

Universal Propulsion Company, Inc.

# ENGINEERING CONTROL PLAN

Former Universal Propulsion Company, Inc.  
Facility Phoenix, Arizona

DECEMBER 2018



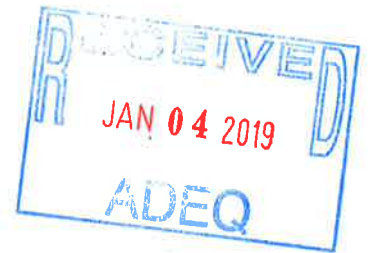
ENGINEERING CONTROL PLAN

**ENGINEERING  
CONTROL PLAN**

Former Universal Propulsion Company, Inc.  
Facility, Phoenix, Arizona

Prepared for:  
Universal Propulsion Company, Inc.

Prepared by:  
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*Michael Nesky*

Michael P. Nesky, P.E.  
Principal Environmental Engineer

Our Ref.:  
03994018

Date:  
December 7, 2018



EXPIRES 03-31-19

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# TRANSMITTAL LETTER

To:

Ms. Caitlin Burwell  
DEUR Coordinator  
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From:

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Arcadis Project File

Date:

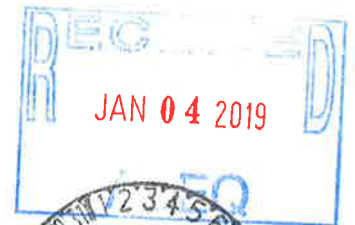
January 4, 2019

Subject:

Engineering Control Plan  
Former Universal Propulsion, Inc. Company, Inc. Facility  
25401 North Central Avenue, Phoenix, AZ  
AZ HWMA Permit  
ID No. AZD 98Q 814 479; Place ID 2279

Arcadis Project No.:

03994018



**We are sending you:**

Attached       Under Separate Cover Via \_\_\_\_\_ the Following Items:

- Shop Drawings       Plans       Specifications       Change Order  
 Prints       Samples       Copy of Letter       Reports  
 Other:

Copies	Date	Check No.	Description	Action*
1	12-7-18		Engineering Control Plan	AS

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**Comments:**

Please contact Michael Nesky at 480-905-9311 with any questions. Thank you.

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Facility, Phoenix, Arizona

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Michael P. Nesky, P.E.  
Principal Environmental Engineer



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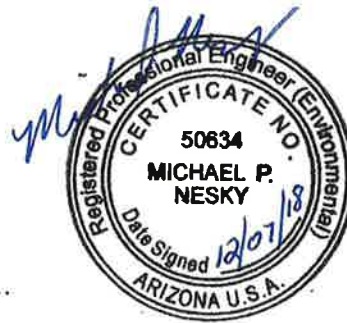
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## ACRONYMS AND ABBREVIATIONS

Arcadis	Arcadis U.S., Inc.
AZ HWMA	Arizona Hazardous Waste Management Act
CMI WP	Corrective Measures Implementation Work Plan
CMS Report	Corrective Measures Study Report
COC	constituent of concern
Facility	25401 North Central Avenue in Phoenix, Arizona
mg/kg	milligrams per kilogram
RI	remedial investigation
RI Report	Final Remedial Investigation Report
SAP	Sampling and Analysis Plan
Site	former UPCO Facility in Phoenix, Arizona
UPCO	Universal Propulsion Company, Inc.
USEPA	United States Environmental Protection Agency
WMP	Waste Management Plan

## 1 INTRODUCTION

This Engineering Control Plan (ECP) describes the controls, inspections, maintenance and contingency plans that will be implemented at the former Universal Propulsion Company, Inc. (UPCO) facility located in Phoenix, Arizona [(Site) (**Figure 1**)] to prevent or minimize potential exposure to constituents of concern (COCs) that remain in soils at the Site above the site clean-up standard. Implementation of this plan is part of ongoing monitoring of the Corrective Measures for Soil Alternative SA-2 pursuant to the Arizona Hazardous Waste Management Act (AZ HWMA) Permit entered into by UPCO and the Arizona Department of Environmental Quality (ADEQ). The Final Remedial Investigation Report (ARCADIS U.S., Inc. [Arcadis] 2011), Quality Assurance Project Plan (QAPP) (Hargis+Associates [H+A] 2004), and Corrective Measures Study Report (Arcadis 2015), Corrective Measures Implementation Work Plan (CMI WP) (Arcadis 2016b) and the Updated Groundwater Monitoring Plan and QAPP Addendum (Arcadis 2016a) support this ECP.

This plan fulfills the requirements for a written ECP in accordance with Arizona Revised Statutes (ARS) §49-152.01 – Engineering Controls. The purpose of the UPCO engineering controls is to protect against erosion and to control potential hazards by eliminating routes of exposure to soil containing COCs and by potentially reducing constituent migration through isolation and elimination of surface water infiltration. This ECP includes the following information:

- Introduction (Section 1)
- Engineering Controls (Section 2)
- Institutional Controls (Section 3)
- Inspection and Maintenance Requirements (Section 4)
- Record Keeping and Reporting (Section 5)
- Contingency Plan (Section 6)
- Cost Analysis (Section 7)
- Financial Responsibility (Section 8)

- References (Section 9)

## 1.1 Site Description and Background

The Site is located at 25401 North Central Avenue in Phoenix, Arizona, near the intersection of Central Avenue and Happy Valley Road (**Figure 1**). The Site is unpaved and surrounded by a security fence, and access is controlled with a locked gate along Happy Valley Road. The Site is approximately 160 acres, and is bounded by Central Avenue to the west, Yearling Road to the north, Happy Valley Road to the south, and Union Hills to the east.

UPCO leased the property from the Arizona State Land Department until they purchased it on November 10, 2015 at a public auction. Prior to being demolished by January 2010, the former UPCO facility consisted of various manufacturing, storage, and administrative buildings/structures, which were separated into operational areas (**Figure 2**). These areas of the Site are: A-Complex, B-Complex, C-Complex, D-Complex, E-Complex (Storage Magazine Area; SMA), F-Complex, Old Burn Area, and the Open Burn Unit (New Burn Area). In accordance with the AZ HWMA Permit for the Site, a Remedial Investigation (RI) Report (Arcadis 2011) was submitted in June 2011 which summarized the soil characterization activities conducted at the Site. The RI soil characterization activities were conducted in phases between 2002 and 2008, with pre-design soil investigations conducted in 2014 and in April 2015. The soil investigation activities included the sampling and analysis of surface and subsurface soil samples at each of the former facility operational areas. The RI Report identified perchlorate and metals (arsenic and lead) in soil as COCs at concentrations higher than cleanup standards (Arcadis 2011).

Hydrogeologic investigation activities were conducted between December 2003 and December 2014 at and near the Site. (CMS; Arcadis 2015). A total of 30 groundwater wells have been installed. The locations of the UPCO monitoring wells are shown on **Figure 3**. **Table 1** includes a summary of well locations and construction details. Remedial investigation activities conducted at the Site indicate that perchlorate has been released to the environment from past operations. Regular groundwater sampling events have been conducted since 2003 to monitor and evaluate

dissolved-phase perchlorate concentrations in groundwater. During the January 2018 sampling event, perchlorate was detected in monitoring wells MW-1, MW-2, MW-13, MW-19, MW-20, EW-1, EW-2, IW-1, IW-3, and RW-1 at or above the groundwater cleanup goal of 14 micrograms per liter ( $\mu\text{g/L}$ ). Concentrations of perchlorate exceeding the groundwater cleanup goal of 14  $\mu\text{g/L}$  were measured most recently within the area estimated to be approximately 300 feet wide and approximately 2,200 feet long, which extends from the vicinity of well IW-1 at the central-eastern property boundary to the vicinity of well MW-1 at the southern property boundary (**Figure 3**).

## 1.2 Regulatory Background

The October 30, 2015 Corrective Measures Study (CMS) Report presented the development, evaluation, and recommendation of the following corrective measures alternatives for the Site:

- Soil Alternative SA-2 – Soil Excavation and Off-Site Disposal, Soil Capping, Deed Restrictions
- Groundwater Alternative GW-2 – Source Area Groundwater Extraction, Ex-Situ Treatment with Anaerobic Bioreactor, Reinjection, and Alluvium In-Situ Biological Reduction

On December 22, 2015, ADEQ approved the CMS Report as a Class 1 Permit Modification with the recommended remedial alternatives SA-2 and GW-2 (ADEQ 2015). The following corrective action objectives (CAOs) for soil and groundwater, as presented in the CMS, were developed to be protective of human health:

### Soil:

- Reduce or eliminate direct contact by a potential receptor (including ingestion, inhalation, or dermal absorption) or threat of direct contact with COCs in surface and subsurface soils.
- Reduce or eliminate the potential for COCs in surface and subsurface soils to migrate to groundwater.

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- To the maximum extent practicable, reduce or eliminate further releases that might pose a threat to human health and the environment.
- In accordance with Part IV, Condition C.10 of the AZ HWMA facility permit, achieve a cleanup level for soils that complies with the Arizona Soil Remediation Standards rule (Arizona Administrative Code Title 18, Chapter 7, Article 2).
- Meet applicable waste management requirements.

### Groundwater:

- Minimize, stabilize, or eliminate further migration of the constituent plume.
- Prevent migration of perchlorate in groundwater at concentrations higher than 14 µg/L to any active private domestic well in the area bounded by Central Avenue, 7th Street, Yearling Road, and Jomax Road.
- Control the source(s) of release(s) to reduce or eliminate, to the maximum extent practicable, further releases that might pose a threat to human health and the environment.
- In accordance with Part IV, Condition C.9 of the AZ HWMA facility permit, achieve a site-wide groundwater cleanup goal for perchlorate of 14 µg/L.
- Achieve the site-wide groundwater cleanup goal within 30 years.
- Meet applicable waste management requirements.

The May 2, 2016 CMI WP describes the plan for implementing remedial alternatives SA-2 and GW-2. ADEQ approved the CMI WP as a Class 1 Permit Modification on June 27, 2016. The following cleanup standards were established for the COCs in soil and groundwater:

### Soil Cleanup Standards

- Perchlorate (soil) = 16 milligrams per kilogram (mg/kg)
- Lead = 400 mg/kg
- Arsenic = 10 mg/kg

### Groundwater Cleanup Standards

- Perchlorate = 14 µg/L
- 1,1-Dichloroethene = 7.0 µg/L
- 1,4-Dioxane = 3.5 µg/L

## 1.3 Closure Activities

Soil Alternative SA-2 was implemented in accordance with the ADEQ-approved CMS, CMI WP, and ADEQ-approved construction design drawings. The Engineering Controls included in Soil Alternative SA-2, consist of four engineered caps and one rip-rap cover, and were installed by February 2018. Implementation, monitoring, maintenance, post-closure care, and financial assurance of the Soil Alternative SA-2 are regulated under the AZHWMA Permit and are described in Section 2.

Implementation, monitoring, maintenance, post-closure care, and financial assurance of Groundwater Alternative GW-2 are also regulated under the AZHWMA Permit. Implementation of Groundwater Alternative GW-2 began with construction of the groundwater treatment facility (GWTF) in August 2018. The GWTF is anticipated to be operational in 2019 and operate for approximately 10 years. Following the completion of Groundwater Alternative GW-2, it is assumed that the site-wide groundwater cleanup goal for perchlorate will have been achieved and there will be no engineering controls necessary to complete Groundwater Alternative GW-2.

## 1.4 Contact Information

The technical contact for this facility is:

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The owner contact for this facility is:

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Remediation Manager  
2730 W. Tyvola Rd.  
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(704) 423-7071

## 2 ENGINEERING CONTROLS

### 2.1 Engineering Control Systems

Four engineered caps and one rip-rap cover were installed in accordance with the ADEQ-approved Soil Alternative SA-2 design drawings (**Appendix A**). The engineered caps are designed and constructed to prevent potential receptor contact with COCs in soils and minimize potential leaching of COCs in soil to groundwater. Specifically, the engineered caps have been designed and installed to protect against soil erosion and settlement, and to provide positive drainage to prevent water from ponding and infiltrating within the engineered cap areas. Per the manufacturer, when properly maintained, the engineered caps (HydroTurf®) are designed to have an operational life of 50-plus years (WatershedGeo®, 2018).

The rip-rap cover was designed and constructed to prevent potential receptor contact with arsenic remaining in soils above the arsenic site cleanup standard of 10 mg/kg and to minimize the potential for soil erosion and migration from beneath the cover. The rip-rap cover was not designed or constructed to protect against infiltration of water through the cover because site specific data indicates that arsenic remaining in soil does not have the potential to leach. The rip-rap cover is located outside ephemeral washes and in an area with low surface water flows, which will minimize degradation of the nonwoven geotextile filter fabric utilized in construction of the cover due to erosion and material decomposition. Therefore, the expected operational life of the filter fabric used in construction of the rip-rap cover is approximately 20 to 30 years (Thrace LinQ, 2018). Because the only other material used in construction of the rip-rap cover is stone, which has nearly infinite operational life, the operational life of the entire rip-rap cover is limited to that of the filter fabric; or approximately 20 to 30 years.

During implementation of Soil Alternative SA-2, the maximum concentration of arsenic detected for in-place soil remaining below the rip-rap cover was 31 mg/kg. **Table 2** presents all the in-place soil arsenic concentrations detected in soil remaining below the rip-rap cover. Arizona's minimum groundwater protection level (GPL) for arsenic is 290 mg/kg. Because the maximum

concentration of arsenic for in-place soil remaining below the rip-rap cover is less than the GPL and depth to groundwater is approximately 250 feet below ground surface (bgs), there is no potential for arsenic remaining in soils to leach to groundwater and cause dissolved-phase arsenic concentrations in groundwater to exceed the cleanup standard. In addition, three composite soil samples were collected from the excavated soils within the Old Burn Area, which included the rip-rap cover area. Each composite soil sample was analyzed for toxicity characteristic leaching procedure (TCLP) RCRA 8 metals in accordance with USEPA Method 6010B/7470A. All three arsenic TCLP concentrations were non-detect at or above the method reporting limit of 0.50 milligrams per liter (mg/L). The arsenic TCLP analytical results also demonstrate that arsenic remaining in soil does not have the potential to leach to groundwater and cause dissolved-phase arsenic concentrations in groundwater to exceed the cleanup standard.

### **2.1.1 Engineered Caps**

The final capping system installed at the UPCO site consists of four engineered caps within the; 1) Waterbore Area, 2) C-Complex Area, and 3) New Burn Area (**Appendix A**). The engineered caps are constructed with a 60mil linear low-density polyethylene (LLDPE) MicroSpike® geomembrane liner overlain by a HydroTurf® CS surface layer to minimize erosion of the soil and to prevent surface water infiltration. The HydroTurf® CS surface layer is made up of woven geotextile and an engineered synthetic turf which is infilled with Hydrobinder®, resulting in a fiber reinforced high-strength concrete matrix. The engineered cap systems are anchored on all sides by a concrete anchor trench. Details for each engineered cap are described below and As-Built drawings are provided in **Appendix A**.

#### **2.1.1.1 Waterbore Area**

The engineered cap within the Waterbore Area caps an area of approximately 16,765 square feet (sq. ft.), which includes the HydroTurf® and concrete anchor trench (**Appendix A**). Within the footprint of the cap, two groundwater monitoring wells (MW-13 and MW-19), and three moisture monitoring wells (MMW-1, MMW-2, and MMW-3) penetrate the HydroTurf®. The cap is



sealed around each well penetration with an LLDPE liner boot. Boot details are shown on the as-builts provided in **Appendix A**. The concrete anchor trench encompasses the entire HydroTurf® to anchor the liner and HydroTurf® into the native ground. The anchor trench is approximately 2'-6" wide and approximately 2' feet deep except where it crosses the ephemeral wash. Due to potential scouring within the wash from rain events, and to protect against surface water infiltrating laterally beneath the cap, the anchor trench upgradient of the cap is a minimum of 4' deep, 8' wide at the surface, and 4' wide at the bottom. The anchor trench downgradient of the cap is a minimum of 4' deep and 2'-6" wide and tied into the downgradient rip-rap apron. Photos of the constructed engineered cap are provided in **Appendix B**.

#### 2.1.1.2 C-Complex Area

The engineered cap within the C-Complex Area caps an area of approximately 6,839 sq. ft., which includes the HydroTurf® and concrete anchor trench (**Appendix A**). The concrete anchor trench encompasses the entire HydroTurf® to anchor the liner and HydroTurf® into the native ground. The anchor trench is approximately 2'-6" wide and approximately 2' feet deep. Photos of the constructed engineered cap are provided in **Appendix B**.

#### 2.1.1.3 New Burn Area

There are two engineered caps located within the New Burn Area covers (**Appendix A**). The larger cap protects an area of approximately 9,664 sq. ft. and the smaller cap protects an area of approximately 2,486 sq. ft. Total area covered includes the HydroTurf® and concrete anchor trench. The concrete anchor trench encompasses the entire HydroTurf® to anchor the liner and HydroTurf® into the native ground. The anchor trench is approximately 2'-6" wide and approximately 2' feet deep.

Within the footprint of the smaller cap, one groundwater monitoring well (MW-21) penetrates the HydroTurf®. The cap is sealed around the well penetration with an LLDPE liner boot. Boot details are shown on the as-builts provided in **Appendix A**. Photos of the constructed engineered cap are provided in **Appendix B**.

### 2.1.2 Rip-Rap Cover

The final cover system installed within the Old Burn Area consists of a rip-rap cover (**Appendix A**) that protects an area of approximately 765 sq. ft. The rip-rap cover is constructed of a 1-foot thick layer of rip-rap stone underlain by a nonwoven geotextile fabric. Prior to installation of the rip-rap cover, the area was excavated, backfilled, and compacted to within 1-foot of the ground surface. A nonwoven geotextile fabric (THRACE LINQ 130EX), 4-feet wide, was installed on top of the soil. Each joint of the geotextile was overlapped a minimum of 12-inches and brought up around the edges of the excavation. D<sub>50</sub> 8-inch size stone, with a size no smaller than 4-inches, was placed on the geotextile within the cap area in a uniform rip-rap layer. The top of the rip-rap cover is at the same grade as the ground surface of the surrounding area. The rip-rap cover was installed in accordance with ADEQ guidance and was subsequently approved by ADEQ via site inspection of the cover construction. As-builts for the rip-rap cover are provided in **Appendix A** and photos of the constructed rip-rap cover are provided in **Appendix B**.

## 2.2 Run-On and Run-Off Controls

Run-on and run-off controls for the engineered caps and rip-rap cover are designed and constructed to provide erosion protection and eliminate pooling and lateral infiltration of water at and near the ground surface. The run-on and run-off controls are described below.

