

## Voluntary Remediation Program Work Plan Checklist

Complete Shaded Areas and Submit with Work Plan

Site Name:		VRP Site Code:	
Volunteer/Applicant Name:			
Volunteer/Applicant Email Address and Phone:			
Authorized Agent (AA)/Consulting Company:			
AA/Consultant Email Address and Phone:			

Reference	Summary of Statutory Requirement	Page(s) Where Addressed in Work Plan	VRP Use Only
	<small>(please review all statutes in their entirety to ensure compliance)</small>	<small>(write N/A if not applicable)</small>	
<a href="#">§49-175A.1</a>	Summary of existing site characterization and assessment information; information regarding any remediation previously conducted; copies of referenced reports not previously submitted;		<input type="checkbox"/>
<a href="#">§49-175A.2</a>	If the site has not been characterized, a plan to conduct site characterization and a schedule for completion.		<input type="checkbox"/>
<a href="#">§49-175A.3.a</a>	If site characterization is completed, a description of how the remediation will comply with <a href="#">§49-175B</a> ("Work Plans") and how the completion of remediation will be verified. A schedule for completion must be included.		<input type="checkbox"/>
<a href="#">§49-175A.3.b</a>	If site characterization is completed, the work plan may provide for the remediation to be conducted in phases or tasks. A schedule for completion must be included.		<input type="checkbox"/>
<a href="#">§49-175A.4</a>	Schedule for submission of progress reports.		<input type="checkbox"/>
<a href="#">§49-175A.5</a>	A proposal for community involvement as prescribed by <a href="#">§49-176</a> ("Community Involvement Requirements")		<input type="checkbox"/>
<a href="#">§49-175A.6</a>	If known, a list of institutional or engineering controls necessary during remediation and after completion of the proposed remediation to control exposure to contaminants.		<input type="checkbox"/>
<a href="#">§49-175A.7</a>	A proposal for monitoring during remediation and after the remediation if necessary to verify whether the approved remediation levels or controls have been attained and will be maintained.		<input type="checkbox"/>
<a href="#">§49-175A.8</a>	A list of any permits or legal requirements known to apply to the work or already performed by the applicant.		<input type="checkbox"/>
<a href="#">§49-175A.9</a>	If requested by the department, information regarding the financial capability of the applicant to conduct the work identified in the application. <i>(IF APPLICABLE)</i>		<input type="checkbox"/>

## Voluntary Remediation Program Work Plan Checklist

Complete Shaded Areas and Submit with Work Plan

Site Name: \_\_\_\_\_

VRP Site Code: \_\_\_\_\_

Reference	Summary of Statutory Requirement	Page(s) Where Addressed in Work Plan	VRP Use Only
	(please review all statutes in their entirety to ensure compliance)	(write N/A if not applicable)	
<a href="#">§49-175B</a>	Remediation levels or controls for remediation conducted pursuant to this article shall be established in accordance with rules adopted pursuant to <a href="#">§49-282.06</a> unless one or more of the following applies: see §49-175B.1 through §49-175B.4, below.		<input type="checkbox"/>
<a href="#">§49-175B.1</a>	The applicant demonstrates that remediation levels, institutional controls, or engineering controls for remediation of contaminated soil comply with <a href="#">§49-152</a> and the rules adopted.		<input type="checkbox"/>
<a href="#">§49-175B.2</a>	The applicant demonstrates that remediation levels, institutional controls, or engineering controls for remediation of landfills or other facilities that contain materials that are not subject to <a href="#">§49-152</a> (i.e.: asbestos) do not exceed a cumulative excess lifetime cancer risk between $1 \times 10^{-4}$ to $1 \times 10^{-6}$ , and a hazard index of no greater than 1.		<input type="checkbox"/>
<a href="#">§49-175B.3</a>	The applicant demonstrates that on achieving remediation levels or controls for a source or potential source of contamination to a navigable water, the source of contamination will not cause or contribute to an exceedance of surface water quality standards, or if a permit is required pursuant to <a href="#">33 United States Code §1342</a> for any discharge from the source, that any discharges from the source will comply with the permit.		<input type="checkbox"/>
<a href="#">§49-175B.4</a>	The applicant demonstrates that, on achieving remediation levels or controls for a source of contamination to an aquifer, the source will not cause or contribute to an exceedance of aquifer water quality standards (AWQS) beyond the boundary of the facility where the source is located.		<input type="checkbox"/>
<a href="#">§49-175C</a>	The VRP may waive any work plan requirement under this section that it determines to be unnecessary to make any of the determinations required under <a href="#">§49-177</a> . <i>If any waivers are requested in the Work Plan or have been previously requested and approved by the VRP, cite them in the Work Plan, including a citation of the statute for which the waiver applies.</i>		<input type="checkbox"/>

## Voluntary Remediation Program Work Plan Checklist

Complete Shaded Areas and Submit with Work Plan

Site Name: \_\_\_\_\_

VRP Site Code: \_\_\_\_\_

**To support the prerequisites established by A.R.S. §49-177 and §49-180, the VRP expects certain documentation to accompany a Work Plan. The following provides a list of attachments/exhibits which are recommended for submittal with a Work Plan to provide the information required by the statutes.**

Work Plan Information	Title of Figure/Table/Attachment/Exhibit Where Requested Information is Cited <small>(write N/A if not applicable)</small>	Figure/Table/ Attachment or Report Page Number <small>(write N/A if not applicable)</small>	VRP Use Only
Site Location Map <i>(topographic or aerial)</i>			<input type="checkbox"/>
Site Map <i>(to scale)</i>			<input type="checkbox"/>
Historical Sampling Data Table			<input type="checkbox"/>
Historical Sample Location Map <i>(to scale)</i>			<input type="checkbox"/>
Proposed Sample Location Map <i>(to scale)</i>			<input type="checkbox"/>
Sampling and Analysis Plan <i>(includes Field Sampling Plan &amp; Quality Assurance Plan)</i>			<input type="checkbox"/>
Proposed Remediation System Location Map			<input type="checkbox"/>
Proposed Remediation System Layout <i>(Design Drawings)</i>			<input type="checkbox"/>
Schedule for Implementation of Project Activities* <i>(Gantt Style Chart)</i>			<input type="checkbox"/>
<small>*Project Activities are defined in A.R.S. §§49-175A.2 through 49-175A.4, and 49-176A.2 (Community Involvement).</small>			
Proposed Language for Public Notification of Remediation <i>(i.e.: example signage)</i>			<input type="checkbox"/>
Plan for Investigative Derived Waste (IDW)			<input type="checkbox"/>
Evaluation of Remedial Alternatives <i>(i.e: for Feasibility Study Work Plan)</i>			<input type="checkbox"/>

**DOES THE WORK PLAN PROPOSE IMPLEMENTING SITE-SPECIFIC REMEDIATION LEVELS?**

Yes                      No  
                     

**DOES THE WORK PLAN PROPOSE EVALUATION OF BACKGROUND LEVELS?**

Yes                      No  
                     

NOTE: When reports are submitted which document any type of sampling activity, the submittal of Electronic Data per ADEQ's [Groundwater Data Submittal Guidance \(V3.4\)](#) is strongly recommended.

**VOLUNTARY REMEDIATION  
PROGRAM WORK PLAN**

**FORMER MYSTIC MINE AREA  
NE OF LONE MOUNTAIN PARKWAY AND  
NORTH VISTANCIA BOULEVARD  
PEORIA, ARIZONA**

**GEOtek PROJECT No. 1795.1-PHR**



**G E O T E K**

GEOTECHNICAL | ENVIRONMENTAL | MATERIALS

**VOLUNTARY REMEDIATION PROGRAM  
WORK PLAN REVISED**

**FORMER MYSTIC MINE AREA  
NE OF LONE MOUNTAIN PARKWAY AND  
NORTH VISTANCIA BOULEVARD  
PEORIA, ARIZONA**

DATED: JUNE 25, 2020

PREPARED FOR:

**LAKE PLEASANT (PHOENIX) ASLI VIII, LLC  
c/o AVANTI ACQUISITION COMPANY, LLC AND  
4248 NORTH CRAFTSMAN COURT, SUITE 100  
SCOTTSDALE, AZ 85251**

PREPARED BY:



**GEO TEK RESIDENTIAL, LLC  
4050 EAST COTTON CENTER BOULEVARD, SUITE 49  
PHOENIX, AZ 85040 PHONE: 480-505-9422**

GEO TEK PROJECT No. 1795.1-PHR

BY:

  
\_\_\_\_\_  
HOLLY LAND  
SENIOR REGULATORY SPECIALIST

AND BY:

  
\_\_\_\_\_  
CHET L. PEARSON, P.E.  
PRINCIPAL ENGINEER



## TABLE OF CONTENTS

<b>1.0 INTRODUCTION</b> .....	<b>1</b>
1.1 SITE DESCRIPTION .....	1
1.2 VRP ACTIVITIES .....	2
1.3 AVAILABLE DOCUMENTS .....	3
<b>2.0 SUMMARY OF PREVIOUS ASSESSMENTS</b> .....	<b>3</b>
2.1 ALLWYN PHASE I ESA AND LIMITED SOIL ASSESSMENT .....	3
2.2 ALLWYN PHASE II ESA.....	4
2.3 ALLWYN GEOTECHNICAL EVALUATION.....	5
<b>3.0 ADDITIONAL GTR SITE CHARACTERIZATION</b> .....	<b>6</b>
3.1 GTR ADDITIONAL ASSESSMENT .....	6
3.2 FIELD WORK AND RESULTS .....	7
3.3 WASTE ROCK VOLUME ESTIMATES .....	10
3.4 SAMPLE ANALYSIS.....	10
3.5 ADEQ XRF SAMPLING AND RESULTS .....	12
<b>4.0 REMEDIATION ACTIVITIES</b> .....	<b>14</b>
4.1 PLANNED REMEDIAL ACTIVITIES.....	14
4.2 COMPLIANCE CONSIDERATIONS .....	17
4.2.1 Stormwater Pollution Prevention .....	17
4.2.2 Dust Control.....	18
4.2.3 Soil Remediation Levels and Groundwater Protection Levels.....	18
4.2.4 Clean Water Act Section 404.....	19
4.3 SCHEDULE.....	19
4.4 COMMUNITY INVOLVEMENT .....	20

## **FIGURES**

1	Site Vicinity Map
2	Maricopa Assessor's Parcel Map and Site Boundary
3	Allwyn Phase I ESA Sample Location Map
4	Allwyn Phase II ESA Sample Location Map
5	Allwyn Phase II ESA Background Samples
6	GTR Sample Location Map
7	ADEQ's Sample Locations
8	Mine Waste Material Areas
9	Consolidated and Moved Materials Areas
10	Arsenic Isopleth Map Waste Rock Samples
11	Lead Isopleth Map Waste Rock Samples

## **TABLES**

1	Sample Information
2.1	Summary of RCRA Metals in Background Soil Samples and Regulatory Standards – Allwyn Phase II ESA
2.2	Summary of Metals in Soil Samples and Regulatory Standards – Allwyn Phase I ESA
2.3	Summary of Metals in Soil Samples and Regulatory Standards – Allwyn Phase II ESA

- 2.4 Summary of Chromium in Soil Samples and Regulatory Standards – Allwyn Phase II ESA
- 2.5 Summary of Leachable Metals in Soil Samples and Regulatory Standards – Allwyn Phase II ESA
- 3 Summary of RCRA Metals in Soil Samples and Regulatory Standards – GTR 2019 Assessment
- 4 Alternative GPL Calculations for Lead

**APPENDICES**

- A Previous Reports
- B Sampling and Analysis Plan
- C Quality Assurance Project Plan
- D Laboratory Analytical Results
- E ADEQ's Sample Analysis
- F Preliminary Grading Plan
- G Community Involvement

## **I.0 INTRODUCTION**

Lake Pleasant (Phoenix) ASLI VIII, LLC (Avanti) owns land located northeast of Lone Mountain Parkway and North Vistancia Boulevard in Peoria, Arizona. Avanti is developing the Lake Pleasant Heights residential community on this land. An area of mine waste rock was identified on the Site, and this area was assessed. Based on the previous sampling and testing, heavy metals were identified in the mine waste rock materials at concentrations greater than regulatory standards. Avanti desires to consolidate the mine waste rock piles into a single pile in a smaller area to allow for surrounding development. The consolidated pile will be covered with soil to provide a barrier over the waste rock materials. Avanti entered the Arizona Department of Environmental Quality (ADEQ) Voluntary Remediation Program (VRP) to conduct the remedial actions. Avanti retained GeoTek Residential, LLC (GTR) to oversee this project.

### **I.1 SITE DESCRIPTION**

The Site is located northeast of Lone Mountain Parkway and North Vistancia Boulevard in Peoria, Arizona at the approximate location shown on Figure 1. The Site is identified as a portion of Maricopa County Assessor's Parcel Number (APN) 503-88-006G previously identified as portions of APNs 503-88-006A and 006B within the Lake Pleasant Heights Property, and it covered about 25 acres of land as shown in Figure 2. The center of the Site was estimated to be located at a latitude of approximately 33.7881° North and a longitude of approximately -112.3236° West. The Site is located in Section 12, Township 5 North, Range 1 West of the Gila and Salt River Baseline and Meridian System.

Based on GTR's review of historical documents, the Site was historically vacant desert land used for livestock grazing. The Mystic Mine records indicated that mining claims were first filed and staked in 1972 and 1973. They were initially mining lead (concentrations up to 2 percent) and zinc, but some gold was discovered in a 1975 drilling program. The Mystic Mine records indicated that numerous exploration holes were drilled in 1980-1981 and in 1987-1988 to assess the ore bodies. An inspection record from 1997 indicated that Fischer Watt produced 18,000 tons of ore. The mine had a total length of 3,250 feet.

Based on GTR's review of aerial photographs and mining records, the entrance to the Mystic Mine was located in the north-central portion of the Site, and the inclined entrance extended westerly off the Site. The deeper portions of the underground mine were on and off the Site. We found no records of leaching procedures on the Site. The leaching ponds for this mine were west of the Site. In the 1990s, there were various piles of materials on the main portion of the Site. In a 1996-1997 aerial photograph, we observed an apparent construction trailer and some equipment on this portion of the Site. East of construction trailer, we observed a ramp that descended approximately 20 feet into the ground to an apparent mine entrance. In a 2002 aerial photograph, the ramp and mine entrance were filled, and mining activities appeared to be abandoned. The mine waste rock materials were spread across approximately 6 to 7 acres of land located on the Site.

## **I.2 VRP ACTIVITIES**

Avanti submitted a VRP application request to ADEQ on August 13, 2019. In a letter dated August 30, 2019, ADEQ notified Avanti the Site was accepted into the VRP. ADEQ wanted to call the project Mystic at Lake Pleasant Heights, and it has a Site Code of 513298-00. Caitlin Burwell was identified as the project manager.

This Work Plan summarizes previous assessments of the Site. The mine waste rock materials were assessed for a variety of contaminants including heavy metals, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), polynuclear aromatic hydrocarbons (PAHs), total cyanide, and free cyanide. Metals were the only identified constituents of concern (COCs) at concentrations above remedial standards. The current mine waste rock piles will be consolidated into a composite stockpile to be covered with soil and remain in place. The area cleared of the current waste rock will be available for future residential development, and the composite stockpile will remain an undeveloped track area with a deed restriction.

The goal of this Work Plan is to obtain an unconditional determination of No Further Action (NFA) from the ADEQ VRP for the Resource Conservation and Recovery Act (RCRA) metals arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver in the area cleared of waste rock (areas reclaimed for development) without an encumbrance (e.g. environmental use restriction or activity and use limitation) on the title. The stockpile will contain waste rock materials with elevated concentrations of metals, so these materials will be covered with soil and remain in an undeveloped tract along the future El Mirage Road. This tract area will need a conditional NFA and a declaration of environmental use restriction (DEUR) due to the waste rock materials. The current and foreseeable use of this area are residential subdivisions and some limited commercial areas.

Except for lead, the appropriate remedial goals are the ADEQ pre-determined  $10^{-5}$  residential soil remediation levels (SRLs) and the minimum groundwater protection levels (GPLs). For lead, GTR calculated a Site-specific Alternative GPL of 1,448.3 milligrams per kilogram (mg/kg). Therefore, the requested remediation goal for lead is the ADEQ pre-determined  $10^{-5}$  residential SRL of 400 mg/kg. The COCs include RCRA Metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver).

GTR submitted an initial Remediation Work Plan dated April 2, 2020 which included options to remediate the areas to be reclaimed for development by excavating the soil to below the SRLs, minimum or alternative GPLs, except for arsenic. For arsenic, the remediation goal was to be either be the calculated, Site-specific background concentration or remediation to bedrock in the areas reclaimed for development whichever is most appropriate. However, as discussed in Section 3.5, the results of the background arsenic evaluation indicate excavation to bedrock in the areas to be reclaimed for development will be the most cost-effective option. Therefore, this revised Work Plan includes excavation to bedrock in the areas to be reclaimed for development. The excavated material will be placed into the consolidation pile with waste rock materials and covered with soil to provide a Cap over the waste rock materials. The compacted Cap soil should provide a physical barrier to human contact with the waste rock materials, and the compacted Cap soil and grading of the pile should promote runoff of

stormwater off the pile to limit water infiltration into the waste rock materials in the future. A conditional NFA and a DEUR will be requested for the consolidation pile area as discussed above.

### **I.3 AVAILABLE DOCUMENTS**

Reports summarizing pertinent assessment activities and previous remediation activities performed at the Site are listed below. An electronic copy of the pertinent portion of each report was previously provided to ADEQ and is included with this Work Plan as Appendix A. These reports are discussed in more detail in Section 2.

