ -	$ -	$ -	$ -		$ -	$ -
Supervisor's Truck	$ 73	$ 73	$ -	$ -	$ -	$ -	1	$ 146	$ 292
Air Compressor + tools	$ 94	$ 94	$ 94	$ -	$ -	$ -		$ -	$ -
Welding Equipment	$ 94	$ 94	$ 94	$ -	$ -	$ -		$ -	$ -
Heavy Duty Drill Rig	$ 501	$ 501	$ -	$ -	$ -	$ -	1	$ 1,002	$ 2,005
Pump (plugging) Drill Rig	$ 501	$ 501	$ -	$ -	$ -	$ -		$ -	$ -
Concrete Pump	$ 94	$ 94	$ 94	$ -	$ -	$ -		$ -	$ -
Gas Engine Vibrator	$ 94	$ 94	$ 94	$ -	$ -	$ -		$ -	$ -
Generator 5KW	$ 94	$ 94	$ 94	$ -	$ -	$ -		$ -	$ -
HDEP Welder (pipe or liner)	$ 94	$ 94	$ 94	$ -	$ -	$ -		$ -	$ -
5 Ton Crane Truck	$ 135	$ 135	$ -	$ -	$ -	$ -		$ -	$ -
20 Ton Crane	$ 184	$ 184	$ -	$ -	$ -	$ -	1	$ 369	$ 737
Trucks									
725	$ 123	$ 123	$ 123	$ -	$ -	$ -		$ -	$ -
740	$ 160	$ 160	$ 160	$ -	$ 25	$ 162	5	$ 3,329	$ 6,658
769D	$ 160	$ 160	$ 160	$ -	$ 25	$ 324		$ -	$ -
777D (two transports) (8)	$ 187	$ 187	$ 187	$ 89,985	$ 25	$ 486		$ -	$ -
613E (5,000 gal) Water Wagon	$ 187	$ 187	$ 187	$ -	$ -	$ -		$ -	$ -
621E (8,000 gal) Water Wagon	$ 187	$ 187	$ 187	$ -	$ 25	$ 324	15	$ 13,659	$ 27,319
Dump Truck (10-12 yd3)	$ 140	$ 140	$ 140	$ -	$ -	$ -		$ -	$ -
Miscellaneous									
Equipment for dry hole abandonment (420D 4WD Backhoe)	$ 123	$ 123	$ 123	$ -	$ -	$ -		$ -	$ -
Pilot car (Light Truck)	$ 73	$ 73	$ 73	$ -	$ -	$ -		$ -	$ -
Truck Tractor + Lowbed Trailer 75 ton	$ 187	$ 187	$ 187	$ -	$ -	$ -		$ -	$ -
Truck Tractor + Flatbed Trailer 40 ton	$ 160	$ 160	$ 160	$ -	$ -	$ -		$ -	$ -
Light Truck + Flatbed Trailer 25 ton	$ 94	$ 94	$ 94	$ -	$ -	$ -		$ -	$ -
							46		**$ 58,390**

Footnotes and explanations of assumptions
(1) The sum of the cost of equipment from either the SRCE or RSM equipment tab plus Davis-Bacon labor tab
(2) Assumes minimum of 30 minutes load and secure and 30 minutes unsecure and unload machine.
(3) No "Deadhead" (empty) charge for Mob up to 50 miles. More than 50 miles the cost of deadhead same rate as loaded miles.
(4) Only large equipment requires disassembly for transport. Includes cost of mechanic + mechanic's truck + crane operator + crane.
(5) Nevada Dept. of Transportation overdimensional permits are $25 per trip or $60 per year. 9/7/2023
(6) Sum of mobilization plus all ancillary costs for one way loaded and return empty.
(7) Two transports are required but the second transport does not need pilot cars or permits or a heavy duty trailer.
(8) Two transports required with both requiring full complement of pilot cars and permits.
(9) For large mining operations, mobilization may be required from more than one location. For example, the Elko yard may not have four 631 scrapers.
Additional equipment may need to mobilize from Reno, Las Vegas, or Salt Lake City. Input the further distance here.
(10) Pilot Car costs based on SRCE light truck costs and Davis-Bacon wages
(11) SRCE costs based on July 2023 vendor quotes.
(12) RS Means costs based on R.S. Means Heavy Construction Cost Data, 2019, Q2 escalated to 2023 Q3 using USBR Historic Cost Composite Trends
(13) Davis Bacon wages based on 2023 determination.

Closure Cost Estimate
User 2

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety Cost Basis: Southern Nevada

EQUIPMENT UTILIZATION

SRCE Tab	Dozers		Excavators	Trucks	Loaders		Water Wagons	Motor Graders	Compactor	Cranes	Largest No. of trucks
	D8R	D9R	345B	740	966G	988G	621E	14G	CS533	20-ton	
Exploration											
Expl. Roads & Pads											
Waste Rock Dumps	304	11	0	1,520	0	304	0	0	0	0	5
Heap Leach											
Tailings											
Roads	0	8	0	0	0	0	0	0	0	0	0
Pits											
Quarries & Borrow Pits											
Underdground Openings											
Haul Material	166	0	0	646	0.00	166	0	0	166	0	5
Foundations & Buildings											
Other Demo & Equip Removal											
Sediment & Drainage Control	0	0	15	0	0	0	0	0	0	0	0
Process Ponds											
E-Cell Cost Estimator											
Landfills											
Yards, Etc.											
Waste Disposal											
Well Abandonment[2]											
Misc. Cost											
Monitoring											
Constr. Mgmt[1]	0	0	0	0	0	0	960	960	0	0	0
User 5	0	0	814	1,221	613	1,632	0	0	0	897	3
User 6	3	0	56	31	82	19	0	0	3	82	3
User 7	0	0	179	0	358	0	0	0	0	175	0
User 8	0	0	0	0	36	0	0	0	0	0	0
Hours	473	19	1,065	3,418	1,089	2,121	960	960	169	1,154	5
Number of units	1	1	1	4	2	2	1	1	1	1	
Weeks for specified fleets	12	1	27	22	14	27	24	24	5	29	
Months for specified fleets	3	0	6	5	3	6	6	6	1	7	

1. Large Water Truck (621E 8,000gal) and 14G/H required for road maintenance during construction.
2. Heavy duty drill rig included for Well Abandonment.
3. Tabs that are shaded gray do not have equipment fleet costs associated with them.

Closure Cost Estimate
User 3

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety **Cost Basis: Southern Nevada**

SEED MIXTURE

Quote provided by AZ Revegetation 7/25/2022

Supply		
Quoted Cost	$19,835	
Quantity Quoted	8	acres
Cost/Acre	**$2,479**	**$/acre**

Arizona Revegetation & Monitoring Co.
217 Lyle Canyon Rd, Elgin Az. 85611
520-455-5780
jim@azreveg.com

Invoice – Rummel Construction Co. – Hydroseeding Supplies – South 32 Patagonia –
PO # PA92150-13

Materials for 8 acres including:

320 lbs. South 32 Seed M ix	@ $29.50	= $ 9440.00
24 Bags Tackifier	@ $79.00	= $ 1896.00
320 Bales Of Hydrostraw	@ $ 22.75	= $ 7280.00
		$18,616.00

Delivery N/C
Delivery completed 7/25/22

Total $18,606.00
Tax 1,228.56
$19,834.56

Total Due $19,834.56

Thank You

Jim Koweek 7/25/22

Invoice due upon receipt.

Closure Cost Estimate
User 4

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety **Cost Basis: Southern Nevada**

WATER SAMPLE ANALYSIS
Quote provided by ACZ Laboratories, Inc 9/6/2023

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Analytical Quote

Kara Haas
South32
749 Harshaw Rd
Patagonia, AZ 85624

Page 1 of 3
9/6/2023

Quote Number: POC-2-SEMI-ANN

Matrix: Groundwater POC-2 Semi-Annual Suite

Parameter	Method	Detection Limit	Cost/Sample
Diskette/QC Summary			
Quality Control Summary			$0.00
Metals Analysis			
Antimony, dissolved	M200.8 ICP-MS	0.0004 mg/L	$17.04
Arsenic, dissolved	M200.8 ICP-MS	0.0002 mg/L	$17.04
Barium, dissolved	M200.7 ICP	0.009 mg/L	$9.04
Beryllium, dissolved	M200.8 ICP-MS	0.00008 mg/L	$17.04
Cadmium, dissolved	M200.8 ICP-MS	0.00005 mg/L	$17.04
Chromium, dissolved	M200.8 ICP-MS	0.0005 mg/L	$17.04
Copper, dissolved	M200.8 ICP-MS	0.0008 mg/L	$17.04
Iron, dissolved	M200.7 ICP	0.06 mg/L	$9.04
Lead, dissolved	M200.8 ICP-MS	0.0001 mg/L	$17.04
Manganese, dissolved	M200.7 ICP	0.01 mg/L	$9.04
Mercury, dissolved	M245.1 CVAA	0.0002 mg/L	$22.08
Nickel, dissolved	M200.7 ICP	0.008 mg/L	$9.04
Selenium, dissolved	M200.8 ICP-MS	0.0001 mg/L	$17.04
Thallium, dissolved	M200.8 ICP-MS	0.0001 mg/L	$17.04
Zinc, dissolved	M200.7 ICP	0.02 mg/L	$9.04
Misc.			
Electronic Data Deliverable			$0.00
Radiochemistry			
Combined Radium (total)	Calculation (RA226 + RA228)	2	$0.00
Gross Alpha Total, corrected	Calculation	2	$0.00
Gross Alpha, total	M900.0	2 pCi/L	$54.00
Radium 226 + Alpha Emitting Radium Isotope	M903.0	1 pCi/L	$83.20
Radium 228, total	M904.0	1.5 pCi/L	$99.20
Uranium, Isotopic Total	Eichrom ACW03	1 pCi/L	$114.88
Wet Chemistry			
Alkalinity as CaCO3	SM2320B - Titration	2 mg/L	$11.76
Conductivity @25C	SM2510B	1 umhos/cm	$8.00
Cyanide, Free	D6888-09/OIA-1677-09	0.003 mg/L	$33.84
Fluoride	SM4500F-C	0.15 mg/L	$10.96
Nitrate as N	Calculation: NO3NO2 minus NO2	Calculation	$0.00

REPAD.09.06.05.01 S/ tjv D/ 21 P/

Closure Cost Estimate
User 4

ACZ Laboratories, Inc.

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Analytical Quote

Kara Haas
South32
749 Harshaw Rd
Patagonia, AZ 85624

9/6/2023

Nitrate/Nitrite as N	M353.2 - Automated Cadmium Redu	0.02 mg/L	$10.96
Nitrite as N	M353.2 - Automated Cadmium Redu	0.01 mg/L	$10.96
pH (lab)	SM4500H+ B	0.1 C	$8.00
Residue, Filterable (TDS) @180C	SM2540C	20 mg/L	$14.08
Sulfate	D516-02/-07/-11 - TURBIDIMETRIC	1 mg/L	$10.96
		Cost/Sample:	**$691.44**

Closure Cost Estimate
User 5

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety Cost Basis: Southern Nevada

RIPRAP - PROCESS AND PLACE

Quantities

Closure Channel Riprap

Riprap Size (D_{50})	Station Range	Length (ft)	Cross Sectional Area (sf)	Volume (cf)	Volume (cy)
6"	2650 to 3400	750	37	27,750	**1,028**
	3535 to 3800	265	37	9,805	**363**
	3900 to 4300	400	37	14,800	**548**
12"	0 to 50	50	80	3,989	**148**
	1800 to 2300	500	80	39,890	**1,477**
	5220 to 5650	430	80	34,305	**1,271**
18"	50 to 1100	1050	104	109,295	**4,048**
	1200 to 1800	600	104	62,454	**2,313**
	2300 to 2650	350	104	36,432	**1,349**
	3400 to 3535	135	104	14,052	**520**
	3800 to 3900	100	104	10,409	**386**
	4300 to 4425	125	104	13,011	**482**
24"	1100 to 1200	100	140	13,955	**517**
	4425 to 5220	795	140	110,942	**4,109**

Culvert Riprap Apron- East Culverts

Riprap Size (D_{50})	Depth (ft)	Width (ft)	Length (ft)	Volume (cf)	Volume (cy)
18"	3	33	30	2,970	**110**

Closure Spillway- Active Closure

Riprap Size (D_{50})	Depth (ft)	Area (sf)	Volume (cf)	Volume (cy)
12" Grouted	2	8,641	17,282	**640**

Total Quantities

Riprap Size (D_{50})	Volume (cy)
6"	1,939
12"	2,896
18"	9,208
24"	4,626
12" Grouted	640

Produce Riprap From Non-PAG Waste Rock Stockpile

Assume raw material Produced From existing Non-PAG Waste Rock Stockpile		
Quantity	1	CY
Allowance for Overbuild and Wastage (15%)	0.15	
Unit Quantity With Allowance	1.15	CY
Assumed Quarried Cost (Feed Material Provided b	$0.00	$/CY
Production:		
Bucket Capacity Heaped (cy)	8.3	
Bucket Fill Factor	0.75	
Corrected Bucket Payload	6.2	CY
Cycle Time (min)	1.0	
Loader Uncorrected Hourly Production	373.5	CY/HR
Job Efficiency	0.67	
Operator Skill	0.85	
Machine Availability	0.90	
Overbuild/Wastage Allowance	10.0%	
Loader Corrected Hourly Production	171.4	CY/HR
Waste Product (riprap) - D_{50}=6"	50.0%	Usable Product
Waste Product (riprap) - D_{50}=12"	40.0%	Usable Product
Waste Product (riprap) - D_{50}=18"	20.0%	Usable Product
Waste Product (riprap) - D_{50}=24"	10.0%	Usable Product
Usable Product (riprap) - D_{50}=6"	85.7	CY/HR
Usable Product (riprap) - D_{50}=12"	68.6	CY/HR
Usable Product (riprap) - D_{50}=18"	34.3	CY/HR
Usable Product (riprap) - D_{50}=24"	17.1	CY/HR

Closure Cost Estimate
User 5

Equipment	Equip Rate	Labor Rate	Quantity	Usage	Total Cost/Hr
20-ton Crane (Only D_{50}=18" & 24")	$ 309.20	$ 95.07	1.0	100%	$ 404.27
CAT 988 Loader	$ 257.24	$ 94.44	2.0	100%	$ 703.36
Bar screen	$ 25.00		2.0	100%	$ 50.00
966 Loader	$ 131.09	$ 94.44	1.0	100%	$ 225.53
Laborer		$ 69.99	3.0	100%	$ 209.97
Foreman		$ 141.77	1.0	50%	$ 70.89
Pickup	$ 29.11		1.0	50%	$ 14.56
	Equip ($/Unit)	**Labor ($/Unit)**		Fleet Cost/Hr	$ 1,274.30
6"	$ 8.28	$ 6.58		**Unit Production Cost/CY D_{50}=6" Riprap**	**$ 14.87**
12"	$ 10.36	$ 8.23		**Unit Production Cost/CY D_{50} =12" Riprap**	**$ 18.58**
18"	$ 29.73	$ 19.23		**Unit Production Cost/CY D_{50} =18" Riprap**	**$ 48.96**
24"	$ 59.46	$ 38.45		**Unit Production Cost/CY D_{50} =24" Riprap**	**$ 97.91**

Production:

Assumed CY/HR D_{50}=6" riprap	175	CY/HR
Assumed CY/HR D_{50}=12" riprap	95	CY/HR
Assumed CY/HR D_{50}=18" riprap	45	CY/HR
Assumed CY/HR D_{50}=24" riprap	30	CY/HR

Equipment	Equip ($/Unit)	Labor ($/Unit)	Quantity	Usage	Total Cost/Hr
20-ton Crane (Only D_{50}=18" & 24")	$ 309.20	$ 95.07	1.0	100%	$ 404.27
CAT 988 Loader	$ 257.24	$ 94.44	1.0	100%	$ 351.68
CAT 345 Excavator	$ 161.04	$ 94.90	2.0	100%	$ 511.88
740	$ 183.40	$ 73.67	3.0	100%	$ 771.21
621 Water Wagon	$ 135.33	$ 73.67	0.0	50%	$ -
14 Motor Grader	$ 168.18	$ 94.44	0.0	50%	$ -
Laborer	$ -	$ 69.99	5.0	100%	$ 349.95
Foreman	$ -	$ 141.77	1.0	50%	$ 70.89
Pickup	$ 29.11	$ -	1.0	50%	$ 14.56
Survey	$ 29.11	$ 152.23	1.0	15%	$ 27.20
	Equip ($/Unit)	**Labor ($/Unit)**		Fleet Cost/Hr	$ 2,097.36
6"	$ 6.56	$ 5.42		**Unit Placement Cost/CY D_{50}=6" Riprap**	**$ 11.98**
12"	$ 12.09	$ 9.99		**Unit Placement Cost/CY D_{50} =12" Riprap**	**$ 22.08**
18"	$ 32.39	$ 23.20		**Unit Placement Cost/CY D_{50} =18" Riprap**	**$ 55.59**
24"	$ 48.59	$ 34.80		**Unit Placement Cost/CY D_{50} =24" Riprap**	**$ 83.39**
	Equip ($/Unit)	**Labor ($/Unit)**			
6"	$ 14.85	$ 12.00		**Total Unit Cost/CY D_{50}=6" Riprap**	**$ 26.85**
12"	$ 22.44	$ 18.22		**Total Unit Cost/CY D_{50}=12" Riprap**	**$ 40.66**
18"	$ 62.12	$ 42.43		**Total Unit Cost/CY D_{50}=18" Riprap**	**$ 104.55**
24"	$ 108.05	$ 73.25		**Total Unit Cost/CY D_{50}=24" Riprap**	**$ 181.30**

Grouted Riprap

Supply Cost (Assumed Same Cost as Concrete from On-site Batch Plant from Flour)	**$260.00**	$/cy
Assumed Void Ratio	0.40	
Wastage	0.10	
Grout Thickness to Riprap Thickness	0.67	
12" Grouted Riprap	0.29	cy grout/cy riprap
18" Grouted Riprap	0.44	cy
24" Grouted Riprap	0.59	cy
Grout Placement Rate	**10**	**cy/hr**

Equipment	Equip Rate	Labor Rate	Quantity	Usage	Total Cost/Hr
Laborer		$ 69.99	3.0	100%	$ 209.97
Grout Pump	$ 145.80		1.0	100%	$ 145.80
Foreman		$ 141.77	1.0	50%	$ 70.89
Pickup	$ 29.11		1.0	50%	$ 14.56
Survey	$ 29.11	$ 152.23	1.0	10%	$ 18.13
	Equip ($/Unit)	**Labor ($/Unit)**		Fleet Cost/Hr	$ 459.34
	$ 16.33	$ 29.61		**Unit Cost/CY**	**$ 45.93**
				Total Cost/CY	**$305.93**

Material ($/Unit)	Equip ($/Unit)	Labor ($/Unit)		
$ 76.65	$ 27.26	$ 26.94	**Total Unit Cost/CY D=12" Grouted Riprap**	**$ 130.85**
$ 114.97	$ 69.34	$ 55.52	**Total Unit Cost/CY D=18" Grouted Riprap**	**$ 239.83**
$ 153.30	$ 117.67	$ 90.71	**Total Unit Cost/CY D=24" Grouted Riprap**	**$ 361.68**

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety **Cost Basis: Southern Nevada**

SPILLWAY CULVERTS (ACTIVE CLOSURE)

Quantities

Item	West 42" Dia CPe Culverts	East 36" Dia CPe Culverts
Culvert Length (ft):	82	1101
Number of culverts	3	2
Total Length (ft)	**246**	**2202**
Pipe Bedding Volume:		
Cross section area (sf)	25.2	13.95
Pipe bedding per linear foot of culvert (cy/ft)	**0.93**	**0.52**
Pipe Backfill Volume:		
Cross section area (sf)	72.3	48
Pipe backfill per linear foot of culvert (cy/ft)	**2.68**	**1.78**
Random Fill Volume:		
Cross section area (sf)	30.3	22.5
Random fill per linear foot of culvert (cy/ft)	**1.12**	**0.83**
Excavation Volume:		
Cross section area (sf)	156.3	98.7
Excavated volume per linear foot of culvert (cy/ft)	**5.79**	**3.66**

	Quantity	Material Cost	Equip Cost	Labor Cost	Total Cost
	Unit/ft	**$/ft**	**$/ft**	**$/ft**	**$/ft**
42 inch CPe	3.00	$ 333.90	$ 52.95	$ 42.06	$ 428.92
Pipe Bedding	0.93	$ 16.12	$ 1.63	$ 1.59	$ 19.34
Pipe Backfill	2.68	$ -	$ 12.01	$ 12.09	$ 24.10
Random Fill	1.12	$ -	$ 3.64	$ 2.52	$ 6.16
Excavation	5.79	$ -	$ 2.72	$ 2.41	$ 5.13
	Total	**$ 350.02**	**$ 72.96**	**$ 60.67**	**$ 483.65**

	Quantity	Material Cost	Equip Cost	Labor Cost	Total Cost
	Unit/ft	$/ft	$/ft	$/ft	$/ft
36 inch CPe	2.00	$ 120.71	$ 35.30	$ 28.04	$ 184.06
Pipe Bedding	0.52	$ 8.93	$ 0.90	$ 0.88	$ 10.71
Pipe Backfill	1.78	$ -	$ 7.98	$ 8.03	$ 16.00
Random Fill	0.83	$ -	$ 2.70	$ 1.87	$ 4.58
Excavation	3.66	$ -	$ 1.72	$ 1.52	$ 3.24
	Total	**$ 129.64**	**$ 48.61**	**$ 40.34**	**$ 218.60**

Unit Rate - 42 inch Diameter CPe Culvert

Supply (Quote recv from ISCO in February 2023)

Item	Unit	Price/Unit	Freight/Unit	Tax/Unit	Total Price / Unit
42 inch diameter CPE culvert	ft	104.41	FOB	6.89	111.30

42 inch CPe - Install
Installation Rate **60.00 ft/hr**
Installation Fleet Hours **4.10 hr**

Equipment	Equip Rate	Operator	Quantity	Usage	Equip Cost/Hr	Labor Cost/Hr	Total Cost/Hr
20 Ton Crane	$ 309.20	$ 95.07	2.0	100%	$ 618.40	$ 190.14	$ 808.54
966G	$ 131.09	$ 95.07	2.0	100%	$ 262.18	$ 190.14	$ 452.32
345B	$ 161.04	$ 94.90	1.0	100%	$ 161.04	$ 94.90	$ 255.94
General Laborer		$ 69.99	4.0	100%	$ -	$ 279.96	$ 279.96
Foreman	$ 29.11	$ 141.77	1.0	50%	$ 14.56	$ 70.89	$ 85.44
Survey	$ 29.11	$ 152.23	1.0	10%	$ 2.91	$ 15.22	$ 18.13
						Material Unit Cost ($/ft)	**$ 111.30**
						Labor Unit Cost ($/ft)	**$ 14.02**
						Equipment/Operating Unit Cost ($/ft)	**$ 17.65**
						Total Capital Cost ($/ft)	**$ 142.97**

Unit Rate - 36 inch Diameter CPe Culvert

Supply (Quote recv from ISCO in February 2023)

Item	Unit	Price/Unit	Freight/Unit	Tax/Unit	Total Price / Unit
36 inch diameter CPE culvert	ft	56.62	FOB	3.74	60.36

36 inch CPe - Install
Installation Rate **60.00 ft/hr**
Installation Fleet Hours **36.70 hr**

Equipment	Equip Rate	Operator	Quantity	Usage	Equip Cost/Hr	Labor Cost/Hr	Total Cost/Hr
20 Ton Crane	$ 309.20	$ 95.07	2.0	100%	$ 618.40	$ 190.14	$ 808.54
966G	$ 131.09	$ 95.07	2.0	100%	$ 262.18	$ 190.14	$ 452.32
345B	$ 161.04	$ 94.90	1.0	100%	$ 161.04	$ 94.90	$ 255.94
General Laborer		$ 69.99	4.0	100%	$ -	$ 279.96	$ 279.96
Foreman	$ 29.11	$ 141.77	1.0	50%	$ 14.56	$ 70.89	$ 85.44
Survey	$ 29.11	$ 152.23	1.0	10%	$ 2.91	$ 15.22	$ 18.13
						Material Unit Cost ($/ft)	**$ 60.36**
						Labor Unit Cost ($/ft)	**$ 14.02**
						Equipment/Operating Unit Cost ($/ft)	**$ 17.65**
						Total Capital Cost ($/ft)	**$ 92.03**

Unit Rate - Pipe Bedding
Process and Place

Processing

Drilling and Blasting	$ -	$/ton	
Haulage to Stockpile	$ 3.50	$/ton	Estimated
Allowance for overbuild and wastage	10%		
Feed Material Cost	$ 3.85	$/ton	
Cost/ton to process	$ 5.75	$/ton	
Allowance for crushing and screening reject	30%		
Stockpiling loss	5%		
Gradation Factor	0%		
Allowance for overbuild and wastage of finish product	5%		
Size-ratio requirements	5%		
Processing Cost	$ 8.65	$/ton	
Conversion factor (ton to cubic yard)	1.55	t/cy	
Processing Cost /CY	**17.28**	**$/cy**	

Placement
Infrastructure Pad area to TSF
Assumptions:

Average One Way Haul Distance	3,500	ft
Haul Speed Limit	25	mph

Loader (Estimated Production)

Bucket Capacity (Heaped)	8.30	cy
Bucket Fill Factor	0.75	
Corrected Bucket Payload for Bank	6.23	cy
Average Cycle Time	0.85	min
First Dump	0.10	min
Truck Maneuver time	0.70	min
Truck Capacity (Heaped)	29.70	cy
Dumps per Truck	4.00	
Truck Payload	24.90	cy
Time to Load Truck	3.35	min
Loader Uncorrected Hourly Production	445.97	cy/hr
Job Efficiency	0.83	
Operator Skill	0.85	
Machine Availability	0.90	
Loader Corrected Hourly Production	284.31	cy/hr
Trucks Loaded/Hour	11.42	

Estimated Number Trucks/ Loading Unit

Truck Waiting Time	1.00	min
Truck Maneuver time	0.70	min
Truck travel time loaded	1.59	min
Truck travel time empty	1.59	min
Dump time	1.00	min
Total Truck Cycle Time	8.53	min
Trips/Hour (Assumes 50 Operating Minutes)	5.86	min
Number Trucks (Assuming Available 50min/hr)	3.00	
Total Fleet Hours	**0.27**	**hr**

Closure Cost Estimate
User 6

Equipment	Equip Rate	Operator	Quantity	Usage	Equip Cost/Hr	Labor Cost/Hr	Total Cost/Hr
988G	$ 257.24	$ 94.44	1.0	50%	$ 128.62	$ 47.22	$ 175.84
740	$ 183.40	$ 73.67	3.0	50%	$ 275.10	$ 110.51	$ 385.61
621 Water Wagon	$ 135.33	$ 73.67	0.0	100%	$ -	$ -	$ -
14G/H	$ 168.18	$ 94.44	0.0	100%	$ -	$ -	$ -
Laborer with Skid Steer	$ 50.00	$ 69.99	1.0	100%	$ 50.00	$ 69.99	$ 119.99
Laborer with Jumping Jack	$ 10.25	$ 69.99	2.0	100%	$ 20.50	$ 139.98	$ 160.48
Foreman	$ 29.11	$ 141.77	1.0	50%	$ 14.56	$ 70.89	$ 85.44
Survey	$ 29.11	$ 152.23	1.0	30%	$ 8.73	$ 45.67	$ 54.40
						Material Unit Cost ($/cy)	**$ 17.28**
						Labor Unit Cost ($/cy)	**$ 1.70**
						Equipment/Operating Unit Cost ($/cy)	**$ 1.75**
						Total Capital Cost ($/cy)	**$ 20.74**

Unit Rate - Pipe Backfill
Process and Place

Process
Material removed from trench stockpiled near excavation for pipe backfill placement

Placement

Bucket Size	5.0	cy
Travel Time - 820 feet	0.5	min
Dump and Maneuver	0.35	min
Load and Maneuver	0.45	min
Trips per Hour	46.2	
Loader Productivity	230.8	cy/hr
Machine Availability	0.90	
Job Efficiency	0.83	
Operator Experience	0.85	
Material Weight	0.85	
Corrected Productivity	125.0	cy/hr
Total Fleet Hours	**1.76**	**hr**

Equipment	Equip Rate	Operator	Quantity	Usage	Equip Cost/Hr	Labor Cost/Hr	Total Cost/Hr
988G	$ 257.24	$ 94.44	1	100%	$ 257.24	$ 94.44	$ 351.68
740	$ 183.40	$ 73.67	1	100%	$ 183.40	$ 73.67	$ 257.07
621 Water Wagon	$ 135.33	$ 73.67	0.0	100%	$ -	$ -	$ -
14G/H	$ 168.18	$ 94.44	0.0	20%	$ -	$ -	$ -
Laborer with Skid Steer	$ 50.00	$ 69.99	2.0	100%	$ 100.00	$ 139.98	$ 239.98
Laborer with Jumping Jack	$ 10.25	$ 69.99	2.0	100%	$ 20.50	$ 139.98	$ 160.48
Foreman	$ 29.11	$ 141.77	1.0	50%	$ 14.56	$ 70.89	$ 85.44
Survey	$ 29.11	$ 152.23	1.0	30%	$ 8.73	$ 45.67	$ 54.40
						Material Unit Cost ($/cy)	$ -
						Labor Unit Cost ($/cy)	$ 4.52
						Equipment Unit Cost ($/cy)	$ 4.49
						Total Captial Cost ($/cy)	$ 9.00

Unit Rate - Random Fill
Load, Haul, Stockpile, and Place

Average one way haul distance	3000	ft
Haul speed limit	25	mph

Load

Bucket Capacity	6	cy
Bucket fill factor	0.85	
Corrected bucket payload	5.1	cy
Cycle time	0.5	min
First Dump	0.1	min
Truck Manuever Time	0.45	min
Truck capacity	29.7	cy
Dumps per truck	5	
Truck payload	25.5	cy
Time to load truck	2.55	min
Loader Uncorrected Production	600.00	cy/hr
Job Efficiency	0.67	
Operator Skill	0.85	
Machine Availability	0.90	
Loader Corrected Production	306.00	cy/hr
Trucks Loaded/hour	12.00	

Haul

Truck Waiting Time	1	min
Truck travel time loaded	1.14	min
Dump time	1	min
Total Truck Cycle Time	6.82	min
Trips/Hour (assumes 50 operating minutes)	7.33	min
Number of Trucks	3	

Total Fleet Hours **0.30 hr**

Equipment	Equip Rate	Operator	Quantity	Usage	Equip Cost/hr	Labor Cost/hr	Total Cost/hr
345B	$ 161.04	$ 94.90	1	100%	$ 161.04	$ 94.90	$ 255.94
740	$ 183.40	$ 73.67	3	100%	$ 550.20	$ 221.01	$ 771.21
621 Water Wagon	$ 135.33	$ 73.67	0	100%	$ -	$ -	$ -
14G/H	$ 168.18	$ 94.44	0	100%	$ -	$ -	$ -
D8R	$ 212.16	$ 95.07	1	100%	$ 212.16	$ 95.07	$ 307.23
CS533E Vibratory Roller	$ 33.09	$ 95.07	1	100%	$ 33.09	$ 95.07	$ 128.16
Foreman	$ 29.11	$ 141.77	1	75%	$ 21.83	$ 106.33	$ 128.16
Survey	$ 29.11	$ 152.23	1	50%	$ 14.56	$ 76.12	$ 90.67
						Material Unit Cost ($/cy)	**$ -**
						Labor Unit Cost ($/cy)	**$ 2.25**
						Equipment Unit Cost ($/cy)	**$ 3.24**
						Total Captial Cost ($/cy)	**$ 5.49**

Unit Rate - Excavation
Excavate and Stockpile

Excavation

Bucket size	5	cy
Cycle time	25	sec
Uncorrected Productivity	720.00	cy/hr
Job Efficiency	0.83	
Operator Experience	0.85	
Material Weight	0.80	
Machine Availability	0.90	
Corrected Productivity	367.20	cy/hr
Total Fleet Hours	**1.29**	**hr**

Equipment	Equip Rate	Operator	Quantity	Usage	Equip Cost/hr	Labor Cost/hr	Total Cost/hr
345B	$ 161.04	$ 94.90	1	100%	$ 161.04	$ 94.90	$ 255.94
Foreman	$ 29.11	$ 141.77	1	30%	$ 8.73	$ 42.53	$ 51.26
Survey	$ 29.11	$ 152.23	1	10%	$ 2.91	$ 15.22	$ 18.13
						Material Unit Cost ($/cy)	**$ -**
						Labor Unit Cost ($/cy)	**$ 0.42**
						Equipment Unit Cost ($/cy)	**$ 0.47**
						Total Captial Cost ($/cy)	**$ 0.89**

Closure Cost Estimate
User 7

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety **Cost Basis: Southern Nevada**

GEOTEXTILE - SUPPLY AND INSTALL (ACTIVE CLOSURE)

Quantity (10 oz/yd^2 non-woven geotextile)

Area Description	Quantity (sf)	Notes
East 36" Dia CPe Culverts Outlet	3,338	Captured in "Other User" tab
Closure Spillway	8,641	
Total Area	**11,979**	

Closure Channel Captured in "Other User" tab

Riprap Size	Station Range	Channel Length (ft)	Cross Sectional Length (ft)	Area (sf)
6"	2650 to 3400	750	82	61,133
	3535 to 3800	265	82	21,600
	3900 to 4300	400	82	32,604
12"	0 to 50	50	91	4,539
	1800 to 2300	500	91	45,390
	5220 to 5650	430	91	39,035
18"	50 to 1100	1050	88	92,327
	1200 to 1800	600	88	52,758
	2300 to 2650	350	88	30,776
	3400 to 3535	135	88	11,871
	3800 to 3900	100	88	8,793
	4300 to 4425	125	88	10,991
24"	1100 to 1200	100	93	9,314
	4425 to 5220	795	93	74,046
			Tota Area	**495,176**

Total Quantities

Geotextile	Quantity (sf)
10 oz/yd2 non-woven	507,155

Geotextile - Supply	**Supply**	**Freight**	**Tax**	**Total Delivered**	
10 oz/yd non-woven geotextile	$ 0.155	$ 0.024	6.6%	**$ 0.19**	Quote received from AGRU on 07/18/2023.