### 2.2.1 Engineered Caps

A concrete anchor trench encompasses each of the four engineered caps (**Appendix A**). The anchor trench provides run-on and run-off control. The anchor trench is a continuous poured concrete apron that is a minimum of 2-feet 6-inch wide and 2-feet deep outside of the wash and a minimum of 2-feet 6-inch wide and 4-feet deep across the wash, as described in Section 2.1. A rip-rap apron, approximately 30-feet wide and 33-feet long, is constructed at the downgradient transition from the anchor trench to soil within the ephemeral wash in the Waterbore Area (**Appendix A**). A nonwoven geotextile fabric (THRACE LINQ 130EX) was installed below the area of rip-rap and anchored on the upstream and downstream ends by a concrete anchor trench. Stone used for the rip-rap were of a minimum D<sub>50</sub> of 12-inches with a size no smaller

than 8-inches placed in uniform layer with a minimum thickness of 24 inches. The surface of the rip-rap apron is at a similar elevation of the surrounding native surface. Procedures for maintaining the run-on and run-off controls for the engineered caps are described in Section 5.1 and construction details for the concrete anchor trench and rip-rap apron are provided in **Appendix A**.

### 2.2.2 Rip-Rap Cover

Rip-rap underlain by a non-woven geotextile fabric, as described in Section 2.1.2, provides the run-on and run-off control for the rip-rap cover located in the Old Burn Area (**Appendix A**). The rip-rap cover protects against erosion of soils containing arsenic concentrations that exceed the site clean-up standard. Procedures for maintaining the cover are described in Section 5.2 and construction details for the rip-rap cover is provided in **Appendix A**.

## 3 INSTITUTIONAL CONTROLS

Institutional Controls shall remain in place to protect the public health and the environment because of ongoing groundwater remediation on a portion of the Property. The Institutional Control consists of the following:

- i. Owner shall be restricted from the drilling and/or installation and/or use of wells within the Institutional Control portions of the Parent Parcel Property (**Figure 4**). Installation and/or use of wells on the Institutional Control portions of the Property will interfere with the ongoing groundwater monitoring and/or remediation taking place on the Engineering Control portions of the Property.
- ii. If a well is required as a result of Owner's remediation plan, Owner shall seek approval in writing from ADEQ and any other necessary state agency before installing the well.
- iii. Restricts the current Owner and subsequent owners from access to subsurface water under all portions of the Institutional Control Property for the duration of the Declaration.

- iv. All Owners shall be restricted from residential use of the portion of the Property as depicted in **Figure 4**.

## 4 INSPECTION AND MAINTENANCE REQUIREMENTS

This section describes the inspection and maintenance process for the ECs and ICs in place at the Site. Inspections will be performed to identify areas requiring action, as applicable, documenting changes in site conditions, and recording information relating to the effectiveness of the ECs. Inspection and maintenance will be performed by qualified personnel knowledgeable of the ECs and ICs in place at the Site. All inspections will be overseen by a Registered Professional Engineer in the State of Arizona. Liner repairs (i.e. woven geotextile or 60 mil LLDPE microspike® liner) will be performed by a Watershed Geosynthetics (WG) trained individual or other qualified person that meets the training requirements of WG. The results of the inspections, the associated checklists/forms, and maintenance performed will be included in a semi-annual inspection report. Reporting details are provided in Section 6.

### 4.1 Engineered CAPs

Prudent care shall be taken when conducting work on covered areas to prevent damage to the engineered caps. Inspections, maintenance, and repair of the engineered caps, HydroTurf® CS systems, will be conducted in accordance with Watershed Geosynthetics, LLC (WG) HydroTurf® CS and Z Monitoring & Maintenance Guidelines (**Appendix C**). Site-specific inspection procedures are listed below, and a comprehensive inspection checklist is provided in **Appendix D**.

#### Waterbore Area Cap:

- Inspect for scouring within the wash upgradient of the cap. If scouring is identified and is greater than one-foot in depth, corrective maintenance shall be conducted.

## ENGINEERING CONTROL PLAN

- Walk the perimeter of the anchor trench and inspect for substantial erosion or subsidence and note signs of areas where pooling of water may occur.
- Inspect the boot around each the five wells that penetrate the cap HydroTurf®. Check to ensure that the two stainless steel bands are tight and in good condition on each of the five boots. Check the condition of the sealant at the top of the boot and confirm that the entire circumference between the boot and well casing is sealed and that there is no excessive cracking or deterioration that could lead to a leak. Check condition of LLDPE boot around each well monument and verify no signs of cracks or punctures through the boot.
- Inspect the rip-rap apron and confirm that no rock has been displaced downstream. Note signs of slumping within the rip-rap apron. Note significant gaps within the rip-rap apron where the underlying geotextile is exposed and note if the rip-rap material is physically deteriorated or otherwise compromised.

### C-Complex Area Cap:

- Walk the perimeter of the anchor trench and inspect for substantial erosion or subsidence and note areas where pooling of water may occur.

### New Burn Area Cap:

- Walk the perimeter of the anchor trenches and inspect for substantial erosion or subsidence and note areas where pooling of water may occur.
- Inspect the boot around the well that penetrates the small cap HydroTurf®. Check to ensure that the two stainless steel bands are tight and in good condition. Check the condition of the sealant at the top of the boot and confirm that the entire circumference between the boot and well casing is sealed and that there is no excessive cracking or deterioration that could lead to a leak.

### **4.1.1 Inspection Frequency**

The engineered caps will be inspected semi-annually for the first 5 years during the months of April and October. After 5 years, inspection frequency will be re-evaluated. In addition, the engineered caps will be inspected following a storm event as follows:

- Storm events will be established by monitoring the Flood Control District of Maricopa County on-line rain gauge (14200) data monthly.
- This rain gauge is located at the Deer Valley Airport monthly within two miles of the site. It is assumed that surface water will flow in the wash when 1-inch or greater of rain-fall occurs within a 24-hour period.
- Therefore, if any 1-day rain event equals or exceeds 1-inch of total rain, a visual surface inspection of the run-on and run-off controls, and cap integrity will be conducted within 7 calendar days.

### **4.1.2 Maintenance Requirements**

Maintenance will be performed on items identified as unacceptable on the inspection check list. Maintenance will be performed within approximately 30 days following the discovery of an unacceptable item and a summary of maintenance performed during the period covered will be provided in the semi-annual inspection report as described in Section 6. Typical maintenance activities and procedures are listed below:

- Scouring in the wash; backfill and compact area with native soil. If scouring continues in same area, fill with a cement grout.
- Cap Perimeter Erosion; backfill and compact area(s) with native soil. If erosion continues in same area, try to slope area to divert surface water away or place a cement grout within that area.
- Boot Seal-Stainless steel Bands; tighten bands if necessary. Replace bands if they no longer work as designed.
- Boot Seal-Sealant; Remove and replace sealant.

- HydroTurf®; all HydroTurf® cap maintenance items shall be done in accordance with WG HydroTurf® CS and Z Monitoring & Maintenance Guidelines (**Appendix C**).
- Rip-Rap; place addition rock in areas where gaps have increased or displaced rock that potentially expose filter fabric below. Remove build-up of debris (litter, wood, etc.) that would impede water flow through the rip-rap area.

### 4.2 Rip-Rap Cover

The rip-rap cover system installed at the Old Burn area (**Appendix A**) is designed and constructed to protect against erosion and possible migration of soils containing arsenic concentrations that exceed the site clean-up standard and to prevent exposure through dermal contact with the soil beneath the cover. Site-specific inspection procedures are listed below, and an inspection checklist is provided in **Appendix D**

- Inspect for trash and debris.
- Inspect for erosion around the edges of area. If erosion exceeds 6-inches in depth, maintenance shall be performed.
- Inspect for animal burrow, holes, and mounds.
- Inspect for long-term effectiveness of rip-rap cover and recurring issues, such as continuous burrows or erosion within same area.

#### 4.2.1 Maintenance Requirements

Maintenance will be performed on items identified as unacceptable on the inspection form. Maintenance will be performed within approximately 30 days following the discovery of an unacceptable item and a summary of maintenance performed during the period covered will be provided in the semi-annual report as described in Section 6. Typical maintenance activities and procedures are listed below:

- Remove trash and unwanted debris from area.

- Stabilize eroded or undercut areas with native soil and compacted. If area continues to erode, fill area with a cement grout or extend the rip-rap cover beyond the design as shown on the plans in **Appendix A**.
- Prepare a plan that more effectively reduces long term maintenance costs and improves overall effectiveness of the cover.

## 5 RECORD KEEPING AND REPORTING

This section describes record keeping and reporting requirements. All inspection components include maintenance and repair requirements.

### 5.1 Record Keeping

Record keeping will be maintained in accordance with this ECP and the AZ HWMA Permit. The following records shall be maintained:

- Current and complete copy of the ECP, including all appendices.
- Current written versions of operating procedures and related guidance as referenced in this ECP.
- All completed inspection forms
- All completed maintenance and repairs
- All records or actions taken to prevent or mitigate releases of constituents to the environment

### 5.2 Inspection Report

Reporting will be performed semi-annually in accordance with A.R.S. §49-152.01. Inspection reports will be prepared and submitted within approximately 30 days following the inspection to:



## ENGINEERING CONTROL PLAN

Arizona Department of Environmental Quality  
Attn: DEUR Coordinator  
1110 W. Washington St., 6<sup>th</sup> Floor  
Phoenix, AZ 85007

The inspection report will contain the following:

- Description of the condition of the ECs
- Nature and cost of all restoration made to the ECs during the calendar year
- Current photographs of the ECs
- Statement describing the status of the financial assurance mechanism
- All completed inspection forms

## 6 CONTINGENCY PLAN

This section describes the restoration of the ECs in the event of an intentional or unintentional breach.

### 6.1 Intentional Breach

In the event that the EC fails and must be restored or does not achieve the intended level of protection or mitigation due to an intentional breach, the SA-2 remedial alternative as described in the CMS will be reevaluated and modified, or implementation of different remedial alternative will be proposed. Proposed changes to the remedial alternative will be coordinated with ADEQ.

### 6.2 Unintentional Breach

In the event of an unintentional breach caused by vandalism, severe weather, or acts of god, the ECs must be restored to its original design. For purposes of estimating costs to restore the ECs in the event of an unintentional breach, it is assumed that approximately 50 sq ft of the engineered cap would be repaired every 10 years. If any of the engineered caps are fully

breached and lead to complete failure of the cap, costs to replace each entire cap once is provided. Summary of repairs to the ECs will be included in the annual report.

## 7 COST ANALYSIS

In accordance with ARS 49-152.01, a cost analysis summary associated with inspection, maintenance, repairing, or restoring of the ECs is provided below. Detailed cost analysis, with a 20% contingency for each item listed below, is provided in **Appendix E**.

- Cost to construct ECs; Per the manufacturer, the designed operational life of the engineered caps is 50-plus years. Cost analysis is for a 30-year period, and therefore, one full reconstruction of the engineered caps is included; \$453,390. Because the operational life of the rip-rap cover is approximately 20 to 30-years, as described in Section 2.1, one full reconstruction cost of the rip rap cover is included; \$2,747.50.
- Semi-Annual Inspection and maintenance costs of ECs; It is assumed that inspection and maintenance will be performed twice per year with an annual cost of \$3,484 for a duration of 30-years; \$104,520.
- Restoring an EC if it fails; Per the manufacturer, the designed operational life of the engineered caps is 50-plus years. Therefore; the only thing that is anticipated to fail are the boot seals. Assumes each boot seal (6 total) to be restored once every ten years. Boot seal restoration includes replacing stainless steel bands, neoprene gasket, and sealant; \$13,500.
- Unintentional breach of an EC; It is assumed that an unintentional breach, of approximately 50 sq ft, may occur once every ten years. Costs associated with repairing an unintentional breach over 30 years is \$1,800.
- Intentional breach of an EC; No intentional breach to an EC will be performed without ADEQ's approval, and none are anticipated; therefore, no costs are provided.
- Semi-Annual Reporting; One report will be prepared and submitted semi-annually for 30 years; \$294,960.

## 8 FINANCIAL RESPONSIBILITY

The current owner shall continue to be responsible for the financial assurance for the duration of DEURs, which includes this ECP. The financial assurance is the mechanism used to cover the costs associated with inspections, maintenance, reporting, or restoration of the ECs. In accordance with A.R.S. 49-152.01, a statement of financial capability of the owner and a dedicated financial mechanism will be prepared and submitted under separate cover for the costs detailed in Section 7.

## 9 REFERENCES

- Arcadis. 2018. Semi-Annual Monitoring Report for August 2017 - January 2018, Former Universal Propulsion Company, Inc. March 30, 2018
- Arcadis. 2017. Site Specific Health and Safety Plan, Former Universal Propulsion Company, Inc., Phoenix, Arizona. September 26, 2017.
- Arcadis. 2016a. Soil Sampling and Analysis Plan; Former Universal Propulsion Company, Inc., Phoenix, Arizona. June 2016.
- Arcadis. 2016b. Updated Groundwater Monitoring Plan; Former Universal Propulsion Company, Inc., Phoenix, Arizona. January 2016.
- Arcadis. 2015a. Corrective Measures Study Report; Former Universal Propulsion Company, Inc., Phoenix, Arizona. October 2015.
- Arcadis. 2015b. Engineered Cap Design Basis Report; Former Universal Propulsion Company, Inc., Phoenix, Arizona. October 30, 2015.
- Arcadis. 2011. Final Remedial Investigation Report, Universal Propulsion Company, Inc. June 2011.
- Hargis + Associates, 2004. Quality Assurance Project Plan, Goodrich Universal Propulsion Company, Inc. July 16, 2004.
- THRACE LINQ, 2018. Geotextile. Retrieved from <https://www.thracelinq.com/specifications.php>
- WatershedGeo®, 2018. HydroTurf®. Retrieved from <http://watershedgeo.com/hydroturf/>

# TABLES

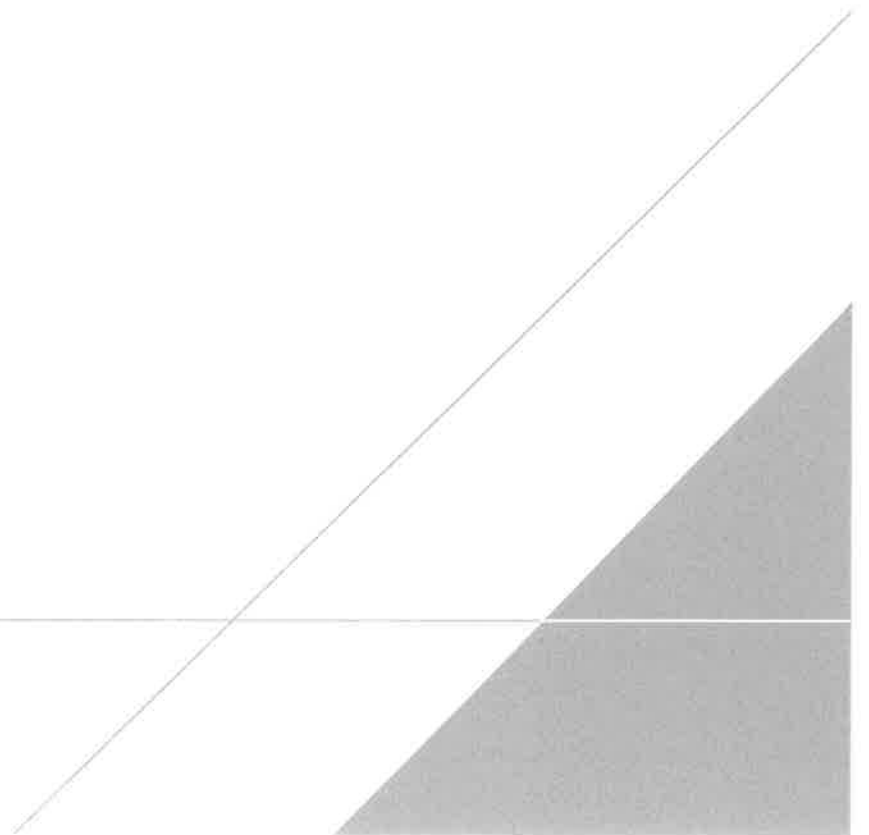


Table 1  
Groundwater Well Summary  
Former Universal Propulsion Company, Inc. Facility  
Phoenix, Arizona



Well ID	Easting	Northing	ADWR Number	Total Casing Depth (feet bgs)	Screened Interval (feet bgs)	Measuring Point Elevation (feet amsl)
MW-1	653227.14	987065.13	55-201495	240	190-240	1560.43
MW-2	653289.68	987649.25	55-201494	250	200-250	1571.22
MW-3	652625.62	988671.09	55-204197	271	221-271	1583.59
MW-4	654284.93	988971.85	55-204196	300	245-295	1620.34
MW-5	653971.17	988127.33	55-204195	285	230-280	TBD <sup>1</sup>
MW-6	652259.53	987361.63	55-204194	210	155-205	1551.65
MW-7	652125.72	986534.14	55-205001	210	155-205	1541.35
MW-8	653422.61	986160.23	55-205002	235	180-230	1542.18
MW-9	654356.82	986138.65	55-901548	255	200-250	1565.60
MW-10	651342.65	987055.87	55-901549	205	150-200	1536.11
MW-11	654182.70	987795.50	55-903736	315	260-310	TBD <sup>1</sup>
MW-12	653210.97	987117.21	55-903737	480	450-480	1560.91
MW-13	654137.59	988274.92	55-217221	490.5	440-490	1597.86
MW-14	653239.01	989362.53	55-217222	500	445-495	1602.48
MW-15	653225.43	989314.03	55-217223	325	270-320	1600.48
MW-16	652624.02	988727.69	55-913047	500	445-495	1585.36
MW-17	652108.14	987746.04	55-913046	260	205-255	1560.72
MW-18	652551.52	986026.10	55-911047	230	175-225	1533.53
MW-19	654123.16	988257.79	55-913045	305	250-300	1597.17
MW-20	653603.36	987861.04	55-914005	290	235-285	TBD <sup>1</sup>
MW-21	653452.17	987298.28	55-914006	270	215-265	1565.28
MW-22	653986.82	988397.29	55-222509	280	210-280	1598.46
PW-1	652363.12	987457.36	55-500290	500	420-480	1554.46
EW-1	654072.86	988197.93	55-222510	300	250-300	TBD <sup>1</sup>
EW-2	653202.70	987087.51	55-222511	305	210-305	TBD <sup>1</sup>
IW-1	654207.54	988310.57	55-222512	335	250-335	TBD <sup>1</sup>
IW-2	653918.36	988425.16	55-222513	285	210-285	1593.68
IW-3	653358.52	987678.13	55-222514	255	180-255	TBD <sup>1</sup>
RW-1	654327.57	988477.20	55-223676	340	265-340	TBD <sup>1</sup>
RW-2	654020.89	988671.20	55-223677	332	252-332	TBD <sup>1</sup>
RW-3	TBD <sup>1</sup>	TBD <sup>1</sup>	55-228101	400	330-400	TBD <sup>1</sup>

**Notes and Abbreviations:**

1 = Wells are part of the groundwater treatment facility and will be resurveyed after construction is complete.  
Coordinates are expressed in North American Datum 83 State Plane Arizona Central (international feet).  
ADWR = Arizona Department of Water Resources  
amsl = above mean sea level