*Phase I Environmental Site Assessment, Lake Pleasant Heights, NE of W. Lone Mountain Rd. & N. Vistancia Blvd., Peoria, AZ (Allwyn Project No. 0151-0001); Allwyn Consultants; December 27, 2016*

*Phase II Environmental Site Assessment, Lake Pleasant Heights, NE of W. Lone Mountain Rd. & N. Vistancia Blvd., Peoria, AZ (Allwyn Project No. 0151-0002); Allwyn Consultants; September 9, 2016.*

*Geotechnical Assessment, Lake Pleasant Heights, NE of W. Lone Mountain Rd. & N. Vistancia Blvd., Peoria, AZ (Allwyn Project No. 0151-0003); Allwyn Consultants; September 27, 2016.*

## **2.0 SUMMARY OF PREVIOUS ASSESSMENTS**

Site assessment and characterization activities were performed by Allwyn in 2016. In addition, GTR performed an additional assessment of the waste rock at the Site in 2019. These assessment activities are detailed in the reports listed in Section 1.3 of this Work Plan. Important details of the characterization activities are summarized in Sections 2.1 through 2.3 below.

### **2.1 ALLWYN PHASE I ESA AND LIMITED SOIL ASSESSMENT**

Allwyn previously conducted a Phase I Environmental Site Assessment (ESA) for Avanti on the entire Lake Pleasant Heights Property. The previous Allwyn report was titled *Phase I Environmental Site Assessment, Lake Pleasant Heights, NE of W. Lone Mountain Rd. & N. Vistancia Blvd., Peoria, AZ (Allwyn Project No. 0151-0001)* and was dated December 27, 2016. At the time of the report, the Property was comprised of three non-contiguous portions of land located north and south of the Central Arizona Project (CAP) Canal identified as APNs 503-88-008, 503-88-007A, 503-88-007G, 503-88-006A, 503-88-006B, 503-88-006C, 503-88-006D, 503-88-006E, and 503-88-019C and covered approximately 1086.50 acres. The Property was mostly undeveloped native desert land with some unpaved roads and dirt trails traversing the Property. Allwyn observed remnants of previous mining activities on the northwest portion of APN 503-88-006A and on APN 503-88-006B of the Site. The remnants included an abandoned mine shaft, about 6 to 7 acres of mine waste materials spread across the ground surface, and

some graded areas previously used by mining vehicles and equipment. Some mine leach pits were observed off the Property directly west of the northwest portion of APN 503-88-006A. Allwyn observed groundwater monitoring wells located near the mining operations that were apparently installed for environmental permit compliance requirements. Based on a review of well records, groundwater levels were reported from 143 to 530 feet below the ground surface (bgs) in various years from 1994 to 2003 at the Property. Based on an Arizona Department of Water Resources (ADWR) map of groundwater levels from 2002-2003, the Property was located within the Hieroglyphic Mountains, and groundwater levels were not shown for the immediate Property vicinity. Groundwater was at a depth of about 452 feet bgs in a well southwest of the Property. The mining operations reportedly extended to a depth of about 300 feet at the mine in the past.

Allwyn conducted a limited soil assessment as part of the Phase I ESA services in the mine waste rock area and adjacent to the off-site leaching pits. Sample locations are shown in Figure 3. Several samples collected from the mine waste material area contained arsenic, chromium, and/or lead at concentrations above their respective residential and non-residential SRLs. The arsenic concentrations were within typical background concentrations for Arizona soils, so these detections could be natural soil background concentrations. One chromium concentration exceeded the residential and non-residential SRLs for Chromium VI, but not the SRLs for Chromium III. One sample contained lead at a concentration of 1,230 mg/kg, well above the residential SRL of 400 mg/kg and the non-residential SRL of 800 mg/kg.

Allwyn completed a Phase I ESA on the Property and recommended additional assessment in these two areas of the Site.

## **2.2 ALLWYN PHASE II ESA**

Allwyn further assessed these areas as part of a Phase II ESA. The previous Allwyn Phase II ESA report was titled *Phase II Environmental Site Assessment, Lake Pleasant Heights, NE of W. Lone Mountain Rd. & N. Vistancia Blvd., Peoria, AZ* (Allwyn Project No. 0151-0002) and was dated September 9, 2016. Allwyn excavated 16 test pits in and around the area of the mine waste rock materials to aid in evaluating the depth and potential impact of the spread mine waste rock material. Sample locations are shown in Figure 4. Allwyn obtained two discrete soil samples from each test pit; one sample within the mine waste rock materials and one sample in the natural soils beneath the mine waste rock material. Allwyn indicated at the test pit locations, mine waste material was present to depths of 1 to 11 feet below ground surface (bgs), but the depth of mine waste materials was about 2 to 4 feet bgs at most locations. As part of the Phase II ESA, Allwyn determined the northern and eastern portions of the mine waste rock area had exposed side slopes of 10 to 15 feet, so the mine waste materials were likely about 10 to 15 feet thick in these areas. Based upon the depths and locations of the exploratory test pits, Allwyn estimated the amount of mine waste rock material to be about 40,000 cubic yards in the 6 to 7 acres covered by these materials. The excavated depths in the northern and eastern perimeters of the mine waste area did not reflect Allwyn's observations of the slopes in these areas.

In general, the mine waste rock materials and natural soils beneath the mine waste rock materials were analyzed for total metal concentrations, total and free cyanide, VOCs, semi-VOCs, and PAHs. Several of these samples contained elevated concentrations of arsenic, chromium, and/or lead, well above typical background concentrations for Arizona soils. Allwyn indicated the samples with the highest arsenic, chromium, and lead concentrations were also analyzed for toxicity characteristic leachate procedure (TCLP) arsenic, TCLP chromium, and/or TCLP lead. According to the report, no TCLP arsenic, TCLP chromium, or TCLP lead were detected, except for one detection of TCLP lead in Sample B-2-2, at a concentration less than the hazardous waste level. Allwyn indicated they would not expect these samples to exhibit hazardous waste characteristics. Allwyn also conducted speciation testing on the samples with the highest detections of chromium. No Chromium VI or Hexavalent Chromium were detected in these samples.

Twenty-two background soil samples were also collected from the mine waste rock surrounding area and other portions of the Property located over several hundred feet from the mine waste rock material area. The locations of the background samples are shown on Figure 6. Allwyn indicated that the natural soils near the mine waste area have variable low to high concentrations of arsenic, chromium, and lead. The soils in other portions of the Property (well away from the mine waste rock area) appear to have arsenic and chromium at concentrations within typical natural soil background concentrations for Arizona soils. Allwyn indicated these soils have some areas with lead concentrations above the typical range of natural soil background concentrations for Arizona soils. Based on the findings, Allwyn suspected that the mine waste materials may have impacted the underlying natural soils, the natural soils may have elevated concentrations of these metals (typical for mining areas), and/or a combination of these factors. Allwyn concluded the mine waste materials would require remedial action prior to the development of the mine waste area.

Allwyn also assessed the two off-site mine leaching pits located approximately 0.2-mile northwest of the mine waste rock area. Allwyn concluded that the soils in this area have naturally occurring elevated lead concentrations, or there may have been some impact to these soils from the off-site operations in the past. However, the detected concentrations were all below the residential SRLs or within the typical range of natural background concentrations for Arizona soils in the case of arsenic. Therefore, Allwyn believed that no additional assessment or remedial actions are required in this area.

### **2.3 ALLWYN GEOTECHNICAL EVALUATION**

Allwyn was also retained to further evaluate the mine area to aid in evaluating geotechnical issues associated with developing the ground surface above the mine workings. The report was titled *Geotechnical Assessment, Lake Pleasant Heights, NE of W. Lone Mountain Rd. & N. Vistancia Blvd., Peoria, AZ* (Allwyn Project No. 0151-0003) and was dated September 27, 2016. As part of this effort, additional mine documents were obtained from several sources. The documents provided additional details on the Mystic Mine shaft and workings. Allwyn indicated the mine waste area contained from 1 foot to over 11 feet of mine waste material or undocumented fill materials. The report indicated there may be as much as 20 to 30 feet of undocumented fill in the location of the filled entrance ramp located on the northern portion of the mine waste rock

area. This volume was not included in Allwyn's previous estimate of the volume of waste rock materials at the Site. Allwyn indicated, based on the size and slope of the mine entrance shaft or incline, the first 400 feet of the shaft should be filled with an inert material in order to be structurally sound for development over this portion of the mine shaft. Mine Shaft I was also located in the northern portion of the mine waste area and was previously open to a depth over 20 feet bgs. Allwyn indicated this shaft likely intersected the mine entrance shaft or incline and was likely an air shaft. Allwyn concluded when the mine features were backfilled, they were not placed under engineering observation and testing for compaction, so no structures or pavement can be constructed on these materials without removal and replacement as compacted fill under engineering observation and testing, assuming that the materials are suitable from an environmental and regulatory perspective. Therefore, the consolidated mine waste rock materials will be placed over the inclined shaft area, since this area is not available for development without significant remedial actions.

### **3.0 ADDITIONAL GTR SITE CHARACTERIZATION**

#### **3.1 GTR ADDITIONAL ASSESSMENT**

GTR reviewed the previous Allwyn data to aid in evaluation the potential need for any additional assessment work on the Site. Based on our review, we believed that some additional backhoe exploratory excavation work was needed in order to further refine the volume estimate of the mine waste rock materials. For example, the mine entrance location was found after most of Allwyn's previous environmental assessment work, and there was likely a significant depth of waste rock at this location. To further assess the mine waste rock materials and the extent of underlying natural soils, GTR excavated through the mine waste materials and into the underlying natural soils to measure the thickness of the existing mine waste rock, and the test pits were extended to underlying rock if possible to measure the thickness of the natural soils between the overlying waste rock and underlying bedrock. Based on the previous sampling and testing, there were numerous samples of the waste rock materials, and these samples indicated that the waste rock had metals concentrations (arsenic, chromium, and/or lead) above and below the residential and non-residential SRLs and minimum GPLs. Similarly, the native soils beneath the waste rock materials had metals concentrations (arsenic, chromium, and/or lead) above and below the residential and non-residential SRLs and minimum GPLs. In a few cases, the native soil metals concentrations were higher than the waste rock material concentrations above the native soils. Therefore, it seemed like the native soils in this area had variable low to high metals concentrations. This trend was also observed in the background soil samples previously obtained. In order to obtain more data for background metals concentrations in the native soils, additional samples of the native soils beneath the waste rock materials and around the mine waste rock area were obtained as part of the additional assessment.

We also excavated test pits/trenches along the inclined mine shaft entrance near the western portion of the mine waste rock area as a potential future storage area for the waste rock materials.

### 3.2 FIELD WORK AND RESULTS

A Site- and project-specific Health and Safety Plan (HASP) was developed to conduct the assessment work in a safe manner in general accordance with Title 29 Code of Federal Regulations Part 1910 (29 CFR 1910). The purpose of the HASP was to assign responsibilities, to establish personnel protection standards and mandatory safety practices and procedures, and to provide for contingencies that may arise while operations are being conducted at the Site. Contamination may be encountered in the areas where sampling is to be performed, requiring a personal protection equipment minimum of nitrile gloves, safety glasses, hard hat, and steel-toe boots. A copy of the HASP was kept on the Site during sampling activities.

The field work was conducted on three separate occasions by Adrian Gora of GTR. The initial sampling was conducted on March 15, 2019, and additional sampling was conducted on March 29, 2019, and April 22, 2019. Sampling locations are shown in Figure 6, and the laboratory results are presented in Table 3. Analytical laboratory reports are provided in Appendix D.

In order to further assess the mine waste rock materials and the extent of the underlying natural soils at the Site, GTR excavated 11 test pits/trenches near the northern and eastern perimeters of the mine waste rock area. GTR attempted to excavate through the mine waste materials and into the underlying natural soils to measure the thickness of the existing mine waste materials at several locations along the slopes adjacent to the wash. GTR also excavated test pits/trenches along the mine shaft entrance or incline near the western portion of the mine waste area to determine if the underlying soils in this area could be excavated and used as potential capping material. The native soils at the Site ranged from light whitish brown due to cementation to reddish brown. The native soils have low concentrations of gravel and cobbles, and the waste rock materials typically had high concentrations of gravel and cobble with little soils. Therefore, the interface between the waste rock materials and the native soils was typically apparent.

Trench T1 – the waste rock materials extended to a depth of about 2 feet at the north end of the trench to 3 feet at the south end. Native soils were observed beneath the waste rock materials, and Sample T1-S1 was obtained from a depth of 2 to 3 feet in the native soil. Rock was encountered at a depth of about 3 feet at the north end and 4 feet at the south end indicating about 1 foot of native soil at this location.

Trench T2 – the waste rock materials extended to a depth of about 7 feet. Native sand soils were observed beneath the waste rock materials, and Sample T2-S1 was obtained from a depth of 7 to 8 feet in the native soil. Rock was encountered at a depth of about 8 feet bgs indicating about 1 foot of native soil at this location.

Trench T3 – the waste rock materials extended to a depth of about 7 feet. Native sand soils were observed beneath the waste rock materials, and Sample T3-S1 was obtained from a depth of 7 to 8 feet in the native soil. Rock was encountered at a depth of about 8 feet bgs indicating about 1 foot of native soil at this location.

Trench T4 – the waste rock materials extended to a depth of about 2 feet. Native sand soils were observed beneath the waste rock materials, and Sample T4-S1 was obtained from a depth of 2 to 3 feet in the native soil. Rock was encountered at a depth of about 3 feet bgs indicating about 1 foot of native soil at this location.

Trench T5 – the waste rock materials extended to a depth of about 1 foot. Native sand soils were observed beneath the waste rock materials, and Sample T5-S1 was obtained from a depth of 1 to 2 feet in the native soil. Rock was encountered at a depth of about 3 feet bgs indicating about 2 feet of native soil at this location.

Trench T6 – this trench was excavated to find the previous mine inclined shaft entrance. We found a ladder in the fill materials. We observed two north-south I beams at an approximate depth of 17 feet at this location, likely associated with the previous mine shaft opening. We also observed some metal mesh that may have been a screen across the previous opening extending to a depth of about 20 feet, the vertical extent of the backhoe. If the I beams were located above the opening in the past, there is likely about 30 feet of fill materials at this location. No voids, shafts, or other indications of the open shaft were observed.

Trench T7 – the waste rock materials extended to a depth of about 1 foot. Native sand soils were observed beneath the waste rock materials, and Sample T7-S1 was obtained from a depth of about 2 feet in the native soil. Rock was encountered at a depth of about 2 feet bgs indicating about 1 foot of native soil at this location.

Trench T8 – the waste rock materials extended to a depth of about 1 foot. Native sand soils were observed beneath the waste rock materials, and Sample T8-S1 was obtained from a depth of about 1 foot in the native soil. Rock was encountered at a depth of about 2 feet bgs indicating about 1 foot of native soil at this location.

Trench T9 – this trench was excavated near the west end of the Site to evaluate the depth of native soils potentially for use as cover materials. Some reddish-brown soils were at the ground surface that may have been fill materials, and light brown native soils were present beneath these surface fill materials to a depth of 2 to 4 feet. Sample T9-S1 was obtained from a depth of 4 feet in the native soil. Rock was encountered at a depth of about 4 feet bgs indicating about 3 feet of native soil at this location.

Trench T10 – the waste rock materials extended to a depth of about 3 feet. Native sand soils were observed beneath the waste rock materials, and Sample T10-S1 was obtained from a depth of about 4 feet in the native soil. Rock was encountered at a depth of about 4 feet bgs indicating about 1 foot of native soil at this location.

Trench T11 – the waste rock materials extended to a depth of about 8 feet. Native sand soils were observed beneath the waste rock materials, and Sample T11-S1 was obtained from a depth of about 8 to 9 feet in the native soil. Rock was encountered at a depth of about 4 feet bgs indicating about 1 foot of native soil at this location.

The depths of waste rock at the trench locations were used to evaluate the volume of waste rock materials at the Site and to aid in remediation planning as discussed in Section 3.4 below.

GTR collected soil samples from the native soils beneath the waste rock and in areas around the mine waste rock materials to further evaluate background concentrations of arsenic, lead, and chromium in the natural soils at the Site. GTR obtained a total of 37 soil samples from the Site. Samples from the test pits were obtained directly from the sidewall of the test pit for the shallower samples, and deeper samples were obtained from the central portion of the backhoe bucket at the desired sampling depth in the native soils. These samples were evaluated by a portable photoionization detector (PID) in the field, and no significant PID readings were detected. At each surface sample location, the loose surface soils were cleared, and a hole was excavated to a depth of about 0 to 3 inches, and a surface soil sample was obtained over this depth interval. In a few cases, the hole was excavated deeper to avoid surface fill materials or disturbed natural soils from on-site activities. No stained or odorous soils or materials were noted in the test pits.

Prior to collecting the samples, GTR staff decontaminated sampling equipment by washing the equipment in a water and Alconox (an anionic cleaning detergent) mix followed by a distilled water rinse. Equipment was air dried or dried with paper towels. Nitrile sampling gloves were worn during sample collection. GTR staff used a clean hand shovel obtain the soil samples from the backhoe bucket or from the test pit excavation. The soil samples were placed into new glass jars provided by the analytical laboratory. Once full, each jar containing a soil sample was sealed with a Teflon-lined lid.

Each jar containing a sample was labeled with a unique sample number. This identification number, sample date and time, selected analytical parameters, and the name of the sampling personnel will be recorded on a chain-of-custody record. The chain-of-custody record accompanied the samples from sample collection until the samples were transferred to the analytical laboratory representative. After the sample containers were labeled with the sample number, the samples were then placed in a re-sealable plastic storage bag and placed in an ice chest with water ice pending delivery to the analytical laboratory. The samples were relinquished (along with chain-of-custody documentation) to a representative of Pace Analytical (Pace) and is analytical laboratory certified (License No. AZ-0612) by the Arizona Department of Health Services (ADHS) for analysis.

The laboratory was requested to analyze the samples RCRA Metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver) – using EPA Methods 6010B and 7471A. The laboratory reports are attached in Appendix D.