Geotextile Installation

Roll Width (ft)	15	
Roll Length (ft)	525	
Roll Area (sf)	7875	10%
Effective Roll Area (sf)	7080	Overlap and 7% Waste (10% total)
Work Day	10	Hr
Rolls Installed per Day	4	Ea
Installation Rate	**2,832**	**sf/hr**
Installation Fleet Hours	**179.09**	**hr**

Equipment	Equip Rate	Operator	Quantity	Usage	Equip Cost/Hr	Labor Cost/Hr	Total Cost/Hr
20 Ton Crane	$ 309.20	$ 95.07	1.0	100%	$ 309.20	$ 95.07	$ 404.27
966G	$ 131.09	$ 95.07	2.0	100%	$ 262.18	$ 190.14	$ 452.32
345B	$ 161.04	$ 94.90	1.0	100%	$ 161.04	$ 94.90	$ 255.94
General Laborer		$ 69.99	6.0	100%	$ -	$ 419.94	$ 419.94
Foreman	$ 29.11	$ 141.77	1.0	50%	$ 14.56	$ 70.89	$ 85.44
Survey	$ 29.11	$ 152.23	1.0	10%	$ 2.91	$ 15.22	$ 18.13
						Material Unit Cost ($/ft)	**$ 0.19**
						Labor Unit Cost ($/ft)	**$ 0.31**
						Equipment/Operating Unit Cost ($/ft)	**$ 0.26**
						Total Capital Cost ($/ft)	**$ 0.77**

Total Cost	Labor Cost	Equipment Cost	Material Cost	Total Cost
Geotextile	$ 0.31	$ 0.26	$ 0.19	$ 0.77

Notes
(1) 14.5' width with overlap and 3% allowance for another trench, end overlap and wastage

Closure Cost Estimate
User 8

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety Cost Basis: Southern Nevada

BENTONITE AMENDMENT - SUPPLY AND PROCESS

Quantity of Low Permeability Soil Layer requiring bentonite amendment:

Riprap Size	Station Range	Length (ft)	X-sec Area (sf)	Volume (cf)	Volume (cy)
6"	2650 to 3400	750	31.0	23,220	**860**
	3535 to 3800	265	31.0	8,204	**304**
	3900 to 4300	400	31.0	12,384	**459**
12"	0 to 50	50	34.6	1,730	**64**
	1800 to 2300	500	34.6	17,300	**641**
	5220 to 5650	430	34.6	14,878	**551**
18"	50 to 1100	1050	34.2	35,900	**1,330**
	1200 to 1800	600	34.2	20,514	**760**
	2300 to 2650	350	34.2	11,967	**443**
	3400 to 3535	135	34.2	4,616	**171**
	3800 to 3900	100	34.2	3,419	**127**
	4300 to 4425	125	34.2	4,274	**158**
24"	1100 to 1200	100	36.4	3,638	**135**
	4425 to 5220	795	36.4	28,922	**1,071**
				Total Volume	**7,073**

Captured in "Other User" tab

Low Permeability Soil Layer in-place density	125	pcf
Low Permeability Soil Layer in-place weight	11,935	tons
Bentonite Amendment (by weight)	4%	
Bentonite Amendment	**477**	**tons**

Bentonite - Supply	Supply ($/ton)	Freight ($/sf)	Tax	Total Delivered Cost ($/sf)	
Bentonite	417.88	included	6.6%	$ **445.46**	WesternGeosystems 7/26/23

Bentonite Cost

Bentonite Supply Cost (Quote Received from WesternGeosystems 7/26/2023)	$ 417.88	/ton
Bentonite Density	1.28	ton/cy
Allowance for Overbuild and Wastage	10%	
Corrected Bentonite Cost	$ 589.52	/cy
Bentonite Percentage	4%	
Cost of Bentonite per Cubic Yard LPSL	$ 23.58	/cy

Process
Assumptions:
Neatline Process Rate **195 BCY (Bank Cubic Yard)**
Installation Fleet Hours **36.28 hr**

Equipment	Equip Rate	Operator	Quantity	Usage	Equip Cost/Hr	Labor Cost/Hr	Total Cost/Hr
Amendment Method (Wirtgen)	$ 750.00	$ 95.07	1.0	100%	$ 750.00	$ 95.07	$ 845.07
966G	131.09	$ 95.07	1.0	100%	$ 131.09	$ 95.07	$ 226.16
Laborer		$ 69.99	1.0	50%	$ -	$ 35.00	$ 35.00
Foreman	$ 29.11	$ 141.77	1.0	50%	$ 14.56	$ 70.89	$ 85.44
						Material Unit Cost ($/ft)	**$ 23.58**
						Labor Unit Cost ($/ft)	**$ 1.52**
						Equipment/Operating Unit Cost ($/ft)	**$ 4.59**
						Total Capital Cost ($/ft)	**$ 29.69**

Closure Cost Estimate
User 9

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety Cost Basis: Southern Nevada

WTP1 CLOSURE

Current Water Treatment Plant 1 Costs[1]	Value	Comment
Labor Cost ($ per year at 120 gpm)	**$618,665**	Labor cost was provided by South32 based on all-inclusive actual costs to operate WTP1.
Operational Costs ($/year at 120 gpm)		Utilities, spares, chemicals, filter cake and small works costs are
WTP1 Utilities	$666,696	provided by South32 based on historical/projected WTP1 cost data at ~120 gpm.
Spares	$305,569	
WTP1 Chemicals (Original Plant)	$96,081	
WTP1 Chemicals (NF Filtration Area)	$188,700	
WTP1 Chemicals (Se Removal Circuit)	$164,326	
WTP1 Filter Cake TSF Blending	$60,000	
WTP1 Small Works	$124,486	
Total ($ per year at 120 gpm)	**$1,605,858**	
Water Treatment Rate (gallons per year)	60,826,000	Based on 352 operating days per year, 24 hour operation
Material Costs ($ per gallon) - Does not include labor	**$0.026**	WTP1 cost excluding labor.

Projected Closure Water Treatment Rate		
January Adit (gallons per minute)	20.0	Value provided by South32 based on historic treatment rates.
January Adit (gallons per year)	10,512,000	This is very conservative because after dewatering activities are complete, the January Adit will be dry.
Duration until plug installation is complete (years)	2.0	Assume a design through construction duration of 21 - 24 months.
Treated January Adit water volume (gallons)	**21,024,000**	
Precipitation over TSF (inches per year)	25.18	Annual precipitation value at site.
Assumed runoff reporting to UDCP (%)	100%	Conservatively assume 100% runoff.
TSF geomembrane area (sf)	2,460,000	As-built TSF geomembrane area plus proposed TSF1.
Total Precipitation over TSF reporting to UDCP (gallons per year)	38,611,012	Assume all precipitation reports to the UDCP as runoff.
Duration until cover construction is complete (years)	2.0	Assume a design through construction duration of 21 - 24 months.
Treated TSF water volume pre-cover (gallons)	**77,222,024**	
Precipitation over Underdrain Collection Pond (inches per year)	25.18	Annual precipitation value at site.
Underdrain Collection Pond geomembrane area (sf)	80,860	As-built UDCP geomembrane area.
Total Precipitation on Underdrain Collection Pond (gallons per year)	1,269,135	Assume no evaporation.
Duration until passive treatment system is constructed (years)	5	Assume UDCP is converted to passive treatment system in Year 5 and no longer collects precipitation over the pond.
Treated UDCP water volume pre-ET cell (gallons)	**6,345,677**	
Draindown rate (gallons per minute)[2]	4.3	See notes below for additional information.
Total draindown (gallons per year)	2,235,018	
Active treatment duration (years)	7	Assume all TSF draindown is treated by WTP1 until passive treatment is established (7 years).
Treated TSF draindown water volume (gallons)	**15,645,126**	
Precipitation over TSF closure cover (inches per year)	25.18	Annual precipitation value at site.
Infiltration through cover (%)	2%	Assume 2% of annual rainfall infiltrated through cover.
Infiltration through cover (inches)	0.50	
TSF geomembrane area (sf)	2,460,000	As-built TSF geomembrane area plus proposed TSF1.
Total infiltration through cover (gallons per year)	772,220	
Active treatment duration (years)	5	Assume all TSF cover infiltration is treated by WTP1 until passive treatment is established (5 years)
Treated TSF cover infiltration water volume (gallons)	**3,861,101**	
Total water treatment (gallons) - Years 1 and 7	**124,097,928**	Assume active treatment is stopped after 7 years and passive treatment system in the Underdrain Collection Pond has been established.

Projected Closure Water Treatment Cost		
Current Labor Cost ($ per year)	**$618,665**	
Water treatment duration (years)	2	WTP1 labor cost does not change until Jan Adit is plugged and TSF closure cap is complete
Labor Cost (Year 1 through 2)	**$1,237,329**	
Labor Cost (Year 3 through 7)		WTP1 labor cost reduces after Jan Adit is plugged and TSF closure cap is complete
Hours of WTP operation per week	40	
Labor cost factor for reduced throughput (%)[3]	23.8%	See notes below for additional information
Water treatment duration (years)	5	
Labor Cost (Year 3 through 7)	**$736,506**	
Labor Cost (Year 1 through 7)	**$1,973,835**	
Water treatment cost ($ per gallon)	$0.026	
Water treatment quantity (gallons)	124,097,928	
Total Operational cost ($)	**$3,276,291**	
Total WTP Cost ($) - Labor and Operational	**$5,250,126**	

Closure Cost Estimate
User 9

Laboratory Sample Analysis

Quarterly Testing	
Testing Frequency (samples per year)	4
Cost per sample	$691
Annual Laboratory Sample Testing Cost ($ per year)	$2,766
Laboratory Sample Testing Duration (years)	7
Total Laboratory Sample Testing Cost	**$19,360**
Annual Testing	
Testing Frequency (samples per year)	1
Cost per sample	$9,880
Annual Laboratory Sample Testing Cost ($ per year)	$9,880
Laboratory Sample Testing Duration (years)	7
Total Laboratory Sample Testing Cost	**$69,160**

Yearly Water Treatment Plant Cost Summary Table

Cost Description	Year							Total
	1	2	3	4	5	6	7	
Labor Cost ($)	$618,665	$618,665	$147,301	$147,301	$147,301	$147,301	$147,301	$1,973,835
January Adit (gallons)	10,512,000	10,512,000	0	0	0	0	0	21,024,000
Precipitation over TSF (gallons)	38,611,012	38,611,012	0	0	0	0	0	77,222,024
Precipitation over Underdrain Collection Pond (gallons)	1,269,135	1,269,135	1,269,135	1,269,135	1,269,135	0	0	6,345,677
Draindown rate (gallons)	2,235,018	2,235,018	2,235,018	2,235,018	2,235,018	2,235,018	2,235,018	15,645,126
Precipitation over TSF closure cover (gallons)	0	0	772,220	772,220	772,220	772,220	772,220	3,861,101
Water treatment volume (gallons)	52,627,165	52,627,165	4,276,374	4,276,374	4,276,374	3,007,238	3,007,238	124,097,928
Average water treatment cost ($ per gallon)	$0.026	$0.026	$0.026	$0.026	$0.026	$0.026	$0.026	
Water Treatment Plant Cost ($) - Operational Cost Only	$1,389,402	$1,389,402	$112,900	$112,900	$112,900	$79,394	$79,394	$3,276,291
Laboratory Sample Analysis	$12,646	$12,646	$12,646	$12,646	$12,646	$12,646	$12,646	$88,520
er Treatment Plant Cost ($) - Labor, Operational and Laboratory C	**$2,020,712**	**$2,020,712**	**$272,847**	**$272,847**	**$272,847**	**$239,341**	**$239,341**	**$5,338,646**

Notes:

[1]Water Treatment Plant 1 cost information provided by South32.

[2]TSF stacking draindown rate (gallons per minute)

Total TSF stacking volume	8,000,000	cy
Average in place dry density (filtered tailings)	108.00	pcf
Average in place moisture content (filtered tailings)	14.40	%
Residual moisture content (assumed)	12.00	%
Total water (percolation through stacking)	67,050,539	gallons
Duration	30	years
Flow rate (requiring treatment)	4.25	gpm

[3]Value based on factoring of operational hours. Current WTP1 staffed 7 days per week and 24 hours per day. Closure (Year 3 - 7) staffed 5 days per week and 8 hours per day.

Consulting Engineers and Scientists

GEI Consultants

October 5, 2023

Kara Haas
Environmental Specialist, South 32
749 Harshaw Road
Patagonia, AZ 85624

Dear Ms. Haas,

We have prepared a price quote for acute whole effluent toxicity (WET) testing for AZPDES Permit No. AZ0026387. All testing would follow requirements in the permit and guidance in the U.S. Environmental Protection Agency methods (EPA-821-R-02-012). According to the permit, either acute or chronic tests are required depending on the duration of a discharge event:

> "Since completion of the chronic WET test for *Ceriodaphnia dubia* and *Pimephales promelas* requires a minimum of three samples be taken for renewals, the chronic WET test will not be required during any given monitoring period in which the discharge(s) does not occur over seven consecutive calendar days and is (are) not repeated more frequently than every thirty days, except as specified in Part I.D (chronic WET testing for effluent characterization is required whether discharging or not). The discharge does not have to be continuous to fall under this requirement."

Acute 96-hour testing using *C. dubia* and *P. promelas* species would be conducted on samples collected from the wastewater treatment plant following pass/fail testing requirements (i.e. control and 100% effluent) with a single renewal at 48 hours. Acute testing requires a minimum of two samples to be collected, one for test initiation and the second for renewals at 48 hours, however, if discharge is not occurring for a second sample event, the test duration will be reduced to 48 hours. Moderately hard reconstituted (MH recon) water will be used as the control water for both tests. Culture water provided by the supplier of the *P. promelas* organisms, will be used as a concurrent control.

According to the permit, reference toxicant tests must be conducted under the same testing conditions as effluent tests:

> "Reference toxicant testing must be conducted using the same test conditions as the effluent toxicity tests (i.e., same test duration, etc.)."

Thus, an additional acute reference toxicant test must be conducted for both the *C. dubia* and *P. promelas* species during the month that testing takes place to account for changes in the methodology from standard laboratory reference toxicity tests (i.e. test duration, non-renewal conditions, etc.). These tests will be charged at a reduced rate and are budgeted for in Table 1.

Memo | Page 2 — October 5, 2023, South 32

Per-test pricing is included in Table 1. These prices include up to three hours consulting per test to assist with any issues that may arise beyond standard WET data interpretation. Any additional consulting will be subject to GEI's Life Sciences Fee Schedule on an hourly basis. An estimate of expected fees would be provided prior to commencing work.

Sample containers, coolers, chain-of-custody forms, and sampling/shipping instructions are provided and will arrive at the facility at least one week prior to collection of the first sample. Our bill would include shipping costs from our facility to the site. **Additional shipping charges to ship the samples to our lab will be paid by the shipper.**

Table 1: Per-test charges for chronic testing for 2024.

Test	Cost per Test
Estimate of shipping charges	$250
Acute *C. dubia* test	$520
Acute *C. dubia* reference toxicity test	$557
Acute *P. promelas* test including culture water control	$829
Acute *P. promelas* reference toxicity test	$691
Total Cost for Single Round of Tests	**$2,847**

Please feel free to contact us should you require any additional information regarding this quote.

Sincerely,
GEI CONSULTANTS, INC.

Alina Iwan,
Lead Laboratory Project Manager

Ivy Sklenar Murphy,
Laboratory Project Manager

Closure Cost Estimate
User 9

Consulting
Engineers and
Scientists

GEI Consultants

October 5, 2023

Kara Haas
Environmental Specialist, South 32
749 Harshaw Road
Patagonia, AZ 85624

Dear Ms. Haas,

We have prepared a price quote for chronic whole effluent toxicity (WET) testing for AZPDES Permit No. AZ0026387. All testing would follow requirements in the permit and guidance in the U.S. Environmental Protection Agency methods (EPA-821-R-02-013). According to the permit, either acute or chronic tests are required depending on the duration of a discharge event:

> "Since completion of the chronic WET test for *Ceriodaphnia dubia* and *Pimephales promelas* requires a minimum of three samples be taken for renewals, the chronic WET test will not be required during any given monitoring period in which the discharge(s) does not occur over seven consecutive calendar days and is (are) not repeated more frequently than every thirty days, except as specified in Part I.D (chronic WET testing for effluent characterization is required whether discharging or not). The discharge does not have to be continuous to fall under this requirement."

Chronic testing using *Ceriodaphnia dubia, Pimephales promelas,* and *Pseudokirchneriella subcapitata* would be conducted on effluent following the dilution series of 0, 12.5, 25, 50, 75, and 100% effluent as specified in the permit. Moderately hard reconstituted (MH recon) water will be used as the dilution water for all tests and culture water, provided by the organism supplier, will be used as a concurrent control for the *P. promelas* and *P. subcapitata* tests, as applicable. Three sample events over the course of seven days will be required. If discharge is not expected to occur over seven days, an alternate sampling plan will be considered.

Per-test pricing is included in Table 1. These prices include up to three hours consulting per test to assist with any issues that may arise beyond standard WET data interpretation. Any additional consulting will be subject to GEI's Life Sciences Fee Schedule on an hourly basis. An estimate of expected fees would be provided prior to commencing work.

Sample containers, coolers, chain-of-custody forms, and sampling/shipping instructions are provided and will arrive at the facility at least one week prior to collection of the first sample. Our bill would include shipping costs from our facility to the site. **Additional shipping charges to ship the samples to our lab will be paid by the shipper.**

Table 1: Per-test charges for chronic testing for 2024.

Test	Cost per Test
Estimate of shipping charges	$350
Chronic *C. dubia* test	$2,144
Chronic *P. promelas* test including culture water control	$2,624
Chronic *P. subcapitata* test including culture water control	$1,915
Total Cost for Single Round of Tests	**$7,033**

Please feel free to contact us should you require any additional information regarding this quote.

Sincerely,
GEI CONSULTANTS, INC.

Alina Iwan,
Lead Laboratory Project Manager

Ivy Sklenar Murphy,
Laboratory Project Manager

ACZ Laboratories, Inc. — **Analytical Quote**
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Kara Haas
South32
749 Harshaw Rd
Patagonia, AZ 85624

Page 1 of 3
9/6/2023

Quote Number: POC-2-SEMI-ANN

Matrix: Groundwater POC-2 Semi-Annual Suite

Parameter	Method	Detection Limit	Cost/Sample
Diskette/QC Summary			
Quality Control Summary			$0.00
Metals Analysis			
Antimony, dissolved	M200.8 ICP-MS	0.0004 mg/L	$17.04
Arsenic, dissolved	M200.8 ICP-MS	0.0002 mg/L	$17.04
Barium, dissolved	M200.7 ICP	0.009 mg/L	$9.04
Beryllium, dissolved	M200.8 ICP-MS	0.00008 mg/L	$17.04
Cadmium, dissolved	M200.8 ICP-MS	0.00005 mg/L	$17.04
Chromium, dissolved	M200.8 ICP-MS	0.0005 mg/L	$17.04
Copper, dissolved	M200.8 ICP-MS	0.0008 mg/L	$17.04
Iron, dissolved	M200.7 ICP	0.06 mg/L	$9.04
Lead, dissolved	M200.8 ICP-MS	0.0001 mg/L	$17.04
Manganese, dissolved	M200.7 ICP	0.01 mg/L	$9.04
Mercury, dissolved	M245.1 CVAA	0.0002 mg/L	$22.08
Nickel, dissolved	M200.7 ICP	0.008 mg/L	$9.04
Selenium, dissolved	M200.8 ICP-MS	0.0001 mg/L	$17.04
Thallium, dissolved	M200.8 ICP-MS	0.0001 mg/L	$17.04
Zinc, dissolved	M200.7 ICP	0.02 mg/L	$9.04
Misc.			
Electronic Data Deliverable			$0.00
Radiochemistry			
Combined Radium (total)	Calculation (RA226 + RA228)	2	$0.00
Gross Alpha Total, corrected	Calculation	2	$0.00
Gross Alpha, total	M900.0	2 pCi/L	$54.00
Radium 226 + Alpha Emitting Radium Isotope	M903.0	1 pCi/L	$83.20
Radium 228, total	M904.0	1.5 pCi/L	$99.20
Uranium, Isotopic Total	Eichrom ACW03	1 pCi/L	$114.88
Wet Chemistry			
Alkalinity as CaCO3	SM2320B - Titration	2 mg/L	$11.76
Conductivity @25C	SM2510B	1 umhos/cm	$8.00
Cyanide, Free	D6888-09/OIA-1677-09	0.003 mg/L	$33.84
Fluoride	SM4500F-C	0.15 mg/L	$10.96
Nitrate as N	Calculation: NO3NO2 minus NO2	Calculation	$0.00

ACZ Laboratories, Inc. — **Analytical Quote**
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Kara Haas
South32
749 Harshaw Rd
Patagonia, AZ 85624

Page 2 of 3
9/6/2023

Nitrate/Nitrite as N	M353.2 - Automated Cadmium Redu	0.02 mg/L	$10.96
Nitrite as N	M353.2 - Automated Cadmium Redu	0.01 mg/L	$10.96
pH (lab)	SM4500H+ B	0.1 C	$8.00
Residue, Filterable (TDS) @180C	SM2540C	20 mg/L	$14.08
Sulfate	D516-02/-07/-11 - TURBIDIMETRIC	1 mg/L	$10.96
		Cost/Sample:	**$691.44**

Closure Cost Estimate
User 10

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety **Cost Basis: Southern Nevada**

JANURAY ADIT REMEDIATION

January Adit Bulkhead Dimensions		
Concrete Bulkhead Dimension 1 (ft)	15	Jan Adit dimensions are estimated.
Concrete Bulkhead Dimension 2 (ft)	15	Jan Adit dimensions are estimated.
Concrete Bulkhead Depth (ft)	30	Assumed bulkhead depth.
Concrete Volume (cy)	250	
Concrete Cost ($ per cubic yard)	$1,200	
Total Concrete Bulkhead Cost ($)	**$300,000**	
Earthworks for bulkhead placement (cy)	15,000	Earthworks to create usable space in vicinity of January Adit.
Excavation and re-palcement of bulkhead earthworks ($ per cy)	$15	
Total Earthworks ($)	**$225,000**	
Injection Grouting		
Outer Grouting Ring Radius (ft)	30	Assume three concentric rings with 10ft hole spacing - Outer 30ft ring radius
Intermediate Grouting Ring Radius (ft)	20	Assume three concentric rings with 10ft hole spacing - Intermediate 20ft ring radius
Inner Grouting Ring Radius (ft)	10	Assume three concentric rings with 10ft hole spacing - Inner 10ft ring radius
Number of Holes	38	Based on 10ft hole spacing around each grouting ring
Confirmation Holes	38	Assume a confirmatory hole is drilled between each of the 10 ft spaced holes to check degree of injection grouting translation laterally
Grouting Confirmatory Holes	19	Assume half of the confirmatory holes require grouting
Hole Depth (ft)	50	Assume competent bedrock is at 30 ft bgs.
Grouting Depth (ft)	20	Injection grout 20 ft of competent bedrock.
Total Drilling Depth (ft)	4,750	
Total Grouting Depth (ft)	1,140	
Drilling Mob/Demob	$10,000	Based on historical site data provided by South32.
Drilling Cost ($ per foot)	$175	Based on historical site data provided by South32.
Grouting Cost ($ per hour)	$310	Assumes $280 per hour and each hole take 15 hours.
Active grouting time per hole (hours)	15	Grouting time/cost includes grout plant elements, injection grout nipple installation and packer testing of the grout holes prior to grouting
Total Cost ($) - Injection Grouting	$1,106,300	
Total Cost ($) - Bulkhead and Injection Grouting	$1,631,300	
Contingency	10%	Additional contingency to cover unknowns beyond the contingency applied by the SRCE model.
Total Cost with Contingency ($)	**$1,800,000**	

Closure Cost Estimate
User 11

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety Cost Basis: Southern Nevada

FUTURE PASSIVE TREATMENT SYSTEM
Engineer's Cost Estimate provided by CPE Consultants

Construction Capital Cost Estimate	Value	Comments
Construction Capital Cost	**$1,017,831**	See sheets below from CPE Consultants. Includes additional contingency of 30% beyond the contingency applied from the SRCE model.
Duration of Closure Cost Estimate	30	years
Passive Treatment System Operating Years	25	years

Sustaining Capital Expenditures	**Value**	**Comments**
BCR Replacement Substrate	$100,000	
Number of Replacements	2	Replace at year 22 and 26
Total BCR Replacement Substrate	**$200,000**	
Permit Revisions	$10,000	
Number of Permit Revisions	6	Permit revisions occur every 5 years
Total Permit Revisions Cost	**$60,000**	
Open Limestone Channel	$5,000	
Number of Limestone Replacements	2	Limestone replacement occurs every 10 years
Total Limestone Replacement Cost	**$10,000**	
Annual Passive Treatment System Misc Cost	$63,101	Cost for first 3 years
Years of Operating	3	
Annual Passive Treatment System Misc Cost	$55,101	Cost for last 23 years
Years Operating	23	
Total Annual Passive Treatment System Cost	**$1,456,626**	
Pump and Blower Replacement	$22,000	
Number of Pump and Blower Replacements	2	Replacement at year 15 and 25
Total Pump and Blower Replacement Cost	**$44,000**	
Seep Pond Sludge Disposal	$20,000	
Number of Seep Pond Sludge Disposals	2	Seep Pond Sludge Disposal every 10 years
Total Seep Pond Sludge Disposal Cost	**$40,000**	
Total Cost Future Passive Treatment System	**$2,828,457**	Cost basis is Q3 2017. Therefore escalation was applied to the total cost value
Escalation (%)	35%	Escalation calculated using Bureau of Reclamation construction indexes composite trend data for Q3 2017 and Q2 2023.
Escalation	$995,330	
Total Cost Future Passive Treatment System	**$3,823,787**	Includes escalation

Closure Cost Estimate
User 11

ARIZONA MINERALS
JANUARY ADIT (NORTON MINE) VRP SITE
SANTA CRUZ COUNTY, ARIZONA
FUTURE PASSIVE TREATMENT SYSTEM
ENGINEER'S COST ESTIMATE

Item	Unit	Quantity	Unit Cost	Total
1. SITE IMPROVEMENT WORK				
1.1. MOBILIZATION				
MOBILIZATION	LS	1	$ 11,000.00	$ 11,000
CLEARING AND GRUBBING	LS	1	$ 6,900.00	$ 6,900
SWPPP	LS	1	$ 10,000.00	$ 10,000
Subtotal Mobilization				**$ 27,900**
1.2. GRADING				
EXCAVATION & BACKFILL	CY	20,000	$ 5.00	$ 100,000
FINE GRADING	SY	9,000	$ 1.00	$ 9,000
RIPRAP PROTECTION, GROUTED, D50 = 8",T=16"	CY	30	$ 100.00	$ 3,000
Subtotal Grading				**$ 112,000**
1.3. EQUIPMENT & PIPING				
REPLACE ONE JANUARY ADIT WELL PUMP TO 20 GPM	LS	1	$ 30,000.00	$ 30,000
MODIFY EXIST. PIPING TO ALLOW WATER DELIVERY TO PTS	LS	1	$ 20,000.00	$ 20,000
Subtotal Equipment & Piping				**$ 50,000**
SUBTOTAL SITE IMPROVEMENT WORK (1.1 - 1.3)				**$ 189,900**
2. PASSIVE TREATMENT SYSTEM - PTS (SOVEREIGN CONSULTING ESTIMATE)				
2.1. BIOCHEMICAL REACTOR (BCR) CELLS				
PIPING (INLET, OUTLET, FLOW CONTROL, OVERFLOW, ETC.)	LS	1	$ 20,000.00	$ 20,000
BCR MEDIA (WOODCHIPS, LIMESTONE, STRAW, MANURE)	CY	3,150	$ 55.00	$ 173,250
LINER & ANCHOR TRENCH (60 MIL HDPE LINER W/10 OZ GEOTEXTILE ABOVE & BELOW)	SF	35,000	$ 3.00	$ 105,000
DRAINAGE LAYER	LS	1	$ 40,000.00	$ 40,000
BALLAST TO PREVENT FLOATING (GRAVEL)	LS	1	$ 15,000.00	$ 15,000
Subtotal Biochemical Reactor Cells				**$ 353,250**
2.2. AEROBIC POLISHING WETLAND				
LINER & ANCHOR TRENCH (60 MIL HDPE LINER W/10 OZ GEOTEXTILE ABOVE & BELOW)	SF	3,200	$ 3.00	$ 9,600
TOPSOIL FILL (T=6")	CY	65	$ 48.50	$ 3,153
PLANTS	EA	1,600	$ 3.00	$ 4,800
Aerobic Polishing Wetland				**$ 17,553**
2.3. MANGANESE REMOVAL BED (MRB)				
LINER & ANCHOR TRENCH	SF	15,500	$ 3.00	$ 46,500
WATER COLLECTION PIPING	FT	900	$ 14.50	$ 13,050

Registered Professional Engineer
CERTIFICATE NO. 15606
Raul Francisco G. Piña
DATE SIGNED 8.12.2020
ARIZONA U.S.A.

\\CPESERVER1\Project\Jobs\346.5 January Adit Active Treatment\CAD\FUTURE PTS\Eng. Cost Estimate\Eng. Cost Estimate 05.23.2017 (Rev.08.16.2017).xlsx

Closure Cost Estimate
User 11

ARIZONA MINERALS
JANUARY ADIT (NORTON MINE) VRP SITE
SANTA CRUZ COUNTY, ARIZONA
FUTURE PASSIVE TREATMENT SYSTEM
ENGINEER'S COST ESTIMATE

Item	Unit	Quantity	Unit Cost	Total
LIMESTONE/GRAVEL MIX (D50=3/8")	CY	650	$ 48.00	$ 31,200
MRB CONDITIONING CHEMICAL (2.5% POTASSIUM PERMANGANATE SOLUTION BATCH)	LB	1,900	$ 15.00	$ 28,500
CONDITIONING CHEMICAL RECYCLE SYSTEM (PUMP & ASSOCIATED PIPING TO RECYCLE $KMnO_4$ SOLUTION)	LS	1	$ 2,000.00	$ 2,000
INLET, OUTLET, & FLOW CONTROL WAT. LEVEL CONTROL, VAULT, PIPING, & LINER BOOTS)	LS	1	$ 20,000.00	$ 20,000
Subtotal Manganese Removal Bed				**$ 141,250**
SUBTOTAL PASSIVE TREATMENT SYSTEM (2.1 - 2.3)				**$ 512,053**
PROJECT SUBTOTAL (1 - 2)				**$ 701,953**
Contingecies - 30%				$ 210,586
Construction Administration, Inspection, and Quality Control - 10%				$ 70,195
Permit Fee - 5%				$ 35,098
PROJECT TOTAL				**$ 1,017,831**
Estimated in Prices of 2017				

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Closure Cost Estimate
User 11

SUMMARY OF JANUARY ADIT PASSIVE TREATMENT OMM COSTS
Revised June 9, 2015
Updated July 28, 2020

Registered Professional Engineer (Civil)
Certificate No. 15606
Raul Francisco G. Piña
Date Signed 8.12.2020
Arizona U.S.A.

ASSUMPTIONS:
- OMM Calendar revised to start in Year 5
- Pumps and Blowers require replacement every 10 years (both pumps).
- Sludge removal from Seep Detention Pond is required every 10 years.
- Electricity is $0.09 per kilowatt hour.
- Permit revisions are every 5 years.
- Liner has 50 year design life, no replacement.
- Reduce OMM Cost by $8,000 @ 3rd year (Year 8) due to reduced monitoring.