**Table 2**  
**In-Place Soil Arsenic Concentrations**  
**Former Universal Propulsion Company, Inc. Facility**  
**Phoenix, Arizona**

OLD BURN AREA							
Location	Sample ID	Sample Date	Matrix	Type	Arsenic Concentration	DU Size (sq ft)	Depth (ft bgs)
					(mg/kg)		
					10*		
OB-EX-03-1	OX1-DU1-2	10/18/2017	SO	Step-out	<b>19</b>	75	0-4
	OX1-DU2	10/5/2017	SO	SW	5.7	44	0-3.5
	OX1-DU4	10/5/2017	SO	SW	<b>6.4</b>	54	0-3.5
	OX1-DU5-2	10/18/2017	SO	Step-out	<b>27</b>	82.5	4.5
	OX1-DU6-1	10/11/2017	SO	Step-out	<b>8.9</b>	82.5	4
OB-EX-02-1	OX2-DU1	10/5/2017	SO	SW	<b>7.1</b>	11	0-2
	OX2-DU2	10/5/2017	SO	SW	<b>7.7</b>	35	0-2
	OX2-DU3	10/5/2017	SO	SW	<b>9.1</b>	35	0-2
	OX2-DU4-2	10/18/2017	SO	Step-out	<b>21</b>	67.5	0-2
	OX2-DU5-2	10/18/2017	SO	B	<b>27</b>	74.25	4.5
	OX2-DU6-2	10/18/2017	SO	Step-out	<b>31</b>	60.75	4.5
	OX2-DU7-2	10/18/2017	SO	Step-out	<b>24</b>	74.25	4.5

Notes:

\* Established site clean-up standard

B = bottom decision unit

DU = decision unit

ft bgs = feet below ground surface

mg/kg = milligram per kilogram

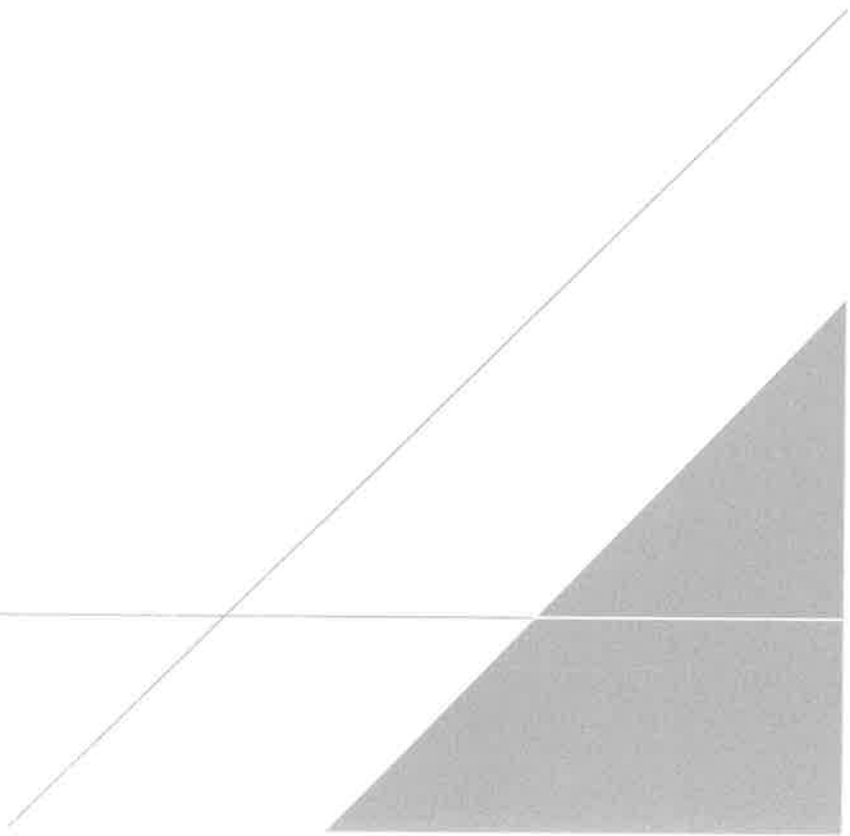
sq ft = square feet

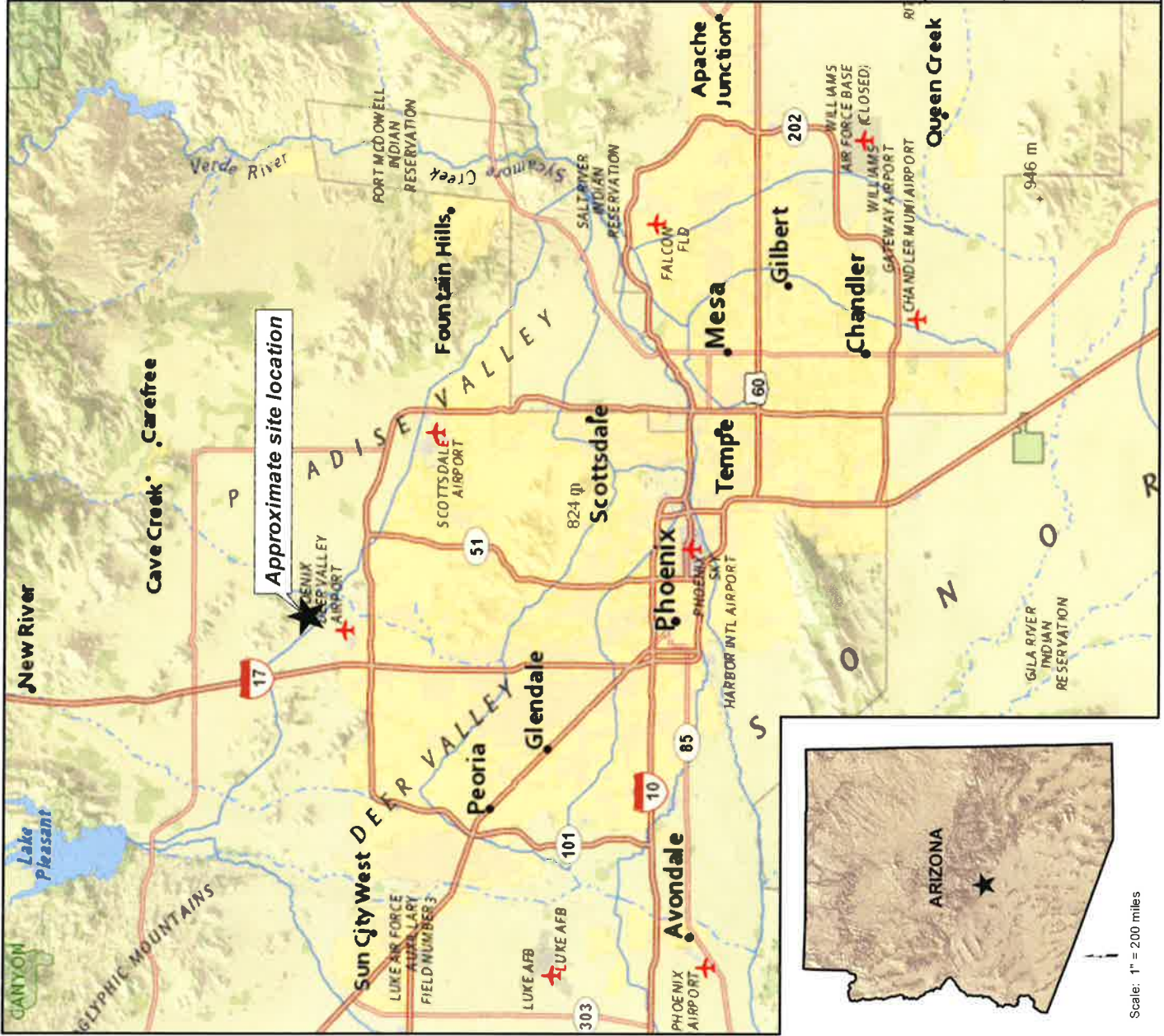
SW = sidewall decision unit

SO = soil

**19** = concentraion exceeded the established site clean-up standard.

# FIGURES



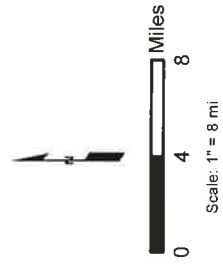


**LEGEND**

★ Approximate site location

**NOTES**

Basemap source: ESRI National Geographic World Map.



FORMER UNIVERSAL PROPULSION COMPANY, INC. FACILITY  
PHOENIX, ARIZONA  
ENGINEERING CONTROL PLAN

**SITE LOCATION MAP**

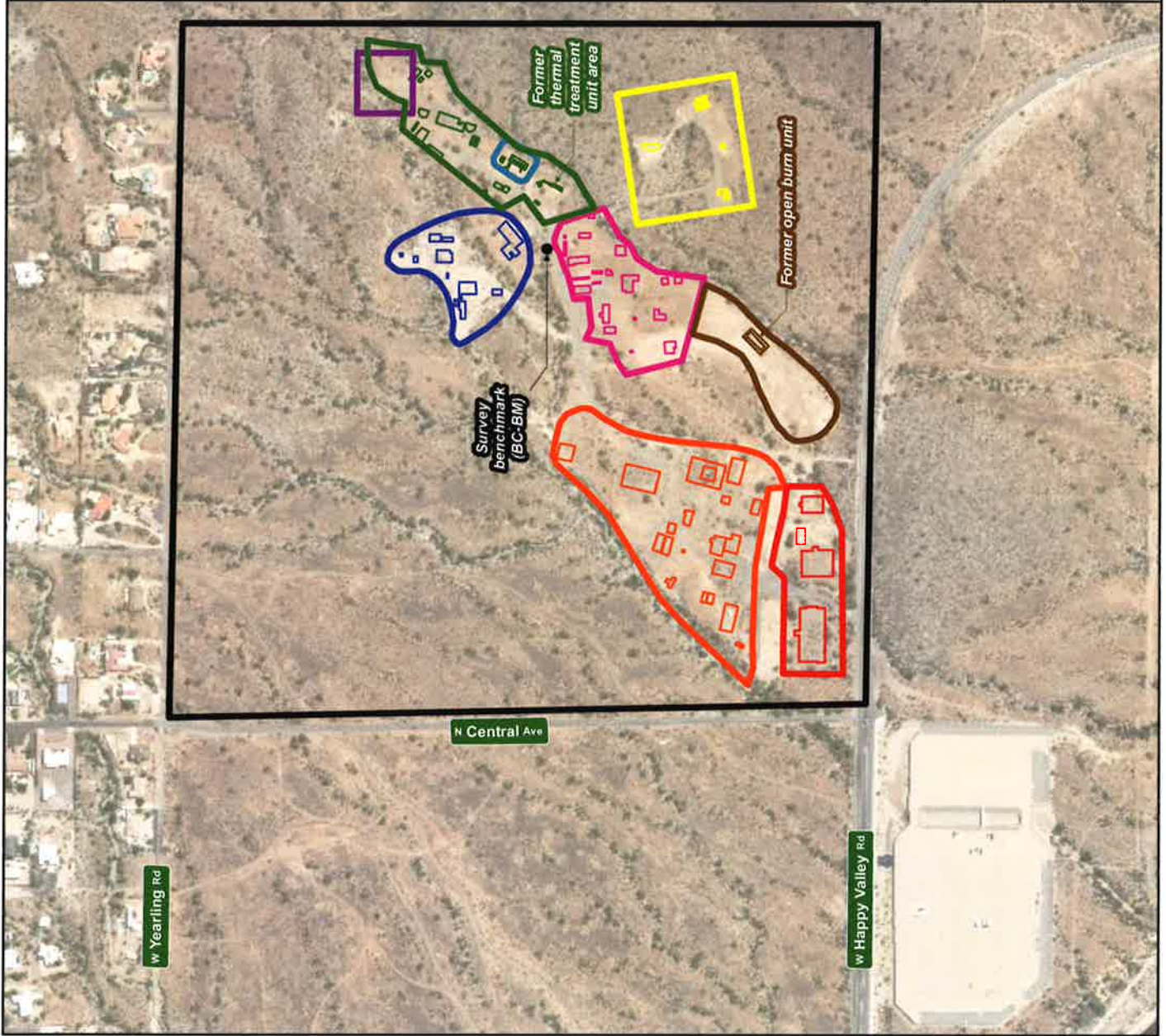


FIGURE

1

Scale: 1" = 200 miles



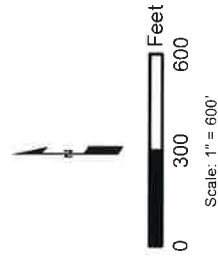


### LEGEND

- Property boundary
- A-Complex
- B-Complex
- C-Complex
- D-Complex
- E-Complex/Storage Magazine Area
- F-Complex
- New Burn Area
- Old Burn Area
- Waterbore Area

### NOTES

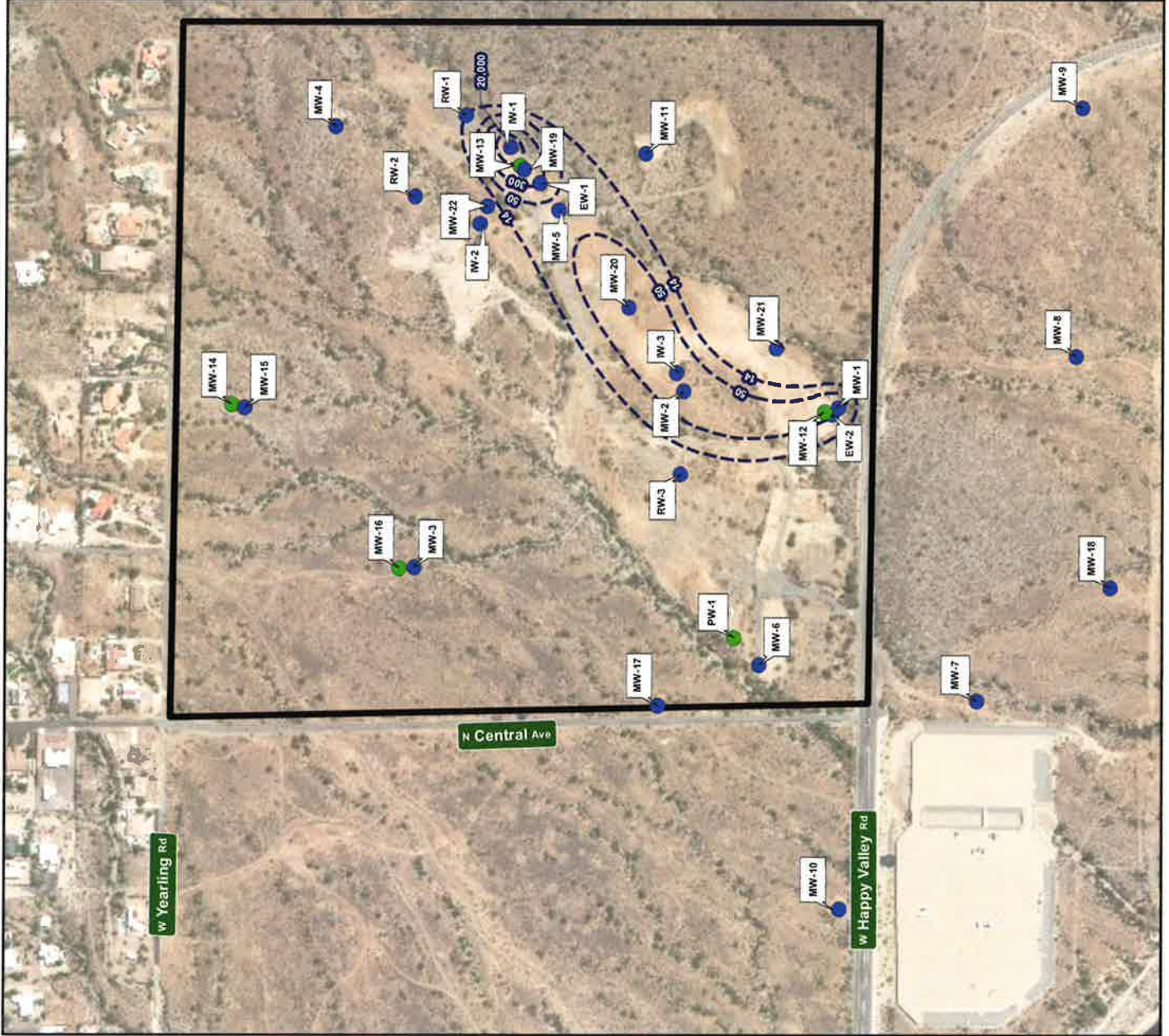
· Aerial photo source: ESRI World Imagery.







FORMER UNIVERSAL PROPULSION COMPANY, INC. FACILITY  
PHOENIX, ARIZONA  
ENGINEERING CONTROL PLAN

### FACILITY OPERATIONAL AREAS



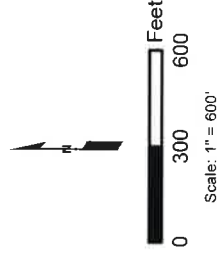


**LEGEND**

-  Property boundary
-  Groundwater well (shallow)
-  Groundwater well (deep)
-  Perchlorate concentration contour (dashed where inferred)

**NOTES**

- Aerial photo source: ESRI World Imagery.
- Perchlorate Isoconcentration contours are expressed in micrograms per liter (µg/L).
- Arizona Health Based Guidance Level (HBGL) for perchlorate = 14 µg/L.