As shown on Table 3, no selenium or silver was detected in the first set of additional samples, and the detected concentrations of barium, cadmium, mercury, and silver did not exceed their respective residential or non-residential SRL or minimum GPL. For the native soil samples obtained from the Site, arsenic was detected at concentrations ranging from 2.95 mg/kg to 239 mg/kg, total chromium was detected at concentrations ranging from 8.01 mg/kg to 232 mg/kg, lead was observed ranging from 11.3 mg/kg to 7,530 mg/kg, mercury was detected at concentrations of less than 0.0200 mg/kg to 0.382 mg/kg, and silver was detected in one sample

at a concentration of 1.54 mg/kg. At various locations, the detected concentrations of arsenic, chromium, and/or lead exceeded their respective residential and non-residential SRLs and/or minimum GPLs. However, based on the previous sampling and testing at the Site, no Chromium VI has been detected in several samples from Site, so we suspect that the identified concentrations of total chromium are likely Chromium III. No detected concentrations exceed the Chromium III residential SRL or minimum GPL for total chromium.

The detected lead and arsenic concentrations detected in Sample G-2 were higher than anticipated for background soil concentrations. Additional research was conducted on this sample location, and a previous exploration shaft was identified in historical aerial photographs. Therefore, the elevated concentrations of arsenic and lead were likely from excavated rock materials used to backfill this exploration shaft, and this sample was no longer considered a background soil sample. Additional samples were obtained from this area on March 29, 2019 to aid in delineating the extent of the additional rock materials with elevated concentrations of lead and arsenic. The lead and arsenic concentrations significantly reduced in a sample (G2-2) obtained from a depth of 3 feet in this area. Sample AD2-4 had high lead and arsenic concentrations similar to Sample G2. Additional surrounding samples were obtained on April 22, 2019 to further delineate the lateral extent. The samples obtained from around this area seemed to delineate the extent of the materials with high concentrations of arsenic and lead. This area was added as an additional area (Area 5) for remedial efforts.

GTR noted that the background soil samples with higher metals concentrations were typically the red colored soils and gray colored soils. The typical light brown soils typically had lower heavy metals concentrations. The soil colors are likely indicators of the parent rock materials that degraded over the years into the soils.

### **3.3 WASTE ROCK VOLUME ESTIMATES**

Allwyn had previously estimated just under 40,000 cubic yards of waste rock materials at the Site. Based on the additional assessment by GTR, some of the previous depth estimates by Allwyn were revised, especially the depth of waste rock materials at the mine entrance, and additional areas were identified as Area 5 in the previous exploration shaft area and Area 7 in the southeastern portion with some mine waste rock materials spread across the ground surface at a lower elevation than the main pile. GTR estimated about 43,000 cubic yards of waste rock materials including the materials with elevated concentrations of lead and arsenic in Area 5.

### **3.4 SAMPLE ANALYSIS**

GTR summarized all of the previous and current laboratory data in tables showing the sample results for the metals analyzed as typically required by ADEQ. Table I shows a listing of the samples and the tests performed on the samples. As previously discussed, no total or free cyanide, VOCs, semi-VOCs, or PAHs were detected in samples of the waste rock materials, so these test results were not summarized in tables. There were numerous metals detections, so the metals test results were summarized in the attached Tables 2.1, 2.2, 2.3, 2.4, 2.5, and 3.

GTR prepared isopleth maps for arsenic and lead showing the variability of arsenic and lead concentrations at the Site. The isopleth maps are included as Figures 10 and 11.

As requested by ADEQ, the background soil sample population and the waste rock sample population were analyzed using the Gilbert Toolbox to evaluate whether the two populations were the same or different. This analysis was to be used in the process to develop a site-specific background concentration for arsenic and lead for use during the remediation. Based on the sampling and testing to date, the natural soils near the Site have variable arsenic, lead, and chromium concentrations. Several samples with elevated concentrations of total chromium have been analyzed for Chromium VI, and Chromium VI was not detected at concentrations above the laboratory reporting limits. Therefore, we presumed that ADEQ would agree with using the Chromium III SRLs for this Site, and based on comments from ADEQ during the review of the initial Work Plan, ADEQ agreed that the Chromium II SRLs can be used for this project. Therefore, based on the detected concentrations, chromium was no longer a driver for the remediation work at the Site.

GTR conducted an initial statistical analysis using the Gilbert Toolbox set of statistical tests including the Quantile Test, Gehan Test, T-Test, and Slippage Test. The objective of conducting the statistical evaluation was to assess the background concentrations of arsenic and lead in the soils compared to the concentrations of arsenic and lead in the waste rock materials to evaluate whether these populations were sufficiently different to calculate a remediation level for arsenic and lead in natural soils. Based on GTR's statistical analysis, the waste rock sample population was slightly different than the background soil sample population. However, as discussed below, ADEQ's consultant did not agree with GTR's evaluation.

The ADEQ had a 3<sup>rd</sup> Party Consultant review the data provided in the initial Work Plan, and based on their initial analysis, it appeared that the difference in the waste rock (potential source) samples and background samples were statistically insignificant as whole, and the background concentrations were similar to potential source areas. Based on discussions with ADEQ, we suspect that there are two or three populations of background soils with different levels of metals concentrations in the Site vicinity. There are native soils at the Site and in the Site vicinity that are different colors - red, gray, and light brown, with varying concentrations of arsenic and lead. The red soil samples appeared to have higher metals concentrations, gray soil samples had intermediate metals concentrations, and light brown soil samples had lower concentrations of lead and arsenic. Therefore, ADEQ indicated additional background soil sampling and testing would likely be required to evaluate two or three background soil populations, and additional statistical evaluation of the new and previous data would be required to determine a Site-specific remediation level for the various background soil units at the Site. Based on our discussions with ADEQ and Avanti, GTR concluded the most cost-effective solution would be to excavate the waste rock materials and underlying native soils to bedrock and place the excavated material in the consolidation pile. ADEQ requested a revised Remediation Work Plan to document this decision.

The ADEQ GPL guidance allows for the calculation of an Alternative GPL using Site analytical data. GTR calculated an Alternative GPL for lead using the approach detailed in the ADEQ in the document titled *A Screening Method to Determine Soil Concentrations Protective of Groundwater*

Quality dated September 1996. The Alternative GPL was calculated using results of samples collected for total and leachable fraction of lead using TCLP and Synthetic Precipitation Leaching Procedure (SPLP) and calculated the following equation:

$$X_s = (292.9)RC_w$$

Where R is the ratio between the total lead concentration and the concentration of the leachable concentration of lead in each soil sample analyzed for both the total concentrations and leachable concentration of lead.  $C_w$  is equivalent to the Aquifer Water Quality Standard (AWQS) for lead of 0.005 milligrams per Liter (mg/L). The constant, 292.9, results from calculations involving the mixing cell dimensions, groundwater flow rate, and infiltration of base case conditions.  $X_s$  is the calculated Alternative GPL and represents the maximum allowable total lead concentration in the soil which achieves protection of groundwater quality. The results of the Alternative GPL calculations are shown in Table 4.

For the samples collected for both total and leachable concentrations of lead, the sample with the lowest ratio (R) between total and leachable concentrations of lead was selected as the basis of the Site-specific Alternative GPL, because it represents the most severe leaching potential for the Site soil. Based on this value of R, the calculated Alternative GPL is 1,448.3 mg/kg. Therefore, the requested remediation goal for lead is the ADEQ pre-determined  $10^{-5}$  residential SRL of 400 mg/kg.

### 3.5 ADEQ XRF SAMPLING AND RESULTS

ADEQ used an X-ray fluorescence (XRF) spectrometer to analyze the soil and sediment samples collected at the Site on October 25, 2019. During the Site walk on October 25 with GTR, ADEQ collected five (5) soil samples and three (3) sediment samples from the wash east of the mine waste rock pile, and replicates were run on each media. A table showing the results is included in Appendix E. Figure 7 shows the location of each sampling point.

Based on the XRF findings, ADEQ requested consideration of the following:

1. The concentrations of antimony observed at the Site are significantly higher than those presented in the Allwyn Phase II ESA. Furthermore, vanadium was not sampled during Phase II ESA activities. As such, the VRP recommends adding antimony and vanadium to the contaminants of potential concern.
2. Sample location S-4 appears to fall outside of the boundary of the consolidation pile, as well as the proposed reclaimed area for development. Based on the results of the XRF analysis and the fact that sample B-12 was not analyzed, the VRP recommends expanding the Site boundaries to include the area around S-4. With further research, GTR expanded the Site boundary to include this area, and Figure 8 shows the area labeled as Area 8.

The previous Phase II ESA work included 12 samples of the waste rock materials analyzed for the 13 Priority Pollutant Metals plus Barium in accordance with typical ADEQ protocols, and

the antimony test results were less than 2.0 mg/kg to 4.11 mg/kg. Therefore, antimony was not considered a COC. ADEQ's samples S-3 and S-5 were a distance from the waste rock area in areas outside of potential waste rock drainage, and these samples had results of 28 and 49 mg/kg, one above the residential SRL in the same range as the waste rock materials. The antimony results on Sample S-4, S-4 Dup, and S-4 Repl were 0.00, 47.26, and 0.00 mg/kg indicating a potential issue with the XRF reading the antimony or highly variable antimony concentrations in the samples. All of the antimony readings were below the non-residential SRL, so placing the waste rock materials in a consolidation pile and placing a DEUR on the pile would be the same remedial solution. Therefore, antimony could be added to future samples to be analyzed if desired.

Vanadium is a similar issue. This metal has typically not been assessed or remediated in the past, and ADEQ's samples outside of the waste rock area were actually higher than the samples within the waste rock area. All of the detected concentrations were below the non-residential SRL, so the remedial action would be the same. Therefore, antimony could be added to future samples to be analyzed if desired.

ADEQ's Sample S-4 is located north of the wash north of the waste rock area. Based on our previous review of aerial photographs, the waste rock piles were south of the wash during the mining activities at the Site. We conducted some additional review of aerial photographs. In the December 2001-February 2002 aerial photograph, this area north of the wash still appeared natural with a dirt road through the area. In a December 2002 aerial photograph, there were some piles in this area that appeared to be scraped from the surrounding ground surface (the piles had track marks up the sides of the piles). We did not see any connection between the waste rock materials south of the wash and these scraped-up soil piles. The mining activities reportedly ended in 2002. In a December 2003-January 2004 aerial photograph, there was some additional materials in the Sample S-4 location, and there was an apparent road across the northern wash. Therefore, this area should be further assessed during the remedial actions to remove the waste rock. We concentrated on the photographs prior to 2002 in the past.

ADEQ indicated antimony and vanadium can be excluded as COCs at the Site. ADEQ concurred with additional assessment in the area around Sample S-4. GTR had already obtained some additional samples from this area. Samples AD-1, AD-1-1, AD-2, and AD-4 were obtained from this area. These samples showed elevated concentrations of arsenic, chromium, and lead similar to the waste rock materials. Therefore, this area was added as Area 8 for remediation. The vertical extent of the apparent waste rock materials in this area was not delineated, so the waste rock and underlying soil will need to be delineated as part of the remediation process.

ADEQ had expressed concern about the potential for waste rock materials to have eroded into the adjacent wash. ADEQ and GTR personnel observed the wash bottom. There were exposed rocks of various types and colors in the bottom of the wash, and there were exposed bedrock outcrops in several portions of the wash near the waste rock materials. The wash bottom in these areas showed signs of large flows in the past. We did not observe indications of waste rock materials in the wash bottom. Therefore, no further assessment or remediation of the adjacent wash are anticipated.

## 4.0 REMEDIATION ACTIVITIES

### 4.1 PLANNED REMEDIAL ACTIVITIES

As part of the previous assessment process, various remedial alternatives were discussed, and consolidating the waste rock materials into a smaller area at this location appeared to be the most desirable remedial option. The remediation scenarios included the following considerations regarding the Site.

- Avanti indicated the planned north-south road (future El Mirage Road) in this area will likely be about 134 feet wide, and it will be located along the western Site border west of the mine waste rock material area. Based on our discussions to date, the mine waste rock material will not be placed in future roadway right-of-way due to various issues associated with this use. In addition, Avanti did not want mine waste rock materials directly adjacent to the road.
- The previous Allwyn geotechnical report limited development over the mine shaft incline and entrance areas unless remedial actions are taken for support of future structures, utility lines, or pavement over these areas. Therefore, this entrance and incline area is desirable as a final storage area for the mine waste rock materials.
- Avanti also indicated the wash along the north and east sides of the mine waste materials is a restricted jurisdictional area under the 404 delineation, and this wash should not be disturbed. Therefore, a layer of mine waste rock material located adjacent to the wash will be excavated in order to provide room for the future Cap to cover the waste rock materials.
- The potential aesthetics associated with the storage of the mine waste materials and the height of the stored materials above surrounding grade were concerns. Avanti indicated the average height of the mine waste rock material if capped should not exceed approximately 5 to 6 feet above the final finished grades, and it would be preferable to have an irregularly shaped pile, so it looks like a landscaped feature rather than a rectangular pile with linear sides. The final finished grades in this area are not yet known, so we have initially estimated that the composited stockpile would be about 3 to 4 feet high with about a 2-foot soil Cap over the tops and sides of the piles.

Avanti indicated that there will be excess soil from the development phases south of the Site. The natural soils in the area around the mine waste rock materials have elevated concentrations of several heavy metals due to the natural rock in the area, and there is limited soil over the underlying rock in the immediate vicinity of the mine waste rock materials. In addition, the natural soils south of the mine site had lower heavy metal concentrations which would be more desirable as the Cap material. Therefore, we have assumed that the soil would come from earthwork operations near the Central Arizona Project Canal south of the Site.

ADEQ wanted some additional assurances that the previous mine entrance shaft opening would not settle and create holes in the future in the consolidated waste pile. During GTR's additional assessment, we excavated this area and found the old mine shaft inclined entrance feature. We did not observe any voids in this area, so the previous remedial measures at the Site may have worked. However, during the initial phase of the excavation work for the remedial efforts, we will over-excavate this area again and search for any significant vertical voids. If found, we will fill the void with waste rock materials. If a large vertical void is identified, this area will be treated with about 5 percent cement by weight to make a soil cement cover over the void. The soil-cement layer will extend at least 10 feet in all directions from the void. This area will then be covered with several feet of compacted fill waste rock materials to verify the integrity of the underlying fill materials in this area and to limit the potential for future openings in these materials.

As shown on Figure 8, the Site was split into eight areas based on the depth of waste rock or additional assessment areas. Area 1 through Area 8 are summarized below:

- Area 1 is the location of previous mine inclined shaft entrance. GTR estimates there is likely about 30 feet of waste rock materials in Area 1.
- Area 2 has waste rock materials to a depth of approximately 8 feet.
- Area 3 has waste rock materials to a depth of approximately 3 feet.
- Area 4 has waste rock materials to a depth of approximately 2 feet.
- Area 5 is associated with previous exploration shaft was identified in historical aerial photographs and was added as an additional area for consideration. Based on the assessment results, this area was added as an area where remedial efforts will occur.
- Area 6 is the location of the mine incline shaft and will be included in the consolidated mine waste area (Cap Area).
- Area 7 in the southeastern portion with some minor mine waste rock materials spread across the ground surface at a lower elevation than the main pile and will be included in the consolidated mine waste area (Cap Area).
- Area 8 is associated with an area identified where additional assessment occurred and is included in the areas to be reclaimed for development. In addition, based on the assessment results, this area was added as an area where remedial efforts will occur.

GTR determined the most cost effective approach for the mine waste rock remediation is to remove the natural soils above the mine incline shaft (Area 6) and in Area 7, consolidate the waste rock materials from portions of Areas 2, 3, and 4, and all of Areas 5 and 8 into one composite pile extending from Area 6 to Area 7, and then cap the material with natural soils from areas south of the Site. The area of the consolidated mine waste area (Cap area) and areas reclaimed for development are shown on Figure 9. Under this remedial approach, mine waste rock materials will be consolidated in the northern portion of the existing mine waste area over the mine entrance and inclined shaft area. Stockpiled soils from previous phases of development will be used for the Cap material. Based on previous geotechnical evaluations, these soils are typically Clayey Sand (SC) soils, so these soils should provide a good Cap material for the desired engineering characteristics. Mine waste rock will also be placed into these newly excavated areas identified as Areas 6 and 7 as shown in Figures 8 and 9. The mine

waste rock material will then be covered with about 2 feet of compacted natural soil to reduce water infiltration into these materials and reduce potential exposure issues.

For ease of discussion, the remedial action areas will be identified as follows (see Figure 9):

- Area A – Northern area reclaimed for development (previously Area 8)
- Area B – Southern area reclaimed for development (previously portions of Areas 2, 3, and 4)
- Area C – Consolidated Mine Waste Area (Cap Area)
- Area D – Previously Area 5 (will be under future North El Mirage Road).

Remediation of the areas to be reclaimed for development (Areas A, B, and D) consists of removal of the waste rock materials and underlying soil to bedrock under observation by GTR. The bedrock surface is probably irregular, but this option includes scraping the bedrock surface to generally remove most of the soil. As previously discussed, the previous assessments at the Site indicated approximately 1 to 2 feet of soil are present in the areas to be reclaimed for development (Areas A and B). Area D consists of the area previously identified as Area 5 and was previous exploration shaft area. The depth of broken rock and soil is unknown in the shaft area. For Area D, the overlying broken rock and soil will be removed until bedrock is encountered around the edges of shaft. The depth of broken rock and soil inside the shaft will be further assessed by excavation. If the broken rock and soil extend below 2 feet below the surrounding bedrock level (likely outcome), then the shaft area will be covered with 1 foot of concrete to provide a permanent barrier over the underlying broken rock and soil materials. This concrete cap will be an environmental barrier. Area D will eventually be under the future El Mirage Road.

The waste rock and soil overlying the bedrock will be excavated and be placed in the consolidated mine waste area (Area C). As discussed above, the waste rock and the excavated soil will be capped using natural soils south of the mine site (e.g. soil from earthwork operations near the Central Arizona Project Canal south of the Site). Previous geotechnical evaluations in these areas indicated that these soils are typically well-graded Clayey Sand (SC) soils. These soils should compact well, have sufficient fines to limit water infiltration, and should not be susceptible to erosion in the future. Therefore, these soils should provide the desired engineering characteristics for the Cap soils.