Item	Unit	Unit Cost	Quantity	Total	Description
OPERATION AND MAINTENANCE COSTS					
Routine Operation, Maintenance, and Monitoring (OMM)					
Contract Project Management	yr	$ 185	12	$ 2,220.00	PM, 1 hour per month
Field Inspection	yr.	$ 100	96	$ 9,600.00	Inspection 8 hrs. per month
Equipment & Maintenance	yr	$ 1,100	12	$ 13,200.00	2 pieces of equipment with labor, 12 days per year
Permit Agency and compliance/documentation	yr	$ 4,000	4	$ 16,000.00	Testing will be reduced to biannually @ 3rd year (Year 8)
Subtotal Monthly Routine OMM				**$ 41,020.00**	
Laboratory Fees					
Metals and Inorganic	ea	$ 800	4	$ 3,200.00	Testing at discharge location.
Subtotal Laboratory				**$ 3,200.00**	
Utilities					
Electricity Pumps & Blowers	yr	$ 8,250	1	$ 8,250.00	Assume Adit Pumps - 7.5hp @ 100%; Seep Pond - 1 hp @ 50%; Air Blowers - 5 hp @100%
Telephone/Data Line	yr	$ 2,400	1	$ 2,400.00	
Subtotal Utilities				**$ 10,650.00**	
Contingency					
15% of annual cost	ls		0.15	**$ 8,230.50**	
ANNUAL OMM COST				**$ 63,100.50**	
Life Cycle Replacement Items					
Upper liner replacement		$ -	0	$ -	Liner has 50 year design life. Therefore, no replacement.
Permit revisions	s	$ 10,000	1	$ 10,000.00	Assume every 5 years.
Pump & Blower replacement	ls	$ 22,000	1	$ 22,000.00	Replacement of all pump & blower equipment in year 15, 25, and 35.
BCR Replacement Substrate	ls	$ 200,000	1	$ 200,000.00	Replace one BCR Substrate in year 22 and 2nd BCR Substrate in year 26, exhume & replace organic substrate & dispose of depleted substrate. Assume hazardous waste disposal.
Open Limestone Channel	ls	$ 5,000	1	$ 5,000.00	Replace consumed limestone @ 10% of media every 10 years.
Seep Pond Sludge Disposal	ls	$ 20,000	1	$ 20,000.00	Every 10 years, collection & disposal of sludge.
Subtotal Life Cycle Replacement Items				**$ 257,000.00**	

Closure Cost Estimate
User 11

JANUARY ADIT
Summary of Construction Cost and Yearly Operation & Maintenance

	Year	Cashflow	Description
	0	-	
	1	-	
	2	-	
	3	-	
	4	-	
	5	1,090,932	Estimated Total Project Const Cost; Add permit revisions
	6	63,101	
	7	63,101	
	8	55,101	Required monitoring reduced to biannual.
	9	55,101	
	10	65,101	Add permit revisions.
	11	55,101	
	12	55,101	
	13	55,101	
	14	55,101	
	15	112,101	Add permit revisions, replace pump & blower equipment, replace limestone liner, remove sludge.
	16	55,101	
	17	55,101	
	18	55,101	
	19	55,101	
	20	65,101	Add permit revisions
	21	55,101	
	22	155,101	Replace BCR substrate
	23	55,101	
	24	55,101	
	25	112,101	Add permit revisions, replace pump & blower equipment, replace limestone liner, remove sludge.
	26	155,101	Replace BCR substrate
	27	55,101	
	28	55,101	
	29	55,101	
	30	65,101	Add permit revisions
OMM Cash Flow		2,828,457	
TOTAL CASH FLOW		2,828,457	

AZ2000 January Adit Summary Construction Cost & Yearly OMM FINAL 150609 updated 200728.xls

Updated July 28, 2020

Closure Cost Estimate
User 11

JANUARY ADIT PASSIVE TREATMENT SYSTEM															
ANNUAL OMM COST PROJECTIONS FOR 30 YEARS															
Revised June 9, 2015 (Upated July 28. 2020)															
YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Annual O&M Costs		-		-	63,101	63,101	63,101	55,101	55,101	55,101	55,101	55,101	55,101	55,101	55,101
Do not include in calculation of Total	-	-						(8,000)							
Life Cycle Replacement Items															
Permit Revisions					10,000					10,000					10,000
$10,000 each, every 5 years															
Pump & Blower Replacement															22,000
$22,000 at Year 15 and 25															
BCR Replacement Substrate															
$100,000 each at Year 22 and 26															
Open Limestone Channel															5,000
$5,000 each every 10 years															
Seep Pond Sludge Disposal															20,000
$20,000 each, every 10 years															
Construction - Engineer's Cost Estimate					1,017,831										
TOTAL	-	-	-	-	1,090,932	63,101	63,101	55,101	55,101	65,101	55,101	55,101	55,101	55,101	112,101
YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Closure Cost Estimate
User 11

JANUARY ADIT PASSIVE TREATMENT SYSTEM															
ANNUAL OMM COST PROJECTIONS FOR 30 YEARS															
Revised June 9, 2015 (Upated July 28. 2020)															
YEAR	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Annual O&M Costs	55,101	55,101	55,101	55,101	55,101	55,101	55,101	55,101	55,101	55,101	55,101	55,101	55,101	55,101	55,101
Do not include in calculation of Total															
Life Cycle Replacement Items															
Permit Revisions					10,000					10,000					10,000
$10,000 each, every 5 years															
Pump & Blower Replacement										22,000					
$22,000 at Year 15 and 25															
BCR Replacement Substrate							100,000				100,000				
$100,000 each at Year 22 and 26															
Open Limestone Channel										5,000					
$5,000 each every 10 years															
Seep Pond Sludge Disposal										20,000					
$20,000 each, every 10 years															
Construction - Engineer's Cost Estimate															
TOTAL	55,101	55,101	55,101	55,101	65,101	55,101	155,101	55,101	55,101	112,101	155,101	55,101	55,101	55,101	55,101
YEAR	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
															2,828,457

AZ2000 January Adit Summary Construction Cost & Yearly OMM FINAL 150609 updated 200728.xls
OMM Costs-30 Yrs
Revised June 9, 2015
Updated July 28, 2020

Closure Cost Estimate
User 12

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety Cost Basis: Southern Nevada

INTERNAL AND EXTERNAL CHANNEL MODIFICATIONS - PASSIVE CLOSURE

Stormwater Diversion Channel Riprap Extension

	Area (sf)	Thickness (ft)	Volume (cf)	Volume (cy)	Notes
12" grouted	45,882	2	91,764	3,399	Captured in "Other User" tab

UDCP Stormwater Diversion Channel (Crest Raise)

	Cross Sectional Area (sf)	Length (ft)	Volume (cf)	Volume (cy)	Notes
Engineered Fill	17	380	6,369	236	Captured in "Material Hauling" tab

TSF Perimeter Road (Embankment) Raise (2 ft)

	Cross Sectional Area (sf)	Length (ft)	Volume (cf)	Volume (cy)	Notes
Engineered Fill	27	200	5,400	200	Captured in "Material Hauling" tab

Access Road Raise

	Volume (cy)	Notes
Engineered Fill	1,857	Captured in "Material Hauling" tab

Remove Culverts in TSF1 Clousre Spillway Section (East and West)

	LS	Notes
West	1	Captured in "Miscellaneous Cost" tab
East	1	Captured in "Miscellaneous Cost" tab

Excavate TSF1 Closure Spillway (West)

	Volume (cy)				Notes
Cut	488				Captured in "Sediment & Drainage Control" tab
Riprap Size	**Length (ft)**	**Cross Sectional Area (sf)**	**Volume (cf)**	**Volume (cy)**	
12" D50 Grouted Riprap	80	222	17,760	**658**	Captured in "Other User" tab
Geotextile	**Length (ft)**	**Cross Sectional Length (ft)**	**Area (sf)**		
10 oz/yd2	80	118	**9,440**		Captured in "Other User" tab
Low Perm	**Length (ft)**	**Cross Sectional Area (sf)**	**Volume (cf)**	**Volume (cy)**	
	80	119	9,520	**353**	Captured in "Material Hauling" tab

Excavate TSF1 Closure Spillway (East)

	Length (ft)	Depth	Side Slopes	Base Width	Notes
Cut	1,100	4	2.5	12	Captured in "Sediment & Drainage Control" tab
Riprap Size	**Length (ft)**	**Cross Sectional Area (sf)**	**Volume (cf)**	**Volume (cy)**	
12" D50 Riprap	1,100	77	84,480	**3,129**	Captured in "Other User" tab
Geotextile	**Length (ft)**	**Cross Sectional Length (ft)**	**Area (sf)**		
10 oz/yd2	1,100	44	48,730		Captured in "Other User" tab

Closure Cost Estimate
User 13

Project Name: Tailings Storage Facility 1 (TSF1) - Reclamation Plan
Date of Submittal: October 2023
File Name: 0014.035 SRCE Model sNV.S32.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_data-USR_1_12_S32_230801.xlsm
Cost Estimate Type: Surety Cost Basis: Southern Nevada

ACCESS ROAD BRIDGE - PASSIVE CLOSURE

Growth Media Storage Area Bridge - Built On Site 3Q22

Span (ft)	46

Access Road Bridge QTY

	LS
Bridge	1

Construction Cost Trend Data (USBR)

3Q22	521
3Q23	536
3Q22 to 2Q23	2.9%

Description	Construction Capital Cost (2Q22)	Escalated Construction Capital Cost (3Q23)
Gabions	$ 38,891.30	$ 40,011.01
Engineering	$ 15,880.00	$ 16,337.20
Construction	$ 450,711.69	$ 463,688.03
Bridge Material	$ 116,439.04	$ 119,791.41
Total	$ 621,922.03	$ 639,827.65
Total/LF	**$ 13,520.04**	**$ 13,909.30**

Proposed Access Road Bridge		
Assumed Span (ft)	90	
Construction Capital Cost ($/LF)	$ 13,909.30	3Q23
Construction Capital Cost ($)	**$ 1,251,837**	3Q23

Material Total	**$ 312,656.91**	
Labor Total	**$ 469,589.90**	50% of Total less Material Cost
Equipment Total	**$ 469,589.90**	50% of Total less Material Cost
Estimated Access Road Bridge C	**$ 1,251,836.72**	

ATTACHMENT B

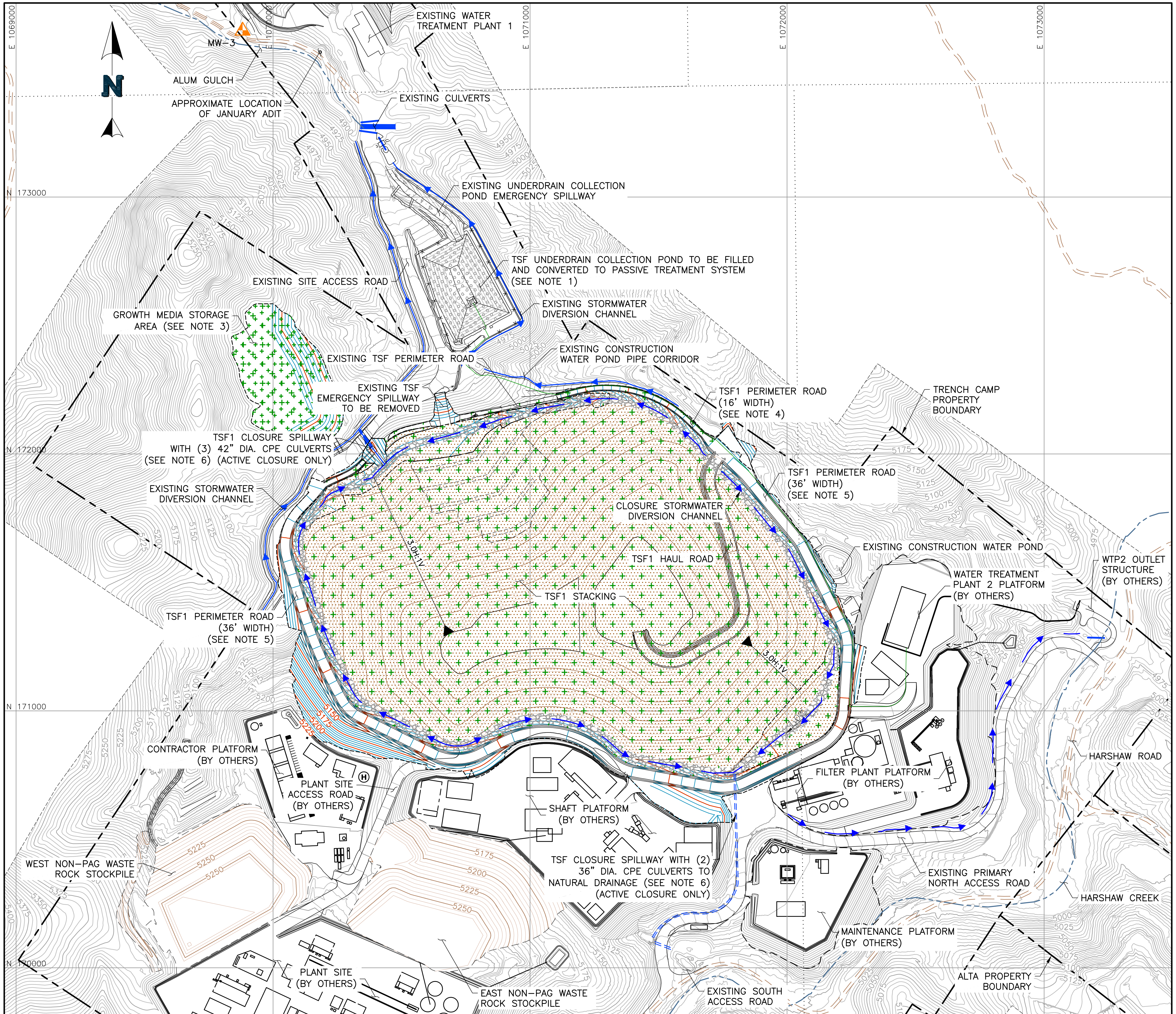
Table 1
South32 Hermosa Inc
Hermosa Project Tailings Storage Facility 1 (TSF1)
Cost Comparison Summary Sheet - Closure and Post Closure

Description	Closure	Post Closure	Total	Comments
Tailings Storage Facility	$5,448,890	$0	$5,448,890	For detailed cost breakdown see SRCE model "Waste Rock Dumps", "Roads", "Haul Material", "Sediment & Drainage Control", "Process Ponds", "Waste Disposal", "Well Abandonment", "Misc. Costs", "Constr. Mgmt" and "Other User."
Reclamation Monitoring and Maintenance	$0	$843,522	$843,522	For detailed cost breakdown see SRCE model "Reclamation Monitoring and Maintenance."
Water Treatment Plant 1	$0	$5,338,646	$5,338,646	For detailed cost breakdown see SRCE model "User 9."
January Adit Plug	$1,800,000	$0	$1,800,000	For detailed cost breakdown see SRCE model "User 10."
Underdrain Collection Pond (Passive Treatment System)	$1,376,004	$2,447,783	$3,823,787	For detailed cost breakdown see SRCE model "User 11."
Passive Closure Bridge	$1,251,837	$0	$1,251,837	For detailed cost breakdown see SRCE model "User 13."
Subtotal Operational and Maintenance Costs (direct cost)	**$9,876,731**	**$8,629,951**	**$18,506,682**	Summation of costs labeled as operational and maintenance costs in SRCE.
SRCE Indirect Cost (total indirect cost as % of direct cost)		33%		Average value of indirects. Indirects include engineering, design, and construction (ED&C) plan, contingency, insurance, performance bond, contractor profit, contract administration, and government indirect cost.
SRCE Indirect Cost	**$3,282,815**	**$2,868,412**	**$6,151,227**	
Total	**$13,159,546**	**$11,498,363**	**$24,657,909**	**Summation of direct and indirect costs.**

Table 2
South32 Hermosa Inc
Hermosa Project Tailings Storage Facility 1 (TSF1)
Cost Comparison - Closure and Post Closure

Description		Closure	Post Closure	Total	Comments
Tailings Storage Facility	Waste Rock Dumps (Dry Stack TSF)	$771,467	$0	$771,467	For cost details see SRCE model "Waste Rock Dumps" (includes grading, topsoil placement, ripping/scarifying and revegetation costs).
	Roads	$14,895	$0	$14,895	For cost details see SRCE model "Roads" (includes grading and scarifying/revegetation costs).
	Quarries & Borrow Pits	$16,098	$0	$16,098	For cost details see SRCE model "Quarries & Borrow Pits" (includes scarifying/revegetation costs).
	Haul Material	$282,041	$0	$282,041	For cost details see SRCE model "Haul Material" (includes hauling/crushing/screening/compacting costs).
	Sediment & Drainage Control	$3,839	$0	$3,839	For cost details see SRCE model "Sediment & Drainage Control" (includes excavation costs).
	Waste Disposal	$7,308	$0	$7,308	For cost details see SRCE model "Waste Disposal" (includes solid waste off site costs).
	Well Abandonment	$1,389	$0	$1,389	For cost details see SRCE model "Well Abandonment" (includes monitoring wells).
	Misc. Costs	$66,757	$0	$66,757	For cost details see SRCE model "Misc. Costs" (includes buried pipe removal).
	Constr. Mgmt	$684,454	$0	$684,454	For cost details see SRCE model "Constr. Mgmt" (includes construction management, construction support and road maintenance).
	Other Users - Riprap (D_{50}=6in)	$52,093	$0	$52,093	For cost details see SRCE model "Other User" (refer to "User 5" for unit rate build up).
	Other Users - Riprap (D_{50}=12in)	$245,002	$0	$245,002	For cost details see SRCE model "Other User" (refer to "User 5" for unit rate build up).
	Other Users - Riprap (D_{50}=18in)	$962,806	$0	$962,806	For cost details see SRCE model "Other User" (refer to "User 5" for unit rate build up).
	Other Users - Riprap (D_{50}=24in)	$838,842	$0	$838,842	For cost details see SRCE model "Other User" (refer to "User 5" for unit rate build up).
	Other Users -Grouted Riprap (D_{50}=12in)	$614,669	$0	$614,669	For cost details see SRCE model "Other User" (refer to "User 5" for unit rate build up).
	Other Users - 36" Dia. CPe Culvert	$101,416	$0	$101,416	For cost details see SRCE model "Other User" (refer to "User 6" for unit rate build up).
	Other Users - 42" Dia. CPe Culvert	$11,867	$0	$11,867	For cost details see SRCE model "Other User" (refer to "User 6" for unit rate build up).
	Other Users - 10 oz/yd2 non-woven geotextile	$396,923	$0	$396,923	For cost details see SRCE model "Other User" (refer to "User 7" for unit rate build up).
	Other Users - Bentonite (for Low Permeability Soil Layer amendment	$354,439	$0	$354,439	For cost details see SRCE model "Other User" (refer to "User 8" for unit rate build up).
	Mob/Demob	$22,585	$0	$22,585	For cost details see SRCE model "User 1". Please note, the mobilization and demobilization for the equipment (motor grader and water truck) associated with "reclamation monitoring and maintenance" is captured under reclamation monitoring and maintenance as a post closure cost.
	Subtotal	**$5,448,890**	**$0**	**$5,448,890**	
Reclamation Monitoring and Maintenance	Revegetation Maintenance	$0	$52,438	$52,438	For cost details see SRCE model "Reclamation Monitoring and Maintenance" (includes 25% of area requiring reseeding).
	Erosion Mainenance	$0	$59,132	$59,132	For cost details see SRCE model "Reclamation Monitoring and Maintenance" (includes 10% of growth media volume requiring maintenance).
	Reclamation Monitoring	$0	$542,520	$542,520	For cost details see SRCE model "Reclamation Monitoring and Maintenance" (includes field engineer to perform monitoring for 30 years).
	Water Quality Monitoring	$0	$153,627	$153,627	For cost details see SRCE model "Reclamation Monitoring and Maintenance" (includes sample analysis and reporting for 30 years).
	Mob/Demob	$0	$35,805	$35,805	For cost details see SRCE model "User 1". Please note, the mobilization and demobilization for the equipment (motor grader and water truck) associated with "reclamation monitoring and maintenance" is captured as a post closure cost.
	Subtotal	**$0**	**$843,522**	**$843,522**	
Water Treatment Plant 1	Labor Cost	$0	$1,973,835	$1,973,835	For cost details see SRCE model "User 9."
	Water Treatment Cost	$0	$3,276,291	$3,276,291	For cost details see SRCE model "User 9."
	Laboratory Cost	$0	$88,520	$88,520	For cost details see SRCE model "User 9."
	Subtotal	**$0**	**$5,338,646**	**$5,338,646**	
January Adit Plug	Earthworks	$225,000	$0	$225,000	For cost details see SRCE model "User 10."
	Bulkhead	$300,000	$0	$300,000	For cost details see SRCE model "User 10."
	Injection Grouting	$1,106,300	$0	$1,106,300	For cost details see SRCE model "User 10."
	Additional Contingency	$163,130	$0	$163,130	For cost details see SRCE model "User 10."
	Subtotal	**$1,800,000**	**$0**	**$1,800,000**	Please note, in the SRCE model this value was rounded up to nearest $10,000.
Underdrain Collection Pond (Passive Treatment System)	Construction Capital Costs	$1,017,831	$0	$1,017,831	For cost details see SRCE model "User 11."
	BCR Replacement Substrate	$0	$200,000	$200,000	For cost details see SRCE model "User 11."
	Permit Revisions	$0	$60,000	$60,000	For cost details see SRCE model "User 11."
	Limestone Channel	$0	$10,000	$10,000	For cost details see SRCE model "User 11."
	Misc Cost	$0	$1,456,626	$1,456,626	For cost details see SRCE model "User 11."
	Pump and Blower Replacement	$0	$44,000	$44,000	For cost details see SRCE model "User 11."
	Seep Pond Sludge Disposal	$0	$40,000	$40,000	For cost details see SRCE model "User 11."
	Escalation	$358,173	$637,157	$995,330	For cost details see SRCE model "User 11."
	Subtotal	**$1,376,004**	**$2,447,783**	**$3,823,787**	
Passive Closure Bridge	Construction Capital Costs	$1,251,837	$0	$1,251,837	For cost details see SRCE model "User 13."
	Subtotal	**$1,251,837**	**$0**	**$1,251,837**	
Total Costs (Direct Cost)		**$9,876,731**	**$8,629,951**	**$18,506,682**	Summation of costs labeled as operational and maintenance costs in SRCE.
SRCE Indirect Cost (total indirect cost as % of direct cost)			33%		Average value of indirects. Indirects include engineering, design, and construction (ED&C) plan, contingency, insurance, performance bond, contractor profit, contract administration, and government indirect cost.
		$3,282,815	**$2,868,412**	**$6,151,227**	
Total		**$13,159,546**	**$11,498,363**	**$24,657,909**	**Summation of direct and indirect costs.**

FIGURES



LEGEND:

- EXISTING GROUND CONTOURS
- PROPOSED CLOSURE CONTOURS
- PROPOSED STACKING CONTOURS
- EXISTING ROADS/TRAILS
- EXISTING ROADS/TRAILS
- PROJECT BOUNDARY
- SECTION LINES
- STORMWATER DIVERSION CHANNEL
- CULVERT (EXISTING OR PROPOSED)
- RECLAIM PIPE (SEE NOTE 2)
- LIMITS OF GROWTH MEDIA
- LIMITS OF REVEGETATION
- PASSIVE TREATMENT SYSTEM AREA
- LIMITS OF RIPRAP ARMORING
- EXISTING WILDLIFE FENCE
- MW-3 MONITORING WELL (TO BE ABANDONED)

NOTES:

1. THE PASSIVE TREATMENT SYSTEM IS TO BE DESIGNED BASED ON POST CLOSURE WATER CHEMISTRY AND FLOW RATES. ACTIVE TREATMENT OF UNDERDRAIN FLOWS WILL CONTINUE UNTIL AN APPROPRIATE PASSIVE TREATMENT SYSTEM CAN BE ESTABLISHED.
2. RECLAIM PIPE TO BE REMOVED FOLLOWING ESTABLISHMENT OF AN APPROPRIATE PASSIVE TREATMENT SYSTEM.
3. GROWTH MEDIA STORAGE AREA TO BE REVEGETATED AFTER GROWTH MEDIA IS MOVED TO THE TAILINGS STORAGE FACILITY.
4. PERIMETER ROAD TO BE RIPPED AND REVEGETATED AT CLOSURE.
5. A PORTION OF THE TSF1 PERIMETER ROAD WILL REMAIN OPEN AFTER CLOSURE OF THE TSF1 TO MAINTAIN ACCESS AROUND THE SITE AND TO TSF2. THE OPEN PORTION OF THE ROAD WILL BE RIPPED DURING CLOSURE OF THE TSF2.
6. CULVERTS INSTALLED AS A PART OF TSF1 ACTIVE CLOSURE TO BE UTILIZED TO MAINTAIN ACCESS TO THE SITE DURING OPERATIONS. AT PASSIVE CLOSURE, THE CULVERTS WILL BE REMOVED AND REPLACED WITH AN ARMORED OPEN CHANNEL SPILLWAY CAPABLE OF SAFELY PASSING THE PMF IN CONJUNCTION WITH CLOSURE OF TSF2.
7. ALL CUT AND FILL SLOPES LOCATED ALONG THE EXTERIOR OF THE TSF PERIMETER ROAD WERE HYDROSEEDED AS PART OF THE VRP TSF CONSTRUCTION.

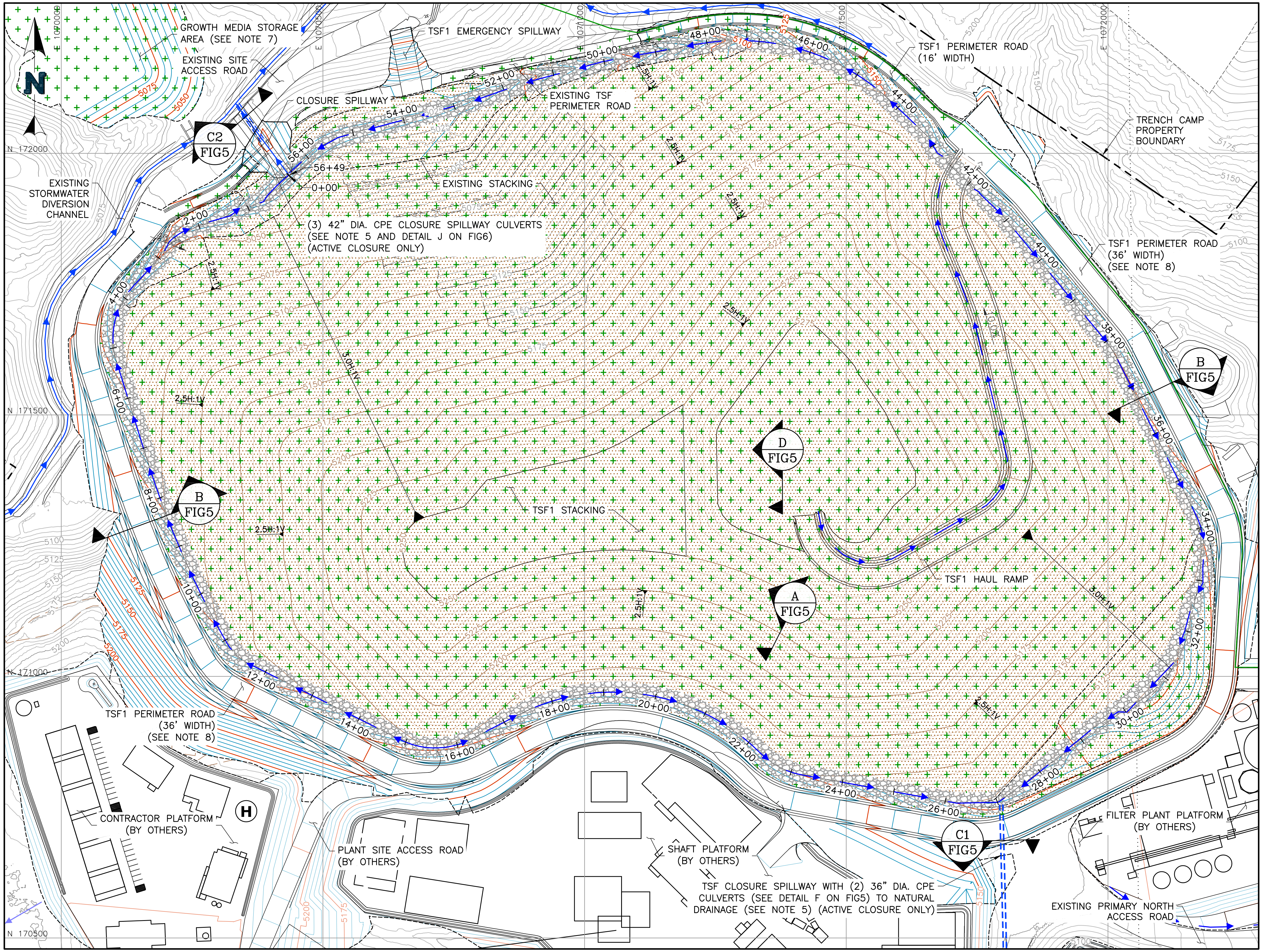
0 200 400 FEET

REFERENCE:

EXISTING GROUND TOPOGRAPHY DEVELOPED FROM MARCH 2020 AND APRIL 2023 AERIAL SURVEY DATA PROVIDED BY SOUTH32 (AMI). DATA PROJECTED TO STATE PLANE ARIZONA CENTRAL NAD 83 FEET, NAVD88.

NewFields	CLIENT: SOUTH32 HERMOSA INC.
PROJECT	TAILINGS STORAGE FACILITY 1 (TSF1) SRCE MODEL UPDATE
TITLE	CLOSURE STRATEGY (ACTIVE CLOSURE) GENERAL ARRANGEMENT
FILENAME	14.035.001F
FIGURE NO.	FIG1
REVISION	A

\\nfenglewood\Projects\0014.035 Hermosa TSF1-3 Design ADEQ APP Submittal\A-CAD\FIGS\SRCE Model\14.035.001F.dwg-10/6/2023 4:03 PM



0 100 200 FEET

LEGEND:

- EXISTING GROUND CONTOURS
- PROPOSED GROUND CONTOURS (SEE NOTE 1)
- PROPOSED GROUND CONTOURS (BY OTHERS)
- PROPOSED STACKING CONTOURS (SEE NOTE 4)
- EXISTING ROADS/TRAILS
- PROJECT BOUNDARY
- SECTION LINES
- RECLAIM PIPE (SEE NOTE 6)
- PROPOSED CULVERT
- STORMWATER DIVERSION CHANNEL
- LIMITS OF RIPRAP ARMORING
- LIMITS OF GROWTH MEDIA
- LIMITS OF REVEGETATION

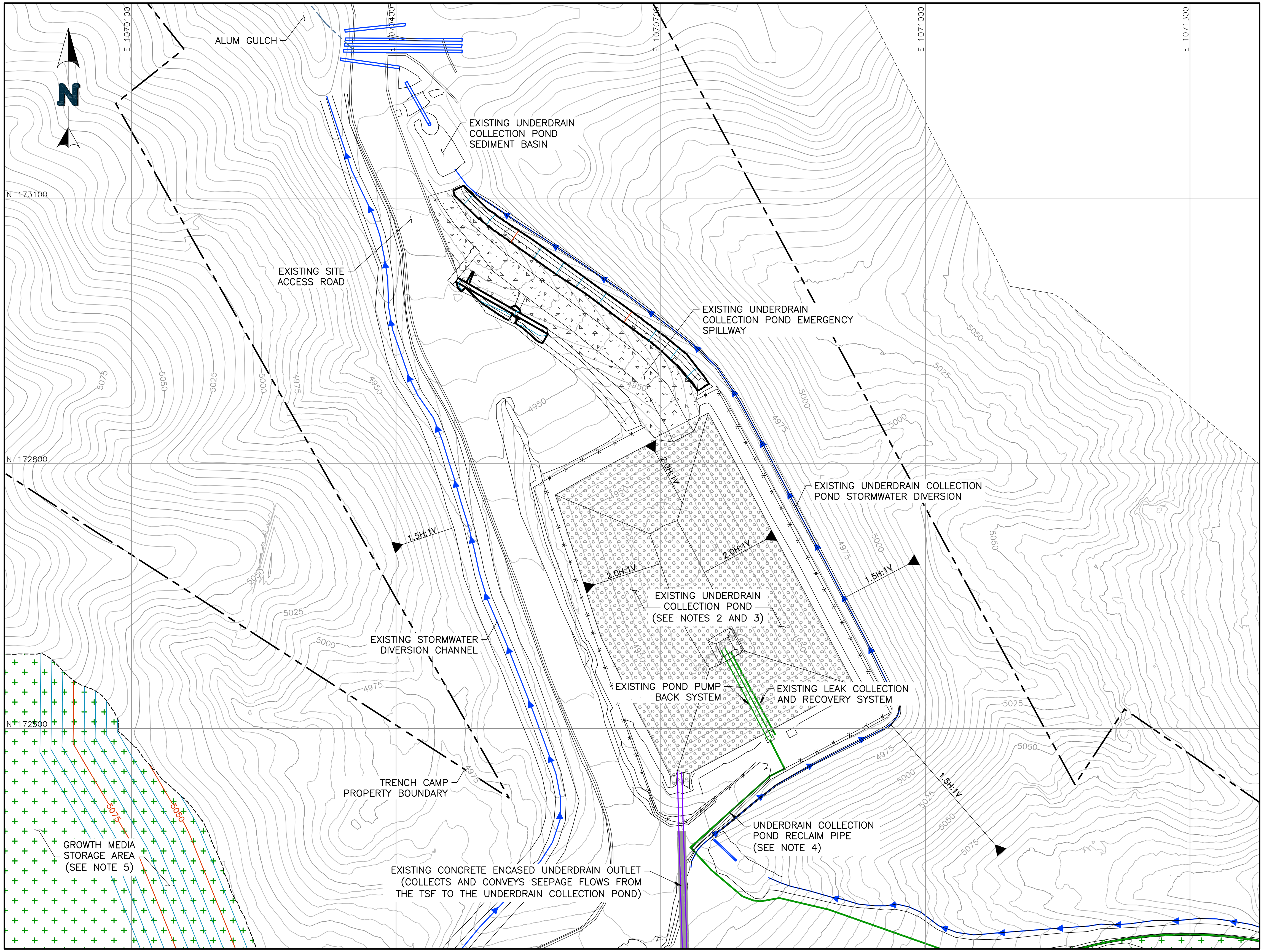
NOTES:

1. COVER MATERIAL TO BE HYDROSEEDED.
2. ALL CUT AND FILL SLOPES LOCATED ALONG THE EXTERIOR OF THE TSF PERIMETER ROAD WERE HYDROSEEDED AS PART OF THE VRP TSF CONSTRUCTION.
3. TSF ROCK ARMOR BERMS TO BE RE-GRADED TO 2.5H:1V OPEN SLOPES PRIOR TO GROWTH MEDIA PLACEMENT. COMPOSITE STACKING SLOPE WILL REMAIN AT 3H:1V WITH 12.5 FEET BENCHES REMAINING IN PLACE EVERY 25 VERTICAL FEET.
4. STACKING CONTOURS SHOWN REPRESENT MID BENCH LENGTHS WHICH ARE USED AS INPUT INTO THE SRCE MODEL TO ESTIMATE REGRADING COSTS.
5. CULVERTS INSTALLED AS A PART OF TSF1 ACTIVE CLOSURE TO BE UTILIZED TO MAINTAIN ACCESS TO THE SITE DURING OPERATIONS. AT PASSIVE CLOSURE, THE CULVERTS WILL BE REMOVED AND REPLACED WITH AN ARMORED OPEN CHANNEL SPILLWAY CAPABLE OF SAFELY PASSING THE PMF IN CONJUNCTION WITH CLOSURE OF TSF2. A PORTION OF THE MAINTENANCE PLATFORM MAY NEED TO BE REMOVED DURING PASSIVE CLOSURE.
6. RECLAIM PIPE TO BE REMOVED FOLLOWING ESTABLISHMENT OF AN APPROPRIATE PASSIVE TREATMENT SYSTEM.
7. GROWTH MEDIA STORAGE AREA TO BE REVEGETATED AFTER GROWTH MEDIA IS MOVED TO THE TAILINGS STORAGE FACILITY
8. A PORTION OF THE TSF1 PERIMETER ROAD WILL REMAIN OPEN AFTER TSF1 CLOSURE TO MAINTAIN ACCESS AROUND THE SITE AND TO TSF2.