FORMER UNIVERSAL PROPULSION COMPANY, INC. FACILITY  
PHOENIX, ARIZONA  
ENGINEERING CONTROL PLAN

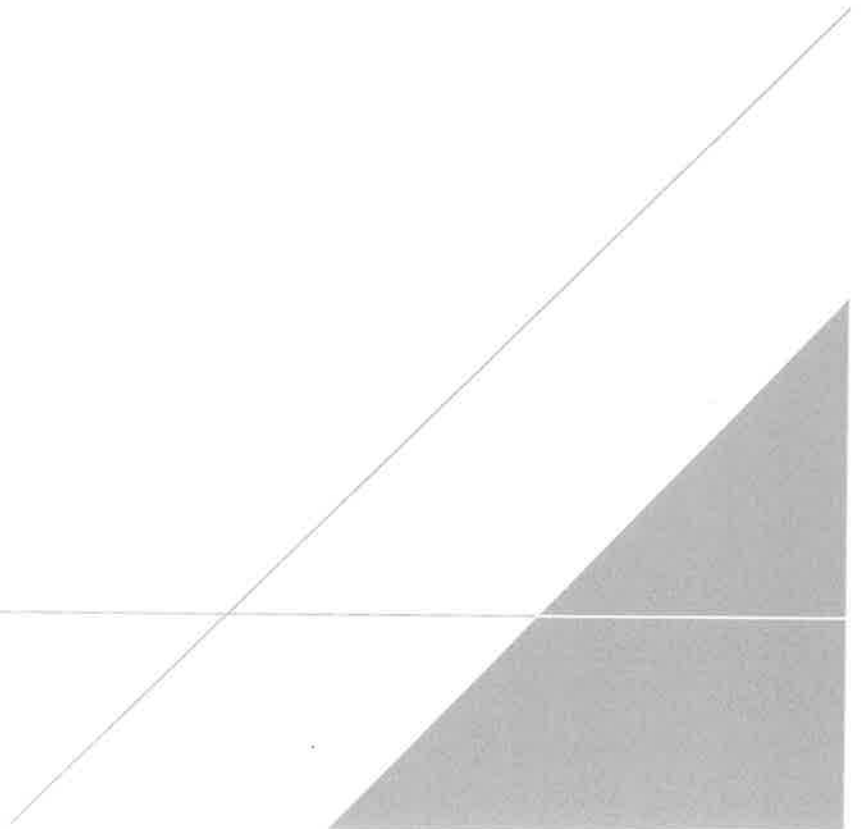
GROUNDWATER WELL LOCATIONS AND 2018  
PERCHLORATE ISOCONCENTRATION CONTOURS





# APPENDIX A

As-Built



# CONSTRUCTION DRAWINGS FOR SOIL EXCAVATION AND CAPPING FORMER UPKO FACILITY FOR UTC AEROSPACE SYSTEMS

PHOENIX, ARIZONA  
JANUARY 2018

CONSULTANTS



SEALS



CITY OF PHOENIX  
**UTC AEROSPACE SYSTEMS**  
25401 N. CENTRAL AVENUE  
PHOENIX, ARIZONA

**FORMER UPKO FACILITY  
SOIL REMEDIATION**

**3994003**

1	10/2018	RECORD DRAWING	JLP
---	---------	----------------	-----

NO.	DATE	ISSUED FOR	BY

COPYRIGHT: ARCADIS U.S., INC.  
2017

DATE: JANUARY 2018

PROJECT NO.: 3994003

FILE NAME: C-00

DESIGNED BY: JLP

DRAWN BY: JP

CHECKED BY: MN

SHEET TITLE

**COVER PAGE**

SCALE: NONE

**C-00**

SHEET 1 OF 13



PROJECT LOCATION

## INDEX TO DRAWINGS

- C-00 COVER PAGE
- C-01 OVERALL SITE PLAN
- C-02 C-COMPLEX EXCAVATION AND RESTORATION PLAN AND ENGINEERED CAP DESIGN
- C-03 C-COMPLEX PLAN AND CROSS SECTIONS
- C-04 E-COMPLEX EXCAVATION AND RESTORATION PLAN
- C-05 OLD BURN AREA EXCAVATION AND RESTORATION PLAN
- C-06 OLD BURN CAP DESIGN CROSS SECTIONS
- C-07 NEW BURN AREA EXCAVATION AND RESTORATION PLAN
- C-08 NEW BURN AREA CAP DESIGN CROSS SECTIONS
- C-09 WATERBORE EXCAVATION AND RESTORATION PLAN
- C-10 WATERBORE AREA CAP DESIGN CROSS SECTIONS
- C-11 DETAILS
- C-12 DETAILS

## CONTACTS

CLIENT CONTACT: BRUCE C. AMIG  
MANAGER, REMEDIAL PROGRAMS  
UTC AEROSPACE SYSTEMS  
2730 W. TYVOLA ROAD  
CHARLOTTE, NC 28217

PROPERTY OWNER AND MANAGER: UNIVERSAL PROPULSION COMPANY, INC. IN MARICOPA COUNTY

PREPARER: ARCADIS INC. (ARCADIS)  
JENA PRIOR PROJECT ENGINEER  
410 N. 44TH STREET  
SUITE 1000  
PHOENIX, ARIZONA 85008  
PHONE, 602.438.0883  
FAX, 602.438.0102

## PROPERTY DATA

PROPERTY ADDRESS: 25401 N. CENTRAL AVENUE  
PHOENIX, ARIZONA

PARENT PARCEL: APN 210-14-050

LAND USE: VACANT COMMERCIAL LAND

LEGAL DESCRIPTION: THE SOUTHEAST QUARTER OF SECTION 5, TOWNSHIP 4 NORTH, RANGE 3 EAST, OF THE GILA AND SALT RIVER MERIDIAN, MARICOPA COUNTY, ARIZONA, CONTAINING 156.87 ACRES, MORE OR LESS

PROPERTY DIMENSIONS: 2616.27' X 2638.92' APPROXIMATE

ACREAGE: 156.87



PROJECT LOCATION

NOT TO SCALE





CONSULTANTS



SEALS



CITY OF PHOENIX  
UTC AEROSPACE SYSTEMS  
25401 N. CENTRAL AVENUE  
PHOENIX, ARIZONA

FORMER UPCO FACILITY  
SOIL REMEDIATION

3994003

1	10/2018	RECORD DRAWING	JLP
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DATE: JANUARY 2018

PROJECT NO.: 3994003

FILE NAME: C-03

DESIGNED BY: JLP

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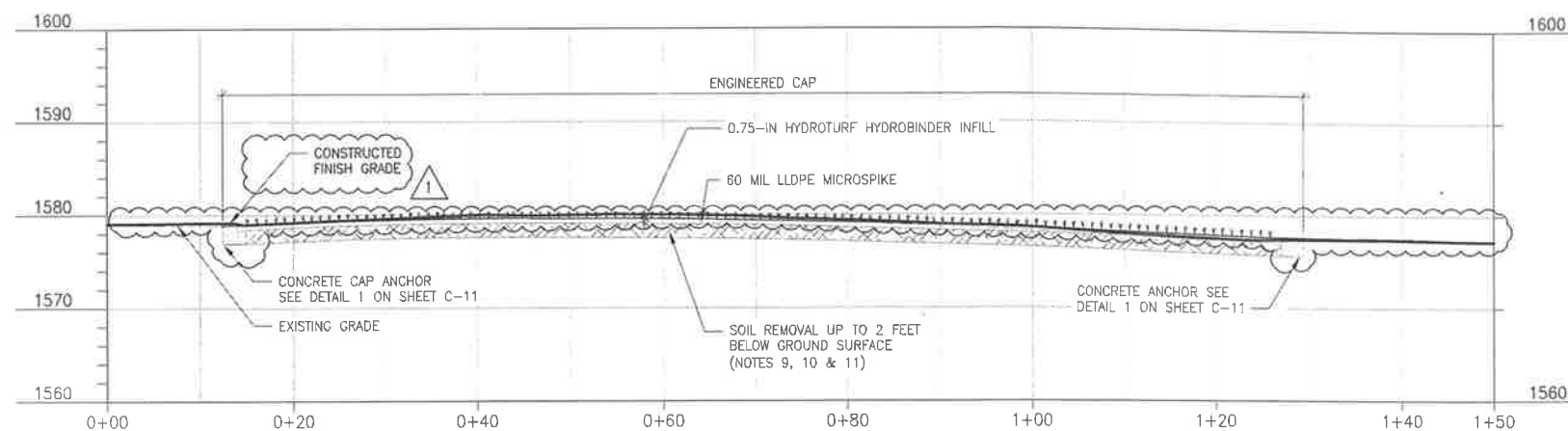
SHEET TITLE

C-COMPLEX  
PLAN AND  
CROSS SECTIONS

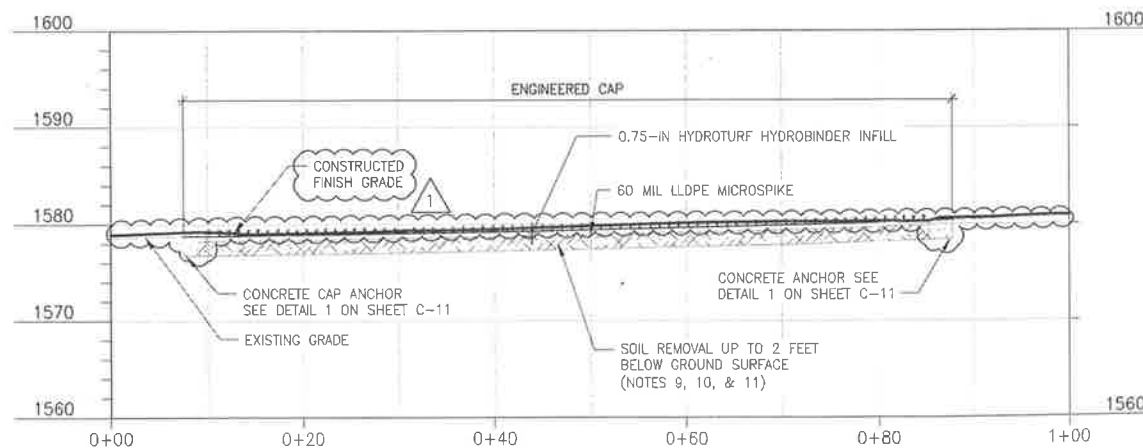
SCALE: H: 1"=10' V: 1"=10'

C-03

SHEET 4 OF 13



1 SECTION 1  
C-02 SCALE: 1"=10'-0"



2 SECTION 2  
C-02 SCALE: 1"=10'-0"

NOTES:

- REMOVED SOIL SHALL BE REPLACED WITH FREE DRAINING ROCK FILL. REMOVED SOIL SHALL BE DISPOSED OF PROPERLY OFF-SITE.
- ALL COORDINATED LISTED ARE 1983 (2007 EPOCH) STATE PLANE GROUND COORDINATES ARIZONA CENTRAL ZONE, STANDARD TRANSVERSE MERCATOR PROJECTION, WITH A SCALE OF ORIGIN POINT OF X=0.0000 Y=0.0000. USING A GRID ADJUSTMENT FACTOR BACK TO GRID COORDINATES DIVIDE EACH COORDINATE VALUE BY 1.00016.
- UNITS =INTERNATIONAL FEET, 1 FOOT = 0.3048 METER EXACTLY.
- ALL BEARINGS ARE GRID BEARING, DISTANCES ARE GROUND DISTANCES AND COORDINATES ARE GROUND COORDINATES.
- THE FIELD PORTION OF THIS SURVEY WAS PERFORMED JANUARY 2014.
- VERTICAL DATUM IN NORTH AMERICAN VERTICAL DATUM OF 1988.
- HYDROTURF CS = SYSTEM TYPICALLY USED FOR HIGH VELOCITY CONDITIONS AND FOR PROTECTION OF CRITICAL STRUCTURES.
- POSITIVE DRAINAGE WILL BE MAINTAINED.
- BACKFILL MATERIAL WILL BE CLEAN FILL FROM AN APPROVED ON-SITE SOURCE AT THE E-COMPLEX AREA.
- COMPACTED BACKFILL WILL BE PLACED IN LIFT THICKNESS NOT EXCEEDING 12-INCHES AND COMPACTED TO A MINIMUM OF 90% RELATIVE COMPACTION AS DETERMINED BY ASTM D1557 WITHIN +/- 2% OF OPTIMUM MOISTURE CONTENT.
- COMPACTION TESTS WILL BE PERFORMED AT A RATE OF ONE TEST PER 400 SQUARE FEET OF PLACED BACKFILL PER LIFT.
- HYDROTURF CS TO BE INSTALLED IN COMPLIANCE WITH THE CONSTRUCTION QUALITY ASSURANCE (CQA) PLAN AND MATERIAL SPECIFICATIONS.







CONSULTANTS



SEALS



CITY OF PHOENIX  
UTC AEROSPACE SYSTEMS  
25401 N. CENTRAL AVENUE  
PHOENIX, ARIZONA

FORMER UPCO FACILITY  
SOIL REMEDIATION

3994003

1	10/2018	RECORD DRAWING	JLP
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NO.	DATE	ISSUED FOR	BY

COPYRIGHT: ARCADIS U.S., INC.  
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DATE: JANUARY 2018

PROJECT NO.: 3994003

FILE NAME: C-05

DESIGNED BY: JLP

DRAWN BY: JP

CHECKED BY: MN

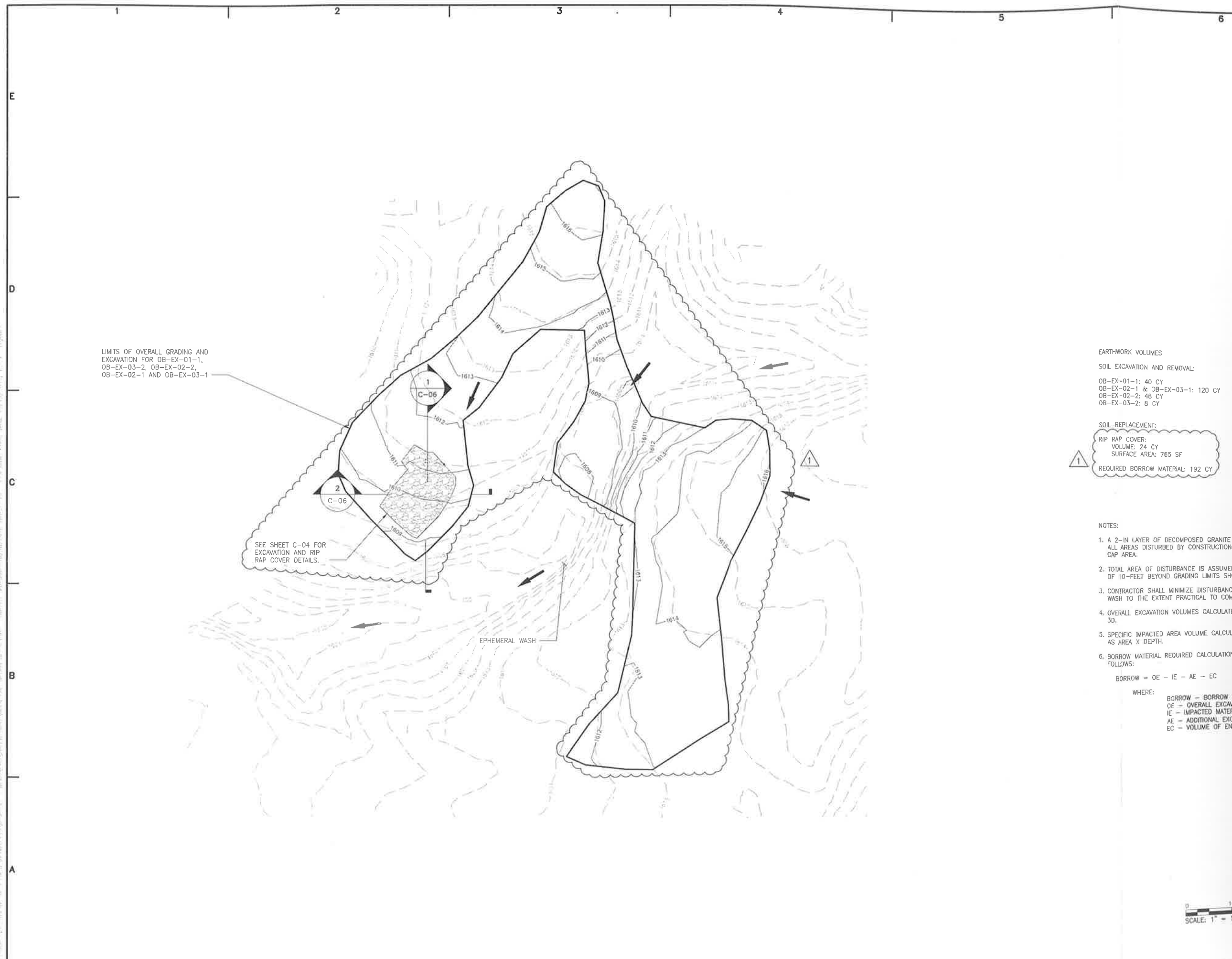
SHEET TITLE

OLD BURN AREA  
EXCAVATION AND RESTORATION  
PLAN

SCALE: 1" = 10'

C-05

SHEET 8 OF 13



EARTHWORK VOLUMES

SOIL EXCAVATION AND REMOVAL:

OB-EX-01-1: 40 CY  
OB-EX-02-1 & OB-EX-03-1: 120 CY  
OB-EX-02-2: 48 CY  
OB-EX-03-2: 8 CY

SOIL REPLACEMENT:

1 RIP RAP COVER:  
VOLUME: 24 CY  
SURFACE AREA: 765 SF

REQUIRED BORROW MATERIAL: 192 CY

- NOTES:
- A 2-IN LAYER OF DECOMPOSED GRANITE WILL BE PLACED OVER ALL AREAS DISTURBED BY CONSTRUCTION, EXCEPT THE RIP RAP CAP AREA.
  - TOTAL AREA OF DISTURBANCE IS ASSUMED TO EXTEND A MAXIMUM OF 10-FEET BEYOND GRADING LIMITS SHOWN.
  - CONTRACTOR SHALL MINIMIZE DISTURBANCE WITHIN THE EPHEMERAL WASH TO THE EXTENT PRACTICAL TO COMPLETE THE WORK.
  - OVERALL EXCAVATION VOLUMES CALCULATED USING AUTOCAD CIVIL 3D.
  - SPECIFIC IMPACTED AREA VOLUME CALCULATIONS WERE DETERMINED AS AREA X DEPTH.
  - BORROW MATERIAL REQUIRED CALCULATION DETERMINED AS FOLLOWS:
- BORROW = OE - IE - AE - EC
- WHERE:
- BORROW - BORROW MATERIAL REQUIRED
  - OE - OVERALL EXCAVATION VOLUME
  - IE - IMPACTED MATERIAL REMOVED
  - AE - ADDITIONAL EXCAVATION VOLUME (OE-IE)
  - EC - VOLUME OF ENGINEERED COVER



CONSULTANTS



SEALS



CITY OF PHOENIX  
UTC AEROSPACE SYSTEMS  
25401 N. CENTRAL AVENUE  
PHOENIX, ARIZONA

FORMER UPCO FACILITY  
SOIL REMEDIATION

3994003

1	10/2018	RECORD DRAWING	JLP
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NO.	DATE	ISSUED FOR	BY

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2017

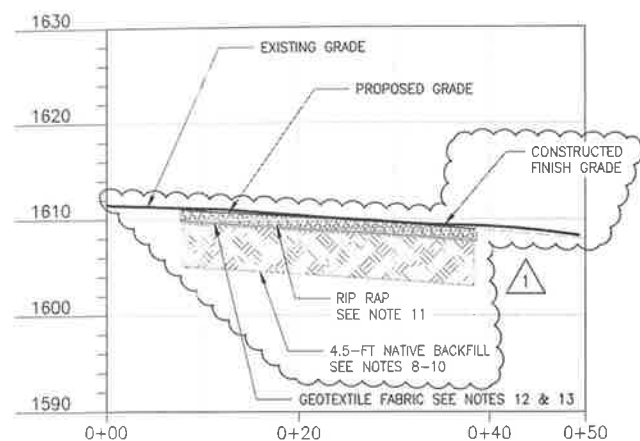
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PROJECT NO.: 3994003  
FILE NAME: C-06  
DESIGNED BY: JLP  
DRAWN BY: JP  
CHECKED BY: MN