As requested by ADEQ, Avanti retained Atwell LLC to provide a preliminary grading plan of the consolidated mine waste material pile. Atwell used the figures generated by GTR and overlaid the identified areas on an existing topographic map of the area. The preliminary grading plan and some cross sections are attached in Appendix F. Avanti wanted to limit the average height of the material in the pile to about 5 to 6 feet above current grade. GTR estimated that the mine waste rock materials could be consolidated into an area of approximately 3.5 acres in size reclaiming an area of approximately 3 acres (See Figure 9). The mine waste rock pile will be shaped into a more natural look with curvilinear sides and differing heights as shown on the plans. GTR estimates that approximately 19,200 cubic yards of materials will be placed in the consolidation area (Area C) and covered with an approximate 2-foot cap (approximately 9,800 cubic yards). The soil Cap (Area C) will be hydro-seeded with

natural desert grasses to provide some additional erosion control. During future development activities, the pile may be covered with landscaping gravel and rock with minimal small desert vegetation with no watering system. The final pile will need to be surveyed to provide an exact area for the DEUR.

There has been limited assessment of the surface soils south of the Site as part of the background soil sampling and testing to date (see Allwyn Phase II ESA data). However, prior to placement of the Cap material, the imported soil to be used for the Cap material will be sampled and analyzed for RCRA metals. An estimated 9,800 cubic yards of material will be used to cover the consolidation pile. It is anticipated that the Cap materials will consist of soil from earthwork operations near the Central Arizona Project Canal south of the Site. To assess the imported material, GTR will collect composite samples of imported Cap material at a rate of 1 composite sample per 2,000 cubic yards of Cap material. The samples will be submitted to an ADHS-certified analytical laboratory and analyzed for total concentrations of the RCRA metals arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver using EPA Methods 6010/7471. The procedures used to collect the soil samples are outlined in the Sampling and Analysis Plan (SAP) in Appendix B of this Work Plan. In addition, quality assurance/quality control (QA/QC) samples will be collected as described in the SAP and Quality Assurance Project Plan (QAPP) in Appendix C of this Work Plan. The results of the import material soil sampling will be compared to the  $10^{-5}$  residential SRLs, minimum GPLs or Alternative GPLs, whichever is lowest. If the analytical results are less than the applicable remediation level, the soil will be used as the Cap material covering the consolidation pile and covering the concrete cap over the exploratory shaft in Area D.

Following remediation activities and submittal of the Site Remediation Report and a DEUR application, GTR will request a conditional NFA determination for Area C and an unconditional NFA determination for Areas A, B, and D for the RCRA metals including, arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver. There will be a 45-day public comment period for the NFA determinations. Upon completion of this process, GTR will prepare an Engineering Control Plan in general agreement with typical ADEQ requirements to document the maintenance and inspections of the soil Cap acting as an engineering control. Avanti will retain a surveyor to survey the DEUR area, and GTR will submit a draft DEUR. After review and ADEQ approval of the DEUR, it will be recorded with Maricopa County.

## **4.2 COMPLIANCE CONSIDERATIONS**

Avanti and its contractors will comply with applicable local, state, and federal rules and regulations related to the remediation and assessment activities at the Site. The primary regulatory requirements for this project are described in the following sections.

### **4.2.1 Stormwater Pollution Prevention**

Construction activities, including those associated with remediation, that disturb more than 1.0 acre and have the potential to enter waters of the United States or a storm drain system must obtain authorization prior to the discharge. Construction activities disturbing more than one acre can obtain authorization through a Construction General

Permit issued by ADEQ. To obtain authorization for stormwater discharges associated with construction activity under this general permit, the operator must comply with the requirements of the General Permit, including implementation of a Stormwater Pollution Prevention Plan (SWPPP) tailored to the site and submission of a Notice of Intent (NOI).

Prior to field activities, the remediation contractor will prepare a SWPPP in accordance with the Construction General Permit for the remediation activities. Following preparation of the SWPPP, the remediation contractor will submit a NOI to be covered under the general permit using the ADEQ's myDEQ online system, pay the applicable fees, and receive authorization to discharge from the ADEQ. Based on GTR's review, the Site is not within ¼ mile of impaired, not attaining, or Outstanding Arizona Waters; therefore, submission and approval of the SWPPP to the ADEQ is not required. In addition, following completion of the remediation activities and Site stabilization the remediation contractor will submit a Notice of Termination (NOT) to ADEQ upon completion of the remediation and assessment activities.

#### **4.2.2 Dust Control**

Maricopa County requires a Dust Control Permit when dust generating operations (DGO) disturb an area greater than one tenth of an acre of land (4,356 square feet) during typical construction activities. The remediation contractor will complete a dust control permit application on-line and will prepare a Dust Control Plan for the remediation activities. In general, the dust control plan will require a variety of dust control measures during the excavation and grading activities. The main dust control measure will be to apply water to all waste rock materials and soil prior to disturbance to limit dust emissions. The controls and procedures to minimize dust including control of dust from excavation areas, stockpiles, vehicle track-out will be implemented as described in the SWPPP. In addition, erosion control and stabilization procedures will be implemented as described in the SWPPP and Section 4.0 of this VRP Work Plan.

#### **4.2.3 Soil Remediation Levels and Groundwater Protection Levels**

Soil remediation will be conducted under the Voluntary Remediation Program Statute (A.R.S. 49-171). The applicable standards for soil remediation are contained in A.R.S. 49-152 and the Arizona Administrative Code (A.A.C.) Title 18, Chapter 7, Article 2). The foreseeable Site use is likely residential use. As such, the appropriate remedial goals for the areas to be reclaimed for development are the ADEQ pre-determined  $10^{-5}$  residential SRLs, the minimum or Site-specific Alternative GPLs for the Site COCs.

In addition, GTR calculated Site-specific Alternative GPL for lead of 1,448.3 mg/kg; therefore, the requested remediation goal for lead is the  $10^{-5}$  residential SRL of 400 mg/kg, which is the more conservative value. For the RCRA metals arsenic, barium, cadmium, chromium, mercury, selenium, and silver the requested remediation levels either the  $10^{-5}$  residential SRL or minimum GPL, whichever is lowest. The areas to be reclaimed for development will be excavated to bedrock. The requested remediation levels are summarized below:

<b>Metal</b>	<b>Requested Remediation Level (mg/kg)</b>	<b>Requested Remediation Level Basis</b>
Arsenic	10	10 <sup>-5</sup> Residential SRL
Barium	12,000	Minimum GPL
Cadmium	29	Minimum GPL
Chromium	590	Minimum GPL
Lead	400	10 <sup>-5</sup> Residential SRL
Mercury	12	Minimum GPL
Selenium	290	Minimum GPL
Silver	390	10 <sup>-5</sup> Residential SRL

The consolidated stockpile of waste rock materials will contain materials with COCs greater than the remediation levels, so a DEUR will be required on this area. In order to complete the DEUR, the consolidation pile area will need to be surveyed to develop an exact legal description of this area. Upon approval of the final remediation report, GTR will prepare a DEUR for submittal to ADEQ. GTR will prepare an Engineering Control Plan to provide the owner with information on how the engineering control minimizes exposure to the contaminants in the consolidated waste rock pile, on maintenance of the pile, annual inspections of the pile, and annual reports to ADEQ. The Engineering Control Plan will be submitted to ADEQ for approval. Upon approval of the final DEUR, Avanti will record the DEUR with Maricopa County.

#### **4.2.4 Clean Water Act Section 404**

Section 404 of the Clean Water Act (CWA) regulates the discharge of dredged or fill material into waters of the United States, including wetlands. Activities in waters of the United States regulated under this program include fill for development, water resource projects (such as dams and levees), infrastructure development (such as highways and airports) and mining projects. Section 404 requires a permit before dredged or fill material may be discharged into waters of the United States, unless the activity is exempt from Section 404 regulation (e.g., certain farming and forestry activities).

Remediation activities as discussed in this Work Plan will not discharge dredged or fill material into water of United States. Disturbance of the Site washes will be minimized, and fill materials will not be placed in the Site washes above the ordinary high-water mark (OHWM). Therefore, based on GTR’s research a Section 404 permit will not be needed. If at any time during remediation activities, it becomes necessary to fill a wash above the OHWM, the remediation contractor will obtain a Section 404 permit prior to filling.

### **4.3 SCHEDULE**

The work will be performed in general conformance with the following anticipated schedule:

<b>Activity</b>	<b>Estimated Completion Date</b>
Work Plan Submitted to ADEQ	April 2020
ADEQ Work Plan review and comments	June 2020
Revised Work Plan Submitted to ADEQ	June 2020
ADEQ Approval of the Revised Work Plan	June 2020
45-Day Public Comment for Work Plan	September 1, 2020
Remediation Planning and Scheduling	December 30, 2020
Remediation Field Work Completed	March 30, 2021
Site Remediation Report Submitted to ADEQ	April 30, 2021
ADEQ review of Site Remediation Report (estimate)	May 30, 2021
Revision of Site Remediation Report based on ADEQ comments	June 30, 2021
NFA Determination Reports Submitted to ADEQ	August 1, 2021
45-Day Public Comment	September 30, 2021
ADEQ Review and NFA Determination	October 30, 2021
Prepare Engineering Control Plan	December 15, 2021
Submit Draft DEUR	December 30, 2021
ADEQ Approval of DEUR and Recording	January 30, 2022

The schedule will be accelerated whenever possible.

#### **4.4 COMMUNITY INVOLVEMENT**

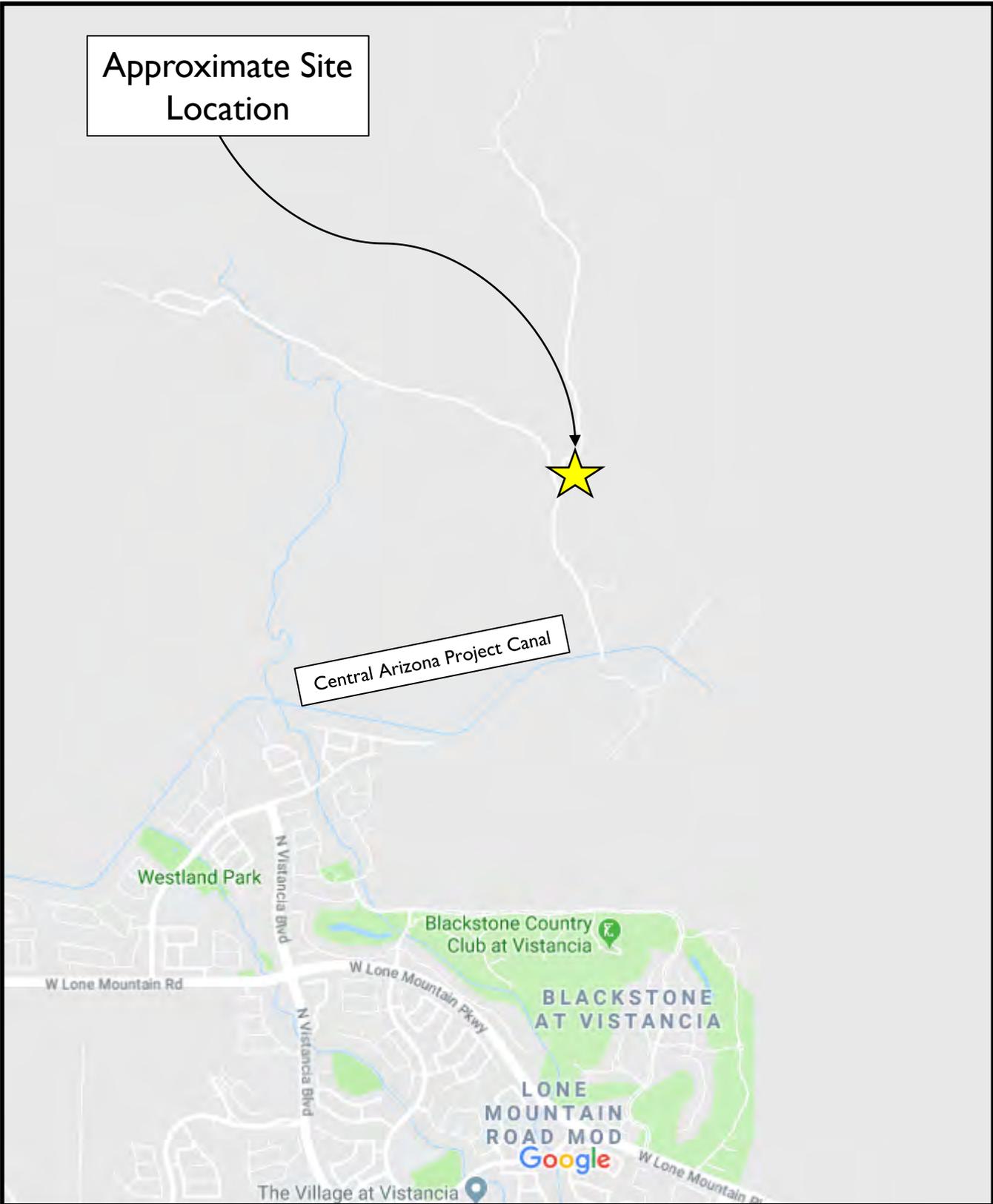
Community Involvement activities will be conducted by Avanti in general conformance with the requirements of ARS 49-173. Remediation will be conducted to obtain an NFA determination based on meeting residential SRLs or excavation to bedrock and is not expected to take more than 180 days to complete.

GTR will notify the surrounding community of the planned remediation activities by posting informational signs. Signs notifying the public that remediation of the Site is occurring under the oversight of ADEQ's VRP will be posted near the Central Arizona Project Canal to the south. The signs will include contact information for ADEQ and GTR. The signs will be installed at least 10 days prior to initiating remediation activities at the Site. An example of the community involvement sign is provided in Appendix G.

Upon submittal of the request for an NFA determination from ADEQ, GTR will provide general notice of the request to the public, make the Site Remediation Report available to the public, and provide opportunity for comment for 45 days.

# FIGURES

Approximate Site Location



Central Arizona Project Canal

Westland Park

Blackstone Country Club at Vistancia

BLACKSTONE AT VISTANCIA

LONE MOUNTAIN ROAD MOD  
Google

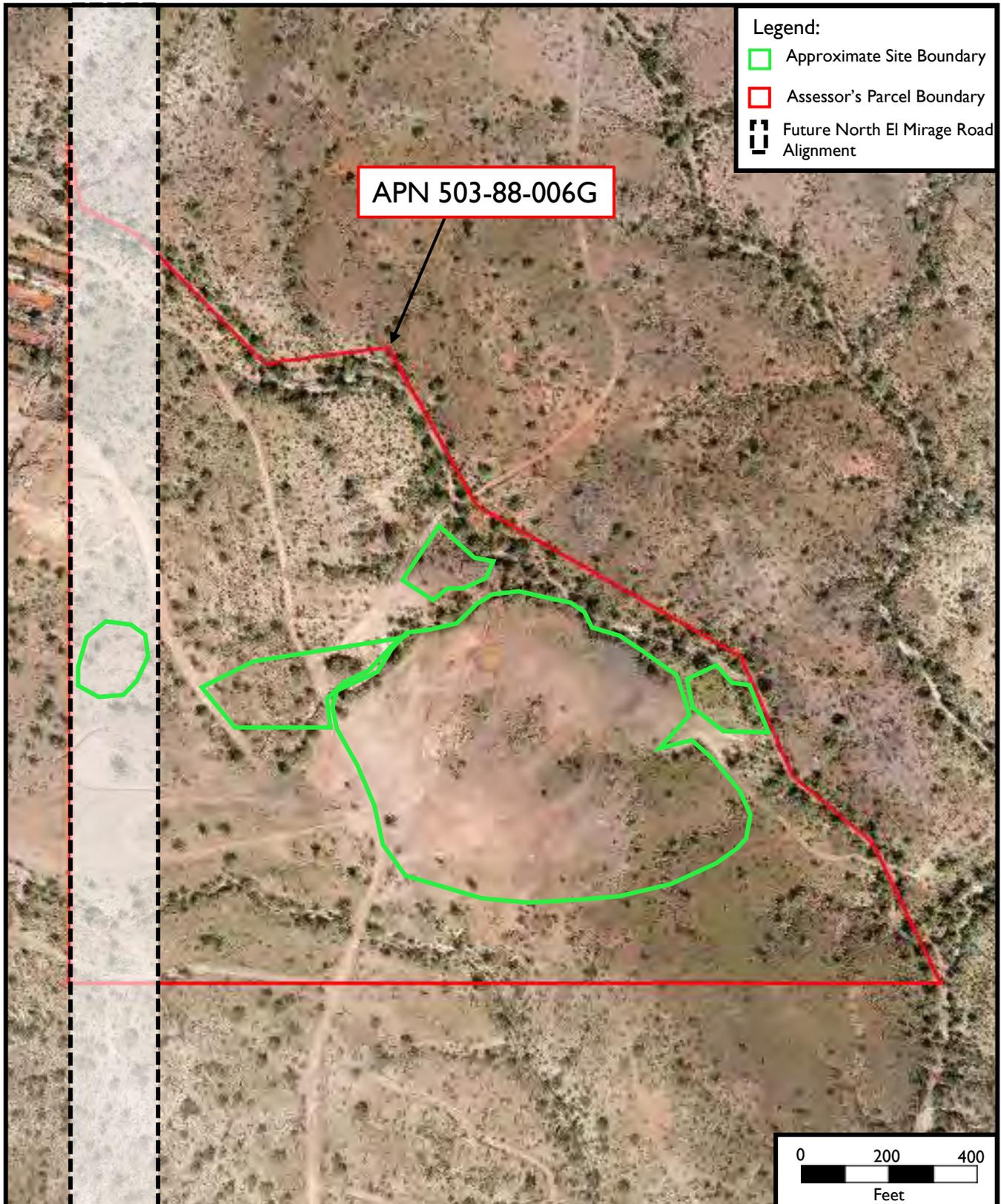
The Village at Vistancia

  
**GEOTEK**  
GeoTek Residential, LLC  
4050 East Cotton Center  
Boulevard, Suite 49  
Phoenix, Arizona 85040  
<http://www.geotekusa.com/>