REFERENCE:

EXISTING GROUND TOPOGRAPHY DEVELOPED FROM MARCH 2020 AND APRIL 2023 AERIAL SURVEY DATA PROVIDED BY SOUTH32 (AMI). DATA PROJECTED TO STATE PLANE ARIZONA CENTRAL NAD 83 FEET, NAVD88.

NewFields	CLIENT: SOUTH32 HERMOSA INC.
PROJECT	TAILINGS STORAGE FACILITY 1 (TSF1) SRCE MODEL UPDATE
TITLE: CLOSURE STRATEGY (ACTIVE CLOSURE) TSF1 PLAN VIEW	FILENAME: 14.035.002F; FIGURE NO.: FIG2; REVISION: A



LEGEND:

- EXISTING GROUND CONTOURS
- PROPOSED GROUND CONTOURS
- PROJECT BOUNDARY
- EXISTING FENCE
- EXISTING 36" DIA. HDPE DR11 UNDERDRAIN OUTFALL PIPE (SOLID) (SEE NOTE 3)
- EXISTING CONCRETE ENCASED UNDERDRAIN
- RECLAIM PIPE (SEE NOTE 4)
- 12" DIA. LCRS PIPE
- STORMWATER DIVERSION CHANNEL
- LIMITS OF GEOSYNTHETIC CEMENTITIOUS COMPOSITE MATS (GCCM)
- REPURPOSED AREA FOR PASSIVE TREATMENT SYSTEM
- LIMITS OF REVEGETATION
- CULVERT (EXISTING OR PROPOSED)

NOTES:

1. COVER MATERIAL TO BE HYDROSEEDED.
2. THE PASSIVE TREATMENT SYSTEM IS TO BE DESIGNED BASED ON POST CLOSURE WATER CHEMISTRY AND EXPECTED FLOW RATES. ACTIVE TREATMENT OF UNDERDRAIN FLOW WILL BE CONTINUED UNTIL AN APPROPRIATE PASSIVE SYSTEM CAN BE ESTABLISHED. AFTER ~2 YEARS OF SUCCESSFUL PASSIVE TREATMENT HAS BEEN COMPLETED, THE ACTIVE TREATMENT SYSTEM WILL BE DISCONTINUED.
3. THE EXISTING UNDERDRAIN COLLECTION POND WAS CONSTRUCTED WITH A LINER SYSTEM CONSISTING OF A GEONET SITED BETWEEN TWO 60mil HDPE DOUBLE TEXTURED GEOMEMBRANE LAYERS, ALL OVERLYING A GEOSYNTHETIC CLAY LINER (GCL). A LEAK COLLECTION RECOVERY SYSTEM (LRCS) WAS CONSTRUCTED BETWEEN THE PRIMARY AND SECONDARY GEOMEMBRANE LAYERS FOR RECOVERY OF SEEPAGE FLOW IN THE EVENT OF PRIMARY GEOMEMBRANE LEAKAGE.
4. RECLAIM PIPE TO BE REMOVED FOLLOWING ESTABLISHMENT OF AN APPROPRIATE PASSIVE TREATMENT SYSTEM.
5. GROWTH MEDIA STORAGE AREA TO BE REVEGETATED AFTER GROWTH MEDIA IS MOVED TO THE TAILINGS STORAGE FACILITY.

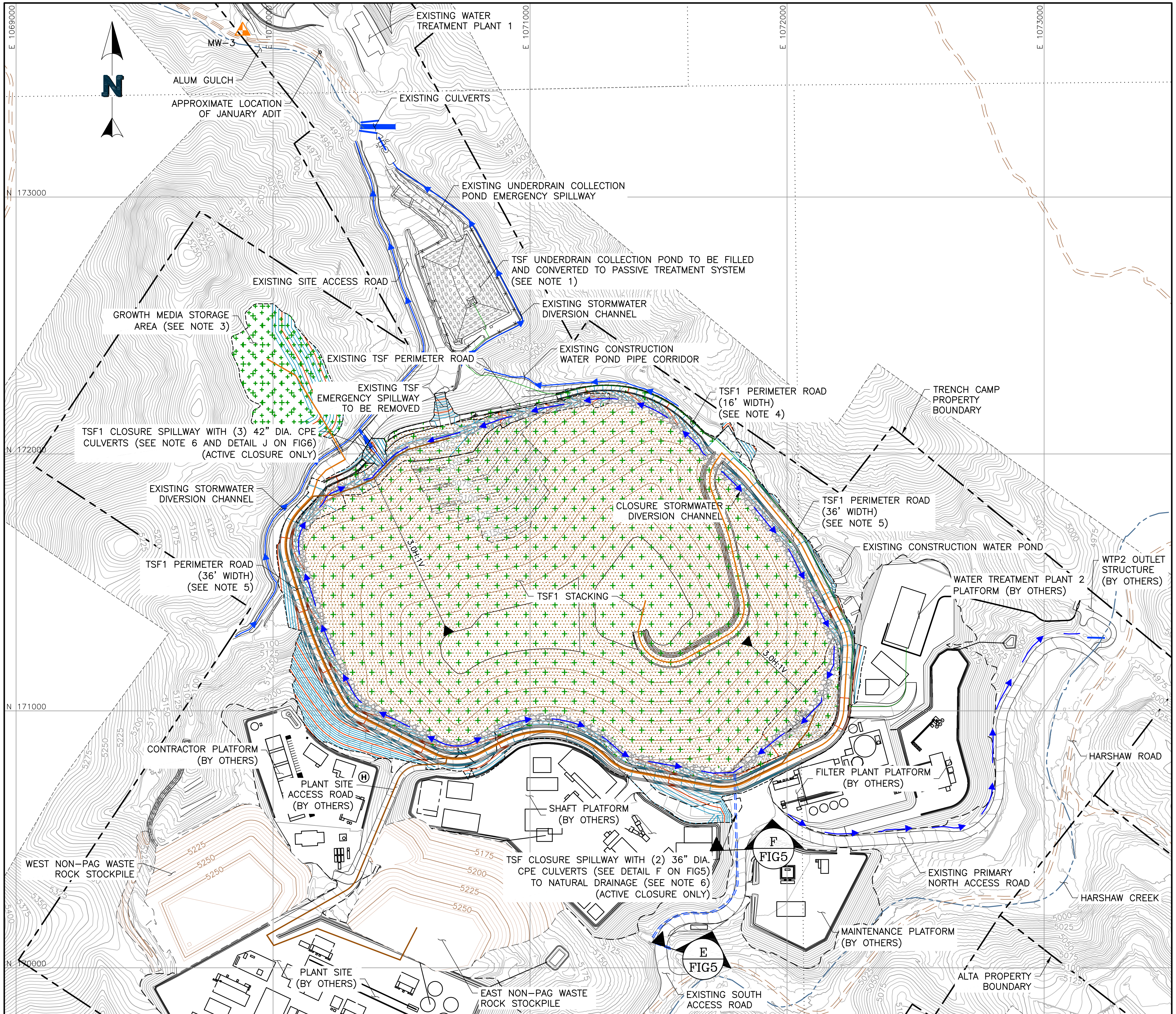
0 60 120 FEET

REFERENCE:

EXISTING GROUND TOPOGRAPHY DEVELOPED FROM MARCH 2020 AND APRIL 2023 AERIAL SURVEY DATA PROVIDED BY SOUTH32 (AMI). DATA PROJECTED TO STATE PLANE ARIZONA CENTRAL NAD 83 FEET, NAVD88.

NewFields	CLIENT: SOUTH32 HERMOSA INC.
PROJECT	TAILINGS STORAGE FACILITY 1 (TSF1) SRCE MODEL UPDATE
TITLE: CLOSURE STRATEGY (ACTIVE CLOSURE) UNDERDRAIN COLLECTION POND PLAN VIEW	FILENAME: 14.035.003F; FIGURE NO.: FIG3; REVISION: A

\\nfenglewood\Projects\0014.035 Hermosa TSF1-3 Design ADEQ APP Submittal\A-CAD\FIGS\SRCE Model\14.035.003F.dwg-8/22/2023 11:47 AM



LEGEND:

- EXISTING GROUND CONTOURS
- PROPOSED CLOSURE CONTOURS
- PROPOSED STACKING CONTOURS
- EXISTING ROADS/TRAILS
- EXISTING ROADS/TRAILS
- PROJECT BOUNDARY
- SECTION LINES
- STORMWATER DIVERSION CHANNEL
- CULVERT (EXISTING OR PROPOSED)
- RECLAIM PIPE (SEE NOTE 2)
- LIMITS OF GROWTH MEDIA
- LIMITS OF REVEGETATION
- PASSIVE TREATMENT SYSTEM AREA
- LIMITS OF RIPRAP ARMORING
- EXISTING WILDLIFE FENCE
- MW-3 MONITORING WELL (TO BE ABANDONED)
- CLOSURE TSF HAUL ROUTE FROM GROWTH MEDIA STOCKPILE
- CLOSURE TSF HAUL ROUTE FROM NON-PAG WASTE ROCK STOCKPILE

NOTES:

1. THE PASSIVE TREATMENT SYSTEM IS TO BE DESIGNED BASED ON POST CLOSURE WATER CHEMISTRY AND FLOW RATES. ACTIVE TREATMENT OF UNDERDRAIN FLOWS WILL CONTINUE UNTIL AN APPROPRIATE PASSIVE TREATMENT SYSTEM CAN BE ESTABLISHED.
2. RECLAIM PIPE TO BE REMOVED FOLLOWING ESTABLISHMENT OF AN APPROPRIATE PASSIVE TREATMENT SYSTEM.
3. GROWTH MEDIA STORAGE AREA TO BE REVEGETATED AFTER GROWTH MEDIA IS MOVED TO THE TAILINGS STORAGE FACILITY.
4. PERIMETER ROAD TO BE RIPPED AND REVEGETATED AT CLOSURE.
5. A PORTION OF THE TSF1 PERIMETER ROAD WILL REMAIN OPEN AFTER TSF1 CLOSURE TO MAINTAIN ACCESS AROUND THE SITE AND TO TSF2.
6. CULVERTS INSTALLED AS A PART OF TSF1 ACTIVE CLOSURE TO BE UTILIZED TO MAINTAIN ACCESS TO THE SITE DURING OPERATIONS. AT PASSIVE CLOSURE, THE CULVERTS WILL BE REMOVED AND REPLACED WITH AN ARMORED OPEN CHANNEL SPILLWAY CAPABLE OF SAFELY PASSING THE PMF IN CONJUNCTION WITH CLOSURE OF TSF2.
7. ALL CUT AND FILL SLOPES LOCATED ALONG THE EXTERIOR OF THE TSF PERIMETER ROAD WERE HYDROSEEDED AS PART OF THE VRP TSF CONSTRUCTION.

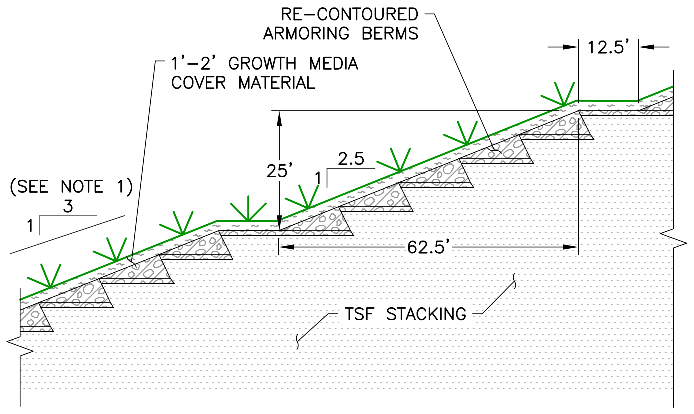
0 200 400 FEET

REFERENCE:

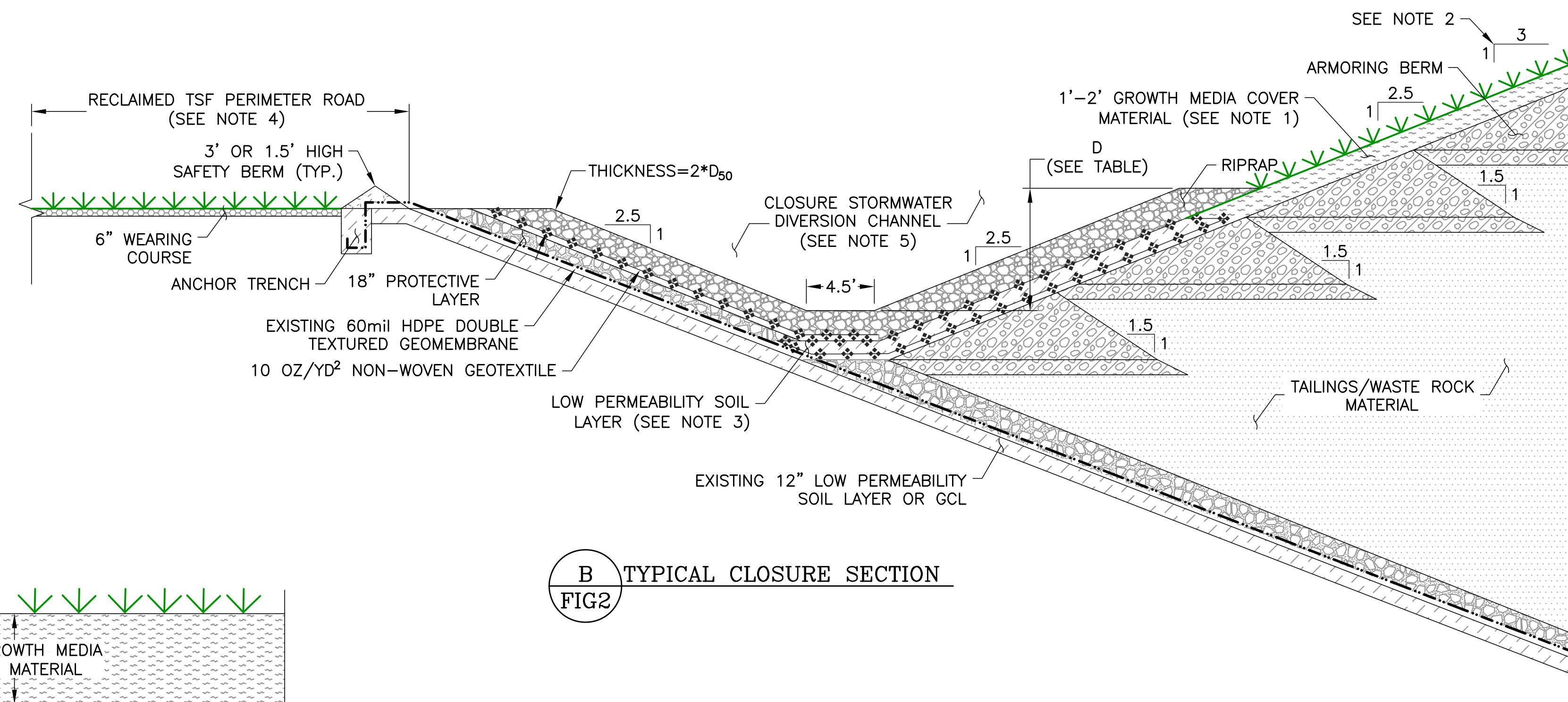
EXISTING GROUND TOPOGRAPHY DEVELOPED FROM MARCH 2020 AND APRIL 2023 AERIAL SURVEY DATA PROVIDED BY SOUTH32 (AMI). DATA PROJECTED TO STATE PLANE ARIZONA CENTRAL NAD 83 FEET, NAVD88.

NewFields	CLIENT: SOUTH32 HERMOSA INC.
PROJECT	TAILINGS STORAGE FACILITY 1 (TSF1) SRCE MODEL UPDATE
TITLE	CLOSURE STRATEGY (ACTIVE CLOSURE) HAUL ROADS PLAN VIEW
FILENAME	14.035.005F
FIGURE NO.	FIG4
REVISION	A

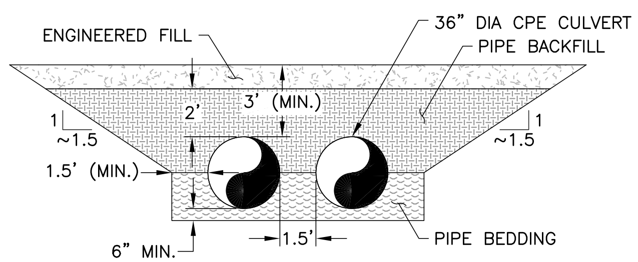
\\nfenglewood\Projects\0014.035 Hermosa TSF1-3 Design ADEQ APP Submittal\A-CAD\FIGS\SRCE Model\14.035.005F.dwg-10/9/2023 5:08 PM



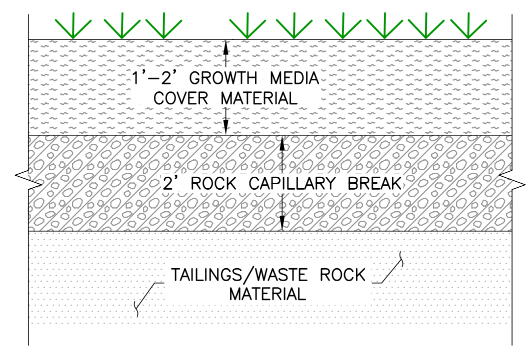
A
FIG2
CLOSURE STACKING



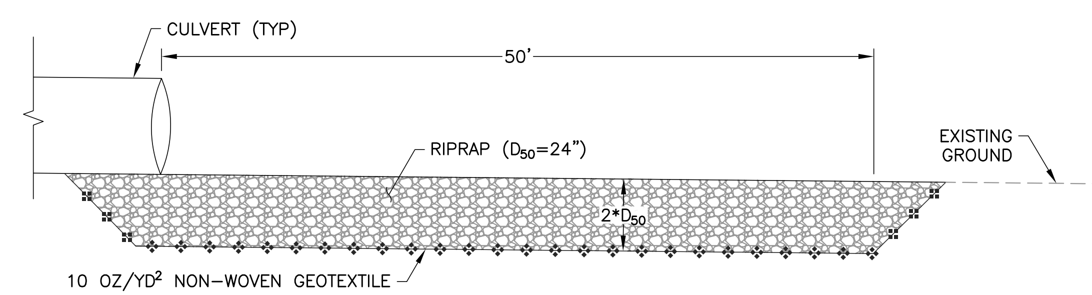
B
FIG2
TYPICAL CLOSURE SECTION



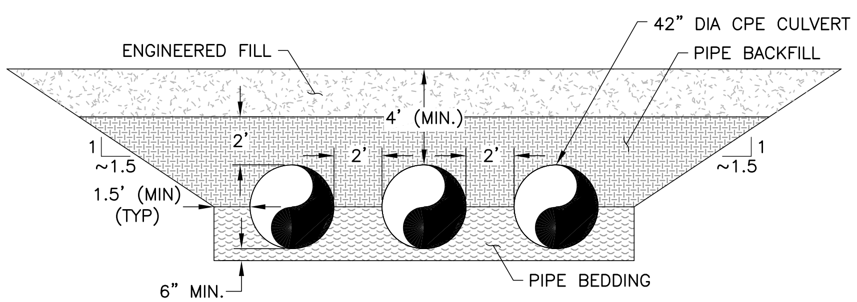
C1
FIG2
TYPICAL SPILLWAY CULVERT SECTION



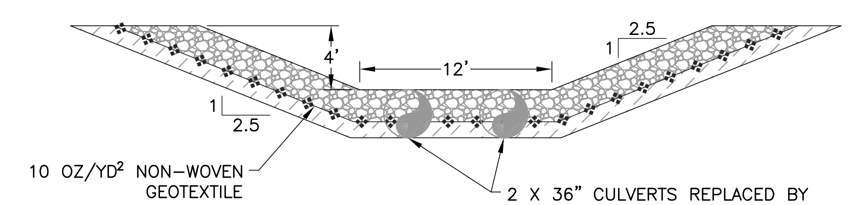
D
FIG2
PAD CLOSURE SECTION



E
FIG4
TYPICAL SPILLWAY CULVERT OUTLET



C2
FIG2
TYPICAL SPILLWAY CULVERT SECTION



F
FIG4
TSF CLOSURE SPILLWAY

NOTES:

1. GROWTH MEDIA COVER MATERIAL TO BE HYDROSEEDED.
2. 3H:1V COMPOUND SLOPE IS COMPRISED OF 25 FT HIGH 2.5H:1V SLOPE IN COMBINATION WITH A 12.5 FT BENCH.
3. LOW PERMEABILITY SOIL LAYER TO BE PLACED AT CHANNEL BOTTOM DURING CLOSURE TO PREVENT POTENTIAL RECHARGE TO THE UNDERDRAIN SYSTEM.
4. PERIMETER ROAD TO BE RIPPED AND REVEGETATED AT CLOSURE.
5. ACTUAL CLOSURE CHANNEL DIMENSIONS AND ARMORING TO BE DETERMINED AT TIME OF CLOSURE BASED ON AS-BUILT STACKING INFORMATION.
6. CULVERTS INSTALLED AS A PART OF THE TSF1 ACTIVE CLOSURE TO BE UTILIZED TO MAINTAIN ACCESS TO THE SITE DURING OPERATION OF TSF2. DURING PASSIVE CLOSURE, THE CULVERTS WILL BE REMOVED AND REPLACED WITH AN ARMORED OPEN CHANNEL SPILLWAY CAPABLE OF SAFELY PASSING THE PMF.

INTERNAL CLOSURE CHANNEL DIMENSIONS

CHANNEL SLOPE	MINIMUM DEPTH (D)	APPROXIMATE RIPRAP SIZE (D50)	STATION RANGE (SEE ALIGNMENT ON FIG2)
<=1%	5.5'	6"	26+50 TO 34+00 35+35 TO 38+00 39+00 TO 43+00
>1% TO <5%	5.5'	12"	0+00 TO 0+50 18+00 TO 23+00 52+20 TO 56+50
5% TO 10%	4'	18"	0+50 TO 11+00 12+00 TO 18+00 23+00 TO 26+50 34+00 TO 35+35 38+00 TO 39+00 43+00 TO 44+25
>10%	3.5'	24"	11+00 TO 12+00 44+25 TO 52+20

NewFields

CLIENT: SOUTH32 HERMOSA INC.

PROJECT: TAILINGS STORAGE FACILITY 1 (TSF1) SRCE MODEL UPDATE

TITLE: CLOSURE STRATEGY (ACTIVE AND PASSIVE) CLOSURE SECTIONS & DETAILS

FILENAME: 14.035.006F

FIGURE NO.: FIG5

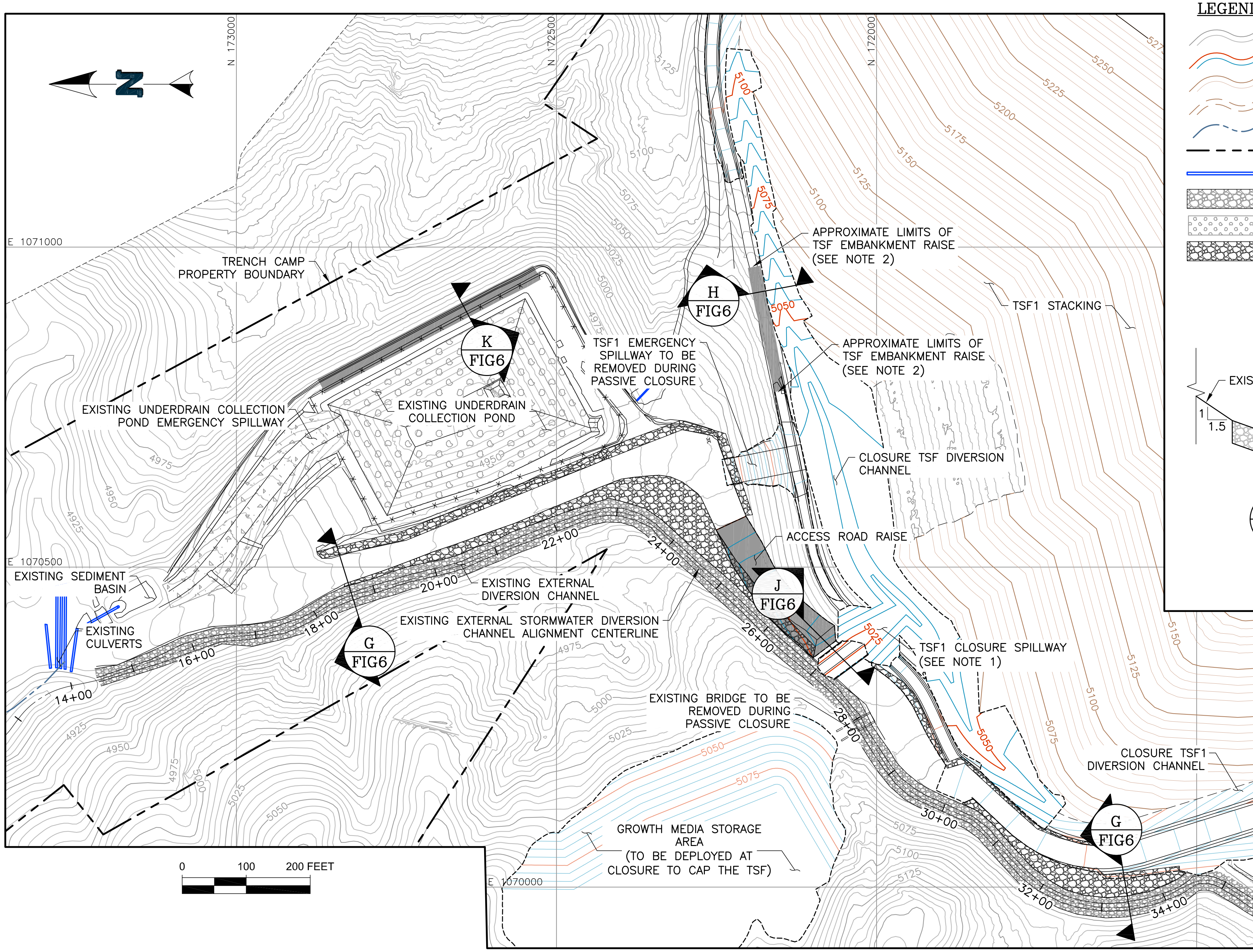
REVISION: A

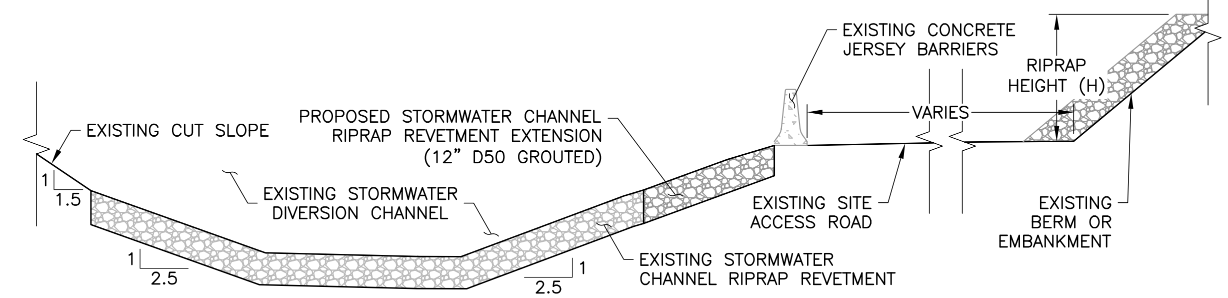
LEGEND:

- EXISTING GROUND CONTOURS
- CLOSURE GROUND CONTOURS
- TSF1 AND AD STACKING CONTOURS
- EXISTING ROADS/TRAILS
- EXISTING DRAINAGES
- PROJECT BOUNDARY
- EXISTING CULVERT
- RIPRAP LINED STORMWATER DIVERSION CHANNEL
- PASSIVE TREATMENT SYSTEM AREA
- PROPOSED 12" D50 GROUTED RIPRAP

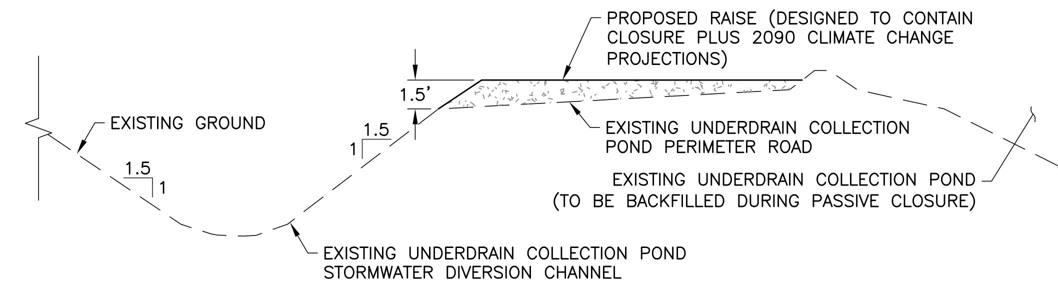
NOTES:

1. AS PART OF CLOSURE CONSTRUCTION, A TRAPEZOIDAL SPILLWAY WILL BE CUT INTO THE EXISTING TSF PERIMETER ROAD (EMBANKMENT) AND EXISTING ACCESS ROAD. THE TRAPEZOIDAL SPILLWAY WILL OUTLET THE CLOSURE TSF DIVERSION CHANNELS INTO THE EXISTING EXTERNAL STORMWATER DIVERSION CHANNEL. A BRIDGE WILL BE CONSTRUCTED TO SPAN THE SPILLWAY TO MAINTAIN SITE ACCESS.
2. THE TSF PERIMETER ROAD (EMBANKMENT) WILL REQUIRE A 2FT RAISE FOR PASSIVE CLOSURE TO DIRECT STORM FLOWS TO THE TSF SPILLWAY CONSIDERING INCREASED STORM INTENSITY FROM CLIMATE CHANGE. RAISE TO BE CONSTRUCTED PRIOR TO TSF CLOSURE SPILLWAY CONSTRUCTION.
3. PASSIVE CLOSURE DESIGN CONSIDERS 2090 CLIMATE CHANGE PROJECTIONS AS PROVIDED BY SOUTH32 IN THE POTENTIAL IMPACT OF CLIMATE CHANGE (PICC) ASSESSMENT. CLIMATE CHANGE PROJECTIONS TO BE UPDATED DURING FINAL CLOSURE DESIGN.



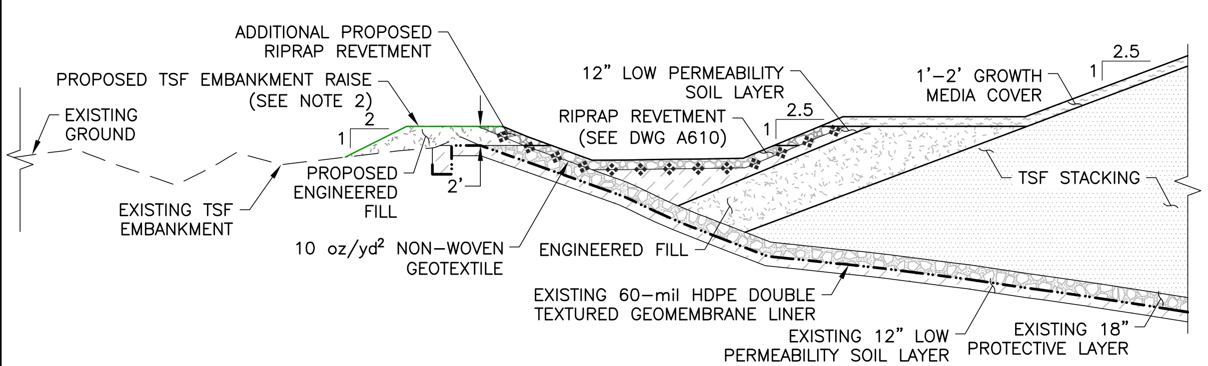


G FIG6 EXISTING STORMWATER DIVERSION CHANNEL RIPRAP EXTENSION SECTION (SEE NOTE 3)

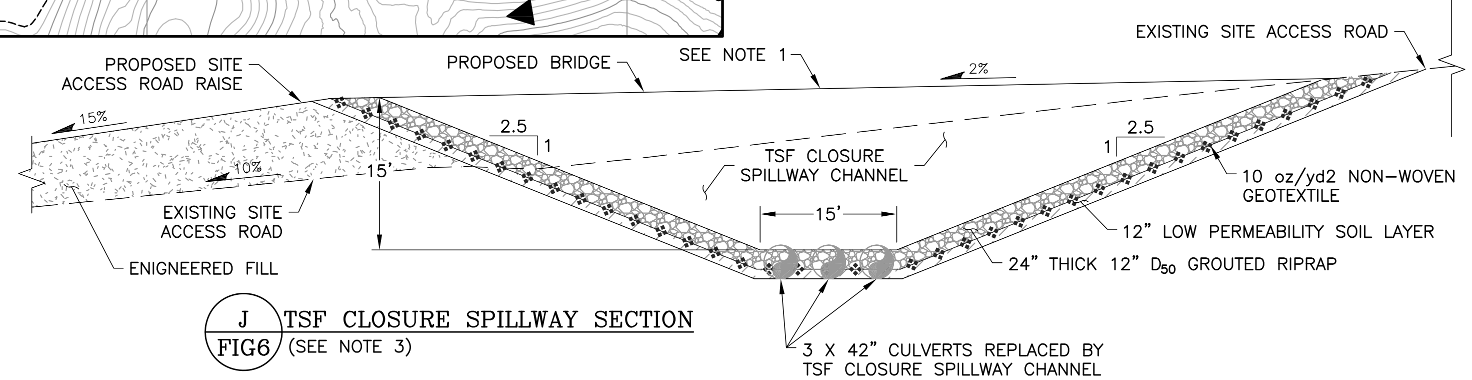


K FIG6 UDCP STORMWATER DIVERSION CHANNEL SECTION (SEE NOTE 3)

STATION	MINIMUM RIPRAP HEIGHT ABOVE ACCESS ROAD (H) (ft)
18+00 – 27+00	3.0
27+00 – 34+50	2.0



H FIG6 TSF PERIMETER ROAD (EMBANKMENT) RAISE SECTION (SEE NOTE 3)



J FIG6 TSF CLOSURE SPILLWAY SECTION (SEE NOTE 3)

REFERENCE:

EXISTING GROUND TOPOGRAPHY DEVELOPED FROM MARCH 2020 AND APRIL 2023 AERIAL SURVEY DATA PROVIDED BY SOUTH32 (AMI). DATA PROJECTED TO STATE PLANE ARIZONA CENTRAL NAD 83 FEET, NAVD88.