SHEET TITLE

OLD BURN AREA CAP DESIGN  
CROSS SECTIONS

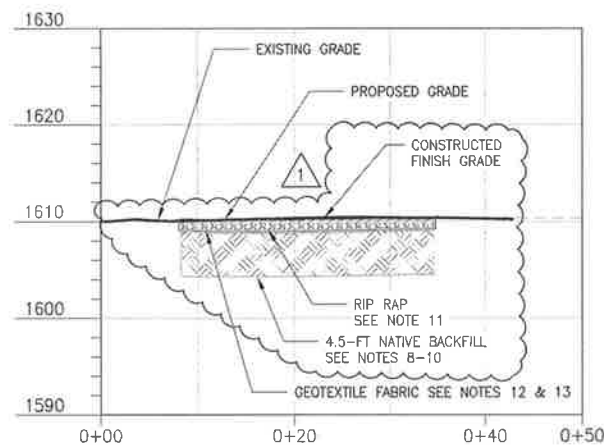
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C-06  
SHEET 7 OF 13



1 SECTION 1

C-05 SCALE: 1" = 10' HORIZONTAL  
SCALE: 1" = 10' VERTICAL



2 SECTION 2

C-05 SCALE: 1" = 10' HORIZONTAL  
SCALE: 1" = 10' VERTICAL

NOTES:

- REMOVED SOIL SHALL BE REPLACED WITH FREE DRAINING ROCK FILL. REMOVED SOIL SHALL BE DISPOSED OF PROPERLY OFF-SITE.
- ALL COORDINATED LISTED ARE 1983 (2007 EPOCH) STATE PLANE GROUND COORDINATES ARIZONA CENTRAL ZONE. STANDARD TRANSVERSE MERCATOR PROJECTION, WITH A SCALE OF ORIGIN POINT OF X=0.0000 Y=0.0000. USING A GRID ADJUSTMENT FACTOR BACK TO GRID COORDINATES DIVIDE EACH COORDINATE VALUE BY 1.00016.
- UNITS = INTERNATIONAL FEET. 1 FOOT = 0.3048 METER EXACTLY.
- ALL BEARINGS ARE GRID BEARING, DISTANCES ARE GROUND DISTANCES AND COORDINATES ARE GROUND COORDINATES.
- THE FIELD PORTION OF THIS SURVEY WAS PERFORMED JANUARY 2014.
- VERTICAL DATUM IN NORTH AMERICAN VERTICAL DATUM OF 1988.
- POSITIVE DRAINAGE WILL BE MAINTAINED.
- BACKFILL MATERIAL WILL BE CLEAN FILL FROM AN APPROVED ON-SITE SOURCE AT THE E-COMPLEX AREA.
- COMPACTED BACKFILL WILL BE PLACED IN LIFT THICKNESS NOT EXCEEDING 12-INCHES AND COMPACTED TO A MINIMUM OF 90% RELATIVE COMPACTION AS DETERMINED BY ASTM D1557 WITHIN +/- 2% OF OPTIMUM MOISTURE CONTENT.
- COMPACTION TESTS WILL BE PERFORMED AT A RATE OF ONE TEST PER 1,000 SQUARE FEET OF PLACED BACKFILL PER LIFT.
- RIP RAP SHALL HAVE A D50 OF 8-IN WITH A MINIMUM OF 4-IN AND SHALL BE PLACED IN A 12-IN THICK LAYER.
- GEOTEXTILE SHALL BE THRACE LINEQ 130-EX OR EQUIVALENT.
- GEOTEXTILE SHALL EXTEND ALMOST TO SURFACE OF RIP RAP COVER.

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PHOENIX, ARIZONA

FORMER UPSCO FACILITY  
SOIL REMEDIATION

3994003

1	10/2018	RECORD DRAWING	JLP
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DATE: JANUARY 2018

PROJECT NO.: 3994003

FILE NAME: C-07

DESIGNED BY: JLP

DRAWN BY: JP

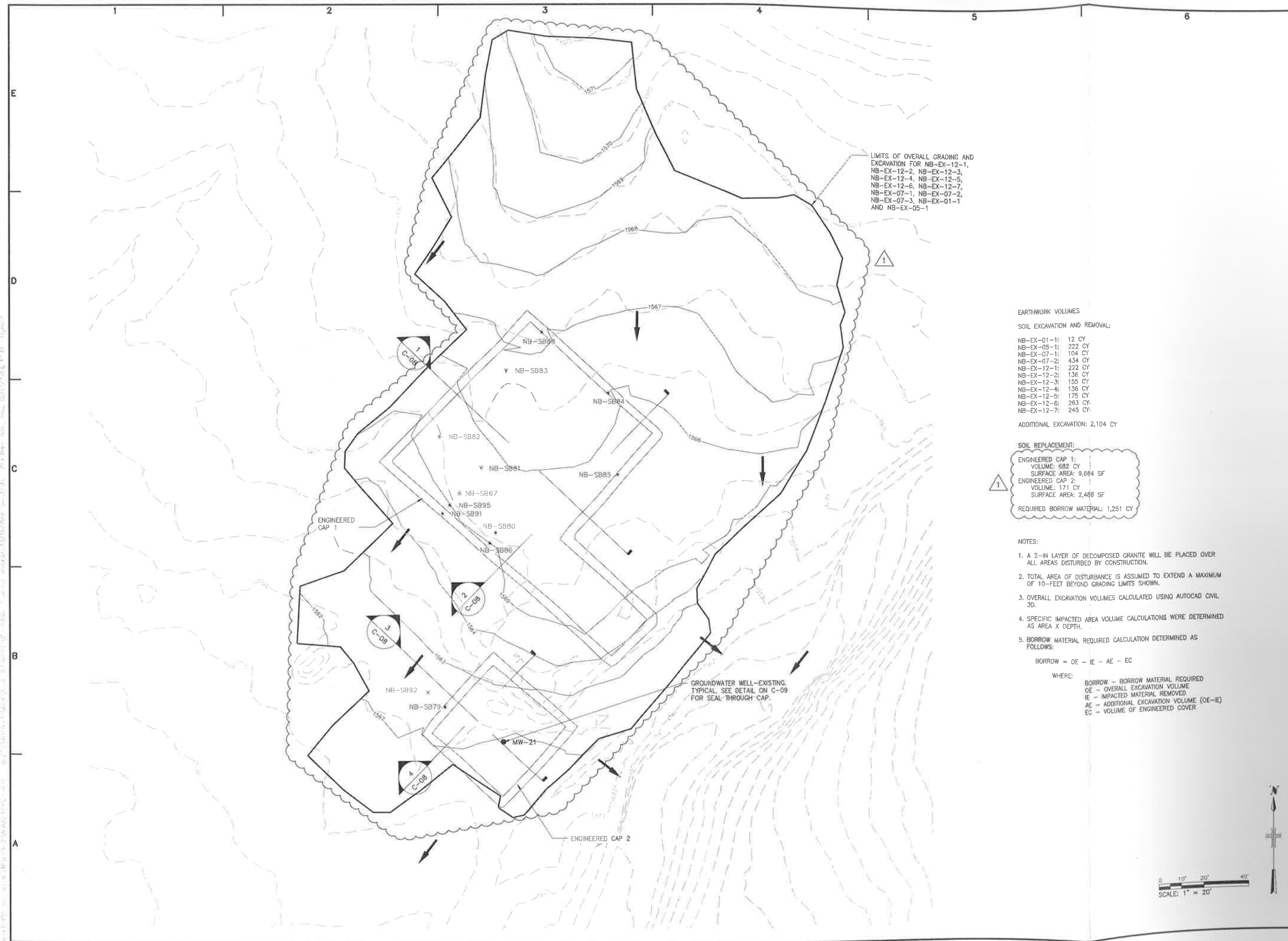
CHECKED BY: MN

SHEET TITLE

NEW BURN AREA  
EXCAVATION AND RESTORATION  
PLAN

SCALE: 1" = 10'

C-07  
SHEET 8 OF 13



LIMITS OF OVERALL GRADING AND  
EXCAVATION FOR NB-EX-12-1,  
NB-EX-12-2, NB-EX-12-3,  
NB-EX-12-4, NB-EX-12-5,  
NB-EX-12-6, NB-EX-12-7,  
NB-EX-07-1, NB-EX-07-2,  
NB-EX-07-3, NB-EX-01-1  
AND NB-EX-05-1

EARTHWORK VOLUMES

SOIL EXCAVATION AND REMOVAL:

- NB-EX-01-1: 12 CY
- NB-EX-05-1: 222 CY
- NB-EX-07-1: 104 CY
- NB-EX-07-2: 434 CY
- NB-EX-12-1: 222 CY
- NB-EX-12-2: 136 CY
- NB-EX-12-3: 155 CY
- NB-EX-12-4: 136 CY
- NB-EX-12-5: 175 CY
- NB-EX-12-6: 263 CY
- NB-EX-12-7: 245 CY

ADDITIONAL EXCAVATION: 2,104 CY

SOIL REPLACEMENT:

- ENGINEERED CAP 1:  
VOLUME: 682 CY  
SURFACE AREA: 9,684 SF
  - ENGINEERED CAP 2:  
VOLUME: 171 CY  
SURFACE AREA: 2,488 SF
- REQUIRED BORROW MATERIAL: 1,251 CY

NOTES:

1. A 2-IN LAYER OF DECOMPOSED GRANITE WILL BE PLACED OVER ALL AREAS DISTURBED BY CONSTRUCTION.
2. TOTAL AREA OF DISTURBANCE IS ASSUMED TO EXTEND A MAXIMUM OF 10- FEET BEYOND GRADING LIMITS SHOWN.
3. OVERALL EXCAVATION VOLUMES CALCULATED USING AUTOCAD CIVIL 3D.
4. SPECIFIC IMPACTED AREA VOLUME CALCULATIONS WERE DETERMINED AS AREA X DEPTH.
5. BORROW MATERIAL REQUIRED CALCULATION DETERMINED AS FOLLOWS:

BORROW = OE - IE - AE - EC

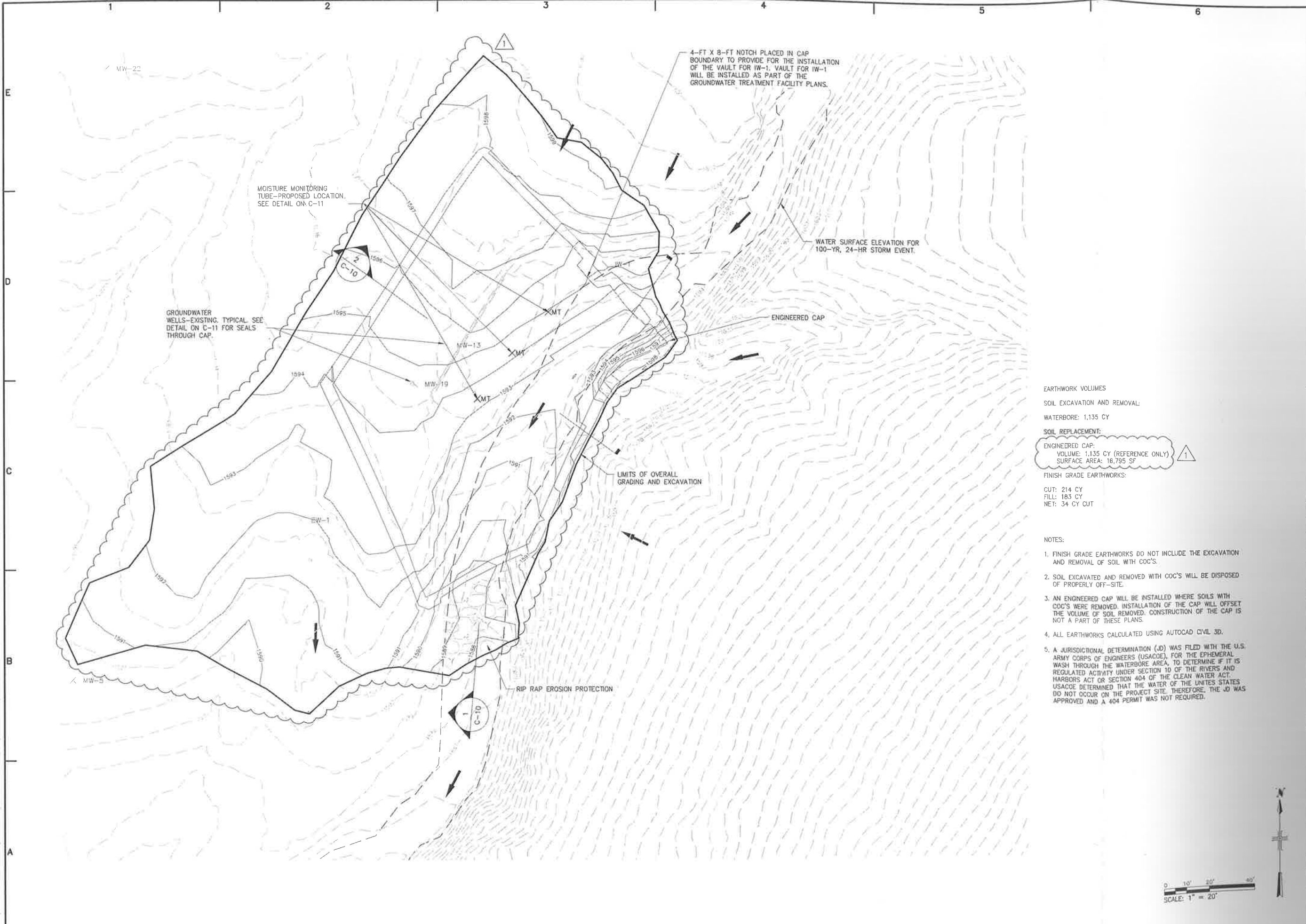
WHERE:

- BORROW - BORROW MATERIAL REQUIRED
- OE - OVERALL EXCAVATION VOLUME
- IE - IMPACTED MATERIAL REMOVED
- AE - ADDITIONAL EXCAVATION VOLUME (OE-IE)
- EC - VOLUME OF ENGINEERED COVER

GROUNDWATER WELL-EXISTING.  
TYPICAL. SEE DETAIL ON C-09  
FOR SEAL-THROUGH CAP.







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FILE NAME: C-09  
DESIGNED BY: JLP  
DRAWN BY: JP  
CHECKED BY: MN

SHEET TITLE

**WATERBORE  
EXCAVATION AND RESTORATION  
PLAN**

SCALE: 1" = 10'

**C-09**  
SHEET 10 OF 13

**EARTHWORK VOLUMES**  
SOIL EXCAVATION AND REMOVAL:  
WATERBORE: 1,135 CY  
**SOIL REPLACEMENT:**  
ENGINEERED CAP:  
VOLUME: 1,135 CY (REFERENCE ONLY)  
SURFACE AREA: 16,795 SF  
FINISH GRADE EARTHWORKS:  
CUT: 214 CY  
FILL: 183 CY  
NET: 34 CY CUT

- NOTES:
1. FINISH GRADE EARTHWORKS DO NOT INCLUDE THE EXCAVATION AND REMOVAL OF SOIL WITH COC'S.
  2. SOIL EXCAVATED AND REMOVED WITH COC'S WILL BE DISPOSED OF PROPERLY OFF-SITE.
  3. AN ENGINEERED CAP WILL BE INSTALLED WHERE SOILS WITH COC'S WERE REMOVED. INSTALLATION OF THE CAP WILL OFFSET THE VOLUME OF SOIL REMOVED. CONSTRUCTION OF THE CAP IS NOT A PART OF THESE PLANS.
  4. ALL EARTHWORKS CALCULATED USING AUTOCAD CIVIL 3D.
  5. A JURISDICTIONAL DETERMINATION (JD) WAS FILED WITH THE U.S. ARMY CORPS OF ENGINEERS (USACE), FOR THE EPHEMERAL WASH THROUGH THE WATERBORE AREA, TO DETERMINE IF IT IS REGULATED ACTIVITY UNDER SECTION 10 OF THE RIVERS AND HARBORS ACT OR SECTION 404 OF THE CLEAN WATER ACT. USACE DETERMINED THAT THE WATER OF THE UNITED STATES DID NOT OCCUR ON THE PROJECT SITE. THEREFORE, THE JD WAS APPROVED AND A 404 PERMIT WAS NOT REQUIRED.