**Figure 1**  
**Site Vicinity Map**  
**Voluntary Remediation Work Plan**  
Former Mystic Mine Area  
NE of Lone Mountain Parkway and  
North Vistancia Boulevard, Peoria, Arizona  
Project No.: 1795.1-PHR June 2020

Lake Pleasant (Phoenix) ASLI VIII, LLC  
c/o Avanti Acquisition Company, LLC  
Voyager Investment Properties  
4248 North Craftsman Court  
Suite 100, Scottsdale, Arizona 85251



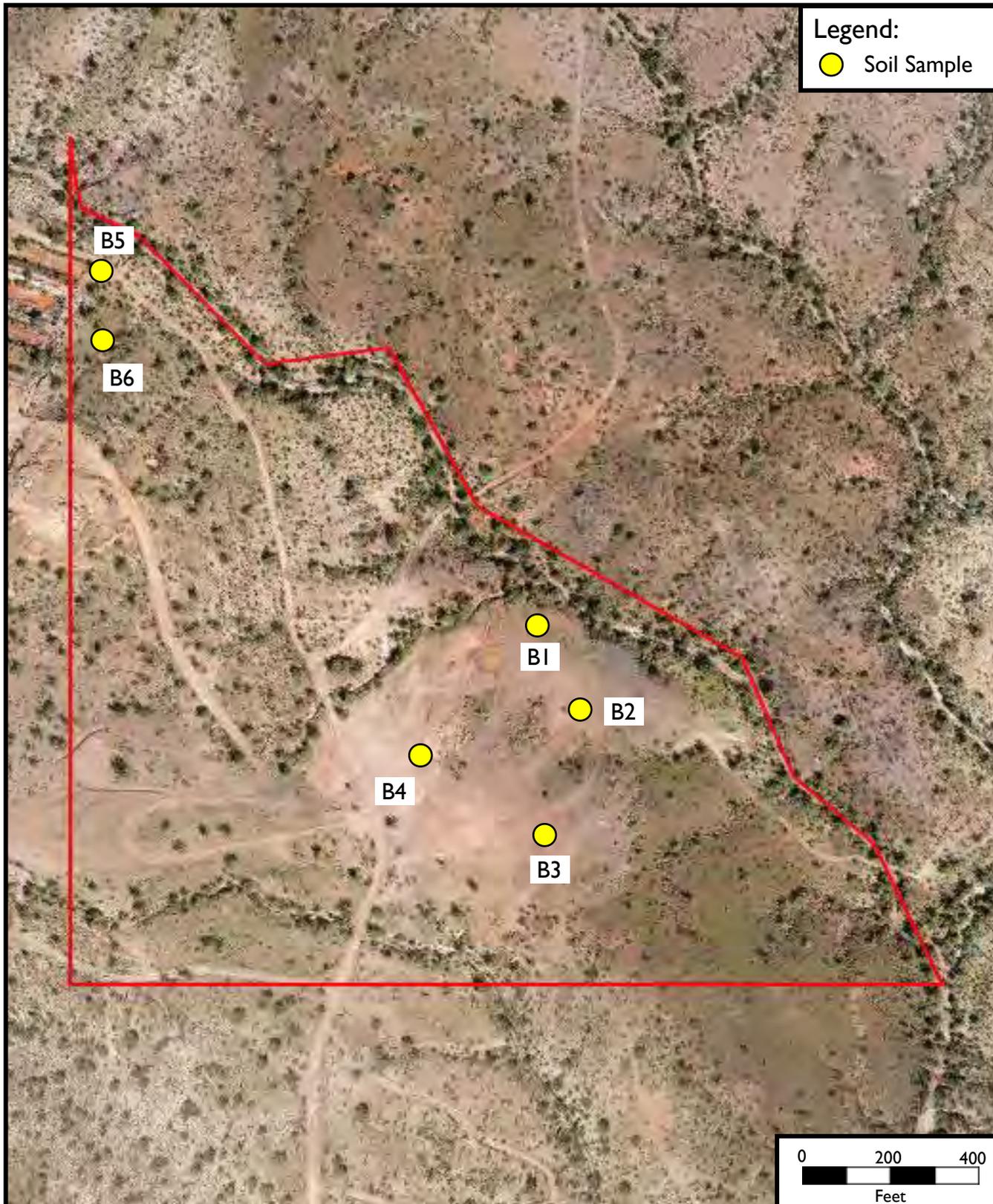


**Figure 2**  
**Maricopa County Assessor's Parcel Map**  
**Voluntary Remediation Work Plan**  
 Former Mystic Mine Area  
 NE of Lone Mountain Parkway and  
 North Vistancia Boulevard, Peoria, Arizona  
 Project No.: 1795.1-PHR June 2020

Lake Pleasant (Phoenix) ASLI VIII, LLC  
 c/o Avanti Acquisition Company, LLC  
 Voyager Investment Properties  
 4248 North Craftsman Court  
 Suite 100, Scottsdale, Arizona 85251



**GEOTEK**  
**GeoTek Residential, LLC**  
 4050 East Cotton Center  
 Boulevard, Suite 49  
 Phoenix, Arizona 85040  
<http://www.geotekusa.com/>



**Figure 3**  
**Allwyn Phase I ESA Sample Locations**

**Voluntary Remediation Work Plan**  
 Former Mystic Mine Area  
 NE of Lone Mountain Parkway and  
 North Vistancia Boulevard, Peoria, Arizona

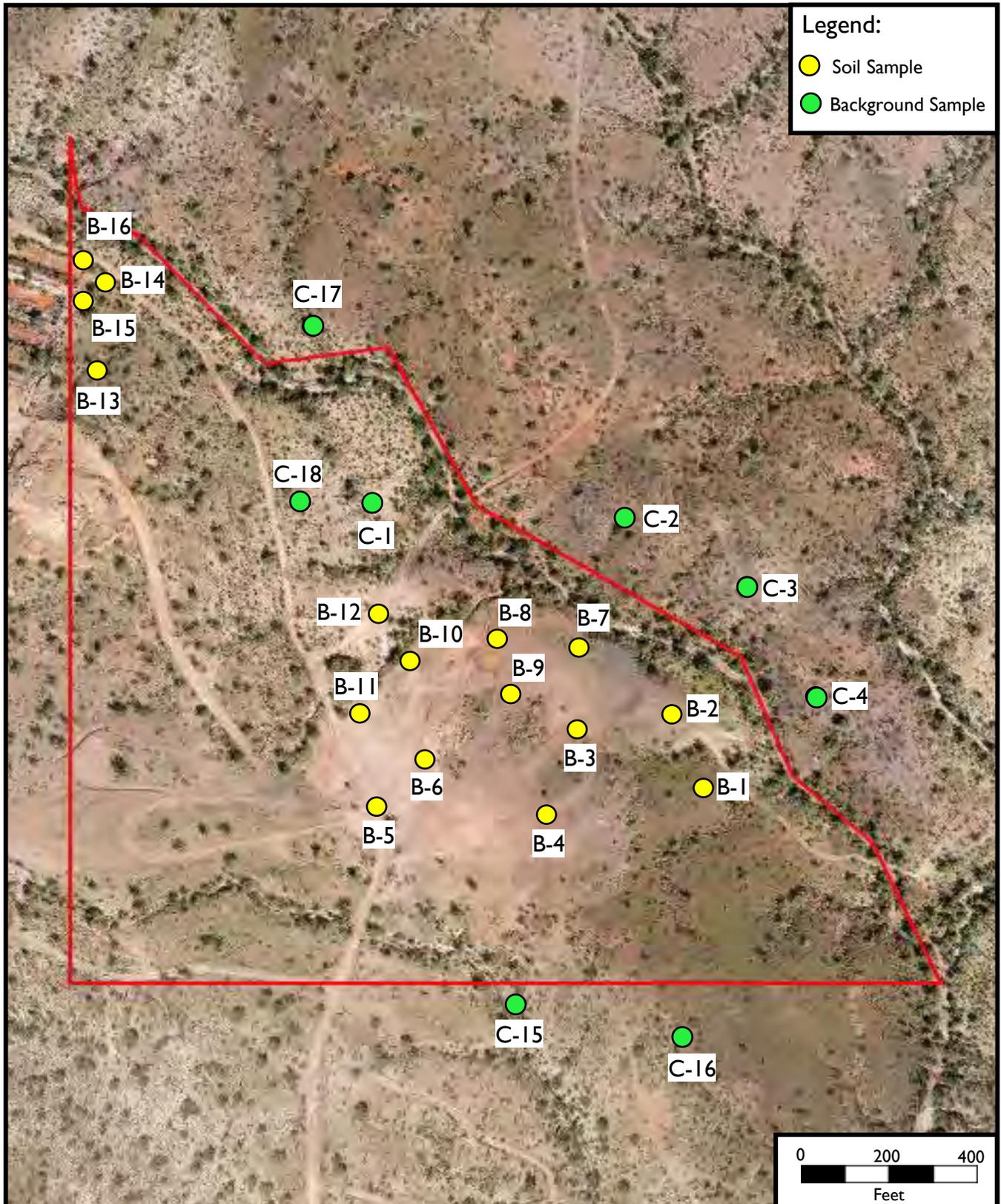
Lake Pleasant (Phoenix) ASLI VIII, LLC  
 c/o Avanti Acquisition Company, LLC  
 Voyager Investment Properties  
 4248 North Craftsman Court  
 Suite 100, Scottsdale, Arizona 85251



**GEOTEK**  
**GeoTek Residential, LLC**  
 4050 East Cotton Center  
 Boulevard, Suite 49  
 Phoenix, Arizona 85040  
<http://www.geotekusa.com/>

Project No.: 1795.1-PHR

June 2020



**Figure 4**  
**Allwyn Phase II ESA Sample Locations**

**Voluntary Remediation Work Plan**  
 Former Mystic Mine Area  
 NE of Lone Mountain Parkway and  
 North Vistancia Boulevard, Peoria, Arizona

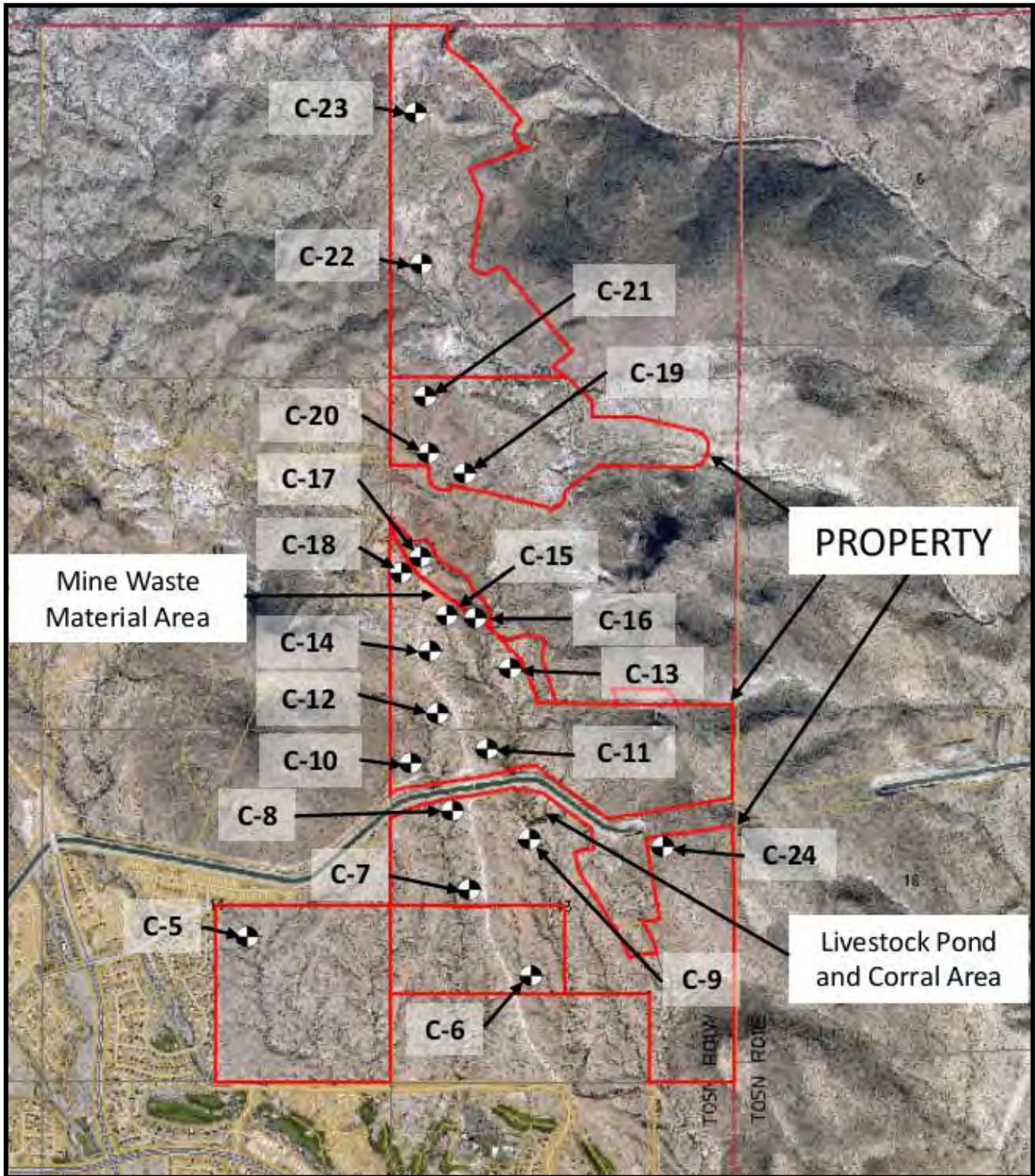
Project No.: I795.I-PHR

June 2020

Lake Pleasant (Phoenix) ASLI VIII, LLC  
 c/o Avanti Acquisition Company, LLC  
 Voyager Investment Properties  
 4248 North Craftsman Court  
 Suite 100, Scottsdale, Arizona 85251

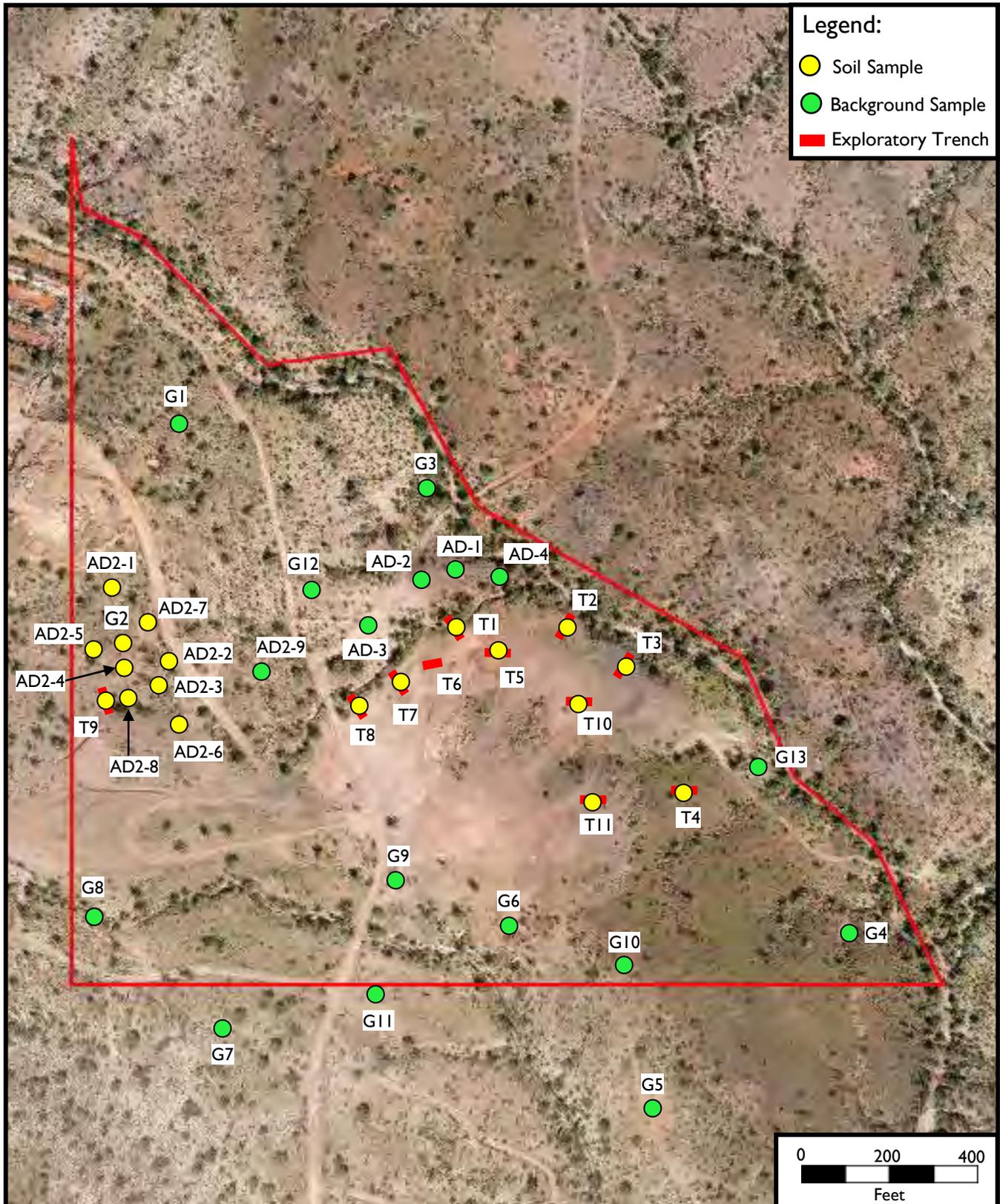


**GEOTEK**  
**GeoTek Residential, LLC**  
 4050 East Cotton Center  
 Boulevard, Suite 49  
 Phoenix, Arizona 85040  
<http://www.geotekusa.com/>



**Note:** The aerial photograph and parcels depicted in the figure are from 2016, when the Allwyn Phase II ESA was conducted