NewFields	CLIENT: SOUTH32 HERMOSA INC.
PROJECT	TAILINGS STORAGE FACILITY 1 (TSF1) SRCE MODEL UPDATE
TITLE	CLOSURE STRATEGY (PASSIVE CLOSURE) PLAN VIEW, SECTIONS & DETAILS
FILENAME	14.035.007F
FIGURE NO.	FIG6
REVISION	A

ATTACHMENT D

Proposed Aquifer Protection Permit Revisions

STATE OF ARIZONA
AQUIFER PROTECTION PERMIT NO. P-512235
PLACE ID 18640 LTF 98095
~~MINOR~~SIGNIFICANT AMENDMENT

1.0 AUTHORIZATION

In compliance with the provisions of Arizona Revised Statutes (A.R.S.) Title 49, Chapter 2, Articles 1, 2 and 3, Arizona Administrative Code (A.A.C.) Title 18, Chapter 9, Articles 1 and 2, A. A. C. Title 18, Chapter 11, Article 4 and amendments thereto, and the conditions set forth in this permit, the Arizona Department of Environmental Quality (ADEQ) hereby authorizes ~~Arizona Minerals Inc~~South32 Hermosa Inc. to operate the Hermosa Project Property located approximately 5 miles south of the Town of Patagonia, Arizona, over groundwater of the Santa Cruz groundwater basin, in Section 32 in Township 22S, Range 16E and in Township 23S, Range 16E ; and un-surveyed Sections 3 and 4, of the Gila and Salt River Baseline and Meridian.

This permit becomes effective on the date of the Water Quality Division Deputy Director's signature and shall be valid for the life of the facility (operational, closure, and post-closure periods) unless suspended or revoked pursuant to A.A.C. R18-9-A213. The permittee shall construct, operate and maintain the permitted facilities:

1. Following all the conditions of this permit including the design and operational information documented or referenced below, and
2. Such that Aquifer Water Quality Standards (AWQS) are not violated at the applicable point(s) of compliance (POC) set forth below or if an AWQS for a pollutant has been exceeded in an aquifer at the time of permit issuance, that no additional degradation of the aquifer relative to that pollutant and as determined at the applicable POC occurs as a result of the discharge from the facility.

1.1. PERMITTEE INFORMATION

Facility Name:	Hermosa Project
Facility Address:	749 Harshaw Road Patagonia, Arizona 85624
County:	Santa Cruz
Annual Registration Fee Flow Rate:	6,652,000 gallons per day (gpd)
Permittee:	South32 Hermosa Inc.
Permittee Address:	1860 E River Road, Suite 200 Tucson, Arizona 85718
Facility Contact:	Brent Musslewhite
Emergency Phone No.:	(520) 485-1300
Latitude/Longitude:	31° 27' 59.4" N/110° 43' 35.8" W
Legal Description:	Section 32 in Township 22S, Range 16E and in Township 23S, Range 16E; and un-surveyed Sections 4 and 5, of the Gila and Salt River Baseline and Meridian.

1.2. AUTHORIZING SIGNATURE

____

Randall Matas, Deputy Director
Water Quality Division
Arizona Department of Environmental Quality

Signed this _______ day of _________________, 2023

THIS AMENDED PERMIT SUPERCEDES ALL PREVIOUS PERMITS

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TABLE OF TABLES

2.0 SPECIFIC CONDITIONS

[A.R.S. §§ 49-203(4), 49-241(A)]

2.1. FACILITY / SITE DESCRIPTION

[A.R.S. § 49-243(K)(8)]

The Hermosa Project Property is located approximately 5 miles south of the Town of Patagonia, Arizona. Arizona Minerals Inc. (~~AMI~~now South32 Hermosa, Inc.) purchased the historic, January and Norton Mine Claims and the Trench Camp Mine C~~c~~laims and associated Tailings Pile/waste rock from the ASARCO Trust in early 2016. The historic Mine Claims are closed and not considered APP regulated facilities and thus exempt according to the Arizona Revised Statue (A.R.S.) § 49 ~~-~~-201.7 and A.R.S. § 49-250.B.11. The original APP application ~~h~~was ~~been~~ submitted for APP-regulated discharges associated with ADEQ's Voluntary Remediation Program (VRP) project related to eliminating discharges of mine impacted water from January Adit mine workings and tailing piles (which includes potentially acid generating ~~(~~[PAG]~~)~~ waste rock) seepage to Alum Gulch.

The ~~Trench Camp~~ historic tailings piles (1 through 4) were located within an unlined natural basin in a three pile configuration. Tailings Pile #1 contained tailings and potentially acid generating (PAG) waste rock. Stockpiles #2 and #4 contained only tailings and ~~have been~~were combined into one pile~~ referred to as Tailings Pile #2 and are generally divided by the 5,100 foot contour elevation~~. In addition Tailings Pile # 3 contained only tailings.

The ~~Trench Camp~~ TSF was originally ~~is~~ designed as a lined, dry-stack permanent storage area for the remediation of the ~~existing~~ historic tailings piles, described above. Placement of the ~~existing~~ historic tailings piles on the lined permanent containment ~~is~~ was part of the VRP program in Arizona under the site code 505143-2. Tailings, PAG waste rock and impacted soils beneath the ~~existing~~historic tailings piles ~~are to be~~were excavated and placed in the lined ~~Trench Camp~~ TSF as an earthen material. PAG development rock from site surface construction and from an ~~planned~~ exploration decline or shaft, solids from the water treatment plants WTP1 and WTP2, core cuttings, drill cuttings, and stormwater best management practices (BMPs) solids ~~will~~are also be stored in the lined TSF as a co-mingled material with the historic~~existing~~ tailings and PAG waste rock. Additionally, ~~the~~ construction or development rock ~~may be~~was placed on the exterior face of the TSF thereby acting as ~~rock~~ armoring, to prevent water and wind erosion prior to closure.

The ~~Trench Camp~~ TSF ~~shall be constructed in three stages;~~ construction began in 2018. The TSF consists of a lined tailings storage facility, two stormwater detention ponds and an underdrain collection pond. The tailings seepage water ~~in the Trench Camp TSF will be~~is collected through an ~~underground~~ underdrain collection system and gravity fed to the double lined underdrain collection pond (~~UCP~~UDCP). The ~~UCP~~UDCP ~~will be~~was constructed downgradient of the ~~Trench Camp~~ TSF. The captured tailings seepage water, precipitation that falls within the ~~UCP~~UDCP and water from the January Adit (the January and Norton Mine Claims) ~~will be~~are piped to~~ ~~ WTP1 and/or WTP2 for treatment and discharge to Alum Gulch and/or Harshaw Creek under AZPDES permit No AZ0026387. The TSF was constructed in stages as follows:

Interim Stage

The materials from historic Tailings Pile #1, which included 225,000 cubic yards of tailings, waste rock, and native material, were excavated, hauled and temporarily placed on Tailings Piles #2 and #4 in order to provide space for the Stage 1 TSF. The temporary placement of Tailing Pile #1 on Tailings Piles #2 and #4 consisted of approximately 5H:1V (horizontal: vertical) slopes, 50 feet (ft.) setback from the brow of the existing slope on Tailings Pile #2, and an approximate maximum height of 30 ft.

Stage 1

Stage 1 of the ~~Trench Camp~~ TSF was constructed and utilizes approximately 650,000 square feet (ft^2) of lined containment. Approximately 950,000 cubic yards of tailings, waste rock and native material were excavated, hauled, placed and compacted within the lined Stage 1 ~~Trench Camp~~ TSF from temporary Tailings Pile #1 and Tailings Piles #2 and #4. This volume includes the 225,000 cubic yards of Interim Stage material discussed above.

Stage 2

Stage 2 of the ~~Trench Camp~~ TSF was constructed after Stage 1 and utilizes approximately 596,000 ft^2 of additional lined containment. Approximately 280,500 cubic yards of additional tailings, waste rock and native material were excavated, hauled, placed and compacted within the lined Stage 2 ~~Trench Camp~~ TSF from Tailings Piles #2 and #4, and Tailings Pile #3. All historic tailings, waste rock and native materials from Tailings Piles #1, #2, #3 and #4 have been relocated within the constructed Stage 1 and 2 TSF lined containment as a compacted earthen fill totaling approximately 1,230,500 cubic yards.

To complete the design stacking geometry, approximately 1,400,000 cubic yards of additional material including exploration decline or shaft development rock, filter cake from WTP1 ~~(approximately 20,097 cubic yards)~~ and WTP2 ~~(approximately 14,949 cubic yards)~~, core cutting solids ~~(approximately 105 cubic yards)~~, drill cuttings ~~(approximately 5 cubic yards)~~, construction PAG rock ~~(approximately 385,051 cubic yards)~~, and sediments from stormwater control features ~~(approximately 9,000 cubic yards)~~, ~~will be~~ were placed in the ~~Trench Camp~~ TSF. ~~These volumes are estimates only, but reflect the overall proportion of each type of material expected to be placed into the TSF.~~ The actual volumes of the various materials placed in the TSF may vary so long as all placement requirements are met for each material type (see Section 2.2.1.1). The permitted elevation of the Stage 2 TSF is ~~and the elevation of the completed TSF does not exceed~~ 5,175 feet. All materials ~~will be~~are/were placed within the existing lined Stage 1 and Stage 2 TSF footprint.

Stage 3 (TSF1):

The TSF expansion, referred to as "TSF1", will increase the geomembrane lined footprint laterally from the current footprint of approximately 28 acres to approximately 55 acres. TSF1 will have a maximum stacking height of 243 feet reaching a maximum elevation of 5275 feet. TSF1 will employ a composite lining system consisting of 60 mil double sided textured HDPE geomembrane overlying either 12 inches of compacted LPSL or GCL. With the permitting of TSF1 (Stage 3), the following materials will be permitted for placement in TSF1:

- Historic tailings (during Stages 1 and 2)
- Production tailings (dry stack) (Stage 3)
- Development rock from exploration and future mine development
- Soil and rock from construction cuts, including PAG
- Solids associated with water treatment including filter cake
- Core-cutting solids
- Drill cuttings
- Assay rejects
- Sediments from vehicle and equipment wash sumps
- Sediments from stormwater BMPs

Dry stack historic and production tailings are the primary material placed in TSF1. Filter cake from WTP1 and WTP2, core cutting solids, drill cuttings, assay rejects, sediments from vehicle and equipment wash sumps, and sediments from stormwater BMPs constitute a small amount (<2%) of the total TSF1 volume.

The site includes the following permitted discharging facilities:

Table 1: DISCHARGING FACILITIES		
Facility	**Latitude**	**Longitude**
Lined Tailings Storage Facility (TSF1)	31° 27' 59.4" N	110° 43' 35.8" W
Underdrain Collection Pond (~~UCP~~UDCP)	31° 27' 59" N	110° 43' 39.2" W
AZPDES Outfall 001	31° 28' 15" N	110° 43' 43" W
AZPDES Outfall 002	31° 27' 56.62" N	110° 43' 11.51" W

2.1.1. Annual Registration Fee

[A.R.S. § 49-242 and A.A.C. R18-14-104]

The annual registration fee for this permit is payable to ADEQ each year. The permitted flow for fee calculation is 6,652,000 gallons per day (gpd). If the facility is not yet constructed or is incapable of discharge at this time, the permittee may be eligible for reduced fees under the rule. Send all correspondence requesting reduced fees to the Water Quality Division of ADEQ. Please reference the permit number, LTF number and why reduced fees are requested under the rule.

2.1.2. Financial Capability

[A.R.S. § 49-243(N) and A.A.C. R18-9-A203]

The Permittee shall be required to demonstrate financial capability under A.R.S. § 49-243(N) and A.A.C. R18-9-A203. The Permittee shall be required to maintain financial capability throughout the life of the facility. The closure costs are $13,159,546, and post-closure costs are $11,498,363, for a total of $24,657,909. The financial assurance mechanism shall be demonstrated through a "performance surety bond" or another approved mechanism as per A.A.C. R18-9-A203(C)(2).

2.2. BEST AVAILABLE DEMONSTRATED CONTROL TECHNOLOGY (BADCT)

[A.R.S. § 49-243(B) and A.A.C. R18-9-A202(A)(5)]

Facilities regulated by this permit shall be designed, constructed, operated, and maintained to meet requirements specified by A.R.S. §49-243(B) and A.A.C. R18-9-A202(A)(5).

2.2.1. Engineering Design

The ~~Trench Camp~~ TSF and the ~~UCP~~UDCP employ prescriptive BADCT components (in accordance with the Arizona Mining BADCT Guidance Manual (AMBGM)). BADCT has been determined in accordance with the AMBGM. The design of the ~~UCP~~UDCP incorporates enhanced discharge control measures (such as double liner and leak collection and recovery systems) that go beyond the prescriptive components identified in the AMBGM for non-stormwater impoundments.

2.2.1.1. Tailings ~~Impoundment~~ Storage Facility 1 (TSF1) (Stages 1, ~~and~~ 2, and 3 ~~TSF~~)

The lined, dry stack TSF will be constructed in ~~two~~ three Stages (in addition to the "Interim Stage" described in Section 2.1). Stages 1 and 2 have been completed. BADCT for each Stage is provided below:

2.2.1.1.1. Stage 1

Prior to placement of the tailings material, the basin area was~~shall be~~ cleared of any vegetation and stripped of any growth media and graded to have maximum slopes of 2.5H (horizontal):1V (vertical). A composite liner system consisting of a 12 inch thick low permeability soil layer (LPSL) having a coefficient of permeability that is less than or equal to 1.0 x 10-6 centimeters/second (cm/sec) overlain by a double-sided textured 60 mil high density polyethylene (HDPE) liner ~~shall be~~was placed over the graded area. The geomembrane ~~shall be~~is anchored in the perimeter road at a setback of 3 ft. with trenched dimensions of 3 ft. deep by 2 ft. wide. An 18 inch (in.) protective layer composed of 1 1/2 in. minus granular material ~~shall be~~was placed over the geomembrane. An underdrain collection system, consisting of a series of pipes ~~shall be~~was placed in topographic lows to collect drainage from the base of the facility and convey them to the ~~UCP~~UDCP via the concrete encased underdrain outlet pipe works. At the outlet point of the underdrain pipes, valves ~~shall be installed to~~ control flow to the ~~Underdrain Collection Pond~~UDCP. The maximum permitted elevation of the Stage 1 TSF ~~shall not exceed~~was 5,175 ft.

External and internal stormwater channels ~~shall be constructed to appropriately~~ capture and convey stormwater from a 100-year/24-hour storm event. A geomembrane lined external stormwater detention basin having the capacity of 2.66 million gallons (8.16 ac. ft.) ~~shall be constructed to~~ routes runoff from the east side (upstream) of Stage 1 to the underdrain collection system via a pipe located in the basin low point. After Tailings Piles 1, 2 and 4 ~~a~~were relocated to the Stage 1 TSF, the external stormwater detention basin pipe ~~shall be~~was capped and the detention basin ~~shall be~~ was expanded as part of the Stage 2 TSF basin construction. Two internal detention basins are designed to contain contact stormwater, one having a capacity of 847,214 gallons (2.6 acre feet (ac. ft.)) ~~shall be constructed~~ in the northwestern portion of Stage 1 TSF, and another having a capacity of 488,777 gallons (1.5 ac. ft.) ~~shall be constructed~~ near the northeastern portion of Stage 1 TSF.

2.2.1.1.2. Stage 2

The Stage 2 TSF ~~i~~was~~shall be~~ constructed in a manner similar to that of Stage 1 TSF. The permittee ~~may~~ used a geosynthetic clay liner (GCL) ~~in lieu of the~~and LPSL if field conditions allow its use and it is approved by the design engineer. The maximum elevation of the Stage 2 TSF shall match up with the Stage 1 TSF elevation and shall not exceed 5,175 ft. During the Stage 2 construction, the 2.6 ac. ft. internal detention basin located at the northwestern portion ~~will be~~was expanded to contain a minimum volume of 3,258,514 gallons (10 ac. ft.) of contact stormwater, and another 260,681 gallons (0.8 ac. ft.) internal detention basin will be constructed in the eastern portion of the Stage 2 TSF. The 1.5 ac. ft. internal detention basin located at the northeastern portion of the Stage I TSF ~~will be~~was covered by materials deposited in this stage.

A geomembrane lined external stormwater detention basin having ~~the~~ a minimum capacity of 3.2 million gallons (9.82 ac. ft.) to detain upstream unimpacted runoff on the east side of Stage 2 ~~shall be~~was constructed. The unimpacted runoff captured in this detention pond shall be pumped around the TSF until closure is substantially complete.

~~A minimum of f~~Four (4) piezometers ~~shall be placed~~were installed immediately adjacent to the geomembrane surface within the protective layer next to an underdrain collection pipe within the TSF to measure hydraulic head on the liner system, at the locations and as per the design submitted in the application. The phreatic surface in these piezometers shall be maintained below 1.5 feet.

The permittee is allowed to place additional materials including solids from WTP1 and WTP2, core cutting solids, drill cuttings, construction PAG, and sediment from stormwater BMPs. The placement of the solids shall be in accordance with the recommendations and following all quality control and quality assurance procedures (QA/QC) made in the Attachment C of the application dated August 14, 2020.

~~Solids from WTP~~

~~Filter cake from WTP1 is currently stored on the TSF. Recently permitted upgrades to WTP1 will result in additional filter cake solids at approximately 3,650 cubic yards per year. The solids shall be hauled to the TSF in approximately 20 cubic yard increments.~~

~~WTP2 filter cake is anticipated to be hauled and placed in the TSF at a rate of approximately 4,380 cubic yards per year from the stage one filter press and approximately 146 cubic yards per year from the stage two filter press for an aggregate total of approximately 4,526 cubic yards per year. It will be hauled to the TSF in approximately 20 cubic yard increments. WTP2 filter cake material properties are assumed to be similar in nature to WTP1 filter cake and therefore the placement criteria are the same for both filter cake products.~~

~~The anticipated material properties are as follows based on a control sample obtained November 20th, 2019:~~

- ~~100 percent passing (by dry weight) the no. 200 sieve.~~
- ~~Non-plastic soil.~~
- ~~Moisture content will be 363% (based on dry weight of solids) upon arrival to the TSF.~~

~~Upon placement on the TSF, filter cake from WTP1 and WTP2 shall be spread and dried to reduce the material moisture content. The filter cake shall then be mixed with tailings, on site native borrow material and/or development rock at a minimum ratio of 3:1 (tailings/on site native borrow/development rock to filter cake). After mixing, the material shall be moisture conditioned to within 2 percent below and 3 percent above the optimum moisture content. The material shall be placed in 12-inch maximum loose lifts and compacted to 90 93 percent of the maximum dry density as determined by ASTM D698.~~

~~Core-cutting solids~~

~~Approximately 12 40 cubic yards per year of core cutting solids will be placed on the TSF. This material simply consists of rock fragments generated from cutting of core. Upon placement in the TSF, the core cutting material shall be spread and dried to reduce the material moisture content. The core cutting material shall then be mixed with tailings, on site native borrow material and/or development rock at a minimum ratio of 3:1 (tailings/on site native borrow/development rock to core cutting material). After mixing, the material shall be moisture conditioned to within 2 percent below and 3 percent above the optimum moisture content. The material shall be placed in 12-inch maximum loose lifts and compacted to 90 93 percent of the maximum dry density as determined by ASTM D698.~~

~~Drill Cuttings~~

~~The drill cutting material that is generated from exploration activities is anticipated to be hauled and placed in the TSF at a rate of approximately less than 100 cubic yards per year. Upon placement in the TSF, the drill cutting material shall be spread and dried to reduce the material moisture content. The drill cutting material shall then be mixed with tailings, on site native borrow material and/or development rock at a minimum ratio of 3:1 (tailings/on site native borrow/development rock) to 1 (drill cutting~~

~~material). After mixing, the material shall be placed in 12-inch maximum loose lifts and compacted to 90~~ 93 ~~percent of the maximum dry density as determined by ASTM D698.~~

~~Solids from Stormwater BMPs~~

~~The sediments generated from site stormwater best management practices (BMPs) is anticipated to be hauled and placed in the TSF at a rate of approximately 1,800 cubic yards per year. The material is assumed to comprise of gravel, sand, silt and clay. Upon placement in the TSF, the sediments shall be spread and dried to reduce the material moisture content. The sediments shall then be mixed with tailings, on site native borrow material and/or development rock at a minimum ratio of 3~~:1 ~~(tailings/on site native borrow/ development rock) to 1 (sediment). After mixing, the material shall be placed in 12-inch maximum loose lifts and compacted to 90~~ 93 ~~percent of the maximum dry density as determined by ASTM D698.~~

2.2.1.1.3. Stage 3

Stage 3 (TSF1) shall be constructed in a manner similar to that of Stages 1 and 2. The permittee may use geosynthetic clay liner (GCL) in lieu of the LPSL if field conditions allow its use and it is approved by the design engineer. The maximum elevation of the Stage 3 TSF shall not exceed 5,275 feet. The footprint will expand from approximately 28 acres to 55 acres. In addition to filtered production tailings and materials allowed in previous stages of the TSF development, the permittee is allowed to place additional materials ~~including core cutting solids, drill cuttings, sediments from vehicle & equipment wash sumps, and assay rejects into TSF1.~~as described in section 2.2.1.1.4.

2.2.1.1.4. Materials Descriptions

The primary materials to be placed in TSF1 are historic tailings and filtered production tailings. Other materials will include:

2.2.1.1.4.1. Solids from ~~WTPs~~Water Treatment

Solids from water treatment will consist primarily of filter cake. Filter cake from WTP1 is currently stored on the TSF. It is estimated that WTP1 will result in additional filter cake solids at approximately 3,650 cubic yards per year. The solids shall be hauled to the TSF in approximately 20 cubic yard increments.

WTP2 filter cake is anticipated to be hauled and placed in the TSF at a rate of approximately 4,380 cubic yards per year from the stage one filter press and approximately 146 cubic yards per year from the stage two filter press for an aggregate total of approximately 4,526 cubic yards per year. It will be hauled to the TSF in approximately 20 cubic yard increments. WTP2 filter cake material properties are assumed to be similar in nature to WTP1 filter cake and therefore the placement criteria are the same for both filter cake products.

The anticipated material properties are as follows based on a control sample obtained November 20th, 2019:

- 100 percent passing (by dry weight) the no. 200 sieve.
- Non-plastic soil.
- Moisture content will be 363% (based on dry weight of solids) upon arrival to the TSF.

Upon placement on the TSF, filter cake from WTP1 and WTP2 shall be spread and dried to reduce the material moisture content. The filter cake shall then be mixed with tailings, on site native borrow material and/or development rock at a minimum ratio of 3:1 (tailings/on site native borrow/development rock to filter cake). After mixing, the material shall be moisture conditioned to within 2 percent below and 3 percent above the optimum moisture content. The material shall be placed in 12-inch maximum loose lifts and compacted to 93 percent of the maximum dry density as determined by ASTM D698.

Solids other than filter cake associated with water treatment may be generated. These materials will be handled, mixed, and conditioned to have similar properties as filter cake or tailings when placed in TSF1.

2.2.1.1.4.2. Core-cutting solids

Limited quantities of core cutting solids will be placed on the TSF. This material consists of rock fragments generated from cutting of core. Upon placement in the TSF, the core cutting material shall be spread and dried to reduce the material moisture content. The core cutting material shall then be mixed with tailings, on site native borrow material and/or development rock at a minimum ratio of 3:1 (tailings/on site native borrow/development rock to core cutting material). After mixing, the material shall be moisture conditioned to within 2 percent below and 3 percent above the optimum moisture content. The material shall be placed in 12-inch maximum loose lifts and compacted to 93 percent of the maximum dry density as determined by ASTM D698.

2.2.1.1.4.3. Drill Cuttings

Limited amounts of drill cutting material generated from exploration activities isto be hauled and placed in the TSF. Upon placement in the TSF, the drill cutting material shall be spread and dried to reduce the material moisture content. The drill cutting material shall then be mixed with tailings, on site native borrow material and/or development rock at a minimum ratio of 3:1 (tailings/on site native borrow/development rock to drill cutting material). After mixing, the material shall be placed in 12-inch maximum loose lifts and compacted to 93 percent of the maximum dry density as determined by ASTM D698.

2.2.1.1.4.4. Solids from Stormwater BMPs

The sediments generated from site stormwater best management practices (BMPs) is anticipated to be hauled and placed in the TSF at a rate of approximately 1,800 cubic yards per year. The material is assumed to comprise of gravel, sand, silt and clay. Upon placement in the TSF, the sediments shall be spread and dried to reduce the material moisture content. The sediments shall then be mixed with tailings, on site native borrow material and/or development rock at a minimum ratio of 3:1 (tailings/on site native borrow/ development rock to sediment). After mixing, the material shall be placed in 12-inch maximum loose lifts and compacted to 93 percent of the maximum dry density as determined by ASTM D698.

~~2.2.1.1.2.1.~~2.2.1.1.4.5. Waste/Development Rock

Placement of waste/development rock from decline and shaft excavation was placed on the TSF beginning in Stage 1. This activity will continue into Stage 3.

2.2.1.1.4.6. Construction PAG Rock

PAG material generated during construction of surface buildings/facilities (i.e. rock generated from construction cuts) will be placed on TSF1. This material was placed in the TSF during Stage 2 and will continue into Stage 3.

2.2.1.1.4.7. Assay Rejects

Rock/ore samples will be placed in the TSF after assay.

2.2.1.1.4.8. Sediments from Vehicle and Equipment Wash Sumps

Sediments washed off vehicles will accumulate in concrete-lined sumps at the vehicle washes. These sumps will be cleaned out periodically and placed on the TSF.

2.2.1.1.5. Discharge Controls Elements

TSF1 is designed to meet prescriptive BADCT guidelines. Design elements for the proposed, expanded TSF1 include the following:

- TSF Perimeter Road (forms embankment for West and East Internal Detention Ponds)
- Foundation preparation and removal of low strength and/or deleterious material.
- Constructed from cut/fill operations with upstream (internal) slopes of 2.5H:1V and downstream (external) slopes of 2.0H:1V in fill conditions / 1.5H:1V in cut conditions.
- Composite lining system on upstream embankment slope consisting of 60 mil double sided textured HDPE geomembrane overlying either 12 inches of compacted LPSL or GCL. See Drawing A220 for lining system plan view.
- 18 inches of Protective Layer material overlying the geomembrane liner.
  - Underdrain system consisting of CPe pipe collectors in topographic lows and a dendritic system of 4 inch diameter collector CPe pipe peripheral to the primary collectors.
- One-way light vehicle access road with 1.5 ft high safety berms, 16 ft travel width, 6 inches of wearing course, and stormwater diversion channels as required.

- Haul road with 3 ft high safety berms, 38.5 ft travel width, 6 inches of wearing course, and stormwater diversion channels as required.
- Filtered Tailings Stack:
    - Spreading filtered tailings with a dozer to a nominal thickness not to exceed 12-inches (loose) in depth, and compacted through selective routing of the haulage equipment and dedicated smooth drum vibratory compactors.
    - Moisture conditioning as necessary using a tractor and a disc to facilitate drying prior to compaction.
    - Lime treatment, if needed, by spreading quick lime (~1% by dry weight) over the surface of the filtered tailings and discing the lime into the wet tailings lift to expedite drying.
    - Achieving tailings moisture content at the time of compaction within 3% of the optimum moisture content as determined by ASTM D698 (Standard Proctor). Once the required moisture content is achieved, the
    - Compacting filtered tailings to a minimum of 93% of the maximum dry density after the required moisture content is achieved (per ASTM D698).
    - 3.0H:1V compound slope comprised of 25 ft high 2.5H:1V open slopes in combination with 12.5 ft benches to be placed at 25 ft vertical intervals.
    - Internal stormwater diversion channels to pass peak flows from the design storm ~~(see Section 11)~~.
    - Rock armored exterior tailings slopes to minimize water and wind erosion of the dry stack TSF.
    - Vibrating wire piezometers will be used to monitor the operational performance of TSF1. Vibrating wire piezometers will be placed on the geomembrane surface to measure hydraulic head on the liner system. Additional vibrating wire piezometers will be installed during filtered tailings placement to monitor phreatic conditions within the stack.

The external stormwater diversion channels, underdrain outlet pipework (concrete encasement), the UDCP and its pumping system to WTP1 for TSF1 were designed and constructed as part of the VRP project and will continue to be BADCT elements. These are appropriately sized for the proposed expansion. However, the pumping capacity at the UCDP will be increased by adding a larger capacity pump and a reclaim pipeline from the UDCP to WTP2.

2.2.1.2. Underdrain Collection Pond (UDCP)

The UDCP ~~shall be~~is located downstream of Stage 1 TSF. Valves placed at the inlet end to the ~~UCP~~UDCP from the Stage I TSF, shall remain completely open unless it needs be pumped completely dry for repairs. The ~~UCP~~UDCP crest ~~shall be~~is approximately 200 ft. wide by 345 ft. long and 42 ft. deep. The pond ~~shall bei~~was designed with a 25 ft. wide perimeter access road around the crest, which widens to 50 ft. on the southern edge where the pumps ~~shall b~~are sited for pump maintenance. ~~that may be required.~~ The ~~UCP~~UDCP ~~shall be~~was constructed to maintain a minimum of 2 feet of freeboard from the spillway invert to contain flows from the 100-yr/24-hr storm event, and the maximum operational volume of 2,200,000 gallons. The ~~UCP~~UDCP ~~shall be~~is sized to contain 8,900,000 gallons up to the spillway elevation while maintaining a minimum of seven (7) feet of total freeboard. The pond slopes ~~shall be~~are 2H:1V, and the bottom of the pond ~~shall be~~is graded at 1% to a low point in the corner of the pond. At the low point, two parallel sloping decant structures ~~shall be~~were constructed for housing submersible pumps to reclaim fluids for treatment at the Water Treatment Plant (WTP).

The liner system for the UDCP consists of geonet placed between two 60 mil HDPE double sided textured geomembrane layers overlying 6-inches of compacted low permeability soil layer. The HDPE liner ~~shall be~~is secured in an engineered anchor trench around the impoundment perimeter. A leak collection and removal system (LCRS) ~~shall be~~was installed between the two HDPE liners. The LCRS ~~shall be~~is equipped with a level control to activate a pump, and the outflow ~~shall be~~is measured with a flow totalizer. A record of these measurements shall be maintained in a log book maintained at the site.

~~A minimum of t~~Two (2) piezometers ~~shall be~~are placed along the maximum section of the ~~UCP~~UDCP, at the locations and as per the design submitted in the application.

2.2.1.3. Water Treatment Plant 1 (WTP1)

WTP1 is designed for treating underdrain seepage and storm water runoff from the TSF (via the UDCP) and water piped directly from the January Adit mine workings. The flow rate from the ~~UCP~~UDCP and the January Adit mine workings are anticipated to fluctuate up to a maximum of 120 gallons per minute (gpm) from each source, with a maximum combined flow from both sources not to exceed 120 gpm.

The WTP1 process consists of pH adjustment to 10.5 followed by liquid/solids separation. This process includes various elements including: an equalization tank, a multiflo tank (consisting of reaction, flocculation, and clarifier compartments), an ultrafiltration unit, a pH adjustment tank, a Moving Bed Biofilm Reactor (for treatment of residual ammonia), an electro-reduction circuit (for selenite removal), a thickening tank, a filtrate tank, and a filter press.

Treated water may be used for on-going mine exploration, construction soil conditioning, and future milling and mining operations. Periodic, short-term discharge of treated water or a portion of treated water to Alum Gulch may be necessary during periods of exploration or mine development. Discharges of- treated water from WTP1 through Outfall 1 are authorized under an AZPDES permit (AZ0026387).

2.2.1.4. Water Treatment Plant 2 (WTP2)

WTP2 is designed for treating groundwater pumped from a wellfield to depressurize and dewater the fractured rock aquifer, groundwater and operational water pumped from underground workings, treated mine drainage water, tailings runoff/seepage, core cutting water, drilling water, stormwater, and incidental and intermittent operational water from surface activities, January Adit water, treated water from WTP1, and water from stormwater BMPs. The maximum design flow is 4500 gpm.

WTP2 consists of two treatment circuits. The first circuit will remove suspended solids (TSS) and metals. The second circuit will remove selenate (a species of selenium not removed in the first circuit) and consists of an IX ion exchange column circuit and an Electro Reduction Circuit.

Treated water may be used for on-going mine exploration, construction soil conditioning, and future milling and mining operations. Discharges of treated water from WTP2 through Outfall 2 to Harshaw Creek are authorized under an AZPDES permit (AZ0026387).

2.2.2. Site-Specific Characteristics

Not applicable.

~~2.2.2.~~2.2.3. Pre-Operational Requirements

Not applicable.