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FILE NAME: C-10

DESIGNED BY: JLP

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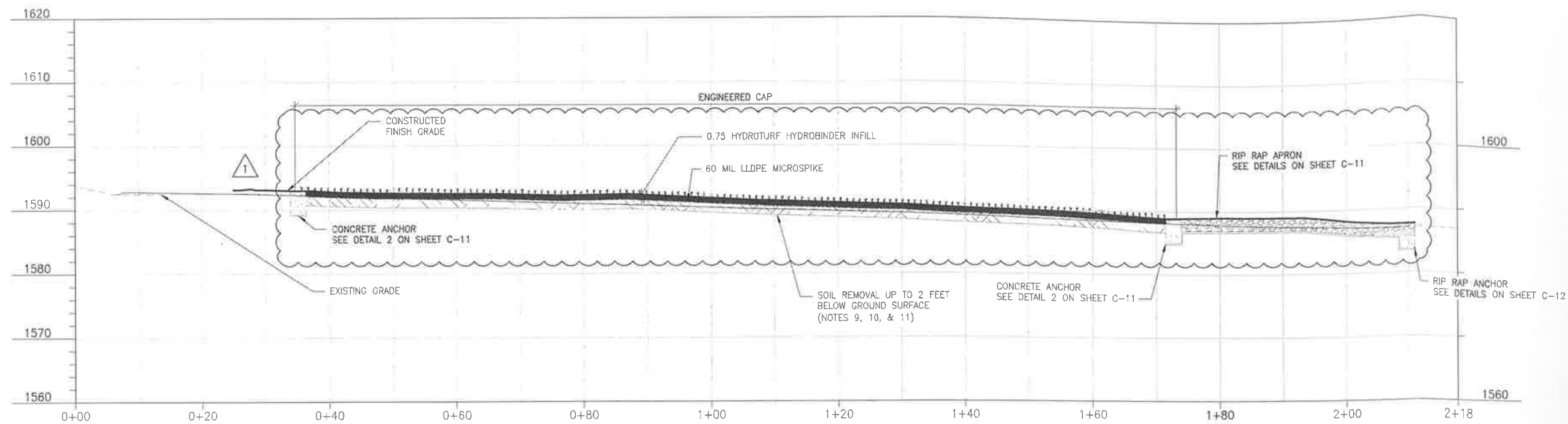
SHEET TITLE

**WATERBORE AREA  
CAP DESIGN  
CROSS SECTIONS**

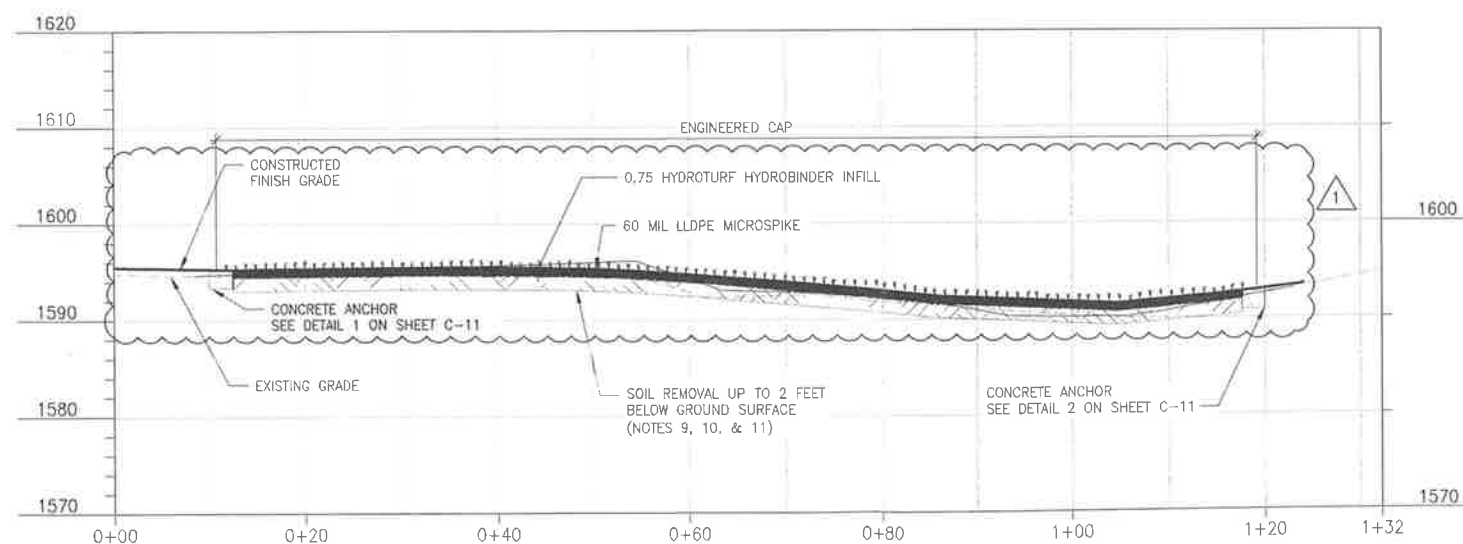
SCALE: 1"=10'

**C-10**

SHEET 11 OF 13



**1 SECTION 1**  
C-09 SCALE: 1"=10'-0"



**1 SECTION 2**  
C-09 SCALE: 1"=10'-0"

NOTES:

- REMOVED SOIL SHALL BE REPLACED WITH FREE DRAINING ROCK FILL. REMOVED SOIL SHALL BE DISPOSED OF PROPERLY OFF-SITE.
- ALL COORDINATED LISTED ARE 1983 (2007 EPOCH) STATE PLANE GROUND COORDINATES ARIZONA CENTRAL ZONE. STANDARD TRANSVERSE MERCATOR PROJECTION, WITH A SCALE OF ORIGIN POINT OF X=0.0000 Y=0.0000. USING A GRID ADJUSTMENT FACTOR BACK TO GRID COORDINATES DIVIDE EACH COORDINATE VALUE BY 1,00016.
- UNITS =INTERNATIONAL FEET, 1 FOOT = 0.3048 METER EXACTLY.
- ALL BEARINGS ARE GRID BEARING, DISTANCES ARE GROUND DISTANCES AND COORDINATES ARE GROUND COORDINATES.
- THE FIELD PORTION OF THIS SURVEY WAS PERFORMED JANUARY 2014.
- VERTICAL DATUM IN NORTH AMERICAN VERTICAL DATUM OF 1988.
- HYDROTURF CS = SYSTEM TYPICALLY USED FOR HIGH VELOCITY CONDITIONS AND FOR PROTECTION OF CRITICAL STRUCTURES.
- POSITIVE DRAINAGE WILL BE MAINTAINED.
- BACKFILL MATERIAL WILL BE CLEAN FILL FROM AN APPROVED ON-SITE SOURCE AT THE E-COMPLEX AREA.
- COMPACTED BACKFILL WILL BE PLACED IN LIFT THICKNESS NOT EXCEEDING 12-INCHES AND COMPACTED TO A MINIMUM OF 90% RELATIVE COMPACTION AS DETERMINED BY ASTM D1557 WITHIN +/- 2% OF OPTIMUM MOISTURE CONTENT.
- COMPACTION TESTS WILL BE PERFORMED AT A RATE OF ONE TEST PER 400 SQUARE FEET OF PLACED BACKFILL PER LIFT.
- HYDROTURF CS TO BE INSTALLED IN COMPLIANCE WITH THE CONSTRUCTION QUALITY ASSURANCE (CQA) PLAN AND MATERIAL SPECIFICATIONS.



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FILE NAME: C-11

DESIGNED BY: JLP

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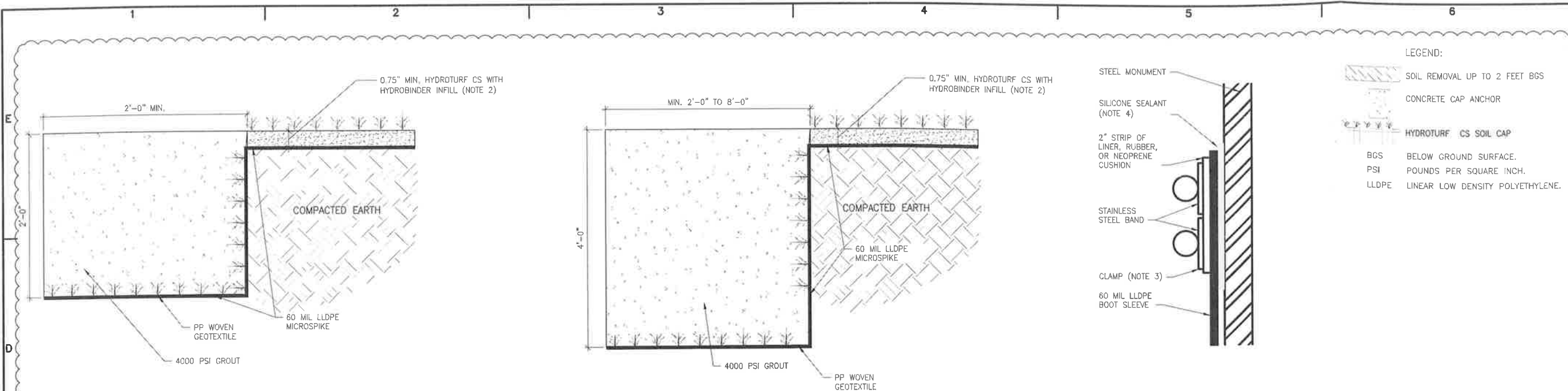
SHEET TITLE

DETAILS

SCALE: N/A

C-11

SHEET 12 OF 13



LEGEND:

SOIL REMOVAL UP TO 2 FEET BGS

CONCRETE CAP ANCHOR

HYDROTURF CS SOIL CAP

BGS BELOW GROUND SURFACE.

PSI POUNDS PER SQUARE INCH.

LLDPE LINEAR LOW DENSITY POLYETHYLENE.

1 HYDROTURF ANCHOR - OUTSIDE OF CHANNEL

C-9 SCALE: NTS

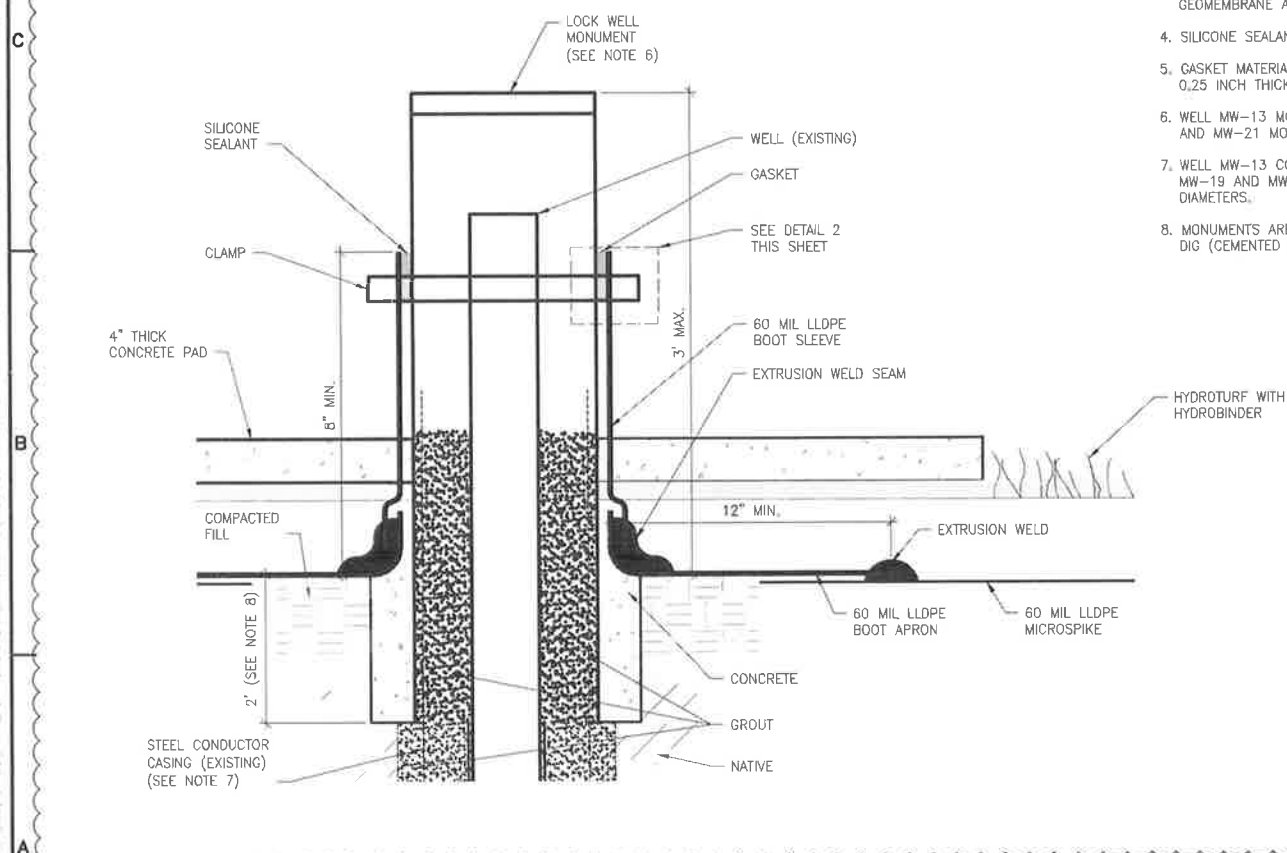
2 HYDROTURF ANCHOR - ACROSS WASH

C-9 SCALE: NTS

5 CLAMP DETAIL

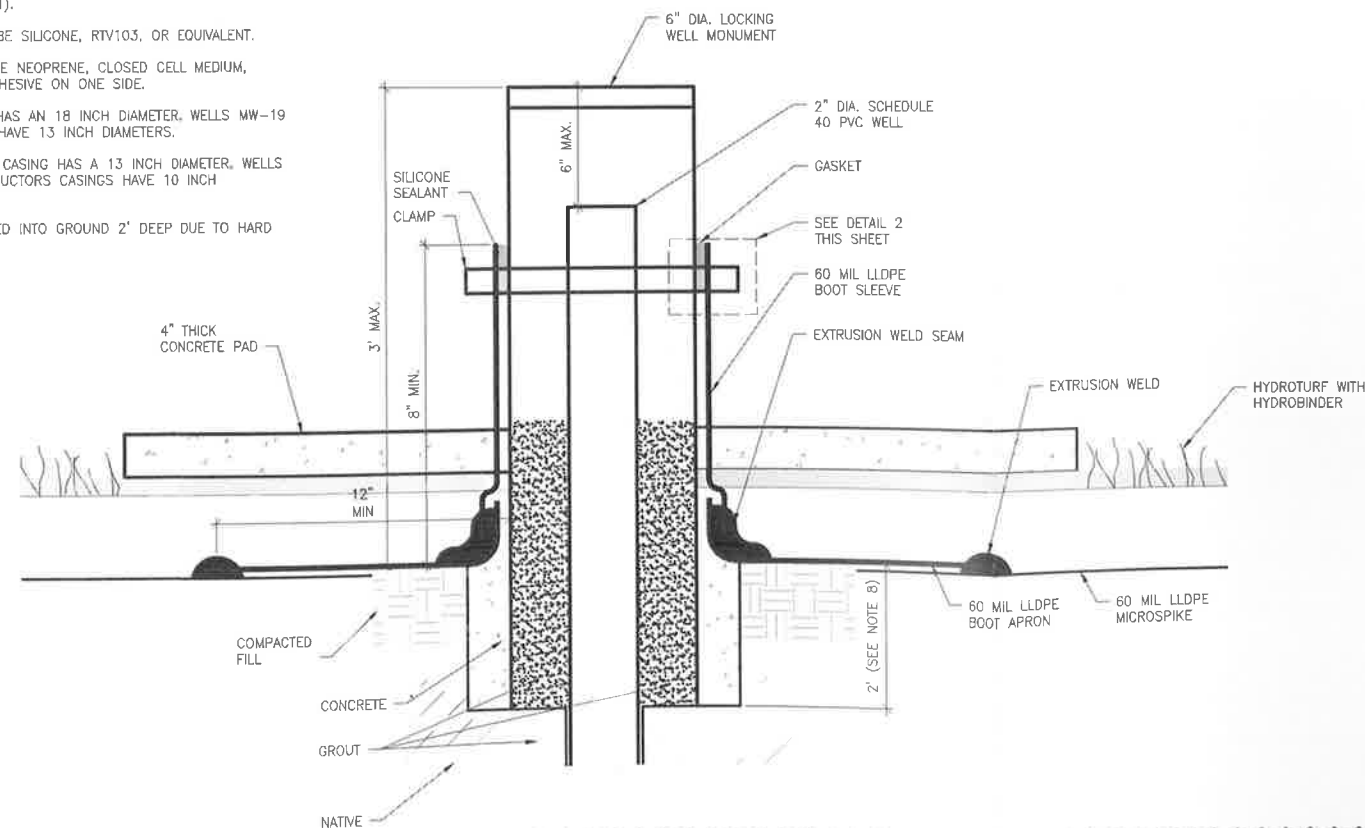
C-9 SCALE: NTS

- NOTE:
- HYDROTURF GOES DOWN INTO TRENCH.
  - HYDROTURF CS INCLUDES: SYNTHETIC TURF; HYDROBINDER INFILL; PP WOVEN GEOTEXTILE; 50 MIL LLDPE DUAL TEXTURED LINER (AGRU AMERICA MICROSPIKE)
  - TWO STAINLESS STEEL "BAND-IT" OR "SCREW-TYPE" CLAMPS; CLAMPS TO BE 1/8" THICK BY 1.5" WIDE TO THE EXACT DIAMETER OF THE PIPE (ALLOWING FOR THE THICKNESS OF THE GEOMEMBRANE AND GASKET).
  - SILICONE SEALANT SHALL BE SILICONE, RTV103, OR EQUIVALENT.
  - GASKET MATERIAL SHALL BE NEOPRENE, CLOSED CELL MEDIUM, 0.25 INCH THICK, WITH ADHESIVE ON ONE SIDE.
  - WELL MW-13 MONUMENT HAS AN 18 INCH DIAMETER, WELLS MW-19 AND MW-21 MONUMENTS HAVE 13 INCH DIAMETERS.
  - WELL MW-13 CONDUCTOR CASING HAS A 13 INCH DIAMETER, WELLS MW-19 AND MW-21 CONDUCTORS CASINGS HAVE 10 INCH DIAMETERS.
  - MONUMENTS ARE EMBEDDED INTO GROUND 2' DEEP DUE TO HARD DIG (CEMENTED ALLUVIUM).