 <b>GEOTEK</b> <b>GeoTek Residential, LLC</b> 4050 East Cotton Center Boulevard, Suite 49 Phoenix, Arizona 85040 <a href="http://www.geotekusa.com/">http://www.geotekusa.com/</a>	<b>Figure 5</b> <b>Allwyn Phase II ESA Background Samples</b>		 N
	<b>Voluntary Remediation Work Plan</b> Former Mystic Mine Area NE of Lone Mountain Parkway and North Vistancia Boulevard, Peoria, Arizona		
	Project No.: I795.I-PHR	June 2020	



**Figure 6**  
**GTR Sample Location Map**

**Voluntary Remediation Work Plan**  
Former Mystic Mine Area  
NE of Lone Mountain Parkway and  
North Vistancia Boulevard, Peoria, Arizona

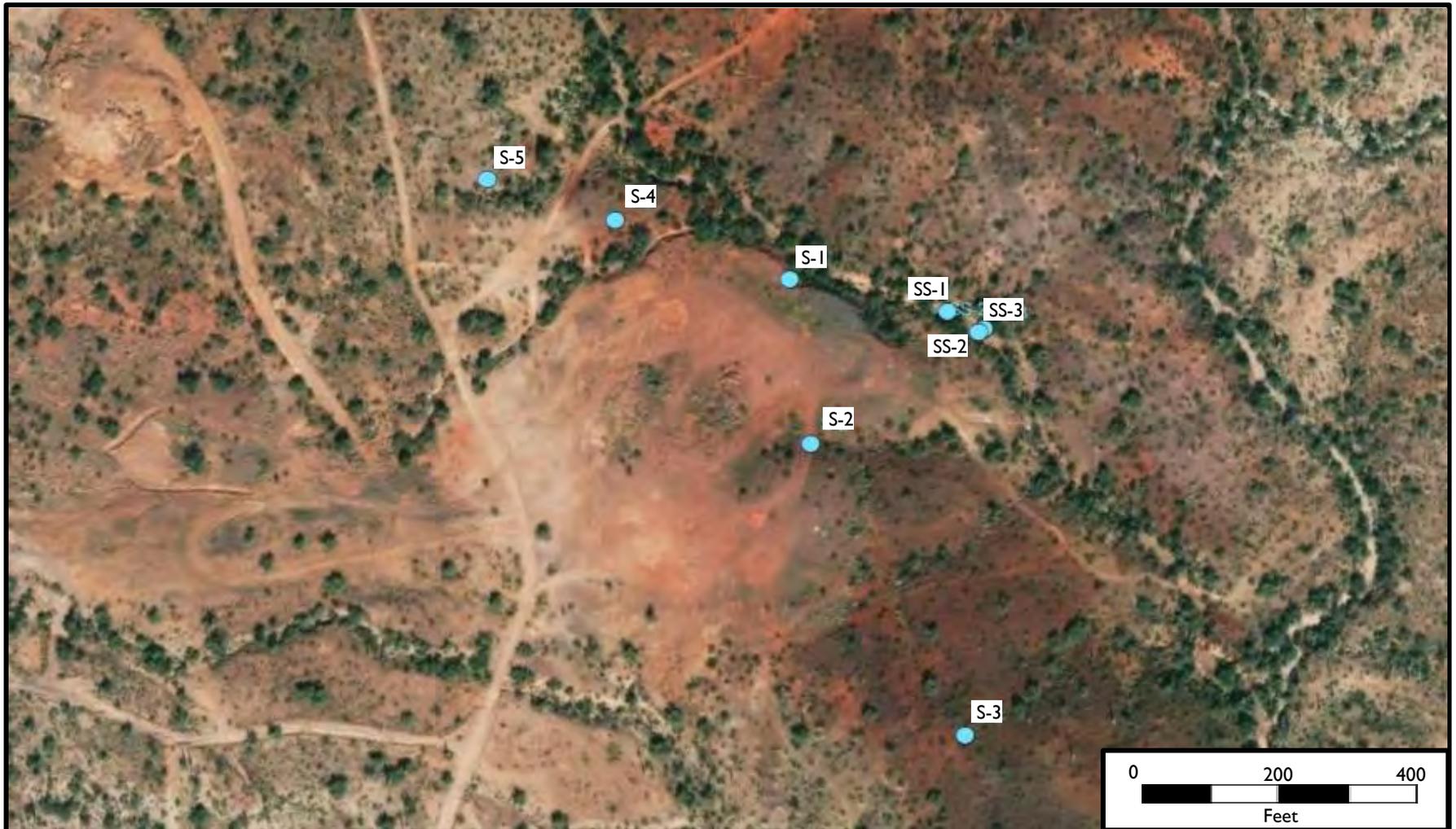
Lake Pleasant (Phoenix) ASLI VIII, LLC  
c/o Avanti Acquisition Company, LLC  
Voyager Investment Properties  
4248 North Craftsman Court  
Suite 100, Scottsdale, Arizona 85251



**GEOTEK**  
**GeoTek Residential, LLC**  
4050 East Cotton Center  
Boulevard, Suite 49  
Phoenix, Arizona 85040  
<http://www.geotekusa.com/>

Project No.: I795.I-PHR

June 2020



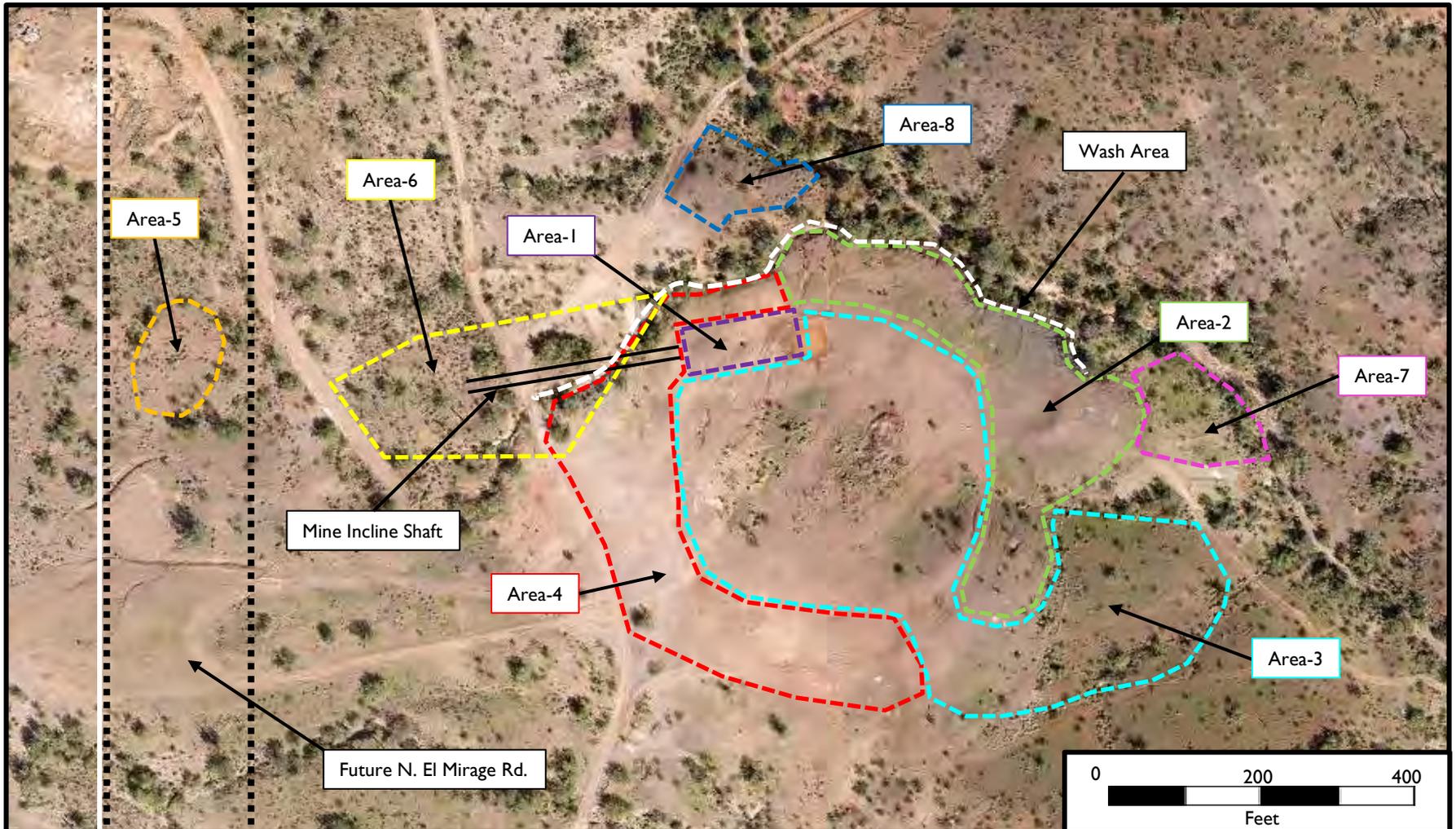
**GeoTek Residential, LLC**  
 4050 East Cotton Center  
 Boulevard, Suite 49  
 Phoenix, Arizona 85040  
<http://www.geotekusa.com/>

June 2020  
 Project Number:  
 1795.1-PHR

**Figure 7**  
**ADEQ's Sample Locations**  
**Voluntary Remediation Work Plan**  
 Former Mystic Mine Area  
 NE of Lone Mountain Parkway and  
 North Vistancia Boulevard, Peoria, Arizona

Lake Pleasant (Phoenix) ASLI VIII, LLC  
 c/o Avanti Acquisition Company, LLC  
 Voyager Investment Properties  
 4248 North Craftsman Court,  
 Suite 100, Scottsdale, Arizona 85251





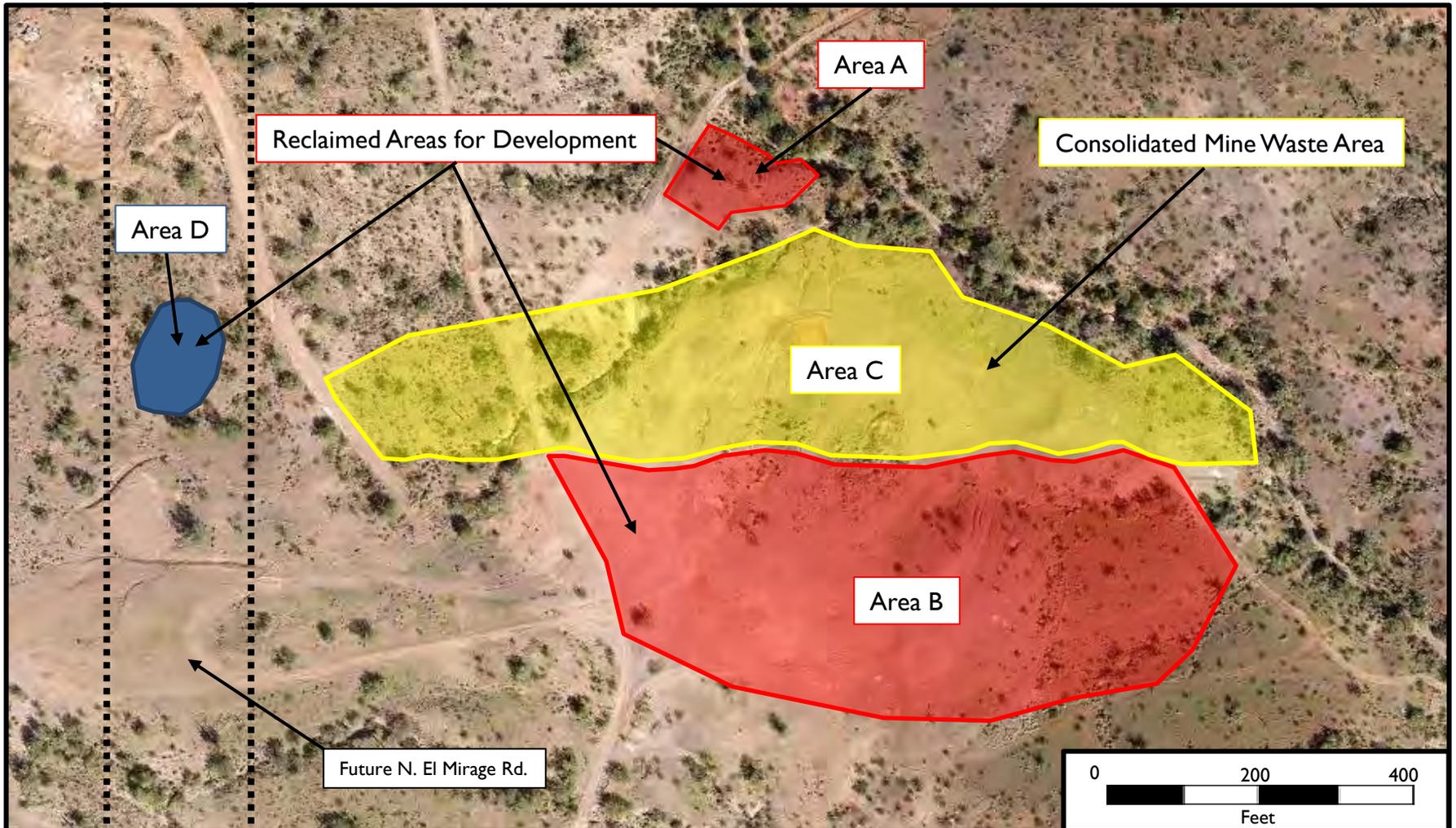
  
**GEOTEK**  
 4050 East Cotton Center Boulevard  
 Suite 49, Phoenix, Arizona 85040  
 (480) 505-9422  
<http://www.geotekusa.com/>

June 2020  
 Project Number:  
 1795.1-PHR

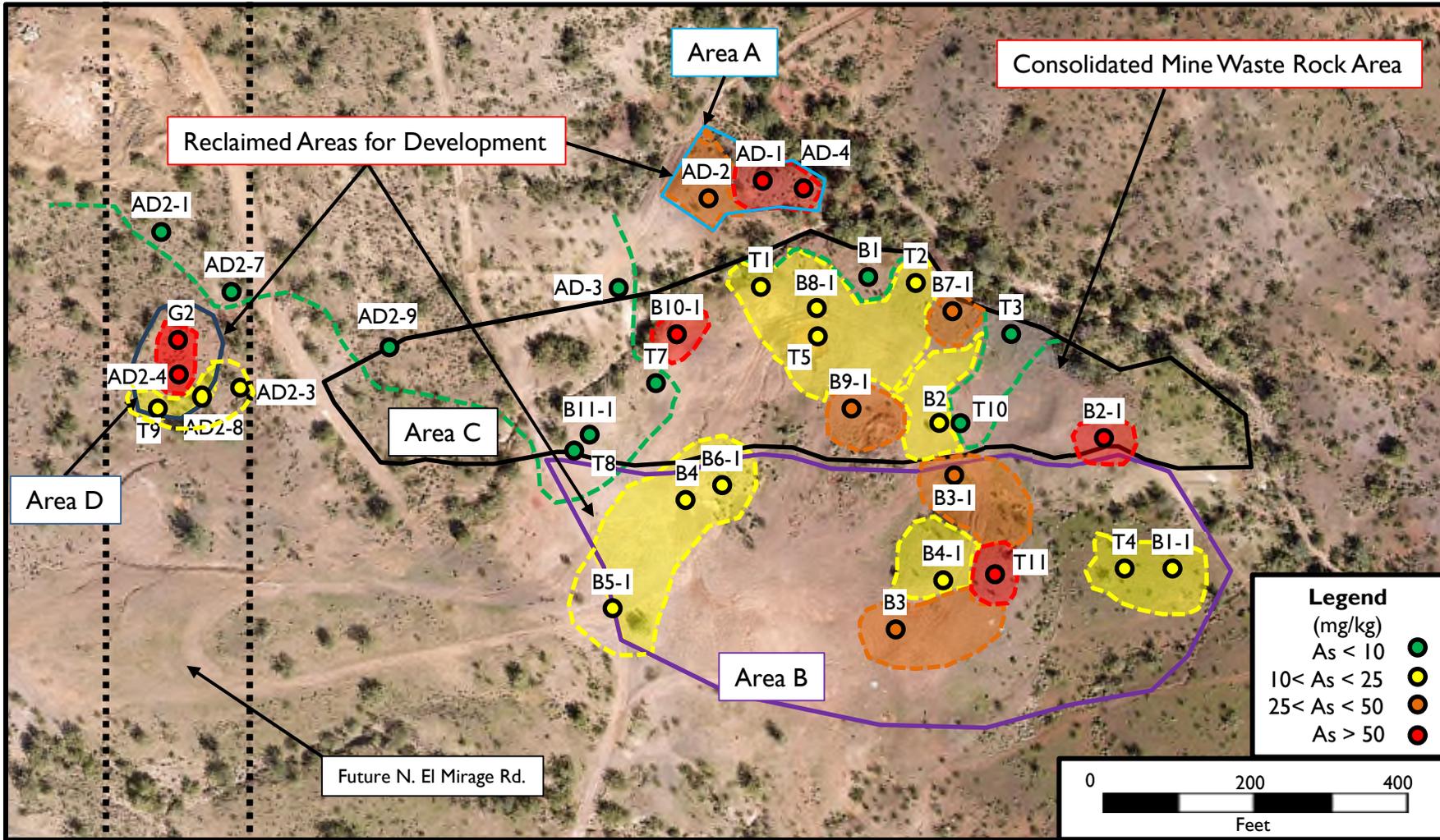
**Figure 8**  
**Mine Waste Material Areas**  
**Voluntary Remediation Work Plan**  
 Former Mystic Mine Area  
 NE of Lone Mountain Parkway and  
 North Vistancia Boulevard, Peoria, Arizona

Lake Pleasant (Phoenix) ASLI VIII, LLC  
 c/o Avanti Acquisition Company, LLC  
 Voyager Investment Properties  
 4248 North Craftsman Court,  
 Suite 100, Scottsdale, Arizona 85251