~~2.2.3.~~2.2.4. Operational Requirements

At a minimum, permitted facilities shall be inspected for performance levels listed in Section 4.2, Table 8: FACILITY INSPECTION AND OPERATIONAL MONITORING~~Table 8: FACILITY INSPECTION AND OPERATIONAL MONITORINGTable 8: FACILITY INSPECTION AND OPERATIONAL MONITORING~~. Results of these inspections shall be documented and maintained on location for at least 10 years from the date of each inspection, as required by Section 2.7.2 of this permit. If damage is identified during an inspection that could cause or contribute to a discharge, proper repairs shall be promptly performed and documented as described in Section 2.5.2 and Section 2.7.2.

2.3. DISCHARGE LIMITATIONS

[A.R.S. §§ 49-201(14), 49-243 and A.A.C. R18-9-A205(B)]

The permittee shall operate and maintain all permitted facilities to prevent unauthorized discharges pursuant to A.R.S. § 49-201(12) resulting from failure or bypassing of BADCT pollutant control technologies.

2.3.1. Tailings Storage Facility (TSF1)

The total deposition of tailings, ~~and~~ development/construction rock (also referred to as waste rock), , and limited amounts of other material (i.e., filter cake from WTP1 and WTP2, core cutting solids, drill cuttings, sediments from stormwater control features, assay rejects, and sediments from vehicle and equipment wash sumps) under this permit shall not cause the ultimate dam crest elevation to exceed an elevation of 5,275 feet above mean sea level (amsl) as per Section 4.2, Table 8: FACILITY INSPECTION AND OPERATIONAL MONITORING~~Table 8: FACILITY INSPECTION AND OPERATIONAL MONITORINGTable 8: FACILITY INSPECTION AND OPERATIONAL MONITORING~~. If the permittee wishes to deposit a greater quantity of material, or modify the ultimate height of the TSF, then the permittee shall apply for a permit amendment pursuant to Section 6.9~~ and Section 3.7 in the Compliance Schedule~~.

2.3.2. Underdrain Collection Pond (~~UCP~~UDCP)

Most water sources that will eventually be routed to WTP1 or WTP2 will first go to the UDCP. (The exception to this is January Adit water which is piped directly to WTP1). Discharge to the ~~UCP~~UDCP shall ~~be limited to~~consist of tailings runoff/seepage water, mine workings water, exploration decline or shaft water, ~~and~~ precipitation falling on the TSF (including the embankment, perimeter road and construction areas), groundwater generated by~~.~~ dewatering of the fractured rock aquifer, groundwater and operational water pumped from underground workings, treated mine drainage water, and storm water. Minor discharges to the UDCP will include core cutting water, drilling water, incidental and intermittent operational water from surface activities, and water from stormwater BMPs.

2.4. POINTS OF COMPLIANCE (POC)

[A.R.S. § 49-244]

The POCs are established by the following monitoring location(s):

Table 2: POINTS OF COMPLIANCE

Well Number	POC Locations	Latitude	Longitude	ADWR Number
POC-1	Conceptual location downgradient of the TSF	31° 28' 15.21" N	110° 43' 42.45" W	TBD
POC-2	200 feet downgradient of the AZPDES Outfall-001 (MW3) and	31° 28' 18.91" N	110° 43' 48.83" W	55-920120

Table 2: POINTS OF COMPLIANCE				
Well Number	**POC Locations**	**Latitude**	**Longitude**	**ADWR Number**
	downgradient of TSF1			
POC-3	Conceptual location approximately one mile to the north-northwest and downgradient of the WTP1 outfall	31° 29' 1.7" N	110° 44' 16.4" W	TBD
POC-4	Conceptual location approximately nine miles to the north and downgradient of the WTP2 outfall	31° 32' 2.4" N	110° 43' 29.3" W	TBD

Groundwater monitoring is required under this permit at POC-2. Groundwater monitoring is not required at POC-~~-~~1, POC-3, and POC-4 unless as contingency monitoring. The Director may amend this permit to designate an additional point or points of compliance if information on groundwater gradient or groundwater usage indicates the need.

2.5. MONITORING REQUIREMENTS

[A.R.S. § 49-243(K)(1), A.A.C. R18-9-A206(A)]

Unless otherwise specified in this permit, all monitoring required in this permit shall continue for the duration of the permit, regardless of the status of the facility. Unless otherwise provided, monitoring shall commence the first full monitoring period following permit issuance. All sampling, preservation and holding times shall be in accordance with currently accepted standards of professional practice. Trip blanks, equipment blanks and duplicate samples shall also be obtained, and Chain-of-Custody procedures shall be followed, in accordance with currently accepted standards of professional practice. Copies of laboratory analyses and Chain-of-Custody forms shall be maintained at the permitted facility. Upon request, these documents shall be made immediately available for review by ADEQ personnel.

2.5.1. Pre-Operational Monitoring

Not applicable.

2.5.2. Facility / Operational Monitoring

Operational monitoring inspections shall be conducted according to Section 4.2, Table 8: FACILITY INSPECTION AND OPERATIONAL MONITORING~~Table 8: FACILITY INSPECTION AND OPERATIONAL MONITORINGTable 8: FACILITY INSPECTION AND OPERATIONAL MONITORING~~.

If any damage of the pollution control structures is identified during inspection that could cause or contribute to a discharge, proper repair procedures shall be performed. All repair procedures and materials used shall be documented in the facility log book as per Section 2.7.2.

2.5.3. Groundwater Monitoring and Sampling Protocols

Groundwater monitoring is required under the terms of this permit at POC-2 per Section 4.2.3.

Static water levels shall be measured and recorded prior to sampling. Wells shall be purged of at least three borehole volumes (as calculated using the static water level) or until field parameters (pH, temperature, and conductivity) are stable, whichever represents the greater volume. If evacuation results in the well going dry, the well shall be allowed to recover to 80 percent of the original borehole volume, or for 24 hours, whichever is shorter, prior to sampling. If after 24 hours there is not sufficient water for sampling, the well shall be recorded as "dry" for the monitoring event. An explanation for reduced pumping volumes, a record of the volume pumped, and modified sampling procedures shall be reported and submitted with the SMRF.

The permittee may conduct the sampling using the low-flow purging method as described in the Arizona Water Resources Research Center, March 1995 Field Manual for Water Quality Sampling. The well must be purged until indicator parameters stabilize. Indicator parameters shall include dissolved oxygen, turbidity, pH, temperature, and conductivity.

~~2.5.2.1.~~2.5.3.1. POC Well Replacement

In the event that one or more of the designated POC wells should become unusable or inaccessible due to damage or any other event, a replacement POC well shall be constructed and installed upon approval by ADEQ. If the replacement well is 50 feet or less from the original well, the ALs and/or aquifer quality limits (AQLs) calculated for the designated POC well shall apply to the replacement well.

~~2.5.3.~~2.5.4. Surface Water Monitoring and Sampling Protocols

Routine surface water monitoring is not required under the terms of this permit.

~~2.5.4.~~2.5.5. Analytical Methodology

All samples collected for compliance monitoring shall be analyzed using Arizona state-approved methods. If no state-approved method exists, then any appropriate EPA-approved method shall be used. Regardless of the method used, the detection limits must be sufficient to determine compliance with the regulatory limits of the parameters specified in this permit. If all methods have detection limits higher than the applicable limit, the permittee shall follow the applicable contingency requirements of Section 2.6 and may propose "other actions" including amending the permit to set higher limits. Analyses shall be performed by a laboratory licensed by the Arizona Department of Health Services, Office of Laboratory Licensure and Certification unless exempted under A.R.S. § 36-495.02. For results to be considered valid, all analytical work shall meet quality control standards specified in the approved methods. A list of Arizona state-certified laboratories can be obtained at the address below:

Arizona Department of Health Services
Office of Laboratory Licensure and Certification
250 North 17th Avenue
Phoenix, AZ 85007
Phone: (602) 364-0720

~~2.5.5.~~2.5.6. Installation and Maintenance of Monitoring Equipment

Monitoring equipment required by this permit shall be installed and maintained so that representative samples required by the permit can be collected. If new groundwater wells are determined to be necessary, the construction details shall be submitted to the Groundwater Protection Value Stream for approval prior to installation and the permit shall be amended to include any new monitoring points.

2.6. CONTINGENCY PLAN REQUIREMENTS

[A.R.S. § 49-243(K)(3), (K)(7) and A.A.C. R18-9-A204 and R18-9-A205]

Commented [JA2]: NOTE FOR ADEQ: The Contingency plan has been revised/updated. Please refer to Attachment D of the application..

2.6.1. General Contingency Plan Requirements

At least one copy of this permit and the approved contingency and emergency response plan (to be submitted as per the compliance schedule in Section 3.0) shall be maintained at the location where day-to-day decisions regarding the operation of the facility are made. The permittee shall be aware of and follow the contingency and emergency plans.

Any AL exceedance, or violation of an AQL, DL, or other permit condition shall be reported to ADEQ following the reporting requirements in Section 2.7.3, unless more specific reporting requirements are set forth in Section 2.6.2 through 2.6.5.

Some contingency actions involve verification sampling. Verification sampling shall consist of the first follow-up sample collected from a location that previously indicated a violation or the exceedance of an AL. Collection and analysis of the verification sample shall use the same protocols and test methods to analyze for the pollutant or pollutants that exceeded an AL or violated an AQL or DL. Where verification sampling is specified in this permit, it is the option of the permittee to perform such sampling. If verification sampling is not conducted within the timeframe allotted, ADEQ and the permittee shall presume the initial sampling result to be confirmed as if verification sampling had been conducted. The permittee is responsible for compliance with contingency plans relating to the exceedance of an AL or violation of a DL, AQL or any other permit condition. The permittee is subject to enforcement action for the failure to comply with any contingency actions in this permit.

2.6.2. Exceeding of Alert Levels and Performance Levels

2.6.2.1. Exceeding of Performance Levels Set for Freeboard

In the event that freeboard performance levels required by Section 4.2, Table 8: FACILITY INSPECTION AND OPERATIONAL MONITORING~~Table 8: FACILITY INSPECTION AND OPERATIONAL MONITORING~~Table 8: FACILITY INSPECTION AND OPERATIONAL ~~MONITORING~~ in a surface impoundment are not maintained, the permittee shall:

1. As soon as practicable, cease or reduce discharging to the impoundment to prevent overtopping. Remove and properly dispose or recycle to other operations the excess fluid in the reservoir until the water level is restored at or below the permitted freeboard limit.
2. Within 5 days of discovery, evaluate the cause of the incident and adjust operational conditions or identify design improvements to the affected system as necessary to avoid future occurrences.
3. Within 30 days of discovery, initiate repairs to the affected system, structure, or other component as necessary to return the system to compliance with this permit, or remove the affected system(s) from service as specified in Section 2.8 (Temporary Cessation) and Section 2.9 (Closure) of this permit. Record any repair procedures, methods, and materials used to restore the facility to operating condition in the facility log/recordkeeping file.
4. If design improvements are necessary, submit an amendment application within 90 days of discovery.
5. The facility is no longer on alert status once the operational indicator no longer indicates that the freeboard performance level is being exceeded. The permittee shall, however, complete all tasks necessary to return the facility to its pre-alert operating condition.

2.6.2.2. Exceeding of Performance Levels Set for Conditions Other Than Freeboard

1. If exceedance of an operational performance level (PL) listed in Section 4.2, Table 8: FACILITY INSPECTION AND OPERATIONAL MONITORING~~Table 8: FACILITY INSPECTION AND OPERATIONAL MONITORING~~Table 8: FACILITY ~~INSPECTION AND OPERATIONAL MONITORING~~ has been observed or noted during required inspection and operational monitoring, such that the result is reasonably likely to ~~could~~ cause or contribute to an unauthorized discharge pursuant to A.R.S. 49-201(12), the permittee shall immediately investigate to determine the cause of the condition. The investigation shall include the following:
   a. Inspection, testing, and assessment of the current condition of all treatment or pollutant discharge control systems that may have contributed to the operational performance condition.

b. Review of recent process logs, reports, and other operational control information to identify any unusual occurrences.

2. ~~The~~ For a PL exceedance satisfying the conditions of paragraph 1 of this subsection, results of the investigation, and any corrective action taken shall be reported to the Groundwater Protection Value Stream, within 30 days of the discovery of the condition. Upon review of the submitted report, the Department may amend the permit to require additional monitoring, increased frequency of monitoring, or other actions.

~~2.~~3. The permittee shall initiate actions identified in the approved contingency plan referenced in Section 2.6.1 and any necessary contingency measures to resolve problems identified by the investigation which may have led to a PL being exceeded. To implement any other corrective action the permittee may choose to obtain prior approval from ADEQ according to Section 2.6.6.

2.6.2.3. Exceedance of Alert Level #1 for Normal Liner Leakage

If an Alert Level #1 (AL #1) as specified in Section 4.2, Table 11: LEAK COLLECTION AND REMOVAL SYSTEM MONITORING, has been exceeded, the permittee shall take the following actions:

1. Within 5 days of AL #1 exceedance, notify Groundwater Protection Value Stream in accordance with Section 2.7.3 Permit Violation and Alert Level Status Reporting. Continue monitoring to determine if the leakage rate is increasing.
2. If the leakage rate continues to exceed AL#1 for 15 days following notification of initial AL #1 exceedance, perform a visual inspection of the liner above the solution level, to determine the location of the leaks in the primary liner.
3. Within 45 days of AL #1 exceedance, if liner damage is evident, the permittee shall complete liner repairs.
4. Within 45 days of AL #1 exceedance, if the visual inspection does not identify the location of leaks, formulate a corrective action plan to determine their location and repair them.
5. Within 90 days of AL #1 exceedance and following formulation of a corrective action plan, the permittee shall complete liner repairs.
6. Within 75 days of AL #1 exceedance (if repairs were completed in Step 3), or 120 days of AL #1 exceedance (if corrective action plan was implemented per Steps 4 and 5), if no alert level exceedance is observed for 30 consecutive days, notify Groundwater Protection Value Stream and document assessment and/or repairs in the log book.
7. Within 120 days of AL #1 exceedance (if repairs were completed in Step 3), or 165 days of AL #1 exceedance (if corrective action plan was implemented per Steps 4 and 5), if 30 consecutive days without an AL #1 exceedance is not achieved, notify Groundwater Protection Value Stream and reassess the entire liner system and complete any necessary repairs as described in Steps 2 and 3 (and if necessary Steps 4 and 5 also). Repeat the assessment and liner repair cycle until requirements of Step No. 6 are attained.
8. A liner leakage assessment and repair report shall be included in the next annual report described in Section 2.7.4.11 (Annual Reporting) of this permit. The permittee may also submit the liner leakage assessment report to the ADEQ prior to the annual report due date. This liner leakage assessment and repair report shall be submitted to Groundwater Protection Value Stream. Upon review of the report, ADEQ may require that the permittee take additional corrective actions to address the problems identified from the assessment of the liner and

perform other applicable repair procedures.

2.6.2.4. Exceedance of Alert Level #2 for Liner Failure or Rips

If the Liner Leakage Discharge Limit (AL #2) specified in Section 4.2, Table 11: LEAK COLLECTION AND REMOVAL SYSTEM MONITORING has been exceeded, the permittee shall:

1. As soon as practicable, cease all discharge to the impoundment, implement control measures to prevent new solution buildup that may subsequently report to the impoundment, and immediately notify Groundwater Protection Value Stream of the AL #2 exceedance.
2. Within 15 days of initial AL #2 exceedance, perform a visual inspection of the liner above the solution level to identify the location of the leak(s). The permittee shall complete liner repairs and discharge to the impoundment shall not be re-initiated until the leak(s) have been identified and repaired.
3. Within 60 days of initial AL #2 exceedance if leaks were found and fixed and if no AL #2 exceedance is observed for 30 consecutive days, submit a liner leakage assessment and repair report to ADEQ. The report shall include the results of the initial liner evaluation, methods used to locate the leak(s), repair procedures and quality assurance/quality control implemented to restore the liner to optimal operational status, and other information necessary to ensure the future occurrence of the incidence will be minimized.
4. Within 30 days of initial AL #2 exceedance if the visual inspection does not identify the location of leaks and AL #2 exceedance continues, formulate a corrective action plan to determine their location and repair them. The corrective action plan will take into account the schedule for a 3rd party contractor to perform electronic leak detection or other methods if required.
5. Within 75 days of initial AL #2 exceedance and following formulation of a corrective action plan, the permittee shall complete liner repairs
6. Within 105 days of AL #2 exceedance and implementation of the corrective action plan per Steps 4 and 5, if no AL #2 exceedance is observed for 30 consecutive days, notify Groundwater Protection Value Stream and document assessment and/or repairs in the log book.
7. Within 105 days of initial AL #2 exceedance, (if repairs were completed in Step 3), or 150 days of AL #2 exceedance (if corrective action plan was implemented per Steps 4, 5, and 6) if 30 consecutive days without an AL #2 exceedance is not achieved, repeat Steps 1 through 7 until AL #2 is not exceeded for 30 consecutive days. When the Steps 1 through 7 are repeated, the notification date is reset. Discharge to the impoundment shall not be re-initiated until the leak(s) have been identified and repaired.
8. Liner leakage assessment and repair reports required by Section 2.6.2.2, shall be referenced in the next annual report described in Section 2.7.4.1 (Annual Reporting) of this permit.

2.6.2.5. Exceeding of Alert Levels Set for Discharge Monitoring

1. If an AL set in Section 4.2, Table 9: ROUTINE DISCHARGE MONITORING has been exceeded, the permittee shall immediately investigate to determine the cause of the AL exceedance. The investigation shall include the following:
   a. Inspection, testing, and assessment of the current condition of all treatment or pollutant discharge control systems that may have contributed to the AL exceedance;
   b. Review of recent process logs, reports, and other operational control information to identify any unusual occurrences;
   c. Sampling of individual waste streams composing the wastewater for the parameters being exceeded;

2. The permittee shall initiate actions identified in the approved contingency plan referenced in Section 5.0 and specific contingency measures identified in Section 2.6 to resolve any problems identified by the investigation, which may have led to an AL exceedance. To implement any other corrective action the permittee shall obtain prior approval from ADEQ according to Section 2.6.6.
3. Within 30 days of an AL exceedance, the permittee shall submit the laboratory results to the Groundwater Protection Value Stream, along with a summary of the findings of the investigation, the cause of the AL exceedance, and actions taken to resolve the problem.
4. Upon review of the submitted report, the Department may amend the permit to require additional monitoring, increased frequency of monitoring, amendments to permit conditions or other actions.

2.6.2.6. TSF Slope Conditions

The permittee shall monitor the TSF perimeter road and dry stack TSF for general slope conditions as per Section 4.2, Table 8: FACILITY INSPECTION AND OPERATIONAL MONITORING to identify unusual scour or degradation of materials, sloughing, rolling rocks or visible seepage. If the TSF exhibits any signs that require maintenance, ~~AMI~~ South32 shall take the following actions:

1. After discovery prevent vehicle and/or foot traffic in the area.
2. Notify the design engineer of record (EOR).
3. If necessary, perform remedial actions approved by the EOR.
4. Monitor the area for signs of decreasing slope stability.

2.6.2.7. TSF Piezometric Head

The permittee shall monitor the piezometric head per Section 4.2, Table 8: FACILITY INSPECTION AND OPERATIONAL MONITORING. If the piezometers read a phreatic surface in excess of 1.5 ft the permittee shall take the following actions:

1. Notify the design engineer.
2. Monitor the phreatic surface within the TSF.
3. Initiate an evaluation to determine the cause of the incident. Identify the circumstances that resulted in the elevated phreatic surface. Implement corrective actions including pumping, if necessary, to resolve the problems identified in the evaluation.
4. If necessary, perform a slope stability analysis on the dry stack TSF with the elevated phreatic surface to determine if any reduction in safe operation of the facility has occurred.
5. Record in the facility log book, the piezometer number, reading and location. Hydrographs of this and all other piezometers will be recorded on at least a monthly basis to allow quick inspection and evaluation of historic facility operations.

2.6.2.8. Exceeding of Alert Levels in Groundwater Monitoring

2.6.2.8.1. Alert Levels for Indicator Parameters

None required by this permit.

2.6.2.8.2. Alert Levels for Pollutants With Numeric Aquifer Water Quality Standards

1. If an AL for a pollutant set in Section 4.2, Table 10: GROUNDWATER MONITORING AT POC-2 ~~has been~~is exceeded, the Permittee shall request that the laboratory verify the

sample results within five (5) days of becoming aware of an AL exceedance. The permittee may use the results of another sample taken between the date of the last sampling event and the date of receiving the result as verification.

2. If verification sampling confirms the AL exceedance or if the Permittee opts not to perform verification sampling, then the permittee shall increase the frequency of monitoring for the pollutant(s) exceeding their respective AL(s) to Quarterly from Semi-Annually. In addition, the permittee shall immediately initiate an investigation of the cause of the AL exceedance, including inspection of all discharging units and all related pollution control devices, review of any operational and maintenance practices that might have resulted in an unexpected discharge, and hydrologic review of groundwater conditions including upgradient water quality.
3. The permittee shall initiate actions identified in the approved contingency plan referenced in Section 5.0 and specific contingency measures identified in Section 2.6 to resolve any problems identified by the investigation which may have led to an AL exceedance. To implement any other corrective action the permittee shall obtain prior approval from ADEQ according to Section 2.6.6. Alternatively, the permittee may submit a technical demonstration, subject to written approval by the Groundwater Protection Value Stream, that although an AL is exceeded, pollutants are not reasonably expected to cause a violation of an AQL. The demonstration may propose a revised AL or monitoring frequency for approval in writing by the Groundwater Protection Value Stream.
4. Within 30 days after confirmation of an AL exceedance, the permittee shall submit the laboratory results to the Groundwater Protection Value Stream along with a summary of the findings of the investigation, the cause of the AL exceedance, and actions taken to resolve the problem.
5. Upon review of the submitted report, the Department may amend the permit to require additional monitoring, increased frequency of monitoring, or other actions.
6. The increased monitoring required as a result of ALs being exceeded may be reduced to the regularly scheduled frequency, if the results of three (3) consecutive monthly sampling events demonstrate that no parameters exceed the AL.
7. If the increased monitoring required as a result of an AL exceedance continues for more than six (6) sequential sampling events, the Permittee shall submit a second (2nd) report documenting an investigation of the continued AL exceedance within 30 days of the receipt of laboratory results of the sixth (6th) sampling event.

2.6.2.8.3. Alert Levels to Protect Downgradient Users from Pollutants Without Numeric Aquifer Water Quality Standards

Not applicable.

2.6.2.8.4. Alert Level for Groundwater Level

Not applicable:

2.6.3. Discharge Limit Violation

2.6.3.1. Liner Failure, Containment Structure Failure, or Unexpected Loss of Fluid

In the event of overtopping, liner failure, containment structure failure, or unexpected loss of fluid as described in Section 2.3, the permittee shall take the following actions:

1. As soon as practicable, cease all discharges as necessary to prevent any further releases to the

environment, including removal of any fluid remaining in the impoundment as necessary, and capture and containment of all escaped fluids.

2. Within 24 hours of discovery, notify Groundwater Protection Value Stream.

3. Within 24 hours of discovery of a failure, estimate the quantity released, collect representative samples of the fluid remaining in affected impoundments and drainage structures, analyze sample(s) according to Section 4.3, Table 12: CONTINGENCY DISCHARGE CHARACTERIZATION, and report in accordance with Section 2.7.3 (Permit Violation and AL Status Reporting). In the 30-day report required under Section 2.7.3, include a copy of the analytical results and forward the report to Groundwater Protection Value Stream.

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4. Within 15 days of discovery, initiate an evaluation to determine the cause for the incident. Identify the circumstances that resulted in the failure and assess the condition of the discharging facility and liner system. Implement corrective actions as necessary to resolve the problems identified in the evaluation. Initiate repairs to any failed liner, system, structure, or other component as needed to restore proper functioning of the discharging facility. The permittee shall not resume discharge to the facility until repairs of any failed liner or structure are performed.

   Repair procedures, methods, and materials used to restore the system(s) to proper operating condition shall be described in the facility log/recordkeeping file and available for ADEQ review. Record in the facility log/recordkeeping file the amount of fluid released, a description of any removal method and volume of any fluid removed from the impoundment and/or captured from the release area. The facility log/recordkeeping file shall be maintained according to Section 2.7.2 (Operation Inspection / Log/Recordkeeping File).

5. As soon as practicable, remove fluid remaining in the surface impoundment as necessary to prevent further releases to the subsurface and/or to perform repairs. Record in the facility log/recordkeeping file the amount of fluid removed a description of the removal method, and other disposal arrangements. The facility log/recordkeeping file shall be maintained according to Section 2.7.2 (Operation Inspection / Log/Recordkeeping File).

6. Within 30 days of discovery of the incident, submit a report to Groundwater Protection Value Stream as specified in Section 2.7.3. Include a description of the actions performed in Subsections 1 through 5 listed above. Upon review of the report, ADEQ may request additional monitoring or remedial actions.

7. Within 60 days of discovery, conduct an assessment of the impacts to soil and/or groundwater resulting from the incident. If soil or groundwater is impacted such that it could or did cause or contribute to an exceedance of an AQL at the applicable point of compliance, submit to ADEQ, for approval, a corrective action plan to address such impacts, including identification of remedial actions and a schedule for completion of activities. At the approval of ADEQ, the permittee shall implement the approved plan.

8. Within 30 days of completion of corrective actions, submit to Groundwater Protection Value Stream, a written report as specified in Section 2.6.6 (Corrective Actions).

9. Upon review of the report, ADEQ may amend the permit to require additional monitoring, increased frequency of monitoring, amendments to permit conditions, or other actions.

2.6.3.2. Overtopping of a Surface Impoundment

If overtopping of fluid from a permitted surface impoundment occurs, and results in a discharge pursuant to A.R.S. § 49-201(12), the permittee shall:

1. As soon as practicable, cease all discharges to the surface impoundment to prevent any further releases to the environment.

2. Within 24 hours of discovery, notify Groundwater Protection Value Stream.

3. Within 24 hours, collect representative samples of the fluid contained in the surface impoundment. Samples shall be analyzed for the parameters specified in Section 4.2, Table 12: CONTINGENCY DISCHARGE CHARACTERIZATION. Within 30 days of the incident, submit a copy of the analytical results to Groundwater Protection Value Stream.

4. As soon as practicable, remove and properly dispose of excess water in the impoundment until the water level is restored at or below the appropriate freeboard as described in Section 4.2, Table 8: FACILITY INSPECTION AND OPERATIONAL MONITORING. Record in the facility log/recordkeeping file the amount of fluid released, a description of the removal method and volume of any fluid removed from the impoundment and/or captured from the release area. The facility log/recordkeeping file shall be maintained according to Section 2.7.2 (Operation Inspection/LogBook/Recordkeeping File).

5. Within 30 days of discovery, evaluate the cause of the overtopping and identify the circumstances that resulted in the incident. Implement corrective actions and adjust operational conditions as necessary to resolve the problems identified in the evaluation. Repair any systems as necessary to prevent future occurrences of overtopping.

6. Within 30 days of discovery of overtopping, submit a report to ADEQ as specified in Section 2.7.3(2) (Permit Violation and Alert Level Status Reporting). Include a description of the actions performed in Subsections 1 through 5 listed above. Upon review of the report, ADEQ may request additional monitoring or remedial actions.

7. Within 60 days of discovery, and based on sampling in Item No. 3 above, conduct an assessment of the impacts to the subsoil and/or groundwater resulting from the incident.

8. If soil or groundwater is impacted such that it could cause or contribute to an exceedance of an AQL at the applicable point of compliance, submit to ADEQ for approval, a corrective action plan to address such impacts, including identification of remedial actions and/or monitoring, and a schedule for completion of activities. At the direction of ADEQ, the permittee shall implement the approved plan.

9. Within 30 days of completion of corrective actions, submit to ADEQ, a written report as specified in Section 2.6.6 (Corrective Actions). Upon review of the report, ADEQ may amend the permit to require additional monitoring, increased frequency of monitoring, amendments to permit conditions, or other actions.

2.6.3.3. Inflows of Unexpected Materials to a Surface Impoundment

The types of materials that are expected to be placed in the permitted surface impoundments are specified in Section 2.3 (Discharge Limitations). If any unexpected materials flow to a permitted surface impoundment, the Permittee shall:

1. As soon as practicable, cease all unexpected inflows to the surface impoundment(s).

2. Within 24-hours of discovery, notify the Groundwater Protection Value Stream.

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3. Within 5 days of the incident, identify the source of the material and determine the cause for the inflow. Characterize the unexpected material and contents of the affected impoundment, and evaluate the volume and concentration of the material to determine if it is compatible with the surface impoundment liner. Based on the evaluation of the incident, repair any systems or equipment and/or adjust operations, as necessary to prevent future occurrences of inflows of unexpected materials.

4. Within 30 days of an inflow of unexpected materials, submit a report to ADEQ as specified in Section 2.7.3(2) (Permit Violation and Alert Level Status Reporting). Include a description of the actions performed in Subsections 1 through 3 listed above.

5. Upon review of the report, ADEQ may amend the permit to require additional monitoring, increased frequency of monitoring, amendments to permit conditions, mitigation, or other actions.

2.6.3.4. Exceeding of Discharge Limitation for Tailings Deposition Height

1. If the DL for tailings deposition height set in Section 4.2, Table 8: FACILITY INSPECTION AND OPERATIONAL MONITORING has been exceeded, the permittee shall immediately investigate to determine the cause of the DL being exceeded. The investigation shall include a review of recent process logs, reports, and other operational control information to identify the cause of the exceedance.

2. The Permittee shall initiate actions to return to compliance with the DL as soon as practicable.

3. Within 30 days of a DL being exceeded, the Permittee shall submit to the ADEQ Groundwater Protection Value Stream, a summary of the findings of the investigation, the cause of the DL being exceeded, and actions taken to resolve the problem.

4. Upon review of the submitted report, the Department may amend the permit to require additional monitoring, increased frequency of monitoring, amendments to permit conditions or other actions.

2.6.3.5. Slope and Berm Failures

If the slope for the TSF or the ~~UCP~~UDCP becomes unstable to the point of failure and results in a discharge, ~~AMI~~South32 will take the following actions:

1. Immediately after discovery, prevent vehicle and/or foot traffic in the area.

2. Notify the ADEQ WQCS within 24 hours.

3. Notify the design engineer immediately.

4. Within 15 days of discovery, initiate an evaluation to determine the cause of the incident. Identify the circumstances that resulted in the failure and assess the condition of the facility and liner system. Implement corrective actions as necessary to resolve the problems identified in the evaluation. Initiate repairs to the slope and/or any failed liner. Repair procedures, methods, and materials used to restore the system(s) to proper operating condition shall be described in the facility log/recordkeeping file and available for ADEQ review.

5. Within 30 days of discovery of the incident, submit a report to ADEQ. Include a description of the actions performed in the steps listed above. Upon review of the report, ADEQ may request additional monitoring or remedial actions.

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6. Within 60 days of discovery, conduct an assessment of the impacts to the subsoil and/or groundwater resulting from the incident. If soil or groundwater is impacted such that it could cause or contribute to an exceedance of an AQL at an applicable monitoring well or a POC (if installed), submit to ADEQ, for approval, a corrective action plan to address problems identified in the assessment, including identification of releases to the environment, remedial actions and/or monitoring, and a schedule for completion of activities. At the direction of ADEQ, implement the approved plan.

7. Within 30 days of completion of corrective actions, submit a written report to ADEQ. Upon review of the report, ADEQ may amend the permit to require additional monitoring, increased frequency of monitoring, amendments to permit conditions, or other actions.

2.6.4. Aquifer Quality Limit Exceedances

1. If an AQL set in Section 4.2 Table 10: GROUNDWATER MONITORING AT POC-2 has been exceeded, the permittee may conduct verification sampling within 5 days of becoming aware of an AQL exceedance. The permittee may use the results of another sample taken between the date of the last sampling event and the date of receiving the result as verification.
2. If verification sampling does not confirm an AQL exceedance, no further action is needed under this Section.
3. If verification sampling confirms that an AQL was exceeded for any parameter or if the permittee opts not to perform verification sampling, then, the permittee shall increase the frequency of monitoring for those parameters as follows:

May use the following table, or may insert alternate monitoring frequencies, if requested by technical staff.

Table 3: ACCELERATED MONITORING - AQUIFER QUALITY LIMIT VIOLATION	
Specified Monitoring Frequency	**Monitoring Frequency for AQL Violation**
Daily or Weekly	Daily
Monthly	Weekly
Quarterly	Monthly
Semi-annually	Quarterly
Annually	Quarterly

In addition, the permittee shall immediately initiate an evaluation for the cause of the violation, including inspection of all discharging units and all related pollution control devices, and review of any operational and maintenance practices that might have resulted in unexpected discharge.

The permittee also shall submit a report according to Section 2.7.3, which includes a summary of the findings of the investigation, the cause of the violation, and actions taken to resolve the problem. A verified exceedance of an AQL will be considered a violation unless the permittee demonstrates within 90 days that the exceedance was not caused or contributed to by pollutants discharged from the facility. Unless the permittee has demonstrated that the exceedance was not caused or contributed to by pollutants discharged from the facility, the permittee shall consider and ADEQ may require corrective action that may include control of the source of discharge, cleanup of affected soil, surface water, or groundwater, and mitigation of the impact of pollutants on existing uses of the aquifer. Corrective actions shall either be specifically identified in this permit, included in an ADEQ approved contingency plan, or separately approved according to Section 2.6.6.

4. Upon review of the submitted report, the Department may amend the permit to require additional monitoring, increased frequency of monitoring, amendments to permit conditions or other actions.
5. The permittee shall notify any downstream or downgradient users who may be directly affected by the discharge.

The increased monitoring for those pollutant(s) required as a result of an AQL exceedance may be reduced to the original sampling frequency for each respective pollutant, if the results of three sequential sampling events demonstrate that the parameter(s) does not exceed their respective AQL(s).