3 GROUNDWATER WELL PENETRATION SEAL

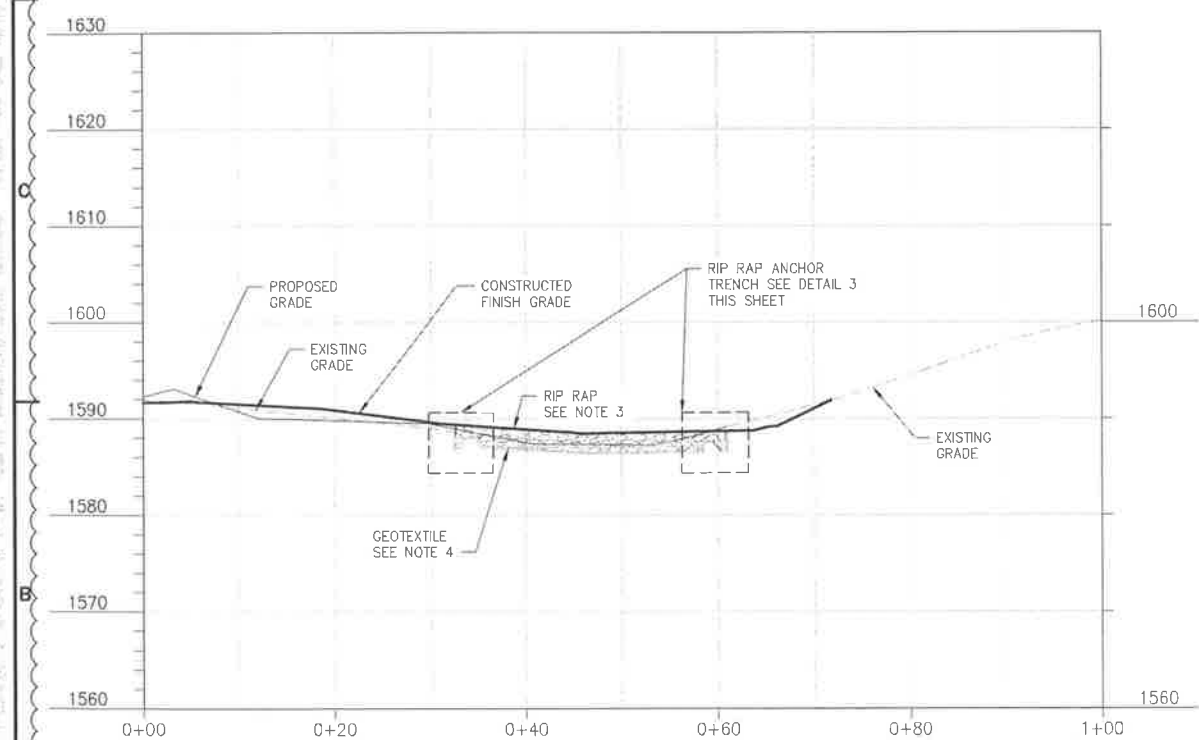
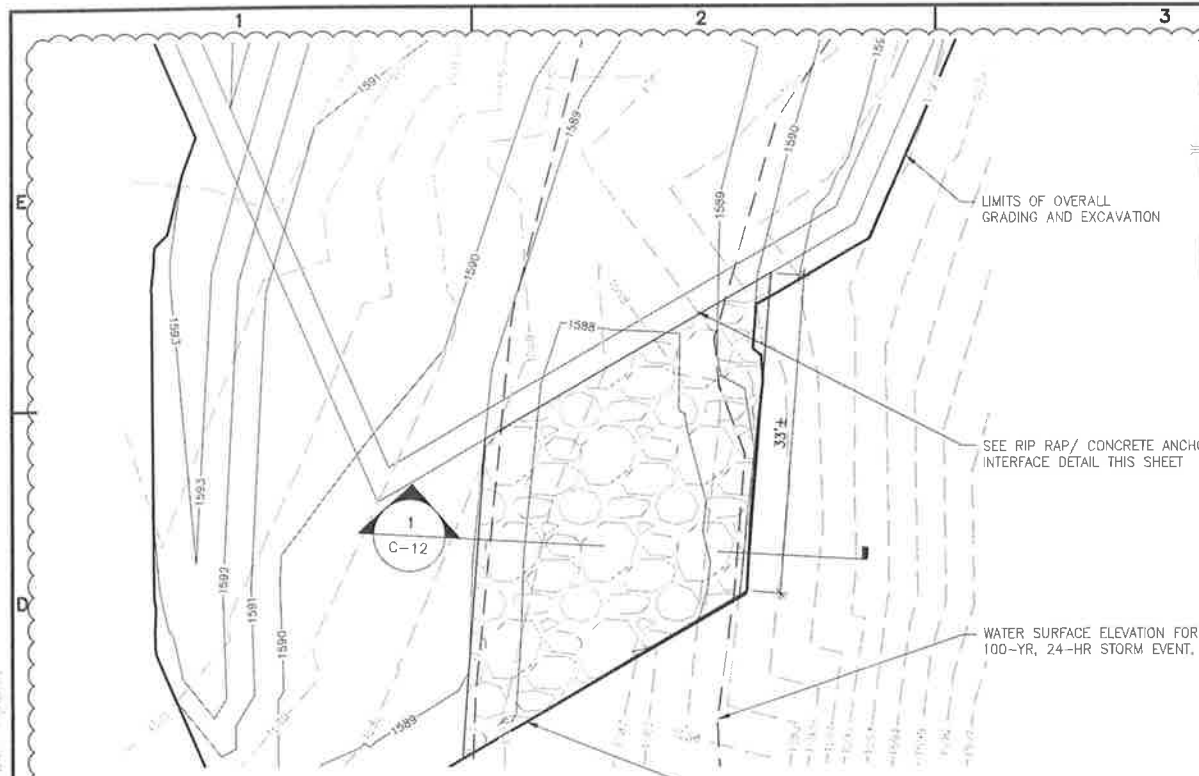
C-9 SCALE: NTS



4 MOISTURE MONITORING WELL PENETRATION SEAL

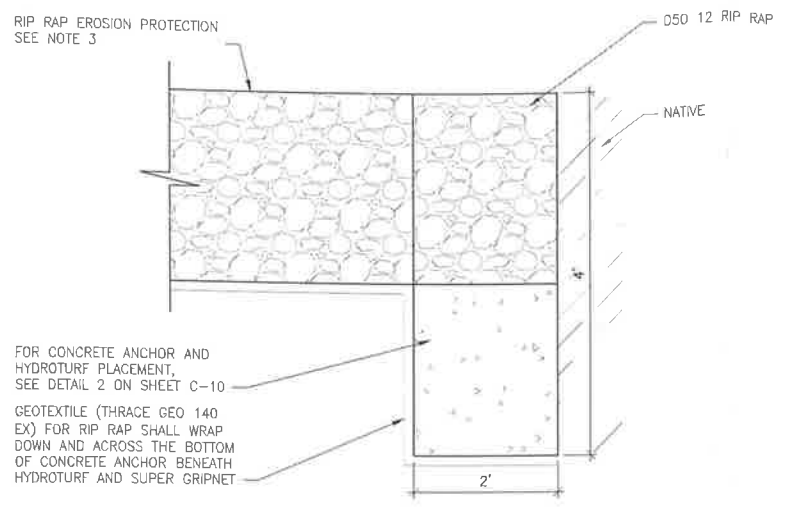
C-9 SCALE: NTS



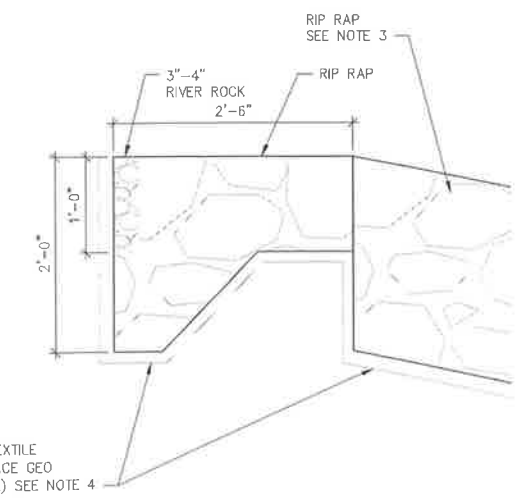


**1 SECTION 1**  
C-12 SCALE: 1"=10'

- NOTES:
- RIP RAP SHALL CONFORM TO MAG STANDARD SPECIFICATION 703.
  - RIP RAP SHALL BE PLACED PER MAG STANDARD SPECIFICATION 220.
  - RIP RAP SHALL HAVE A MINIMUM D50 OF 12-INCHES WITH A SIZE NO SMALLER THAN 8-INCHES IN DIAMETER AND SHALL BE PLACED IN A LAYER A MINIMUM OF 24-INCHES THICK.
  - GEOTEXTILE SHALL CONFORM TO CLASS A PER MAG STANDARD SPECIFICATION 796.
  - CRUSHED STONE BACKFILL SHALL HAVE A MINIMUM UNIT WEIGHT OF 100 PCF AND ANCHOR SHALL WEIGH A MINIMUM OF 134 LB/FT REGARDLESS OF EXCAVATED SLOPE.
  - RIP RAP TO BE INSTALLED IN COMPLIANCE WITH THE CONSTRUCTION QUALITY ASSURANCE (CQA) PLAN AND MATERIAL SPECIFICATIONS.
  - RIP RAP CALCULATIONS ARE INCLUDED IN AN APPENDIX TO THE DRAINAGE MEMORANDUM.
  - RIP RAP SHALL HAVE A MINIMUM D50 OF 8-INCHES WITH A SIZE NO SMALLER THAN 4-INCHES IN DIAMETER AND SHALL BE PLACED IN A LAYER A MINIMUM OF 24-INCHES THICK.
  - GEOTEXTILE SHALL CONFORM TO CLASS A PER MAG STANDARD SPECIFICATION 796. NONWOVEN GEOTEXTILE FABRIC (THRACE LINO 130EX), 4- FEET WIDE, SHALL BE INSTALLED ON TOP OF THE SOIL. EACH JOINT OF THE GEOTEXTILE SHALL BE OVERLAPPED A MINIMUM OF 12-INCHES AND BROUGHT UP AROUND THE EDGES OF THE EXCAVATION.



**2 RIP RAP CONCRETE ANCHOR INTERFACE DETAIL (DOWNSTREAM)**  
C-12 SCALE: 1"=1'-0"



**3 RIP RAP ANCHOR TRENCH (SIDES)**  
C-12 SCALE: 1"=1'-0"



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FILE NAME: C-12

DESIGNED BY: JLP

DRAWN BY: JP

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SHEET TITLE

**DETAILS**

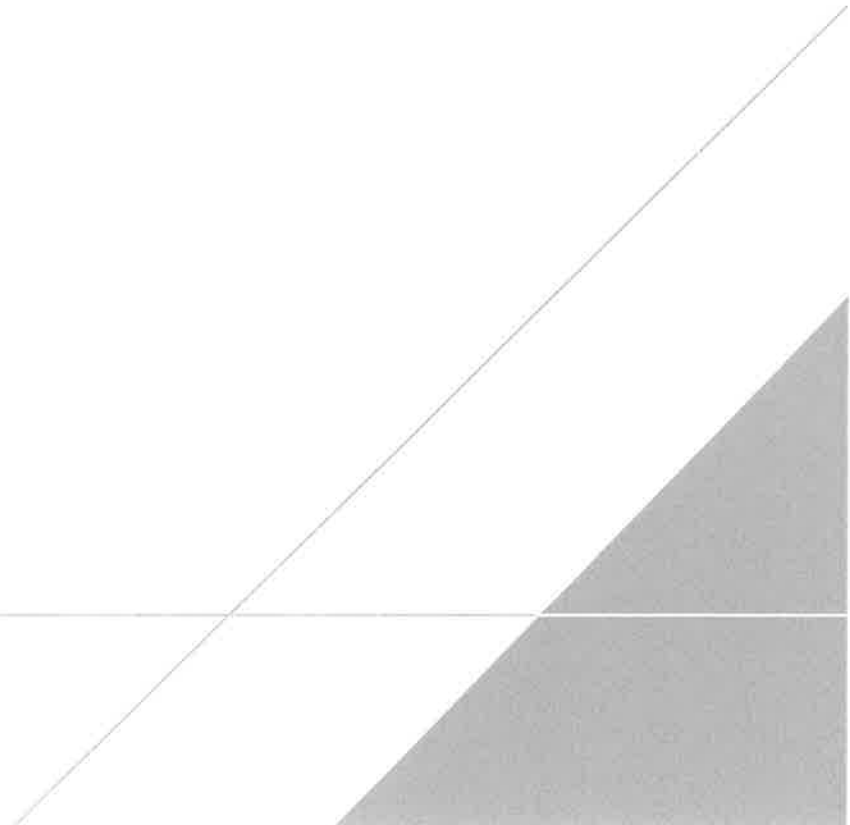
SCALE: AS SHOWN

**C-12**



SHEET 13 OF 13

# APPENDIX B

Photos



**Project Name:** Former Universal Propulsion Company, Inc.

<b>Photo No.</b> <b>1</b>		
<b>Location/Description:</b> Waterbore Area Cap  <b>Additional Details:</b> South Side		
<b>Photo No.</b> <b>2</b>		
<b>Location/Description:</b> Waterbore Area Cap  <b>Additional Details:</b> North Side		

**Project Name:** Former Universal Propulsion Company, Inc.

<b>Photo No.</b> <b>3</b>	
<b>Location/Description:</b> Waterbore Area Cap  Additional Details: Anchor Trench Across Wash; Looking Down Stream.	



<b>Photo No.</b> <b>4</b>	
<b>Location/Description:</b> Waterbore Area Cap  Additional Details: Anchor Trench Across Wash; at Upgradient to Cap	

**Project Name:** Former Universal Propulsion Company, Inc.

<b>Photo No.</b> <b>5</b>	
<b>Location/Description:</b> Waterbore Area Cap	
<b>Additional Details:</b> Anchor Trench Across Wash; at Upgradient to Cap	

<b>Photo No.</b> <b>6</b>	
<b>Location/Description:</b> Waterbore Area Cap	
<b>Additional Details:</b> Anchor Trench across the north side of cap	

**Project Name:** Former Universal Propulsion Company, Inc.

<p><b>Photo No.</b> <b>7</b></p>	
<p><b>Location/Description:</b> Waterbore Area Cap</p> <p><b>Additional Details:</b> Looking Upgradient, from rip rap, of Cap through the wash to Cap</p>	
<p><b>Photo No.</b> <b>8</b></p>	
<p><b>Location/Description:</b> Waterbore Area Cap</p> <p><b>Additional Details:</b> Anchor Trench Across Wash; at Upgradient to Cap</p>	

**Project Name:** Former Universal Propulsion Company, Inc.



<b>Photo No.</b> <b>9</b>
<b>Location/Description:</b> C-Complex Area Cap
<b>Additional Details:</b> Looking North



<b>Photo No.</b> <b>10</b>
<b>Location/Description:</b> C-Complex Area Cap
<b>Additional Details:</b> Looking South



**Project Name:** Former Universal Propulsion Company, Inc.

<b>Photo No.</b> <b>11</b>		
<b>Location/Description:</b> New Burn Area Cap (Large)  <b>Additional Details:</b> Looking South		
<b>Photo No.</b> <b>12</b>		
<b>Location/Description:</b> New Burn Area Cap (Large)  <b>Additional Details:</b> Looking North		



**Project Name:** Former Universal Propulsion Company, Inc.

<b>Photo No.</b> <b>13</b>	
<b>Location/Description:</b>  New Burn Area Cap (Large)	
<b>Additional Details:</b> Looking North	



<b>Photo No.</b> <b>14</b>	
<b>Location/Description:</b>  New Burn Area Cap (Small)	
<b>Additional Details:</b> Looking North	

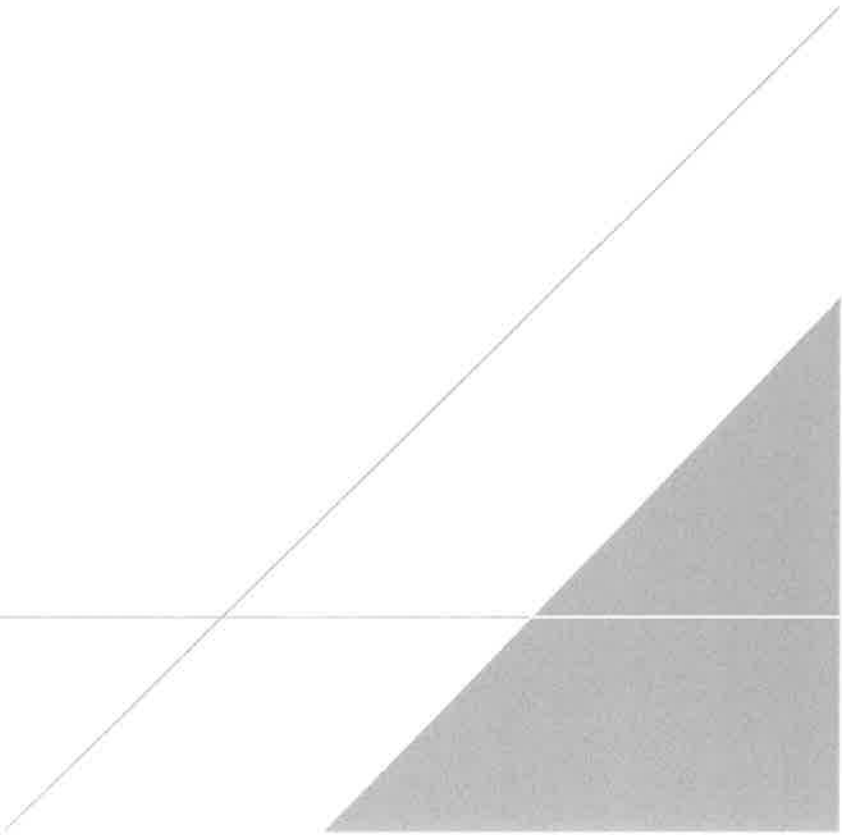


**Project Name:** Former Universal Propulsion Company, Inc.

<p><b>Photo No.</b> <b>15</b></p> <p><b>Location/Description:</b> New Burn Area Cap (Large)</p> <p><b>Additional Details:</b> Looking West</p>	
<p><b>Photo No.</b> <b>16</b></p> <p><b>Location/Description:</b> Old Burn Area Rip Rap Cover</p> <p><b>Additional Details:</b> Looking West</p>	

# APPENDIX C

HydroTurf® CS and Z Monitoring & Maintenance Guidelines



# HYDROTURF® CS AND Z MONITORING & MAINTENANCE GUIDELINES

January 2018, Revision 2.0

Before utilizing this document as a tool, please make sure that you download the latest version of these guidelines from the technical downloads section of our website at [www.watershedgeo.com](http://www.watershedgeo.com).



**HydroTurf®**

Advanced Revetment Technology

# HydroTurf® CS and Z Monitoring & Maintenance Guidelines

## 1.0 Introduction

This document is intended to be a general guide of suggested procedures for Monitoring and Maintenance related to installed HydroTurf® CS and Z Systems. These guidelines do not supersede any site specific regulatory maintenance and reporting requirements; project specific plans, specifications and/or conditions; or Watershed Geosynthetics, LLC (WG) Agreements.

Inspection and repair activities shall be performed by Watershed Geosynthetics (WG) trained individuals. While some corrective procedures can be performed by trained site personnel, a list of trained contractors / installers is available upon request.

## 2.0 Inspections

### 2.1 Owner's Internal Inspections

The owner's designated representative shall establish the site's specific inspection intervals as required by permits and/or internal procedures. A minimum annual inspection interval is to be performed by the owner or owner's representative. Also, inspections should be performed after major storm events. A sample Monitoring & Maintenance Report is included at the end of this document. Please forward a copy of the monitoring and repair reports to WG representative Mr. Curt Boling by email at [cboling@watershedgeo.com](mailto:cboling@watershedgeo.com).

### 2.2 WG Inspections

WG may make periodic site visits related to managing site-specific warranties. WG will coordinate with the owners designated representative.

## 3.0 Visual Monitoring & Documentation

### 3.1 Visually Inspect HydroTurf® CS and Z Noting the Following:

- 3.1.1 Damaged HydroBinder® Infill such as Large Cracks, Excessive Cracking, Crushed Infill, and/or Voids;
- 3.1.2 Damaged Engineered Synthetic Turf;
- 3.1.3 Damaged Geomembrane; and
- 3.1.4 Localized Differential Settlement / Undermining.

### **3.2 Documentation**

Documentation should include a written report (see attached sample Monitoring & Maintenance Report). The report should note locations of areas of damage and have supporting photographs. Documentation and reporting of the repairs (i.e., size, location, area, etc.) with before and after photos shall also be prepared.

## **4.0 Corrective Maintenance and Repair Procedures**

### **4.1 Damaged HydroBinder® Infill**

Visually inspect, document and take photos of areas where there is damage to or concern with the HydroBinder® infill. These areas may include large cracks, excessive cracking, crushed infill, and/or voids. If possible, define the cause(s) of damage so that it may be proactively addressed. Repairing these areas includes the following:

- 4.1.1 Clean the affected area by removing any loose infill and/or other materials. This may require the use of a hammer to break out some of the loose infill areas.
- 4.1.2 Confirm that the synthetic turf and underlying geomembrane are not damaged. If they are damaged, please refer to Sections 4.2 and 4.3 for repair guidelines.
- 4.1.3 Cracks in the HydroBinder® can be sealed by applying concrete crack sealants such as Quikrete Product 8640, Sakrete Product 60205006, or equal. Note that these products can typically be purchased at big box home improvement stores (i.e., Lowes, Home Depot, etc.).
- 4.1.4 For areas of concern that are larger than cracks, new HydroBinder® infill shall be applied to the affected area. If HydroBinder® is not readily available, a dry mortar / concrete mix which meets ASTM C387 with a 5,000 psi 28 day compressive strength may be used as a substitute. These products can typically be purchased at big box home improvement stores (i.e., Lowes, Home Depot, etc.).
  - 4.1.4.1 The dry infill mix shall be applied to a minimum thickness of ¾-in and shall match the thickness of the intact HydroBinder®.
  - 4.1.4.2 The area shall then be raked or broomed to pull the turf fibers up through the dry infill mix.
  - 4.1.4.3 The hydration process must occur the day of the infill placement. The infill is hydrated thoroughly with a light spray of water to avoid displacement of the non-hydrated infill. Do not overhydrate the infill so that water begins to runoff and

causes the loss of cement particles in the infill. The general objective is to soak the area to start the hydration process but not to inundate with water beyond saturation.