 4050 East Cotton Center Boulevard Suite 49, Phoenix, Arizona 85040 (480) 505-9422 <a href="http://www.geotekusa.com/">http://www.geotekusa.com/</a>	June 2020	<b>Figure 9</b> <b>Consolidated and Moved Material Areas</b> <b>Voluntary Remediation Work Plan</b> Former Mystic Mine Area NE of Lone Mountain Parkway and North Vistancia Boulevard, Peoria, Arizona	Lake Pleasant (Phoenix) ASLI VIII, LLC c/o Avanti Acquisition Company, LLC Voyager Investment Properties 4248 North Craftsman Court, Suite 100, Scottsdale, Arizona 85251	
	Project Number: 1795.1-PHR			



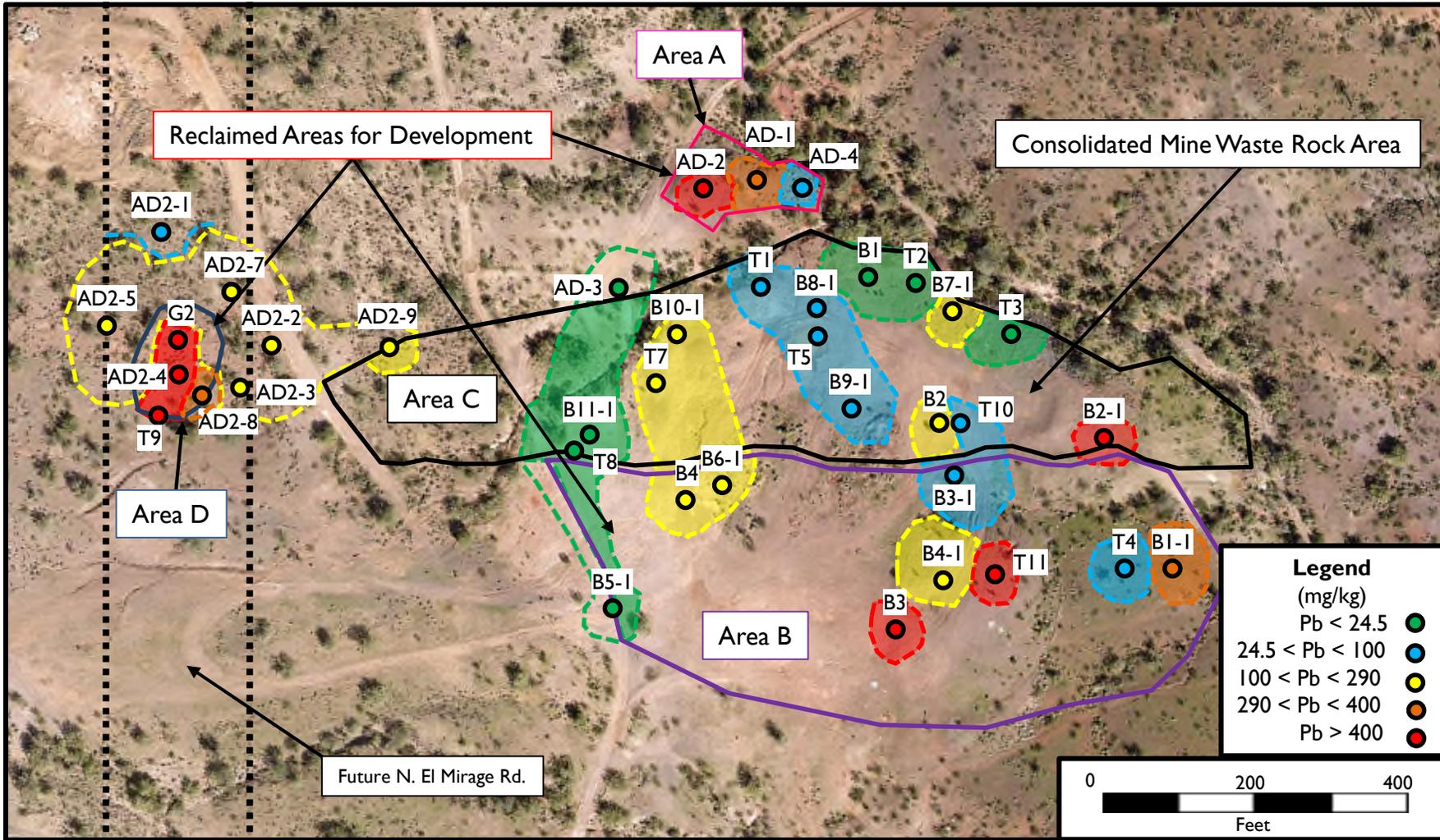
**Figure 10**  
**Arsenic Isopleth Map Waste Rock Samples**  
**Voluntary Remediation Work Plan**  
 Former Mystic Mine Area  
 NE of Lone Mountain Parkway and  
 North Vistancia Boulevard, Peoria, Arizona

Lake Pleasant (Phoenix) ASLI VIII, LLC  
 c/o Avanti Acquisition Company, LLC  
 Voyager Investment Properties  
 4248 North Craftsman Court,  
 Suite 100, Scottsdale, Arizona 85251



**GEOTEK**  
 4050 East Cotton Center Boulevard  
 Suite 49, Phoenix, Arizona 85040  
 (480) 505-9422  
<http://www.geotekusa.com/>

June 2020  
 Project Number:  
 1795.1-PHR



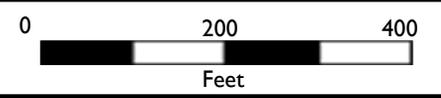
**Figure 11**  
**Lead Isopleth Map Waste Rock Samples**  
**Voluntary Remediation Work Plan**  
 Former Mystic Mine Area  
 NE of Lone Mountain Parkway and  
 North Vistancia Boulevard, Peoria, Arizona

Lake Pleasant (Phoenix) ASLI VIII, LLC  
 c/o Avanti Acquisition Company, LLC  
 Voyager Investment Properties  
 4248 North Craftsman Court,  
 Suite 100, Scottsdale, Arizona 85251



**GEOTEK**  
 4050 East Cotton Center Boulevard  
 Suite 49, Phoenix, Arizona 85040  
 (480) 505-9422  
<http://www.geotekusa.com/>

June 2020  
 Project Number:  
 1795.1-PHR



# **TABLES**

**TABLE I**  
**SAMPLE INFORMATION**

Sample Number	Depth (bgs)	Sample Location	Collection Date	Collection Time	Laboratory Analysis
B1	2.5-3 feet	Northern section of mine waste rock area	7/21/2016	1005	RCRA metals
B2	2-2.5 feet	Eastern section of mine waste rock area	7/21/2016	1016	RCRA metals, total cyanide, free cyanide
B3	2-2.5 feet	Southern section of mine waste rock area	7/21/2016	1022	PP+Metals
B4	1.5-2 feet	Western section on mine waste rock area	7/21/2016	1035	PP+Metals, total cyanide, free cyanide
B5	1.5-2 feet	Off-Site leaching pits northwest of Site	7/21/2016	1048	PP+Metals, total cyanide, free cyanide
B6	1.5-2 feet	Off-Site leaching pits northwest of Site	7/21/2016	1052	RCRA metals, total cyanide, free cyanide
B-1-1	4 feet	Southeast portion of the mine waste rock area	8/19/2016	606	RCRA Metals, SVOCs, PAHs, total cyanide, free cyanide
B-1-2	9 feet		8/19/2016	610	RCRA Metals
B-2-1	6-7 feet	Eastern portion of the mine waste rock area near the wash	8/19/2016	632	PP+Metals
B-2-2	12-13 feet		8/19/2016	651	PP+Metals
B-3-1	1 foot	Base of the southern ridge area in the south-central portion of the mine waste area	8/19/2016	723	RCRA Metals
B-3-2	4 feet		8/19/2016	735	RCRA Metals
B-4-1	2 feet	Southwest of Test Pit B-3 on the south-central portion of the mine waste rock area	8/19/2016	748	PP+Metals
B-4-2	4 feet		8/19/2016	800	N/A
B-5-1	1.5 feet	West of Test Pit B-4 on the west-central portion of the mine waste rock area	8/19/2016	825	PP+Metals
B-5-2	4 feet		8/19/2016	830	PP+Metals
B-6-1	2 feet	Northeast of Test Pit B-5 and was in the west-central portion of the mine waste rock area	8/19/2016	851	RCRA Metals
B-6-2	4 feet		8/19/2016	903	RCRA Metals
B-7-1	6 feet	Northeast of Test Pit B-6 along the wash on the eastern portion of the mine waste rock area	8/19/2016	912	PP+Metals, total cyanide, free cyanide, VOCs, PAHs
B-7-2	12 feet		8/19/2016	927	PP+Metals
B-8-1	1 foot	Northwest of Test Pit B-7 along the wash on the northern portion of the mine waste rock area.	8/19/2016	949	RCRA Metals
B-8-2	2 feet		8/19/2016	1003	RCRA Metals

**TABLE I**  
**SAMPLE INFORMATION**

Sample Number	Depth (bgs)	Sample Location	Collection Date	Collection Time	Laboratory Analysis
B-9-1	3 feet	South of Test Pit B-8 in the central portion of the mine waste rock area	8/19/2016	1022	PP+Metals, total cyanide, free cyanide, PAHs
B-9-2	5 feet		8/19/2016	1037	PP+Metals
B-10-1	2 feet	Northwest of Test Pit B-9 near the wash area on the north-central portion of the mine waste rock area	8/19/2016	1051	RCRA Metals
B-10-2	4 feet		8/19/2016	1059	RCRA Metals
B-11-1	1.5 feet	Southwest of Test Pit B-10 near the northwestern portion of the mine waste rock area	8/19/2016	1120	RCRA Metals
B-11-2	3 feet		8/19/2016	1136	N/A
B-12-1	0.5 foot	Northeast of Test Pit B-11 and north of the wash north of the mine waste rock area	8/19/2016	1149	N/A
B-12-2	1 foot		8/19/2016	1201	N/A
B-13	0.5-1 foot	On the sloped portion of the upper leach pit area off-site in the apparent surface runoff location from the upper pit	8/19/2016	1220	PP+Metals
B-14	0.5-1 foot	Base of the runoff area from the lower pit in the leach pit area off-site	8/19/2016	1231	RCRA Metals
B-15	0.5-1 foot	Base of the runoff area from the lower pit in the leach pit area off-site	8/19/2016	1236	PP+Metals
B-16	0.5-1 foot	Base of the runoff area from the lower pit in the leach pit area off-site	8/19/2016	1239	RCRA Metals, total cyanide, free cyanide
C-1	2-4 inches	Sloped area across wash north of the mine waste rock area.	8/22/2016	610	RCRA Metals
C-2	2-4 inches	Sloped area across wash northeast of the mine waste rock area	8/22/2016	615	Total Arsenic
C-3	2-4 inches	Sloped area across wash east of the mine waste rock area	8/22/2016	617	RCRA Metals
C-3A	6 inches		8/30/2016	1452	RCRA Metals
C-4	2-4 inches	Sloped area across wash southeast of the mine waste rock area	8/22/2016	621	Total Arsenic
C-5	6 inches	South of mine waste rock area	8/30/2016	1125	Total Arsenic
C-6	6 inches	South of mine waste rock area	8/30/2016	1155	RCRA Metals
C-7	6 inches	South of mine waste rock area	8/30/2016	1205	Total Arsenic
C-8	6 inches	South of mine waste rock area	8/30/2016	1218	Total Arsenic

**TABLE I**  
**SAMPLE INFORMATION**

Sample Number	Depth (bgs)	Sample Location	Collection Date	Collection Time	Laboratory Analysis
C-9	6 inches	South of mine waste rock area	8/30/2016	1230	Total Arsenic
C-10	6 inches	South of mine waste rock area	8/30/2016	1245	Total Arsenic
C-11	6 inches	South of mine waste rock area	8/30/2016	1257	RCRA Metals
C-12	6 inches	South of mine waste rock area	8/30/2016	1307	Total Arsenic
C-13	6 inches	South of mine waste rock area	8/30/2016	1340	Total Arsenic
C-14	6 inches	South of mine waste rock area	8/30/2016	1355	Total Arsenic
C-15	6 inches	South of mine waste rock area	8/30/2016	1410	RCRA Metals
C-16	6 inches	South of mine waste rock area	8/30/2016	1422	RCRA Metals
C-17	6 inches	North of mine waste rock area	8/30/2016	1516	RCRA Metals
C-18	6 inches	North of mine waste rock area	8/30/2016	1525	RCRA Metals
C-19	6 inches	North of mine waste rock area	8/30/2016	1545	Total Arsenic
C-20	6 inches	North of mine waste rock area	8/30/2016	1555	Total Arsenic
C-21	6 inches	North of mine waste rock area	8/30/2016	1605	Total Arsenic
C-22	6 inches	North of mine waste rock area	8/30/2016	1623	Total Arsenic
C-23	6 inches	North of mine waste rock area	8/30/2016	1644	RCRA Metals
C-24	6 inches	South of mine waste rock area	8/30/2016	1725	Total Arsenic
G1	0-3 inches	Northeast of mine waste rock area	3/15/2019	743	RCRA Metals
G2	0-3 inches	Near the underground mine workings area	3/15/2019	749	RCRA Metals
G2-2	3 feet		3/29/2019	1004	RCRA Metals
G3	0-3 inches	North of mine waste rock area	3/15/2019	756	RCRA Metals
T1-S1	2-3 feet	Near northern border of mine waste rock area	3/15/2019	809	RCRA Metals
T2-S1	7-8 feet	Near northeast border of mine waste rock area	3/15/2019	831	RCRA Metals
T3-S1	7-8 feet	Near eastern border of mine waste rock area	3/15/2019	858	RCRA Metals
G4	0-3 inches	Southeast of mine waste rock area	3/15/2019	908	RCRA Metals
T4-S1	2-3 feet	Southeast of mine waste rock area	3/15/2019	914	RCRA Metals
G5	0-3 inches	South of mine waste rock area	3/15/2019	925	RCRA Metals

**TABLE I**  
**SAMPLE INFORMATION**

Sample Number	Depth (bgs)	Sample Location	Collection Date	Collection Time	Laboratory Analysis
T5-S1	1-2 feet	Northern portion of mine waste rock area	3/15/2019	1039	RCRA Metals
AD-1	0-3 inches	North of mine waste rock area	3/15/2019	1045	RCRA Metals
AD-1-1	13 inches		3/29/2019	1107	RCRA Metals
AD-2	0-3 inches	North of mine waste rock area	3/15/2019	1048	RCRA Metals
G6	0-3 inches	South of mine waste rock area	3/15/2019	1116	RCRA Metals
G7	0-3 inches	Southwest of mine waste rock area	3/15/2019	1120	RCRA Metals
G8	0-3 inches	West of mine waste rock area	3/15/2019	1123	RCRA Metals
T7-S1	2 feet	Near northeast border of mine waste rock area	3/15/2019	1148	RCRA Metals
T8-S1	1 foot	Near eastern border of mine waste rock area	3/15/2019	1153	RCRA Metals
T9-S1	4 feet	Near the underground mine workings area	3/15/2019	1211	RCRA Metals
T10-S1	4 feet	Near the middle of the mine waste rock area	3/15/2019	1233	RCRA Metals
G9	0-3 inches	Near the southwest border of the mine waste rock area	3/15/2019	1304	RCRA Metals
T11-S1	8-9 feet	Near the southeast border of the mine waste rock area	3/15/2019	1308	RCRA Metals
G11	0-3 inches	South of the mine waste rock area	3/15/2019	1316	RCRA Metals
G12	0-3 inches	North of the mine waste rock area	3/15/2019	1320	RCRA Metals
G13	0-3 inches	Southeast of the mine waste rock area	3/15/2019	1330	RCRA Metals
G10	0-3 inches	South of the mine waste rock area	3/15/2019	1312	RCRA Metals
AD2-1	0-3 inches	Near the underground mine workings area	3/29/2019	1012	RCRA Metals
AD2-2	0-3 inches	Near the underground mine workings area	3/29/2019	1015	RCRA Metals
AD2-3	0-3 inches	Near the underground mine workings area	3/29/2019	1020	RCRA Metals
AD2-4	0-3 inches	Near the underground mine workings area	3/29/2019	1024	RCRA Metals
AD2-5	0-3 inches	Near the underground mine workings area	3/29/2019	1028	RCRA Metals
AD2-6	0-3 inches	Near the underground mine workings area	3/29/2019	1036	RCRA Metals
AD-3	16 inches	North of the mine waste rock area	3/29/2019	1053	RCRA Metals
AD-4	0-3 inches	North of the mine waste rock area	3/29/2019	1112	RCRA Metals

**TABLE I**  
**SAMPLE INFORMATION**

Sample Number	Depth (bgs)	Sample Location	Collection Date	Collection Time	Laboratory Analysis
AD2-7	0-3 inches	Near the underground mine workings area	4/22/2019	948	RCRA Metals
AD2-8	0-3 inches	Near the underground mine workings area	4/22/2019	943	RCRA Metals
AD2-9	0-3 inches	Near the underground mine workings area	4/22/2019	917	RCRA Metals

**Notes:**

- bgs            Below the ground surface
- VOCs        Volatile Organic Compounds
- PAHs        Polynuclear Aromatic Hydrocarbons
- RCRA        Resource Conservation and Recovery Act
- PP+Metals   Total 13 Priority Pollutant plus Barium Metals
- N/A          Not Analyzed
- Time is reported as a 24-hour clock time.