2.6.5. Emergency Response and Contingency Requirements for Unauthorized Discharges

[A.R.S. § 49-201(12) AND PURSUANT TO A.R.S. § 49-241]

2.6.5.1. Duty to Respond

The permittee shall act immediately to correct any condition resulting from a discharge pursuant to A.R.S. § 49-201(12) if that condition could pose an imminent and substantial endangerment to public health or the environment.

2.6.5.2. Discharge of Hazardous Substances or Toxic Pollutants

In the event of any unauthorized discharge pursuant to A.R.S. § 49-201(12) of suspected hazardous substances (A.R.S. § 49-201(19)) or toxic pollutants (A.R.S. § 49-243(I)) on the facility site, the permittee shall promptly isolate the area and attempt to identify the discharged material. The permittee shall record information, including name, nature of exposure and follow-up medical treatment, if necessary, on persons who may have been exposed during the incident. The permittee shall notify the Groundwater Protection Value Stream within 24 hours of discovering the discharge of hazardous material which (a) has the potential to cause an AWQS or AQL exceedance, or (b) could pose an endangerment to public health or the environment.

2.6.5.3. Discharge of Non-Hazardous Materials

In the event of any unauthorized discharge pursuant to A.R.S. § 49-201(12) of non-hazardous materials from the facility, the permittee shall promptly attempt to cease the discharge and isolate the discharged material. Discharged material shall be removed and the site cleaned up as soon as possible. The permittee shall notify the Groundwater Protection Value Stream within 24 hours of discovering the discharge of non-hazardous material which has the potential to cause an AQL exceedance, or could pose an endangerment to public health or the environment.

2.6.5.4. Reporting Requirements

The permittee shall submit a written report for any unauthorized discharges reported under Sections 2.6.5.2 and 2.6.5.3 to the Groundwater Protection Value Stream within 30 days of the discharge or as required by subsequent ADEQ action. The report shall summarize the event, including any human exposure, and facility response activities and include all information specified in Section 2.7.3. If a notice is issued by ADEQ subsequent to the discharge notification, any additional information requested in the notice shall also be submitted within the time frame specified in the notice. Upon review of the submitted report, ADEQ may require additional monitoring or corrective actions.

2.6.6. Corrective Actions

Specific contingency measures identified in Section 2.6 have already been approved by ADEQ and do not require written approval to implement.

With the exception of emergency response actions taken under Section 2.6.5, the permittee shall obtain written approval from the Groundwater Protection Value Stream prior to implementing a corrective action to accomplish any of the following goals in response to exceedance of an AL, AQL, DL, or other permit condition:

1. Control of the source of an unauthorized discharge;
2. Soil cleanup;

3. Cleanup of affected surface waters;
4. Cleanup of affected parts of the aquifer;
5. Mitigation to limit the impact of pollutants on existing uses of the aquifer.

Within 30 days of completion of any corrective action, the operator shall submit to the Groundwater Protection Value Stream, a written report describing the causes, impacts, and actions taken to resolve the problem.

2.7. REPORTING AND RECORDKEEPING REQUIREMENTS

[A.R.S. § 49-243(K)(2) and A.A.C. R18-9-A206(B) and R18-9-A207]

2.7.1. Self-Monitoring Report Form

1. The permittee shall complete the Self-Monitoring Reporting Forms (SMRFs) provided by ADEQ, and submit the completed report through the myDEQ online reporting system. The permittee shall use the format devised by ADEQ.
2. The permittee shall complete the SMRF to the extent that the information reported may be entered on the form. If no information is required during a reporting period, the permittee shall enter "not required" on the form, include an explanation, and submit the form to the Groundwater Protection Value Stream.
3. The tables contained in Section 4.0 list the monitoring parameters and the frequencies for reporting results on the SMRF:
   a. Table 9: ROUTINE DISCHARGE MONITORING
   b. Table 10: GROUNDWATER MONITORING AT POC-2

The parameters listed in the above-identified tables from Section 4.0 are the only parameters for which SMRF reporting is required.

2.7.2. Operation Inspection / Log Book Recordkeeping

A signed copy of this permit shall be maintained at all times at the location where day-to-day decisions regarding the operation of the facility are made. A log book (paper copies, forms, or electronic data) of the inspections and measurements required by this permit shall be maintained at the location where day-to-day decisions are made regarding the operation of the facility. The log book shall be retained for ten years from the date of each inspection, and upon request, the permit and the log book shall be made immediately available for review by ADEQ personnel. The information in the log book shall include, but not be limited to, the following information as applicable:

1. Name of inspector;
2. Date and shift inspection was conducted;
3. Condition of applicable facility components;
4. Any damage or malfunction, and the date and time any repairs were performed;
5. Documentation of sampling date and time;
6. Any other information required by this permit to be entered in the log book; and
7. Monitoring records for each measurement shall comply with A.A.C. R18-9-A206(B)(2).

2.7.3. Permit Violation and Alert Level Status Reporting

1. The permittee shall notify the Groundwater Protection Value Stream within 5 days (except as provided in Section 2.6.5) of becoming aware of an AL exceedance, or violation of any permit

condition, AQL, or DL for which notification requirements are not specified in Sections 2.6.2 through 2.6.5.

2. The permittee shall submit a written report to the Groundwater Protection Value Stream within 30 days of becoming aware of the violation of any permit condition, AQL, or DL. The report shall document all of the following:

    a. Identification and description of the permit condition for which there has been a violation and a description of the cause;

    b. The period of violation including exact date(s) and time(s), if known, and the anticipated time period during which the violation is expected to continue;

    c. Any corrective action taken or planned to mitigate the effects of the violation, or to eliminate or prevent a recurrence of the violation;

    d. Any monitoring activity or other information which indicates that any pollutants would be reasonably expected to cause a violation of an AWQS;

    e. Proposed changes to the monitoring which include changes in constituents or increased frequency of monitoring; and

    f. Description of any malfunction or failure of pollution control devices or other equipment or processes.

2.7.4. Operational, Other or Miscellaneous Reporting

The permittee shall record the information as required in Section 4.2, Table 8: FACILITY INSPECTION AND OPERATIONAL MONITORING in the facility log book as per Section 2.7.2, and report to the Groundwater Protection Value Stream any violations or exceedances as per Section 2.7.3.

2.7.4.1. Annual Report

If an Alert Level #1 or Alert Level #2 has been exceeded as discussed in Sections 2.6.2.3 and 2.6.2.4, the permittee shall submit an annual report that summarizes the results of the liner assessment. The Liner Leakage Assessment Report shall also include information including but not limited to the following: number and location of holes identified; a table summarizing the exceedances including the frequency and quantity of fluid removed, and corrective actions taken.

The permittee shall submit an annual report containing the following:

1. Annual update of the ~~AMI~~South32 seeps and springs catalog, as well as a chart illustrating trends in flows at those seeps and springs.

2. Groundwater monitoring results from MW-9 (located at 110°44’33” W, 31°32’31” N).

3. If updated information becomes available related to mine dewatering, a summary that includes potentiometric maps and hydrographs.

When required the annual report is to be submitted by January 30 of each year to cover activities from January 1 through December 31st of the previous year, consistent with Section 2.7.6.

2.7.5. Reporting Location

All Self-Monitoring Report Forms (SMRFs) shall be submitted through the myDEQ portal accessible on the ADEQ website at: http://www.azdeq.gov/welcome-mydeq

<u>All other documents required by this permit shall be mailed to:</u>

The Arizona Department of Environmental Quality
Groundwater Protection Value Stream
Mail Code 5415B-3
1110 West Washington Street
Phoenix, Arizona 85007
Phone (602) 771-4571

2.7.6. Reporting Deadline

The following table lists the quarterly SMRF report due dates:

Table 4: QUARTERLY REPORTING DEADLINES	
Monitoring Conducted During Quarter:	**Quarterly Report Due By:**
January-March	April 30
April-June	July 30
July-September	October 30
October-December	January 30

The following table lists the semi-annual SMRF report due dates:

Table 5: SEMI-ANNUAL REPORTING DEADLINES	
Monitoring Conducted:	**Report Due By:**
Semi-annual: January-June	July 30
Semi-annual: July-December	January 30

The following table lists the due date for the Annual report per Section 2.7.4.1:

Table 6: ANNUAL REPORTING DEADLINES	
Monitoring Conducted:	**Report Due By:**
Annual: January-December	January 30

2.7.7. Changes to Facility Information in Section 1.0

The Groundwater Protection Value Stream shall be notified within ten days of any change of facility information including Facility Name, Permittee Name, Mailing or Street Address, Facility Contact Person, or Emergency Telephone Number.

2.8. Temporary Cessation

[A.R.S. § 49-243(K)(8) and A.A.C. R18-9-A209(A)]

The permittee shall give written notice to the Groundwater Protection Value Stream before ceasing operation of the facility for a period of 60 days or greater. The permittee shall take the following measures upon temporary cessation:

1. Submittal of Self-Monitoring Report Forms (SMRFs) is still required; report "temporary cessation" in the comment section.

At the time of notification the permittee shall submit for ADEQ approval a plan for maintenance of discharge control systems and for monitoring during the period of temporary cessation. Immediately following ADEQ approval, the permittee shall implement the approved plan. If necessary, ADEQ shall amend permit conditions to incorporate conditions to address temporary cessation. During the period of temporary cessation, the permittee shall provide written notice to the Groundwater Protection Value Stream of the operational status of the facility every three years. If the permittee intends to permanently cease operation of any facility, the permittee shall submit closure notification, as set forth in Section 2.9 below.

2.9. Closure

[A.R.S. §§ 49-243(K)(6), 49-252 and A.A.C. R18-9-A209(B)]

For a facility addressed under this permit, the permittee shall give written notice of closure to the Groundwater Protection Value Stream of the intent to cease operation without resuming activity for which the facility was designed or operated. Submittal of SMRFs is still required; report “closure in process” in the comment section.

2.9.1. Closure Plan

Within 90 days following notification of closure, the permittee shall submit for approval to the Groundwater Protection Value Stream, a closure plan which meets the requirements of A.R.S. § 49-252 and A.A.C. R18-9-A209(B)(3).

If the closure plan achieves clean-closure immediately, ADEQ shall issue a letter of approval to the permittee. If the closure plan contains a schedule for bringing the facility to a clean-closure configuration at a future date, ADEQ may incorporate any part of the schedule as an amendment to this permit.

2.9.2. Closure Completion

Upon completion of closure activities, the permittee shall give written notice to the Groundwater Protection Value Stream indicating that the approved closure plan has been implemented fully and providing supporting documentation to demonstrate that clean-closure has been achieved (soil sample results, verification sampling results, groundwater data, as applicable). If clean-closure has been achieved, ADEQ shall issue a letter of approval to the permittee at that time. If any of the following conditions apply, the permittee shall follow the terms of post-closure stated in this permit:

1. Clean-closure cannot be achieved at the time of closure notification or within one year thereafter under a diligent schedule of closure actions;
2. Further action is necessary to keep the facility in compliance with the AWQS at the applicable POC or, for any pollutant for which the AWQS was exceeded at the time this permit was issued, further action is necessary to prevent the facility from further degrading the aquifer at the applicable POC with respect to that pollutant;
3. Activities are necessary to verify that actions or controls specified as closure requirements in an approved closure plan or strategy are routinely inspected or maintained;
4. Remedial, mitigative or corrective actions or controls are necessary to comply with A.R.S. § 49-201(30) and Title 49, Chapter 2, Article 3;
5. Further action is necessary to meet property use restrictions.
6. SMRF submittals are still required until Clean Closure is issued.

2.10. Post-Closure

[A.R.S. §§ 49-243(K)(6), 49-252 and A.A.C. R18-9 A209(C)]

Post-closure requirements shall be established based on a review of facility closure actions and will be subject to review and approval by the Groundwater Protection Value Stream.

In the event clean-closure cannot be achieved pursuant to A.R.S. § 49-252, the permittee shall submit for approval to the Groundwater Protection Value Stream a post-closure plan that addresses post-closure maintenance and monitoring actions at the facility. The post-closure plan shall meet all requirements of A.R.S. §§ 49-201(30) and 49-252 and A.A.C. R18-9-A209(C). Upon approval of the post-closure plan, this permit shall be amended or a new permit shall be issued to incorporate all post-closure controls and monitoring activities of the post-closure plan.

2.10.1. Post-Closure Plan

A specific post-closure plan may be required upon the review of the closure plan.

2.10.2. Post-Closure Completion

Not required at the time of permit issuance.

3.0 COMPLIANCE SCHEDULE

[A.R.S. § 49-243(K)(5) and A.A.C. R18-9-A208]

Unless otherwise indicated, for each compliance schedule item listed below, the permittee shall submit the required information to the Groundwater Protection Value Stream.

Table 7: COMPLIANCE SCHEDULE ITEMS

No.	Description	Due By:	Permit Amendment Required?
1	The financial assurance mechanism listed in Section 2.1, Financial Capability, is being maintained as per A.R.S. 49-243.N.4 and A.A.C. R18-9-A203(H) for all estimated closure and post-closure costs including updated costs submitted under Section 3.0, No. 2 below. The demonstration shall include a statement that the closure and post-closure strategy has not changed, the discharging facilities listed in the permit have not been altered in a manner that would affect the closure and post-closure costs, and discharging facilities have not been added. The demonstration shall also include information in support of ~~a "performance surety bond"~~ a financial assurance mechanism as required as per A.A.C. R18-9-A203(C)(2).	A~~ugust 25,~~ Six years from amended permit issuance and ~~2027, and~~ every 6 years thereafter, for the duration of the permit.	No
2	The permittee shall submit updated cost estimates for facility closure and post-closure, as per A.A.C. R18-9-A201(B)(5) and A.R.S. 49-243.N.2.a, and an updated financial assurance demonstration for the updated cost estimate as per A.A.C. R18-9-A203(C)(2).	~~August 25, 2027,~~ Six years from amended permit issuance and every 6 years thereafter, for the duration of the permit.	Yes
~~3~~	~~If the permittee wishes to deposit a greater quantity of material into TSF1, or to increase the crest elevation of TSF1 above 5,175 275 feet amsl, then the permittee shall apply for a permit amendment.~~	~~Within six months of determination to increase tailings crest elevation~~	~~Yes~~
4	The permittee shall submit as-built design report of the TSF1 documenting placement of development rock from surface and exploration declines or shaft, solids from water treatment including filter cake ~~from WTP1 and WTP2~~, core cutting solids, drill cutting, and solid from stormwater BMPs, assay rejects, and sediments from vehicle wash sumps when the TSF reaches the maximum permitted elevation of the 5,~~175~~ 275 ft. The design documents shall be sealed by an Arizona licensed professional engineer.	Within 90 days after completion of construction.	No
~~5~~	~~The permittee shall submit as-built design drawings for WTP2 following construction. The design documents shall be sealed by an Arizona licensed professional engineer.~~	~~Within 90 days after completion of construction.~~	~~No~~
6	When applicable, the permittee shall submit an	January 30, 2024, and each year	No

Commented [AJ3]: No need for CSI, because of Section 6.9. Suggest removing.

Commented [AJ4]: COMPLETED

Table 7: COMPLIANCE SCHEDULE ITEMS			
No.	**Description**	**Due By:**	**Permit Amendment Required?**
	annual report as per Section 2.7.4.1	thereafter	

4.0 TABLES OF MONITORING REQUIREMENTS

4.1. PRE-OPERATIONAL MONITORING (or CONSTRUCTION REQUIREMENTS)

Not Required

4.2. COMPLIANCE OR OPERATIONAL MONITORING

Table 8: FACILITY INSPECTION AND OPERATIONAL MONITORING			
The permittee shall record the inspection performance levels in a log book as per Section 2.7.2, and report any exceedances as required by ~~violations or exceedances as per~~ Section 2.6.2.2~~-~~2.7.3~~2.7.32.7.3.~~ In the case of an exceedance, identify which structure exceeds the performance level in the log book.			
TAILINGS STORAGE FACILITY			
Parameter	**Performance Standard**		**Monitoring Frequency**
Facility Height	Does not exceed 5,~~175~~ 275 ft amsl		Annually
Structural Integrity	No visible structural weakness, seepage erosion, sloughing, rolling rocks, or other hazardous conditions		Monthly
Piezometric Head	The phreatic surface in the piezometers shall be less than 1.5 feet[1]		Weekly
PIEZOMETER LOCATION			
Piezometer ID	**Association**	**Latitude**	**Longitude**
P1	TSF	31° 28' 01.3135" N	110° 43' 36.4235" W
P2	TSF	31° 27' 58.5711" N	110° 43' 39.4789" W
P3	TSF	31° 27' 59.3730" N	110° 43' 32.8978" W
P4	TSF	31° 27' 56.4873" N	110° 43' 28.0662" W
P7	TSF	31° 27' 53.369" N	110° 43' 24.745" W
P8	TSF	31° 27' 51.288" N	110° 43' 28.179" W
NOTES: The schedule for P7 and P8 construction is dependent on the TSF1 construction schedule. If replacement of a piezometer is necessary due to malfunction, the permittee may install a replacement piezometer in the same general location, and no permit amendment is necessary. The locational information may be updated in the permit, during any future amendment.			
UNDERDRAIN COLLECTION POND			
Parameter	**Performance Standard**		**Monitoring Frequency**
Freeboard	Minimum of seven (7) feet		Weekly or after a significant rainstorm or other natural disaster
Anchor trench integrity	No impairment		Monthly
Embankment integrity	No visible structural weakness, seepage erosion, or other hazardous conditions		Monthly
Liner Integrity	No visible cracks, punctures, or deteriorations of liner		Monthly
Integrity of Pumping System	Good working condition		Monthly
Sediments/sludge	Remove sediments/sludge as needed to maintain at least 90 percent of designed capacity		Monthly

[1] If the phreatic surface is in excess of 1.5 feet, the permittee shall follow the contingency action per Section 2.6.2.7.

Table 9: ROUTINE DISCHARGE MONITORING						
Sampling Point Number	**Sampling Point Identification**			**Latitude (North)**		**Longitude (West)**
1	AZPDES Outfall 001			31° 28' 15" N		110° 43' 43" W
3	AZPDES Outfall 002			31° 27' 56.62" N		110° 43' 11.51" W
Parameter	**AL[2] for both outfalls**	**DL[3] for Outfall 001**	**DL for Outfall 002**	**Units**	**Sampling Frequency**	**Reporting Frequency**
Flow	N/A	0.172	6.48	mgd[4]	Daily[5]	~~Quarterly~~Monthly
Temperature	Monitor[6]	Monitor	Monitor	Degrees	~~Quarterly~~Monthly	~~Quarterly~~Monthly
pH (field)	Monitor	Monitor	Monitor	S.U.	~~Quarterly~~Monthly	~~Quarterly~~Monthly
Specific Conductance (field)	Monitor	Monitor	Monitor	μmhos/cm	~~Quarterly~~Monthly	~~Quarterly~~Monthly
Nitrate (as N)	8.0	10.0	10.0	mg/L	~~Quarterly~~Monthly	~~Quarterly~~Monthly
Nitrite (as N)	0.8	1.0	1.0	mg/L	~~Quarterly~~Monthly	~~Quarterly~~Monthly
Nitrate-Nitrite as N	8.0	10.0	10.0	mg/L	~~Quarterly~~Monthly	~~Quarterly~~Monthly
Total Dissolved Solids	Monitor	Monitor	Monitor	mg/L	~~Quarterly~~Monthly	~~Quarterly~~Monthly
Total Alkalinity	Monitor	Monitor	Monitor	mg/L	~~Quarterly~~Monthly	~~Quarterly~~Monthly
Sulfate	Monitor	Monitor	Monitor	mg/L	~~Quarterly~~Monthly	~~Quarterly~~Monthly
Metals (Total)						
Antimony	0.0048	0.006	0.006	mg/l	~~Quarterly~~Monthly	~~Quarterly~~Monthly
Arsenic	0.04	0.05	0.05	mg/l	~~Quarterly~~Monthly	~~Quarterly~~Monthly
Barium	1.60	2.00	2.00	mg/l	~~Quarterly~~Monthly	~~Quarterly~~Monthly
Beryllium	0.0032	0.004	0.004	mg/l	~~Quarterly~~Monthly	~~Quarterly~~Monthly
Cadmium	0.004	0.005	0.005	mg/l	~~Quarterly~~Monthly	~~Quarterly~~Monthly
Chromium	0.08	0.1	0.1	mg/l	~~Quarterly~~Monthly	~~Quarterly~~Monthly
Cyanide (as free cyanide)	0.16	0.2	0.2	mg/l	~~Quarterly~~Monthly	~~Quarterly~~Monthly
Fluoride	3.2	4.0	4.0	mg/l	~~Quarterly~~Monthly	~~Quarterly~~Monthly
Lead	0.04	0.05	0.05	mg/l	~~Quarterly~~Monthly	~~Quarterly~~Monthly
Mercury	0.0016	0.002	0.002	mg/l	~~Quarterly~~Monthly	~~Quarterly~~Monthly
Nickel	0.08	0.1	0.1	mg/l	~~Quarterly~~Monthly	~~Quarterly~~Monthly
Selenium	0.04	0.05	0.05	mg/l	~~Quarterly~~Monthly	~~Quarterly~~Monthly
Thallium	0.0016	0.002	0.002	mg/l	~~Quarterly~~Monthly	~~Quarterly~~Monthly
Iron	Monitor[7]	Monitor	Monitor	mg/L	~~Quarterly~~Monthly	~~Quarterly~~Monthly
Copper	Monitor	Monitor	Monitor	mg/L	~~Quarterly~~Monthly	~~Quarterly~~Monthly
Manganese	Monitor	Monitor	Monitor	mg/L	~~Quarterly~~Monthly	~~Quarterly~~Monthly
Zinc	Monitor	Monitor	Monitor	mg/L	~~Quarterly~~Monthly	~~Quarterly~~Monthly
Radionuclides						
Gross Alpha (including Radium 226)[8,9]	12	15	15	pCi/L	~~Quarterly~~Monthly	~~Quarterly~~Monthly
Radium 226 + Radium 228	4	5	5	pCi/L	~~Quarterly~~Monthly	~~Quarterly~~Monthly
Total uranium	Monitor	Monitor	Monitor	pCi/L	~~Quarterly~~Monthly	~~Quarterly~~Monthly

[2] AL = Alert Levels
[3] DL = Discharge Limits
[4] mgd=Million gallons per day
[5] "Daily" means the days that effluent from the Water Treatment Plant is discharged to the AZPDES Outfall 001, or that effluent from the Water Treatment Plant 2 is discharged to the AZPDES Outfall 002. On the days effluent from the Water Treatment Plant is NOT being discharged to the AZPDES Outfall 001, or that effluent from the Water Treatment Plant 2 is NOT being discharged to the AZPDES Outfall 002, indicate "No Flow" on the SMRF reporting form for the appropriate outfall(s).
[6] Monitor = Analysis is required but limits are not established.
[7] Monitoring is required, but no limit is established.
[8] If the gross alpha particle activity is greater than 15 pCi/L, then calculate adjusted gross alpha particle activity
[9] The adjusted gross alpha particle activity is the gross alpha particle activity, including radium 226, and any other alpha emitters, if present in the water sample, minus radon and total uranium (the sum of uranium 238, uranium 235 and uranium 234 isotopes). The gross alpha analytical procedure (evaporation technique: EPA Method 900.0) drives off radon gas in the water samples. Therefore, the Adjusted Gross Alpha should be calculated using the following formula: (Laboratory Reported Gross Alpha MINUS Sum of the Uranium Isotopes).

NOTE: QUARTERLY DISCHARGE MONITORING WILL BE COLLECTED AS 8-hour COMPOSITE SAMPLES.

Table 10: GROUNDWATER MONITORING AT POC-2					
Sampling Point Number	**Sampling Point Identification**			**Latitude (North)**	**Longitude (West)**
2	300 feet downgradient of the AZPDES Outfall-			31° 28' 18.91"	110° 43' 48.83"
Parameter	**AL**	**AQL[10]**	**Units**	**Sampling Frequency**	**Reporting Frequency**
Depth to Water Level	Monitor[11]	Monitor	Feet	Semi-Annually[12]	Semi-Annually
Water Level Elevation	Monitor	Monitor	Feet amsl[13]	Semi-Annually	Semi-Annually
Temperature	Monitor	Monitor	Degrees	Semi-Annually	Semi-Annually
pH	Monitor	Monitor	S.U.	Semi-Annually	Semi-Annually
Specific Conductance	Monitor	Monitor	µmhos/cm	Semi-Annually	Semi-Annually
Nitrate (as N)	8	10	mg/L	Semi-Annually	Semi-Annually
Nitrite (as N)	0.8	1	mg/L	Semi-Annually	Semi-Annually
Nitrate-Nitrite as N	8	10	mg/L	Semi-Annually	Semi-Annually
Total Dissolved Solids	Monitor	Monitor	mg/L	Semi-Annually	Semi-Annually
Total Alkalinity	Monitor	Monitor	mg/L	Semi-Annually	Semi-Annually
Sulfate	Monitor	Monitor	mg/L	Semi-Annually	Semi-Annually
Metals (Dissolved)					
Antimony	0.0048	0.006	mg/L	Semi-Annually	Semi-Annually
Arsenic	0.04	0.05	mg/L	Semi-Annually	Semi-Annually
Beryllium	0.0032	0.004	mg/L	Semi-Annually	Semi-Annually
Barium	1.6	2	mg/L	Semi-Annually	Semi-Annually
Cadmium	Not Established[14]	0.011	mg/L	Semi-Annually	Semi-Annually
Chromium	0.08	0.1	mg/L	Semi-Annually	Semi-Annually
Cyanide (free)	0.16	0.2	mg/L	Semi-Annually	Semi-Annually
Fluoride	3.2	4.0	mg/L	Semi-Annually	Semi-Annually
Lead	0.04	0.05	mg/L	Semi-Annually	Semi-Annually
Mercury	0.0016	0.002	mg/L	Semi-Annually	Semi-Annually
Nickel	0.08	0.1	mg/L	Semi-Annually	Semi-Annually
Selenium	0.04	0.05	mg/L	Semi-Annually	Semi-Annually
Thallium	0.0016	0.002	mg/L	Semi-Annually	Semi-Annually
Iron	Monitor[15]	Monitor	mg/L	Semi-Annually	Semi-Annually
Copper	Monitor	Monitor	mg/L	Semi-Annually	Semi-Annually
Manganese	Monitor	Monitor	mg/L	Semi-Annually	Semi-Annually
Zinc	Monitor	Monitor	mg/L	Semi-Annually	Semi-Annually
Radionuclides					
Gross Alpha (including Radium 226)[16,17]	12	15	pCi/L	Semi-Annually	Semi-Annually
Radium 226 + Radium 228	4	5	pCi/L	Semi-Annually	Semi-Annually
Total uranium	Monitor	Monitor	pCi/L	Semi-Annually	Semi-Annually

[10] AQL = Aquifer Quality Limits
[11] Monitor = Analysis is required but an AQL and/or AL is not established in the permit
[12] Semi-Annual monitoring shall be conducted as follows: During each semi-annual period described in Sections 2.6.2.8.2, 2.6.4, and 2.7.6 sampling shall occur within seven days of a discharge from the WTP outfall, but not exceeding one sampling event per semi-annual period. If no discharge should occur during a semi-annual period, no sample is required for that period. Should sampling frequency increase to Quarterly monitoring, sampling shall be conducted in the same manner as described above, except the period for sampling will be quarterly as described in Sections, 2.6.2.8.2, 2.6.4, and 2.7.6.
[13] amsl = above mean sea level
[14] Not Established means monitoring is required but no limits are specified.
[15] Monitoring is required, but no limit is established.
[16] If the gross alpha particle activity is greater than 15 pCi/L, then calculate adjusted gross alpha particle activity
[17] The adjusted gross alpha particle activity is the gross alpha particle activity, including radium 226, and any other alpha emitters, if present in the water sample, minus radon and total uranium (the sum of uranium 238, uranium 235 and uranium 234 isotopes). The gross alpha analytical procedure (evaporation technique: EPA Method 900.0) drives off radon gas in the water samples. Therefore, the Adjusted Gross Alpha should be calculated using the following formula: (Laboratory Reported Gross Alpha MINUS Sum of the Uranium Isotopes).

Table 11: LEAK COLLECTION AND REMOVAL SYSTEM MONITORING			
LCRS Sump	**Alert Level 1 (gpd)**	**Alert Level 2 (gpd)**	**Monitoring Method**
Underdrain Collection Pond (~~UCP~~UDCP) Sump	3,456	22,896	Automated

Note: The information in this table shall be maintained in a Log Book.

The volume of liquid pumped from the LCRS shall be monitored on a continuous basis using a totalizer and entered in a facility log book on a daily basis. The Alert Level 1 (AL1) or Alert Level 2 (AL2) shall be exceeded when the amount of leakage pumped from the sump for the ~~UCP~~UDCP is greater than the applicable quantity above. Contingency requirements of Sections 2.6.2.3 and 2.6.2.4 shall be followed for AL1 and AL2 exceedances, respectively. An exceedance of AL 1 or AL2 is not a violation of the permit unless the permittee fails to perform actions as required under the Sections referenced above.

NOTE TO ADEQ: Not sure if footnotes transferred when this file was received from ADEQ.

Table 12: CONTINGENCY DISCHARGE CHARACTERIZATION[18]		
Parameter[19]	**Units**	**Monitoring Frequency[20]**
pH (field)	Standard Units	One sample
Total Dissolved Solids (TDS)	mg/L	One sample
Specific Conductance (lab)	umhos/cm	One sample
Hardness [21]	Standard Units	One sample
Nitrate (as N)	mg/L	One sample
Nitrite (as N)	mg/L	One sample
Nitrate-Nitrite as N	mg/L	One sample
Total Alkalinity	mg/L	One sample
Sulfate	mg/L	One sample
Antimony	mg/L	One sample
Arsenic	mg/L	One sample
Beryllium	mg/L	One sample
Barium	mg/L	One sample
Cadmium	mg/L	One sample
Chromium	mg/L	One sample
Cyanide (free)	mg/L	One sample
Fluoride	mg/L	One sample
Lead	mg/L	One sample
Mercury	mg/L	One sample
Nickel	mg/L	One sample
Selenium	mg/L	One sample
Thallium	mg/L	One sample
Iron	mg/L	One sample
Copper	mg/L	One sample
Manganese	mg/L	One sample
Zinc	mg/L	One sample

[18] Contingency discharge characterization shall be conducted for BADCT failures and overtopping. Monitoring under this table per Section 2.6.3.1, Surface Impoundments, Liner Failure, Containment Structure Failure, Unexpected Loss of Fluid, or Section 2.6.3.2, Overtopping of an Impoundment.
[19] Metals shall be analyzed as total metals.
[20] One sample shall be taken within 24 hours of discovery of an event.
[21] Hardness may be expressed as the sum of calcium plus magnesium as calcium carbonate (CaCO3)
mg/L = milligrams per liter umhos/cm = micromhos per centimeter

5.0 REFERENCES AND PERTINENT INFORMATION

The terms and conditions set forth in this permit have been developed based upon the information contained in the following, which are on file with the Department:

APP Application, dated:	April 21, 2023
Contingency Plan, dated:	June 5, 2017

Commented [AJ5]: ADEQ to Update these dates.

Document Reviewed

- Hermosa Project – Trench Camp Property, Aquifer Protection Permit SIGNIFICANT Amendment Application, P-512235, Santa Cruz County, Arizona, dated August 14, 2020

6.0 NOTIFICATION PROVISIONS

6.1. Annual Registration Fees

The permittee is notified of the obligation to pay an Annual Registration Fee to ADEQ. The Annual Registration Fee is based on the amount of daily influent or discharge of pollutants in gallons per day (gpd) as established by A.R.S. § 49-242.

6.2. Duty to Comply

[A.R.S. §§ 49-221 through 263]

The permittee is notified of the obligation to comply with all conditions of this permit and all applicable provisions of Title 49, Chapter 2, Articles 1, 2 and 3 of the Arizona Revised Statutes, Title 18, Chapter 9, Articles 1 through 4, and Title 18, Chapter 11, Article 4 of the Arizona Administrative Code. Any permit non-compliance constitutes a violation and is grounds for an enforcement action pursuant to Title 49, Chapter 2, Article 4 or permit amendment, suspension, or revocation.

6.3. Duty to Provide Information

[A.R.S. §§ 49-243(K)(2) and 49-243(K)(8)]

The permittee shall furnish to the Director, or an authorized representative, within a time specified, any information which the Director may request to determine whether cause exists for amending or terminating this permit, or to determine compliance with this permit. The permittee shall also furnish to the Director, upon request, copies of records required to be kept by this permit.

6.4. Compliance with Aquifer Water Quality Standards

[A.R.S. §§ 49-243(B)(2) and 49-243(B)(3)]

The permittee shall not cause or contribute to a violation of an Aquifer Water Quality Standard (AWQS) at the applicable point of compliance (POC) for the facility. Where, at the time of issuance of the permit, an aquifer already exceeds an AWQS for a pollutant, the permittee shall not discharge that pollutant so as to further degrade, at the applicable point of compliance for the facility, the water quality of any aquifer for that pollutant.

6.5. Technical and Financial Capability

[A.R.S. §§ 49-243(K)(8) and 49-243(N) and A.A.C. R18-9-A202(B) and R18-9-A203(E) and (F)]

The permittee shall have and maintain the technical and financial capability necessary to fully carry out the terms and conditions of this permit. Any bond, insurance policy, trust fund, or other financial assurance mechanism provided as a demonstration of financial capability in the permit application, pursuant to A.A.C. R18-9-A203(C), shall be in effect prior to any discharge authorized by this permit and shall remain in effect for the duration of the permit.

6.6. Reporting of Bankruptcy or Environmental Enforcement

[A.A.C. R18-9-A207(C)]

The permittee shall notify the Director within five days after the occurrence of any one of the following:

1. the filing of bankruptcy by the permittee; or
2. the entry of any order or judgment not issued by the Director against the permittee for the enforcement of any environmental protection statute or rule.

6.7. Monitoring and Records

[A.R.S. § 49-243(K)(8) and A.A.C. R18-9-A206]

The permittee shall conduct any monitoring activity necessary to assure compliance with this permit, with the applicable water quality standards established pursuant to A.R.S. §§ 49-221 and 49-223 and §§ 49-241 through 49-252.