4.1.4.4 It should be verified that the infill has been fully hydrated, and not over hydrated. This verification includes a visual observation that the top of the HydroBinder<sup>®</sup> has a wet sheen (denoting saturation) but that water is not ponding on top. Also, verification can be performed by using a finger or small tool to probe the infill to confirm full hydration of the section was achieved.

4.1.5 Document and report (i.e., size, location, area, etc.) the repairs including before and after photos.

## **4.2 Damaged Engineered Synthetic Turf**

Visually inspect, document and take photos of areas where there is damage to or concern with the engineered synthetic turf layer. If possible, define the cause(s) of damage so that it may be proactively addressed. Repairing these areas includes the following:

- 4.2.1 Clean the affected area by removing any loose infill and/or other materials. This may require the use of a hammer to break out some of the loose infill areas.
- 4.2.2 Cut and remove the damaged synthetic turf 4-in (min) beyond the damaged area.
- 4.2.3 Observe the condition of the subgrade under the engineered synthetic turf (HydroTurf<sup>®</sup> Z). If it is smooth and firm, move forward with patching the engineered synthetic turf. If it is damaged, the subgrade shall be fixed prior to patching the engineered synthetic turf.
- 4.2.4 Confirm that the underlying geomembrane is not damaged (HydroTurf<sup>®</sup> CS). If it is damaged, please refer to Section 4.3 of these guidelines for repair procedures.
- 4.2.5 Cut a patch of new synthetic turf that will extend a minimum of 3-in beyond the damaged area in all directions.
- 4.2.6 Tuck the new synthetic turf patch under the existing synthetic turf such that 3-in (min) of the new turf is covered by the existing turf on all sides.
- 4.2.7 Use the hand-held heat bonding method (hot-air gun with hand pressure) for seaming the 3-in tucked edge to the bottom of the existing synthetic turf.
- 4.2.8 Replace the HydroBinder<sup>®</sup> Infill as described in Section 4.1 of these guidelines.

- 4.2.9 Document and report (i.e., size, location, area, etc.) the repairs including before and after photos.

### **4.3 Damaged Geomembrane (HydroTurf® CS)**

Visually inspect, document and take photos of areas where there is damage to or concern with the geomembrane. If possible, define the cause(s) of damage so that it may be proactively addressed. Repairing these areas includes the following:

- 4.3.1 Clean the affected area by removing any loose infill and/or other materials. This may require the use of a hammer to break out some of the loose infill areas.
- 4.3.2 Cut back and remove the overlying engineered synthetic turf in order to access the damaged area of the geomembrane.
- 4.3.3 Observe the condition of the subgrade under the geomembrane. If it is smooth and firm, move forward with patching the geomembrane. If it is damaged, the subgrade shall be fixed prior to patching the geomembrane.
- 4.3.4 Cut a patch of new geomembrane material. This material shall be the same thickness and resin (e.g., 50 mil LLDPE) as the geomembrane of the existing installation. Patch shall extend a minimum of 4-in beyond the damaged area in all directions. Extrudate rod shall be the same resin type as the resin of the existing geomembrane.
- 4.3.5 Clean the geomembrane and properly grind the location of the extrusion weld.
- 4.3.6 Extrusion weld the patch to the existing geomembrane. The welding technician shall be certified by the International Association of Geosynthetics Installers (IAGI) as a Certified Welding Technician (CWT) for Polyethylene Geomembranes, and have a minimum experience of seaming 1,000,000 sf of polyethylene geomembrane using the same type of seaming apparatus to be used in this repair.
- 4.3.7 The extrusion weld shall be vacuum box tested for leaks in accordance with ASTM D5641.
- 4.3.8 Replace the synthetic turf and HydroBinder® infill as described in Sections 4.2 and 4.1, respectively.
- 4.3.9 Document and report (i.e., size, location, area, etc.) the repairs including before and after photos.



## **4.4 Localized Differential Settlement / Undermining**

If localized differential settlement or undermining occurs under the HydroTurf® system, first determine and address the underlying cause of the settlement / undermining. Then the original grades may be re-established as follows:

- 4.4.1 Cut and remove the HydroBinder® infill, synthetic turf and geomembrane.
- 4.4.2 Place and compact earthen materials in the settled / undermined area to the designated grades. Flowable fill may also be used to re-establish the grades.
- 4.4.3 Replace the HydroTurf® CS system in this area with a patch of new geomembrane, synthetic turf, and infill materials. Each component (geomembrane and synthetic turf) patch shall be seamed into its respective component of the existing HydroTurf® CS system. After the patches are seamed, infill the synthetic turf with the HydroBinder®. The replacement patches shall be installed in accordance with Sections 4.1, 4.2, and 4.3 of these guidelines.
- 4.4.4 Document and report (i.e., size, location, area, etc.) the repairs including before and after photos.

## **5.0 Reporting**

The owner's designated site representative(s) shall be responsible for the monitoring and maintenance procedures and reporting of field documentation. Please forward a copy of the monitoring and repair reports to WG representative Mr. Curt Boling by email at [cboling@watershedgeo.com](mailto:cboling@watershedgeo.com).

## **6.0 Sample - Field Inspection & Documentation Report (Attachment)**

## **7.0 Limitations**

This manual is meant as a guideline only. Watershed Geosynthetics LLC cannot anticipate the many ways this product may be applied either in design or installation. Varying site conditions will require close coordination between the engineer and the installer to account for site conditions and adjust accordingly. When required by state and/or local regulations, a licensed professional engineer or architect will be required.

HydroTurf® is a U.S. registered trademark which designates a product from Watershed Geosynthetics LLC. This product is the subject of issued U.S. and foreign patents and/or pending U.S. and foreign patent applications. All information, recommendations and suggestions appearing in this literature concerning the use of our products are based upon tests and data believed to be reliable; however, this information should not be used or relied upon for any specific application without independent professional examination and verification of its accuracy, suitability and applicability. Since the actual use by others is beyond our control, no guarantee or warranty of any kind, expressed or implied, is made

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## HydroTurf® Monitoring & Maintenance Sample - Field Inspection & Documentation Report

A. Site Information		B. Contact Information				
Facility Name:		Site Operator:				
Address:		Phone #:				
Installation Date:		Inspected By:				
Date of Last Monitoring Event:		Date of Monitoring Event:				
C. HydroTurf® Inspection						
<p>If damage is present, indicate if damage is Minor or Major then use Section D to provide additional information, if necessary. The location and extent of damage shall be noted on site plans which shall be attached to this M&amp;M Report. Photographs of all damage and repairs shall also be included in the report.</p> <p style="text-align: center;">[Minor Damage=no immediate repair needed, but should be repaired or watched during the year.]            [Major Damage= requires immediate repair and submittal of a work scope to conduct repair.]</p>						
		Yes	No	NA	Minor	Major
1	Is the HydroTurf System in good working condition?					
2	Does the HydroBinder have large cracks, excessive cracking, crushed infill, and/or voids?					
3	Is the synthetic turf damaged?					
4	Is the geomembrane exposed and/or damaged?					
5	Is the subgrade smooth and firm?					
6	Evidence of damage due to unauthorized access?					
7	Evidence of settlement and/or ponding water?					
8	Does the HydroTurf have positive drainage?					
9	Any build-up of debris on the HydroTurf?					
10	Evidence of damage due to Burrowing Animals?					
11	Are other hydraulic structures present and in good working condition?					
11a	Culverts					
11b	Drainage Channels and Swales					
11c	Headwalls					
11d	Storm Water Basins					
11e	Slopes					
11f	Sea Walls					
11g	Other					





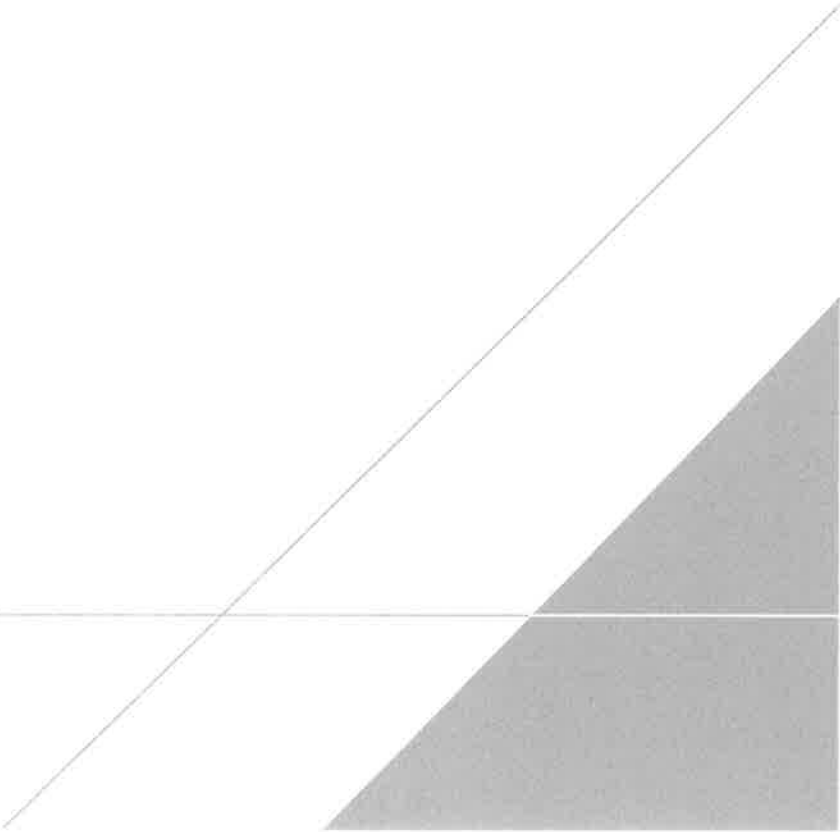
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**WG Watershed Geo®**  
*Unearthing Solutions*

HYDROTURF® is a U.S. registered trademark which designates a product from Watershed Geosynthetics, LLC. This product is the subject of issued U.S. and foreign patents and/or pending U.S. and foreign patent applications. All information, recommendations, and suggestions appearing in this literature concerning the use of our products are based upon tests and data believed to be reliable; however, this information should not be used or relied upon for any specific application without independent professional examination and verification of its accuracy, suitability and applicability. Since the actual use by others is beyond our control, no guarantee or warranty of any kind, expressed or implied, is made by Watershed Geosynthetics LLC as to the effects of such use or the results to be obtained, nor does Watershed Geosynthetics LLC assume any liability in connection herewith. Any statement made herein may not be absolutely complete since additional information may be necessary or desirable when particular or exceptional conditions or circumstances exist or because of applicable laws or government regulations. Nothing herein is to be construed as permission or as a recommendation to infringe any patent.

# APPENDIX D

## Inspection Checklist



**ENGINEERING CONTROL  
INSPECTION CHECKLIST**

Inspector (Print) \_\_\_\_\_ Engineering Control: Rip Rap Cover \_\_\_\_\_ New Burn (Large) \_\_\_\_\_  
 Inspector (Sign) \_\_\_\_\_ Waterbore Area \_\_\_\_\_ New Burn (Small) \_\_\_\_\_  
 Date: \_\_\_\_\_ Time: \_\_\_\_\_ C-Complex Area \_\_\_\_\_

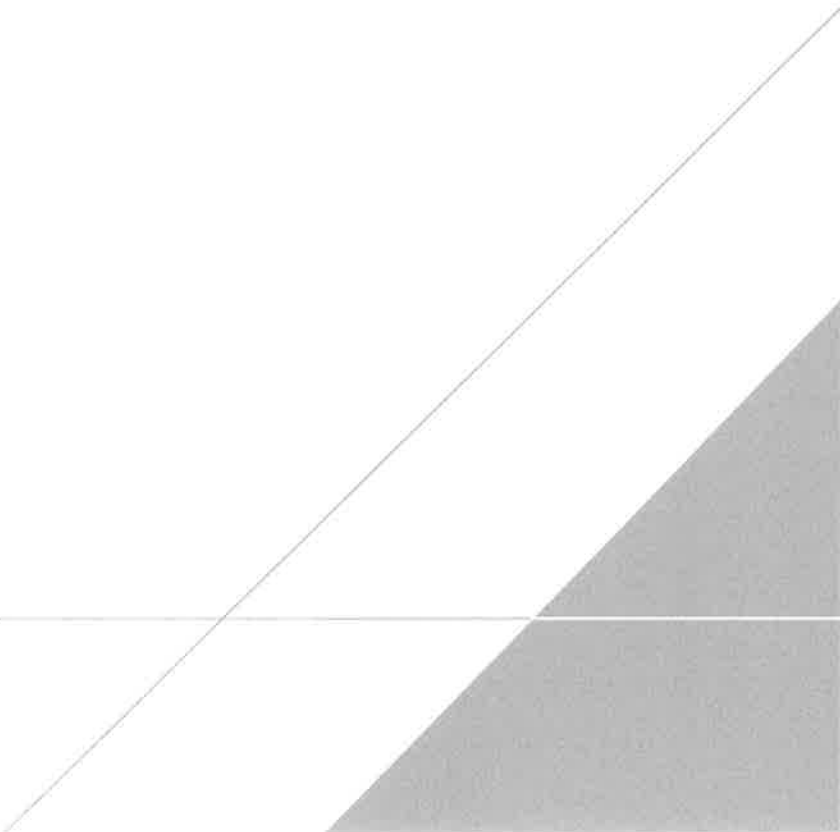
	Acceptable	Unacceptable	NA	Comments/Repair
<b>Cap</b>				
Scouring in Wash				
Cap Perimeter Erosion				
Cap Perimeter Subsidence				
<b>Boot Seals</b>				
Stainless Steel Bands				
MW-13				
MW-19				
MMW-1				
MMW-2				
MMW-3				
MW-21				
Sealant				
MW-13				
MW-19				
MMW-1				
MMW-2				
MMW-3				
MW-21				
LLDPE Boot				
MW-13				
MW-19				
MMW-1				
MMW-2				
MMW-3				
MW-21				
<b>Rip Rap</b>				
Rock Placement				
Slumping				
Trash/Debris				
Perimeter Erosion				
Animal Burrows/holes				
Other				





# APPENDIX E

## Detailed Cost Analysis



APPENDIX E  
 Detailed Cost Analysis  
 Engineering Control Plan  
 Former Universal Propulsion Company, Inc. Facility  
 Phoenix, Arizona

EVENT	Unit	Unit Rate	Quantity	Cost	Notes	Total	Duration-Years
<b>Engineered Caps Reconstruction</b>							
Waterbore - Liner install	per Sq Ft.	10	20250	\$ 202,500.00	Full Replacement	\$ 202,500.00	1
C-Complex - Liner install	per Sq Ft.	10	8250	\$ 82,500.00		\$ 82,500.00	1
New Burn Area - Liner Install (large cap)	per Sq Ft.	10	9900	\$ 99,000.00		\$ 99,000.00	1
New Burn Area - Liner Install (small cap)	per Sq Ft.	10	2500	\$ 25,000.00		\$ 25,000.00	1
Waterbore Area - Anchor Trench	per Sq Ft.	130	120	\$ 15,600.00		\$ 15,600.00	1
C-Complex Area - Anchor Trench	per Sq Ft.	130	50	\$ 6,500.00		\$ 6,500.00	1
New Burn Area - Anchor Trench (large cap)	per Sq Ft.	130	103	\$ 13,390.00		\$ 13,390.00	1
New Burn Area - Anchor Trench (small cap)	per Sq Ft.	130	30	\$ 3,900.00		\$ 3,900.00	1
Waterbore Rip Rap apron (D50-12")	per Ton	40	125	\$ 5,000.00		\$ 5,000.00	1
			subtotal =	\$ 453,390.00		subtotal =	\$ 453,390.00
<b>RIPRAP Cover Reconstruction</b>							
Rock (D50-8")	per Ton	\$ 30	20	\$ 600.00		\$ 600.00	1
Filter Fabric	sq ft	\$ 1.5	765	\$ 1,147.50		\$ 1,147.50	1
Earth Work	Event	\$ 1,000	1	\$ 1,000.00		\$ 1,000.00	1
			subtotal =	\$ 2,747.50	subtotal =	\$ 2,747.50	
<b>Restoring Engineering Control</b>							
	each	\$ 750	6	\$ 4,500.00	Once every 10-years	\$ 13,500.00	3
			subtotal =	\$ 4,500.00	subtotal =	\$ 13,500.00	
<b>Unitentional Breach</b>							
	per Sq Ft.	\$ 12	50	\$ 600.00	500 sq ft every 10-years	\$ 1,800.00	3
			subtotal =	\$ 600.00	subtotal =	\$ 1,800.00	
<b>Engineering Controls Inspection &amp; Maintenance</b>							
Senior Project Manager	hour	\$ 200	2	\$ 400.00	Inspections performed semi-annually	\$ 12,000.00	30
Task Manager	hour	\$ 130	2	\$ 260.00		\$ 7,800.00	30
Project Sci/Eng/Arch/Designer	hour	\$ 121	4	\$ 484.00		\$ 14,520.00	30
Technician I	hour	\$ 82	20	\$ 1,640.00		\$ 49,200.00	30
Truck	each	\$ 150	2	\$ 300.00		\$ 9,000.00	30
Equipment	each	\$ 200	2	\$ 400.00		\$ 12,000.00	30
			subtotal =	\$ 3,484.00	subtotal =	\$ 104,520.00	
<b>Semi-Annual Reporting</b>							
Senior Project Manager	hour	\$ 200	8	\$ 1,600.00	Semi-Annual Reporting	\$ 48,000.00	30
Task Manager	hour	\$ 130	16	\$ 2,080.00		\$ 62,400.00	30
Project Sci/Eng/Arch/Designer	hour	\$ 121	40	\$ 4,840.00		\$ 145,200.00	30
Technician I	hour	\$ 82	16	\$ 1,312.00		\$ 39,360.00	30
			subtotal =	\$ 9,832.00	subtotal =	\$ 294,960.00	

TOTAL =	\$ 870,917.50
Contingency 20%	\$ 174,183.50
<b>FINAL TOTAL =</b>	<b>\$ 1,045,101.00</b>

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