6.8. Inspection and Entry

[A.R.S. §§ 41-1009, 49-203(B), and 49-243(K)(8)]

In accordance with A.R.S. §§ 41-1009 and 49-203(B), the permittee shall allow the Director, or an authorized representative, upon the presentation of credentials and other documents as may be required by law, to enter and inspect the facility as reasonably necessary to ensure compliance with Title 49, Chapter 2, Article 3 of the Arizona Revised Statutes, and Title 18, Chapter 9, Articles 1 through 4 of the Arizona Administrative Code and the terms and conditions of this permit.

6.9. Duty to Modify

[A.R.S. § 49-243(K)(8) and A.A.C. R18-9-A211]

The permittee shall apply for and receive a written amendment before deviating from any of the designs or operational practices authorized by this permit.

6.10. Permit Action: Amendment, Transfer, Suspension, and Revocation

[A.R.S. §§ 49-201, 49-241 through 251, A.A.C. R18-9-A211, R18-9-A212 and R18-9-A213]

This permit may be amended, transferred, suspended, or revoked for cause, under the rules of the Department. The permittee shall notify the Groundwater Protection Value Stream in writing within 15 days after any change in the owner or operator of the facility. The notification shall state the permit number, the name of the facility, the date of property transfer, and the name, address, and phone number where the new owner or operator can be reached. The operator shall advise the new owner or operators of the terms of this permit and the need for permit transfer in accordance with the rules.

7.0 ADDITIONAL PERMIT CONDITIONS

7.1. Other Information

[A.R.S. § 49-243(K)(8)]

Where the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to the Director, the permittee shall promptly submit the correct facts or information.

7.2. Severability

[A.R.S. §§ 49-201, 49-241 through 251, A.A.C. R18-9-A211, R18-9-A212 and R18-9-A213]

The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby. The filing of a request by the permittee for a permit action does not stay or suspend the effectiveness of any existing permit condition.

7.3. Permit Transfer

This permit may not be transferred to any other person except after notice to and approval of the transfer by the Department. No transfer shall be approved until the applicant complies with all transfer requirements as specified in A.A.C. R18-9-A212(B) and (C).

ATTACHMENT E

Contingency Plan

Contingency and Emergency Response Plan

Aquifer Protection Permit No. P-512235

Place ID 18640 LTF 83040

CONTENTS

This Contingency and Emergency Response Plan was prepared under the requirements of Arizona Administrative Code (A.A.C.) R18-9-A204 to define the actions if a discharge results in any of the following:

- A violation of an Aquifer Water Quality Standard (AWQS) or an Acceptable Quality Limit (AQL)
- A violation of a discharge limitation
- A violation of any other permit condition
- An exceedance of an Alert Level (AL), or
- An imminent and substantial endangerment to the public health or the environment occurs.

At least one copy of the Contingency Plan, along with the facility aquifer protection permit (APP or permit), will be maintained where day-to-day decisions regarding the operation of the facilities are made. All employees responsible for facility operations will be made aware of the location of this plan. This Contingency Plan will be updated and submitted to ADEQ within 30 days of the effective date of the APP, or as required by the terms of any amendment of the APP that necessitates a change in the plan, to ensure that it is consistent with the current terms of the permit.

1 EMERGENCY RESPONSE COORDINATORS

South32 Hermosa Inc.'s Emergency Response Coordinator (ERC) should be contacted immediately in the event of an emergency and is responsible for implementing the contingency plan. Information for primary and secondary contacts is included below:

Primary Contact – Emergency Response Coordinator (ERC):
Contact Name: Brent Musslewhite
Job Title: Director, Environment and Permitting
Address: 1860 E River Road, Suite 200, Tucson, AZ 85718
Office Number: 520-485-1300
Cell Number: 505-801-2977

Secondary Contact – Back up ERC:
Contact Name: Kara Haas
Job Title: Principal – Environment
Address: 749 Harshaw Road, Patagonia, Arizona 85624
Office Number: 520-485-1300
Cell Number: 505-947-1738

2 AGENCY CONTACTS

The Arizona Department of Environmental Quality (ADEQ)
Groundwater Protection Value Stream
Address: Mail Code 5415B-3
1110 West Washington Street
Phoenix, Arizona 85007
Phone: (602) 771-4571

ADEQ Non-Emergency Spill / Main Line:

Phone: 602-771-2330

Toll-Free: 800-234-5677

24-hour Environmental Emergency Response / Duty Offices

Phone: (602) 390-7894

Contingency and Emergency Response Plan

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ADEQ SRO:

Address:	400 W. Congress Street, Suite 433
	Tucson, AZ 85701
Phone Number:	520-628-6733

3 UNDERDRAIN COLLECTION POND FREEBOARD (PART 2.6.2.1)

During the operation of the Underdrain Collection Pond (UDCP), South32 Hermosa Inc. (South32) will monitor weekly and after significant storm events to ensure that the minimum freeboard level (which is defined as two feet below the spillway invert or 7 feet of total freeboard) is maintained. The UDCP was designed to meet prescriptive BADCT capacity and storage requirements for the design flood event and estimated inflow seepage. In the event that the UDCP freeboard requirement is not maintained, South32 will take the following actions:

1. As soon as practicable, reduce or cease inflows to the UDCP other than the Tailings Storage Facility (TSF) underdrain collection pipe outlets. The TSF underdrain collection pipe outlet valves should not be closed.
2. Remove and treat at Water Treatment Plant 1 (WTP1) and/or (WTP2), or recycle back into the TSF, the fluid in the UDCP until the water level is restored at or below the permitted freeboard level.
3. Within five (5) days of discovery, evaluate the cause and adjust operational conditions or identify design improvements to avoid future occurrences.
4. Within 30 days of discovery, initiate repairs to the UDCP as necessary to meet required freeboard levels and return the system to compliance.
5. If design improvements are necessary, submit an amendment application within 90 days of discovery.
6. Include and maintain in the facility log all records documenting each freeboard incident and actions taken to correct the problem (including any repair procedures, methods, and materials used to restore the facility to operating condition).
7. The facility is no longer on alert status once the operational indicator no longer indicates that the freeboard performance level is being exceeded. The permittee shall, however, complete all tasks necessary to return the facility to its pre-alert operating condition.

Contingency and Emergency Response Plan

Aquifer Protection Permit No. P-512235

Place ID 18640 LTF 83040

4 UNDERDRAIN COLLECTION POND SPILLWAY ACTIVATION OR OVERTOPPING (PART 2.6.3.2)

If the freeboard is exceeded to the point of spillway activation and results in an unauthorized discharge under Arizona Revised Statutes (A.R.S.) § 49-201(12), South32 will take the following actions:

1. As soon as practicable, reduce or cease inflows to the UDCP other than the TSF underdrain collection pipe outlets. The TSF underdrain collection pipe outlet valves should not be closed.
2. As soon as practicable, remove and treat at WTP1 and/or WTP2,, recycle back into the TSF, or route for temporary storage in a construction water pond the fluid in the UDCP until the specified freeboard level is attained. Record in the facility log/recordkeeping file the amount of fluid released, a description of the removal method, and the volume of any fluid removed from the impoundment and/or captured from the release area. The facility log/recordkeeping file shall be maintained according to the APP and Dam Safety permit requirements.
3. Notify the Groundwater Protection Value Stream within 24 hours of discovery.
4. Within 24 hours of discovery, collect representative samples of the fluid contained in the UDCP. These samples shall be analyzed for the parameters listed in Part 4.2, Table 12 of the permit. Within 30 days of the incident, submit a copy of the analytical results to the Groundwater Protection Value Stream.
5. Within 30 days of discovery, evaluate the circumstances that resulted in the activation of the spillway. Implement corrective actions, including system repairs, and adjust operational conditions to prevent any future occurrences.
6. Within 30 days of discovery of the spillway activation, submit a report to ADEQ as specified in Section 2.7.3(2) of the permit. Include a description of the actions performed in steps 1 through 5 listed above; to the extent that any information required by Part 2.7.3(2) is not already included in the description of the actions performed in steps 1 through 5 listed above, be sure to include it in the report.
7. Within 60 days of discovery, conduct an assessment of the impacts to the subsoil and/or groundwater resulting from the incident. If soil or groundwater is impacted such that it could cause or contribute to an exceedance of an Aquifer Quality Limit (AQL) at the applicable Point of Compliance (POC), submit to ADEQ, for approval, a corrective action plan to address problems identified in the assessment, including identification of releases to the environment, remedial actions and/or monitoring, and a schedule for completion of activities. At the direction of ADEQ, implement the approved plan.
8. Within 30 days of completion of corrective actions, submit a written report to ADEQ describing the causes, impacts, and actions taken to resolve the issue.

5 EXCEEDANCE OF PERFORMANCE LEVELS SET FOR CONDITIONS OTHER THAN FREEBOARD (PART 2.6.2.2)

1. If exceedance of an Operational Performance Level (PL) listed in Section 4.2, Table 8 of the permit has been observed or noted during required inspection and operational monitoring, such that the result is reasonably likely to cause or contribute to an unauthorized discharge pursuant to A.R.S. 49-201(12), South32 will immediately investigate to determine the cause of the condition. The investigation will include the following:
    a. Inspection, testing, and assessment of the current condition of all treatment or pollutant discharge control systems that may have contributed to the operational performance condition.
    b. Review of recent process logs, reports, and other operational control information to identify any unusual occurrences.
2. For a PL exceedance satisfying the conditions of paragraph 1, results of the investigation, and any corrective action taken will be reported to the Groundwater Protection Value Stream within 30 days of discovering the condition. Upon review of the submitted report, the Department may amend the permit to require additional monitoring, increased frequency of monitoring, or other actions.
3. Initiate actions identified in the approved contingency plan and any necessary contingency measures to resolve problems identified by the investigation that may have led to a PL being exceeded. To implement any other corrective action not included herein, South32 may choose to obtain prior approval from ADEQ according to Section 2.6.6 of the permit.
4. Any failure to meet a performance level that does not satisfy the conditions of paragraph 1 shall be recorded in the log book maintained pursuant to Section 2.7.2 of the permit

6 UNDERDRAIN COLLECTION POND UNEXPECTED LOSS OF FLUID (PART 2.6.3.1)

In the event of a liner failure, containment structure failure, or unexpected loss of fluid from the UDCP that results in an unauthorized discharge pursuant to A.R.S. 49-201(12), South32 will take the following actions:

1. As soon as practicable, reduce or cease inflows to the UDCP other than the TSF underdrain collection pipe outlets (the TSF underdrain collection pipe outlet valves should not be closed) to prevent or minimize any unexpected loss of fluid to the environment. Remove fluid remaining in the impoundment as necessary and capture and contain escaped fluids.
2. Notify the ADEQ Groundwater Protection Value Stream within 24 hours.
3. Within 24 hours of discovery, estimate the quantity released and collect representative samples of the fluid remaining in the UDCP. Samples shall be analyzed for the parameters listed in Part 4.2, Table 12 of the permit, and report under Part 2.7.3 of the permit. As part of

the 30-day report required under Part 2.7.3 (See paragraph 6 below), submit a copy of the analytical results to the ADEQ Groundwater Protection Value Stream.

4. Within 15 days of discovery, initiate an evaluation to determine the cause of the incident. Identify the circumstances that resulted in the failure and assess the condition of the facility and liner system. Implement corrective actions as necessary to resolve the problems identified in the evaluation. Initiate repairs to any failed liner system components, embankment structure, or another component as needed to restore the proper functioning of the facility. Do not resume discharging to the UDCP until repairs of any failed design elements are completed. As noted above, the TSF underdrain collection pipe outlets should not be closed. Repair procedures, methods, and materials used to restore the system(s) to proper operating condition shall be described in the facility log/recordkeeping file and available for ADEQ review.
5. Record in the facility log/recordkeeping file the amount of fluid released, a description of any removal method and volume of any fluid removed from the impoundment or captured from the release area, and other disposal arrangements. The facility log/recordkeeping file shall be maintained according to permit requirements.
6. Within 30 days of discovery of the incident, submit a report to the Groundwater Protection Value Stream pursuant to Part 2.7.3. Include a description of the actions performed in steps 1 through 5 listed above; to the extent that any information required by Part 2.7.3(2) is not already included in the description of the actions performed in steps 1 through 5 listed above, be sure to include it in the report.
7. Within 60 days of discovery, conduct an assessment of the impacts to the soil and/or groundwater resulting from the incident. If soil or groundwater is impacted such that it could or did cause or contribute to an exceedance of an AQL at the applicable POC, submit to ADEQ, for approval, a corrective action plan to address problems identified in the assessment, including identification of remedial actions and a schedule for completion of activities. Upon approval by ADEQ, implement the approved plan.
8. Within 30 days of completion of corrective actions, submit a written report to Groundwater Protection Value Stream as specified in Section 2.6.6 of the permit.

7 UNDERDRAIN COLLECTION POND LCRS ALERT LEVELS (PART 2.6.2.3 AND 2.6.2.4)

The UDCP has a double geomembrane liner with a Leakage Collection and Recovery System (LCRS). AL calculations were provided in Table 5.2 of Attachment B of the 2017 application. If an LCRS AL (set forth in Part 4.2, Table 11 of the permit) is exceeded, South32 will take the following actions:

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Alert Level 1 (AL1):

AL1 is a low-level trigger that indicates the presence of a small hole or defect in the primary geomembrane. South32 will monitor to determine if the flow rate increases without any operational changes. Additional information regarding AL1 details can be referenced in Section 5.6 of Attachment B of the 2017 application. AL1 is defined as a loss of 2.4 gallons per minute (gpm), or 3,456 gallons per day (gpd).

1. If AL1 is exceeded, notify the Groundwater Protection Value Stream within 5 days, and continue monitoring to determine if the leakage rate is increasing.
2. If the leakage rate continues to exceed AL1 for 15 days following notification of initial AL #1 exceedance, perform a visual inspection of the liner above the solution level to determine the location of the leaks in the primary liner.
3. Within 45 days of AL1 exceedance, if liner damage is evident, complete liner repairs.
4. Within 45 days of AL1 exceedance, if the visual inspection does not identify the location of leaks, formulate a corrective action plan to determine their location(s) and repair them.
5. Within 90 days of AL1 exceedance and following formulation of a corrective action plan, complete all liner repairs.
6. Within 75 days of AL1 exceedance (if repairs were completed in Step 3) or 120 days of AL1 exceedance (if corrective action plan was implemented per Steps 4 and 5) <u>and</u> no AL1 alert level is exceeded for 30 consecutive days, notify Groundwater Protection Value Stream and document assessment and/or repairs in the logbook.
7. Within 120 days of AL1 exceedance (if repairs were completed in Step 3) or 165 days of AL1 exceedance (if a corrective action plan was implemented per Steps 4 and 5) <u>and</u> the 30 consecutive day period with no AL1 exceedances is not achieved, notify Groundwater Protection Value Stream and reassess the entire liner system and complete any necessary repairs as described in Steps 2 and 3 (and if necessary Steps 4 and 5 also). Repeat the assessment and liner repair cycle until the requirements of Step No. 6 are attained.
8. Submit a liner leakage assessment and repair report in the next annual report described in the permit (Part 2.7.4.1) or submit the liner leakage assessment report to the ADEQ before the annual report due date. Submit this liner leakage assessment and repair report to Groundwater Protection Value Stream.

Alert Level 2 (AL2):

AL2 indicates the presence of a larger hole or defect in the primary geomembrane. Additional information regarding AL2 details can be found in Section 5.6 of Attachment B of the 2017 application. AL2 is defined as a loss of 15.9 gpm, or 22,896 gpd.

1. As soon as practicable, reduce discharges to the UDCP and implement control measures to prevent the buildup of solutions that may subsequently report to the impoundment. As noted above, the TSF underdrain collection pipe outlets should not be closed.
2. If AL2 is exceeded, immediately notify the Groundwater Protection Value Stream.
3. Within 15 days of initial AL2 exceedance, perform a visual inspection of the liner above the solution level to identify the location of the leak(s). Complete liner repairs and do not re-initiate discharge to the UDCP until the leak(s) have been identified and repaired.
4. Within 60 days of initial AL2 exceedance, if leaks were found and fixed and if no AL2 exceedance is observed for 30 consecutive days, submit a liner leakage assessment and repair report to ADEQ. Include the results of the initial liner evaluation, methods used to locate the leak(s), repair procedures, quality assurance/quality control procedures implemented to restore the liner to optimal operational status, and other information necessary to ensure the future occurrence of the incidence will be minimized.
5. Within 30 days of initial AL2 exceedance, if the visual inspection does not identify the location of leaks and AL2 exceedance continues, formulate a corrective action plan to determine their location and repair them. The corrective action plan will take into account the schedule for a 3rd party contractor to perform electronic leak detection or other methods if required.
6. Develop a corrective action plan and complete liner repairs within 75 days of initial AL2 exceedance.
7. Within 105 days of AL2 exceedance and implementation of the corrective action plan per Steps 4 and 5 and if no AL2 exceedance is observed for 30 consecutive days, notify Groundwater Protection Value Stream and document assessment and/or repairs in the logbook.
8. Within 105 days of initial AL2 exceedance, (if repairs were completed in Step 3) or 150 days of AL2 exceedance (if corrective action plan was implemented per Steps 4, 5, and 6) and if 30 consecutive day period without an AL2 exceedance is not achieved, repeat Steps 1 through 7 until AL2 is not exceeded for 30 consecutive days. When the Steps 1 through 7 are repeated, the notification date is reset. Do not re-initiate discharge to the impoundment until the leak(s) have been identified and repaired.
9. Submit the reference liner leakage assessment and repair reports required by the permit in the next annual report required by the permit (Part 2.7.4.1).

8 TSF SLOPE CONDITIONS (PART 2.6.2.6)

South32 will monitor the TSF perimeter road and dry stack TSF for general slope conditions monthly to identify unusual scour or degradation of materials, sloughing, rolling rocks, visible seepage, or visible structural weakness or other hazardous conditions. If the TSF exhibits any signs that require maintenance, South32 will take the following actions:

1. After discovery, prevent vehicle and/or foot traffic in the area.
2. Notify the design engineer.
3. If necessary, perform remedial actions approved by the engineer.
4. Monitor the area for signs of decreasing slope stability.
5. Record in the facility log the slope condition, the location of the area in question, and a description of the maintenance activity.

9 TSF PIEZOMETRIC HEAD (PART 2.6.2.7)

The TSF has piezometers placed within the protective layer on the geomembrane to measure the hydraulic head on the liner system. These piezometers are monitored weekly. If the piezometers read a phreatic surface in excess of 1.5 feet, South32 will take the following actions:

1. Notify the design engineer.
2. Monitor the phreatic surface within the TSF.
3. Initiate an evaluation to determine the cause of the incident. Identify the circumstances that resulted in the elevated phreatic surface. Implement corrective actions, if necessary, to resolve the problems identified in the evaluation.
4. If necessary, perform a slope stability analysis on the dry stack TSF with the elevated phreatic surface to determine if any reduction in the safe operation of the facility has occurred.
5. Record in the facility log the piezometer number, reading, and location. Hydrographs of this and all other piezometers will be recorded on at least a monthly basis to allow quick inspection and evaluation of historic facility operations.
6. See also Section 2.7.3 of the APP permit, which requires reporting all permit violations to the Groundwater Protection Value Stream within five (5) days of discovery.

10 SLOPE AND BERM FAILURE (PART 2.6.3.5)

The TSF meets prescriptive BADCT stability requirements and will be monitored monthly to identify signs of instability before failure can occur (see Part 2.6.2.6). If the dry stack slope for the TSF becomes unstable to the point of failure and results in material overtopping the perimeter road, or if the UDCP becomes unstable to the point of failure and results in a discharge, South32 will take the following actions:

1. Immediately after discovery, prevent vehicle and/or foot traffic in the area.
2. Notify the ADEQ Groundwater Protection Value Stream within 24 hours.

3. Notify the design engineer immediately.
4. Within 15 days of discovery, initiate an evaluation to determine the cause of the incident. Identify the circumstances that resulted in the failure and assess the condition of the facility and liner system. Implement corrective actions as necessary to resolve the problems identified in the evaluation. Initiate repairs to the slope and/or any failed liner. Repair procedures, methods, and materials used to restore the system(s) to proper operating condition shall be described in the facility log/recordkeeping file and available for ADEQ review.
5. Within 30 days of discovery of the incident, submit a report to ADEQ. Include a description of the actions performed in the steps listed above.
6. Within 60 days of discovery, conduct an assessment of the impacts to the subsoil and/or groundwater resulting from the incident. If soil or groundwater is impacted such that it could cause or contribute to an exceedance of an AQL at the applicable POC, submit to ADEQ, for approval, a corrective action plan to address problems identified in the assessment, including identification of releases to the environment, remedial actions and/or monitoring, and a schedule for completion of activities. At the direction of ADEQ, implement the approved plan.
7. Within 30 days of completion of corrective actions, submit a written report to ADEQ.

11 INFLOWS OF UNEXPECTED MATERIALS TO A SURFACE IMPOUNDMENT (PART 2.6.3.3)

The types of materials that are expected to be placed in the permitted surface impoundments are specified in Section 2.3 of the permit (Discharge Limitations). If any unexpected materials flow to a permitted surface impoundment, the following actions will be taken:

1. As soon as practicable, cease all unexpected inflows to the surface impoundment(s).
2. Within 24 hours of discovery, notify the Groundwater Protection Value Stream.
3. Within five (5) days of the incident, identify the source of the material and determine the cause for the inflow. Characterize the unexpected material and contents of the affected impoundment and evaluate the volume and concentration of the material to determine if it is compatible with the surface impoundment liner. Based on the evaluation of the incident, repair any systems or equipment and/or adjust operations as necessary to prevent future occurrences of inflows of unexpected materials.
4. Within 30 days of an inflow of unexpected materials, submit a report to ADEQ as specified in Section 2.7.3(2) of the permit (Permit Violation and Alert Level Status Reporting). Include a description of the actions performed in paragraphs 1 through 3 listed above.

12 EXCEEDING DISCHARGE LIMITATION FOR TAILINGS DEPOSITION HEIGHT (PART 2.6.3.4)

1. If the tailings deposition height exceeds 5,275 ft above mean sea level (the permitted facility height), immediately investigate to determine the cause of the permitted height being exceeded. The investigation will include a review of recent process logs, reports, and other operational control information to identify the cause of the exceedance.
2. Initiate actions to return to compliance as soon as practicable.
    a. Excavate, load, haul, and place tailings deposited above the maximum deposition height to another part of the TSF, if additional storage capacity is available. Report to ADEQ findings of the investigation and actions taken to resolve the issue.
    b. If no additional storage capacity is available in another part of the TSF, use the tailings deposited above the maximum deposition height for cemented tailings paste backfill to be placed in the underground workings. Report to ADEQ findings of the investigation and actions taken to resolve the issue.
    c. If for any reason actions a or b above are not feasible, update the stability model to evaluate the increased stacking height. Within 30 days of the permitted height being exceeded, submit to the ADEQ Groundwater Protection Value Stream, a summary of the findings of the investigation, the cause of the exceedance, a timeline for a significant APP amendment submittal for the higher TSF elevation (if appropriate), and actions taken or proposed to resolve the issue.

13 ALERT LEVELS FOR DISCHARGE MONITORING FROM WTP1 AND WTP2 (PART 2.6.2.5)

1. If an AL established in Section 4.2, Table 9 of the APP for AZPDES Outfall 001 or 002 is exceeded, discharges will be stopped and/or effluent will be diverted and sent through the treatment process again. The operator will immediately investigate to determine the cause of the AL exceedance. The investigation will include the following:
    a. Inspection, testing, and assessment of the current condition of all treatment or pollutant discharge control systems that may have contributed to the AL exceedance.
    b. Review of recent process logs, reports, and other operational control information to identify any unusual occurrences.
    c. Sampling of individual influent streams composing the influent at the plant in question for the parameters being exceeded.

2. Initiate actions identified in the approved contingency plan and specific contingency measures identified herein to resolve any problems identified by the investigation, which may have led to

an AL exceedance. To implement any other corrective action not described herein or in the permit, prior approval from ADEQ must be obtained.

3. Within 30 days of an AL exceedance, submit the laboratory results to the Groundwater Protection Value Stream, along with a summary of the findings of the investigation, the cause of the AL exceedance, and actions taken to resolve the problem.

14 ALERT LEVELS FOR POLLUTANTS WITH NUMERIC AQUIFER WATER QUALITY STANDARDS IN GROUNDWATER MONITORING AT POC-2 (PART 2.6.2.8.2)

1. If an AL for a pollutant set in Section 4.2, Table 10 of the APP permit has been exceeded, request that the laboratory verify the sample results for that pollutant within five (5) days of becoming aware of an AL exceedance. If available, the results of another sample taken between the date of the last sampling event and the date of receiving the result may be used as verification.

2. If verification sampling confirms the AL exceedance or if AMI opts not to perform verification sampling, increase the frequency of monitoring for the pollutant(s) exceeding their respective AL(s) to quarterly from semi-annually. In addition, immediately initiate an investigation of the cause of the AL exceedance, including inspection of all discharging units and all related pollution control devices, review of any operational and maintenance practices that might have resulted in an unexpected discharge, and hydrologic review of groundwater conditions including upgradient water quality.

3. Initiate actions specified in this approved contingency plan and specific contingency measures identified in the APP permit to resolve any problems identified by the investigation that may have led to an AL exceedance. To implement any other corrective action, obtain prior approval from ADEQ according to the APP permit. Alternatively, submit a technical demonstration, subject to written approval by the Groundwater Protection Value Stream, that although an AL is exceeded, pollutants are not reasonably expected to cause a violation of an AQL. The demonstration may propose a revised AL or monitoring frequency for approval in writing by the Groundwater Protection Value Stream.

4. Within 30 days after confirmation of an AL exceedance, submit the laboratory results to the Groundwater Protection Value Stream along with a summary of the findings of the investigation, the cause of the AL exceedance, and actions taken to resolve the problem.

5. The increased monitoring required as a result of ALs being exceeded may be reduced to the regularly scheduled frequency if the results of three (3) consecutive sampling events demonstrate that no parameters exceed the AL.

6. If the increased monitoring required as a result of an AL exceedance continues for more than six (6) sequential sampling events, submit a second report documenting an investigation of

the continued AL exceedance within 30 days of the receipt of laboratory results of the sixth (6th) sampling event.

15 EXCEEDANCE OF AQUIFER QUALITY LIMIT (PART 2.6.4)

1. If an AQL established in Section 4.2, Table 10 of the APP permit has been exceeded, South32 may conduct verification sampling for that parameter within five (5) days of becoming aware of the AQL exceedance. The results of another sample taken between the date of the last sampling event and the date of receiving the result may also be used as verification.
2. No further action is necessary if verification sampling does not confirm an AQL exceedance.
3. If verification sampling confirms that an AQL was exceeded for any parameter or verification sampling is not performed, the frequency of monitoring for those parameters with be increased from semi-annually to quarterly, as shown in Section 2.6.4, Table 3 of the APP.
4. In addition, South32 will immediately initiate an evaluation for the cause of the violation, including inspection of all discharging units and all related pollution control devices, along with a review of any operational and maintenance practices that may have resulted in unexpected discharge.
5. Submit a report according to Section 2.7.3 of the APP permit, which includes a summary of the findings of the investigation, the cause of the violation, and actions taken to resolve the problem. A verified exceedance of an AQL will be considered a violation unless the permittee demonstrates within 90 days that the exceedance was not caused or contributed to by pollutants discharged from the facility. Unless it was demonstrated that the exceedance was not caused or contributed to by pollutants discharged from the facility, ADEQ may require corrective action that may include control of the source of discharge, cleanup of affected soil, surface water, or groundwater, and mitigation of the impact of pollutants on existing uses of the aquifer. Corrective actions will either be specifically identified in the permit, included in an ADEQ approved contingency plan, or separately approved according to Section 2.6.6 of the APP permit.
6. Notify any downstream or downgradient users who may be directly affected by the discharge.
7. The increased monitoring for those pollutant(s) required as a result of an AQL exceedance will be reduced to the original sampling frequency for each respective pollutant if the results of three sequential sampling events demonstrate that the parameter(s) do not exceed their respective AQL(s).

16 EMERGENCY RESPONSE FOR UNAUTHORIZED DISCHARGE (PART 2.6.5)

South32 will take immediate action to correct any condition resulting from an unauthorized discharge pursuant to A.R.S. § 49-201(12) if that condition could pose an imminent and substantial endangerment to public health or the environment.

16.1 DISCHARGE OF HAZARDOUS SUBSTANCES OR TOXIC POLLUTANTS

In the event of an unauthorized discharge of suspected hazardous substances or toxic pollutants on the facility site, South32 will promptly isolate the area and attempt to identify the spilled material. If a subcontractor first recognizes the discharge, the subcontractor must contact a South32 representative immediately to report the discharge. South32 must record the name, nature of exposure, and follow-up medical treatment, if necessary, of persons who may have been exposed during the incident. South32 must notify the Groundwater Protection Value Stream within 24 hours upon discovering the discharge of hazardous material which: a) has the potential to cause an AWQS or AQL exceedance, or b) could pose an endangerment to public health or the environment.

16.2 DISCHARGE OF NON-HAZARDOUS MATERIALS

In the event of any unauthorized discharge of non-hazardous materials from the facility, South32 will promptly attempt to cease the discharge and isolate the discharged material. If a subcontractor first recognizes the discharge, the subcontractor must contact a South32 representative immediately to report the discharge. Discharged material will be removed, and the site will be cleaned up as soon as possible. South32 will notify the Groundwater Protection Value Stream within 24 hours upon discovering the discharge of non-hazardous material that a) has the potential to cause an AQL to be exceeded or b) could endanger public health or the environment.

16.3 REPORTING OF AN UNAUTHORIZED DISCHARGE

For any discharge meeting the reporting triggers of Section 16.2 or 16.3, South32 must submit a written report to the Groundwater Protection Value Stream within 30 days of the discharge or as required by subsequent ADEQ action. The report should summarize the event, including any human exposure and facility response activities, and include all details below:

- Identification and description of the permit condition for which there has been a violation and a description of its cause.
- The period of violation, including exact date(s) and time(s), if known, and the anticipated time period during which the violation is expected to continue.
- Any corrective action taken or planned to mitigate the effects of the violation or to eliminate or prevent the recurrence of the violation.
- Any monitoring activity or other information indicating that any pollutants would be reasonably expected to cause a violation of an AWQS.
- Proposed changes to the monitoring, which include changes in constituents or increased frequency of monitoring.
- Description of any malfunction or failure of pollution control devices or other equipment processes.

If ADEQ issues a notice after the discharge notification, any additional information requested in the notice shall also be submitted within the specified time frame.

17 CORRECTIVE ACTIONS (PART 2.6.6)

Except for emergency response actions, as described in Section 14 of this plan, or actions identified in Section 2.6 of the permit (and herein), South32 must receive written approval from the Groundwater Protection Value Stream before implementing a corrective action to accomplish any of the following goals in response to exceedance of an AL, AQL, DL, or other permit condition:

- Control of the source of an unauthorized discharge.
- Soil clean-up.
- Clean-up of affected surface waters.
- Clean-up of affected parts of the aquifer.
- Mitigation to limit the impact of the pollutants on existing uses of the aquifer.

Within 30 days of completion of any corrective action, South32 will submit to the Groundwater Protection Value Stream a written report describing the causes, impacts, and actions taken to resolve the problem.

18 WTP2 PERFORMANCE OVERSIGHT

The APP requires quarterly discharge (outfall) monitoring of approximately 30 different parameters (except for flow, which is monitored daily). Where numeric AWQS have been established for a monitored parameter, the APP includes an enforceable discharge limit (DL) set equal to that standard, and as an alert level set at 80% of the DL. See PP Part 4.2, Table 9. Exceedance of the DL <u>or</u> the lower alert level triggers contingency action under the permit (Sections 2.6.2.5 and 2.6.4) and this plan (sections 13 and 14, *supra*).

WTP2 will employ proven technologies, and the influent (which will consist primarily of natural groundwater for the life of the plant) is not expected to be of high variability. Nevertheless, various design, operation and monitoring actions will be undertaken to ensure proper performance of the best available demonstrated control technology (BADCT) elements specified in Part 2.2.1.4 of the permit, including:

1. Although not required for this type of plant under A.A.C. R18-5-101 *et seq.*), South32 will have a certified operator (contractor or employee) available to assist in plant operation.

2. To facilitate a smooth startup of operations, WTP2 will be operated upon startup by BQE, the plant designer. BQE is expected to serve as the plant operator for

approximately one year. However, the precise length of time BQE representatives will operate the plant has yet to be determined.

3. Plant operators will be on site 24 hours per day, seven (7) days per week while the plant is operating.

4. The design of WTP2 will include a programmable logic controller (PLC) that will allow the plant to be largely automated. A computer program, referred to as HMI (Human Machine Interface) and running on a stand-alone network, will display information from the PLC, allowing real-time monitoring of plant operations. The information displayed will include instrument readings, motor status, valve status, alarms, and trends. Past information will be available and accessible through the Historian software package that will be installed along with the HMI.

5. The plant design includes an uninterruptible power supply that will ensure power is provided to critical systems in the event that primary power is lost.

6. The plant design includes process instruments to measure level, pressure, and flow at various points in the plant. This will allow operators to monitor in real-time whether treatment components are properly functioning.

   Composite samples of effluent will be monitored daily using instrumentation in the WTP to evaluate discharge water quality.

   In addition, insertion mounts will be used to monitor pH, turbidity, conductivity, and oxidative-reductive potential (ORP). Effluent turbidity, pH, and conductivity will be monitored continuously with inline instrumentation in the WTP2 effluent tank. Measuring these parameters continuously, along with other process instruments, will allow plant operators to continually assess plant performance. In addition, a hand-held pH probe will be maintained on-site, and pH will be measured in plant effluent periodically; the frequency may change as data on plant performance is gathered over time.