**TABLE 2.1**  
**SUMMARY OF RCRA METALS IN BACKGROUND SOIL SAMPLES AND REGULATORY STANDARDS**  
**ALLWYN PHASE II ENVIRONMENTAL SITE ASSESSMENT - 2016**

Metals Analytes	Unit	Analytical Test Results					Residential SRLs			Non-Residential SRLs	Minimum GPL	Typical Natural Soil Background
		Sample Number					Carcinogen		Non-Carcinogen			
		C-1	C-2	C-3	C-3A	C-4	10 <sup>-6</sup> Risk	10 <sup>-5</sup> Risk				
Arsenic	mg/kg	27.9	24.9	61.0	40.9	54.0	10	10	10	10	290	3.1 – 24
Barium	mg/kg	156	---	222	213	---	NE	NE	15,000	170,000	12,000	72.6 – 230
Cadmium	mg/kg	0.543	---	1.30	<0.500	---	NE	NE	39	510	29	ND – 1.7
Chromium III <sup>1</sup>	mg/kg	25.3	---	167	355	---	NE	NE	120,000	1,000,000	590	5.4 – 34
Chromium VI <sup>1</sup>	mg/kg			30		NE	65					
Lead	mg/kg	87.2	27.2	883	18.1	48.2	NE	NE	400	800	290	ND – 24.5
Mercury	mg/kg	<0.0200	---	<0.0200	0.0282	---	NE	NE	23	310	12	ND - 0.25
Selenium	mg/kg	<2.00	---	<2.00	<2.00	---	NE	NE	390	5,100	290	<0.4 - 1.0
Silver	mg/kg	<1.00	---	<1.00	<1.00	---	NE	NE	390	5,100	NE	<0.05 - 0.8

Metals Analytes	Unit	Analytical Test Results					Residential SRLs			Non-Residential SRLs	Minimum GPL	Typical Natural Soil Background
		Sample Number					Carcinogen		Non-Carcinogen			
		C-5	C-6	C-7	C-8	C-9	10 <sup>-6</sup> Risk	10 <sup>-5</sup> Risk				
Arsenic	mg/kg	3.87	4.09	4.20	4.14	5.56	10	10	10	10	290	3.1 – 24
Barium	mg/kg	---	108	---	---	---	NE	NE	15,000	170,000	12,000	72.6 – 230
Cadmium	mg/kg	---	<0.500	---	---	---	NE	NE	39	510	29	ND – 1.7
Chromium III <sup>1</sup>	mg/kg	---	10.4	---	---	---	NE	NE	120,000	1,000,000	590	5.4 – 34
Chromium VI <sup>1</sup>	mg/kg						30		NE	65		
Lead	mg/kg	9.55	7.43	7.28	6.56	35.3	NE	NE	400	800	290	ND – 24.5
Mercury	mg/kg	---	<0.0200	---	---	---	NE	NE	23	310	12	ND - 0.25
Selenium	mg/kg	---	<2.00	---	---	---	NE	NE	390	5,100	290	<0.4 - 1.0
Silver	mg/kg	---	<1.00	---	---	---	NE	NE	390	5,100	NE	<0.05 - 0.8

**TABLE 2.1**  
**SUMMARY OF RCRA METALS IN BACKGROUND SOIL SAMPLES AND REGULATORY STANDARDS**  
**ALLWYN PHASE II ENVIRONMENTAL SITE ASSESSMENT - 2016**

Metals Analytes	Unit	Analytical Test Results					Residential SRLs			Non-Residential SRLs	Minimum GPL	Typical Natural Soil Background
		Sample Number					Carcinogen		Non-Carcinogen			
		C-10	C-11	C-12	C-13	C-14	10 <sup>-6</sup> Risk	10 <sup>-5</sup> Risk				
Arsenic	mg/kg	4.08	6.83	3.41	4.75	4.16	10	10	10	10	290	3.1 – 24
Barium	mg/kg	---	157	---	---	---	NE	NE	15,000	170,000	12,000	72.6 – 230
Cadmium	mg/kg	---	<0.500	---	---	---	NE	NE	39	510	29	ND – 1.7
Chromium III <sup>1</sup>	mg/kg	---	17.5	---	---	---	NE	NE	120,000	1,000,000	590	5.4 – 34
Chromium VI <sup>1</sup>	mg/kg						30					
Lead	mg/kg	9.53	12.7	11.3	13.3	8.04	NE	NE	400	800	290	ND – 24.5
Mercury	mg/kg	---	0.0270	---	---	---	NE	NE	23	310	12	ND - 0.25
Selenium	mg/kg	---	<2.00	---	---	---	NE	NE	390	5,100	290	<0.4 - 1.0
Silver	mg/kg	---	<1.00	---	---	---	NE	NE	390	5,100	NE	<0.05 - 0.8

Metals Analytes	Unit	Analytical Test Results					Residential SRLs			Non-Residential SRLs	Minimum GPL	Typical Natural Soil Background
		Sample Number					Carcinogen		Non-Carcinogen			
		C-15	C-16	C-17	C-18	C-19	10 <sup>-6</sup> Risk	10 <sup>-5</sup> Risk				
Arsenic	mg/kg	5.06	68.2	7.80	6.84	22.6	10	10	10	10	290	3.1 – 24
Barium	mg/kg	121	220	146	139	---	NE	NE	15,000	170,000	12,000	72.6 – 230
Cadmium	mg/kg	<0.500	0.898	<0.500	<0.500	---	NE	NE	39	510	29	ND – 1.7
Chromium III <sup>1</sup>	mg/kg	16.8	202	18.9	26.9	---	NE	NE	120,000	1,000,000	590	5.4 – 34
Chromium VI <sup>1</sup>	mg/kg						30					
Lead	mg/kg	40.7	118	10.9	37.6	12.6	NE	NE	400	800	290	ND – 24.5
Mercury	mg/kg	<0.0200	0.0473	0.0203	0.0201	---	NE	NE	23	310	12	ND - 0.25
Selenium	mg/kg	<2.00	<2.00	<2.00	<2.00	---	NE	NE	390	5,100	290	<0.4 - 1.0
Silver	mg/kg	<1.00	<1.00	<1.00	<1.00	---	NE	NE	390	5,100	NE	<0.05 - 0.8

**TABLE 2.1**  
**SUMMARY OF RCRA METALS IN BACKGROUND SOIL SAMPLES AND REGULATORY STANDARDS**  
**ALLWYN PHASE II ENVIRONMENTAL SITE ASSESSMENT - 2016**

Metals Analytes	Unit	Analytical Test Results					Residential SRLs			Non-Residential SRLs	Minimum GPL	Typical Natural Soil Background
		Sample Number					Carcinogen		Non-Carcinogen			
		C-20	C-21	C-22	C-23	C-24	10 <sup>-6</sup> Risk	10 <sup>-5</sup> Risk				
Arsenic	mg/kg	6.46	10.5	5.10	3.23	5.24	10	10	10	10	290	3.1 – 24
Barium	mg/kg	---	---	---	89.1	---	NE	NE	15,000	170,000	12,000	72.6 – 230
Cadmium	mg/kg	---	---	---	<0.500	---	NE	NE	39	510	29	ND – 1.7
Chromium III <sup>1</sup>	mg/kg	---	---	---	45.4	---	NE	NE	120,000	1,000,000	590	5.4 – 34
Chromium VI <sup>1</sup>	mg/kg	---	---	---		30	NE	NE	65			
Lead	mg/kg	8.98	11.0	15.1	7.58	16.8	NE	NE	400	800	290	ND – 24.5
Mercury	mg/kg	---	---	---	<0.0200	---	NE	NE	23	310	12	ND - 0.25
Selenium	mg/kg	---	---	---	<2.00	---	NE	NE	390	5,100	290	<0.4 - 1.0
Silver	mg/kg	---	---	---	<1.00	---	NE	NE	390	5,100	NE	<0.05 - 0.8

**Notes:**

Resource Conservation and Recovery Act (RCRA) Metals analyzed using EPA Methods 6010B / 7471A

SRLs - Soil Remediation Levels established by the Arizona Department of Environmental Quality, Arizona Administrative Code, Title 18, Chapter 7, Appendix A, January 19, 2007 2

Minimum GPL – Groundwater Protection Levels, established by the Arizona Department of Environmental Quality, *A Screening Method to Determine Soil Concentrations Protective of Groundwater Quality*, September 1996 and November 1, 2008 Minimum GPLs.

Typical natural soil background concentrations from Evaluation of Background Metals Concentrations in Arizona Soils, Prepared by The Earth Technology Corporation, June 1991.

mg/kg milligrams per kilogram

NE Not Established

ND Not Detected

TCLP Toxicity Characteristic Leaching Procedure

<sup>1</sup> Arizona SRLs differentiate Chromium III and Chromium IV. Samples were analyzed for total Chromium. Minimum GPL, typical natural soil background levels, and 20 times TCLP levels are for Total Chromium.

**Shaded** cell value indicates sample result exceeds the residential SRL and non-residential SRL

**Shaded** cell value indicates sample results exceeds the residential SRL

**Shaded** cell value indicates sample result exceeds the residential SRL and minimum GPL

**Shaded** cell value indicates sample results exceeds the minimum GPL.

TABLE 2.2  
 SUMMARY OF METALS IN SOIL SAMPLES AND REGULATORY STANDARDS  
 ALLWYN PHASE I ENVIRONMENTAL SITE ASSESSMENT - 2016

Metals Analytes	Unit	Analytical Test Results						Residential SRLs			Non-Residential SRLs	Minimum GPL	Typical Natural Soil Background
		Sample Number						Carcinogen		Non-Carcinogen			
		B1	B2	B3	B4	B5	B6	10 <sup>-6</sup> Risk	10 <sup>-5</sup> Risk				
Antimony	mg/kg	---	---	<2.00	<2.00	<2.00	---	NE	NE	31	410	35	<0.4 - 3.8
Arsenic	mg/kg	<b>5.12</b>	<b>21.4</b>	<b>27.2</b>	<b>15.7</b>	<b>10.5</b>	<b>5.12</b>	10	10	10	10	290	3.1 - 24
Barium	mg/kg	<b>177</b>	<b>229</b>	NA	NA	NA	<b>177</b>	NE	NE	15,000	170,000	12,000	72.6 - 230
Beryllium	mg/kg	---	---	<b>0.577</b>	<b>3.02</b>	<b>0.654</b>	---	NE	NE	150	1,900	23	0.3 - 2.0
Cadmium	mg/kg	<0.500	<b>1.2</b>	<b>4.18</b>	<0.500	<0.500	<0.500	NE	NE	39	510	29	ND - 1.7
Chromium III <sup>1</sup>	mg/kg	<b>14.7</b>	<b>27.9</b>	<b>13.2</b>	<b>138</b>	<b>15.6</b>	<b>18.3</b>	NE	NE	120,000	1,000,000	590	5.4 - 34
Chromium VI <sup>1</sup>	mg/kg							30					
Copper	mg/kg	---	<2.00	<b>44.0</b>	<b>49.6</b>	<b>28.5</b>	---	NE	NE	3,100	41,000	NE	
Lead	mg/kg	<b>12.3</b>	<b>219</b>	<b>1,230</b>	<b>15.1</b>	<b>86.6</b>	<b>116</b>	NE	NE	400	800	290	ND - 24.5
Mercury	mg/kg	<0.0200	<b>0.0231</b>	<b>0.0747</b>	<0.0200	<b>0.0223</b>	<b>0.0202</b>	NE	NE	23	310	12	ND - 0.25
Nickel	mg/kg	---	---	<b>12.5</b>	<b>262</b>	<b>16.7</b>	---	5,200	NE	1,600	20,000	590	9.2 - 28
Selenium	mg/kg	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	NE	NE	390	5,100	290	<0.4 - 1.0
Silver	mg/kg	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	NE	NE	390	5,100	NE	<0.05 - 0.8
Thallium	mg/kg	---	---	<2.00	<2.00	<2.00	---	NE	NE	5.2	67	12	0.5 - <1.0
Zinc	mg/kg	---	---	<b>1,790</b>	<b>77.5</b>	<b>110</b>	---	NE	NE	23,000	310,000	NE	15 - 81

**Notes:**

Resource Conservation and Recovery Act (RCRA) Metals and Priority Pollutant Metals analyzed using EPA Method 6010B or C. RCRA Metal mercury analyzed using EPA Method 7471B. Result for chromium is total chromium.  
 Analytical results in **bold** exceed Laboratory Reporting Limit  
 SRLs - Soil Remediation Levels established by the Arizona Department of Environmental Quality, Arizona Administrative Code, Title 18, Chapter 7, Appendix A, January 19, 2007 2  
 Minimum GPL – Groundwater Protection Levels, established by the Arizona Department of Environmental Quality, *A Screening Method to Determine Soil Concentrations Protective of Groundwater Quality*, September 1996 and November 1, 2008 Minimum GPLs.  
 Typical natural soil background concentrations from Evaluation of Background Metals Concentrations in Arizona Soils, Prepared by The Earth Technology Corporation, June 1991.  
 mg/kg milligrams per kilogram  
 NE Not Established  
 --- Not Analyzed

**TABLE 2.2**  
**SUMMARY OF METALS IN SOIL SAMPLES AND REGULATORY STANDARDS**  
**ALLWYN PHASE I ENVIRONMENTAL SITE ASSESSMENT - 2016**

ND Not Detected

TCLP Toxicity Characteristic Leaching Procedure

I Arizona SRLs differentiate Chromium III and Chromium IV. Samples were analyzed for total Chromium. Minimum GPL, typical natural soil background levels, and 20 times TCLP levels are for Total Chromium.

**Shaded** cell value indicates sample result exceeds the residential SRL and non-residential SRL

**Shaded** cell value indicates sample results exceeds the residential SRL

**Shaded** cell value indicates sample result exceeds the residential SRL and minimum GPL

**Shaded** cell value indicates sample results exceeds the minimum GPL.

TABLE 2.3  
 SUMMARY OF METALS IN SOIL SAMPLES AND REGULATORY STANDARDS  
 ALLWYN PHASE II ENVIRONMENTAL SITE ASSESSMENT - 2016

Metals Analytes	Unit	Analytical Test Results						Residential SRLs			Non-Residential SRLs	Minimum GPL	Typical Natural Soil Background
		Sample Number						Carcinogen		Non-Carcinogen			
		B-1-1	B-1-2	B-2-1	B-2-2	B-3-1	B-3-2	10 <sup>-6</sup> Risk	10 <sup>-5</sup> Risk				
Antimony	mg/kg	---	---	<2.00	<2.00	---	---	NE	NE	31	410	35	<0.4 - 3.8
Arsenic	mg/kg	38.2	41.7	71.7	26.9	30.5	46.9	10	10	10	10	290	3.1 - 24
Barium	mg/kg	125	80.8	---	---	190	184	NE	NE	15,000	170,000	12,000	72.6 - 230
Beryllium	mg/kg	---	---	0.736	0.741	---	---	NE	NE	150	1,900	23	0.3 - 2.0
Cadmium	mg/kg	1.83	0.707	3.77	1.19	0.689	1.40	NE	NE	39	510	29	ND - 1.7
Chromium III <sup>1</sup>	mg/kg	79.1	204	14.8	21.6	187	170	NE	NE	120,000	1,000,000	590	5.4 - 34
Chromium VI <sup>1</sup>	mg/kg							30		NE	65		
Copper	mg/kg	---	---	110	54.4	---	---	NE	NE	3,100	41,000	3,100	9.2 - 28
Lead	mg/kg	292	35.9	1,170	357	57.4	100	NE	NE	400	800	290	ND - 24.5
Mercury	mg/kg	0.0346	<0.0200	0.0670	0.0404	0.0571	0.0221	NE	NE	23	310	12	ND - 0.25
Nickel	mg/kg	---	---	12.1	20.3	---	---	5,200	NE	1,600	20,000	290	9.2 - 28
Selenium	mg/kg	<2.00	<2.00	2.04	<2.0	<2.00	<2.00	NE	NE	390	5,100	290	<0.4 - 1.0
Silver	mg/kg	<1.00	<1.00	<1.00	<1.00	---	<1.00	NE	NE	390	5,100	NE	<0.05 - 0.8
Thallium	mg/kg	---	---	<2.00	<2.00	---	---	NE	NE	5.2	67	12	0.5 - <1.0
Zinc	mg/kg	---	---	2,420	498	---	---	NE	NE	23,000	310,000	23,000	15 - 81

TABLE 2.3  
 SUMMARY OF METALS IN SOIL SAMPLES AND REGULATORY STANDARDS  
 ALLWYN PHASE II ENVIRONMENTAL SITE ASSESSMENT - 2016

Metals Analytes	Unit	Analytical Test Results						Residential SRLs			Non-Residential SRLs	Minimum GPL	Typical Natural Soil Background
		Sample Number						Carcinogen		Non-Carcinogen			
		B-4-1	B-5-1	B-5-2	B-6-1	B-6-2	B-7-1	10 <sup>-6</sup> Risk	10 <sup>-5</sup> Risk				
Antimony	mg/kg	<2.00	<2.00	<2.00	---	---	2.01	NE	NE	31	410	35	<0.4 - 3.8
Arsenic	mg/kg	10.9	10.2	5.48	17.4	3.50	41.8	10	10	10	10	290	3.1 - 24
Barium	mg/kg	---	---	---	116	94.6	---	NE	NE	15,000	170,000	12,000	72.6 - 230
Beryllium	mg/kg	0.776	0.739	0.454	---	---	0.452	NE	NE	150	1,900	23	0.3 - 2.0
Cadmium	mg/kg	0.518	<0.500	<0.500	2.52	<0.500	3.17	NE	NE	39	510	29	ND - 1.7
Chromium III <sup>1</sup>	mg/kg	37.4	24.8	14.6	17.9	8.36	80.8	NE	NE	120,000	1,000,000	590	5.4 - 34
Chromium VI <sup>1</sup>	mg/kg							30		NE	65		
Copper	mg/kg	28.5	18.8	20.4	---	---	26.0	NE	NE	3,100	41,000	3,100	
Lead	mg/kg	84.7	17.8	12.1	215	8.28	124	NE	NE	400	800	290	ND - 24.5
Mercury	mg/kg	<0.0200	<0.0200	<0.0200	0.0418	<0.0200	0.0319	NE	NE	23	310	12	ND - 0.25
Nickel	mg/kg	61.1	36.2	18.1	---	---	80.7	5,200	NE	1,600	20,000	290	9.2 - 28
Selenium	mg/kg	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	NE	NE	390	5,100	290	<0.4 - 1.0
Silver	mg/kg	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	NE	NE	390	5,100	NE	<0.05 - 0.8
Thallium	mg/kg	<2.00	<2.00	<2.00	---	---	<2.00	NE	NE	5.2	67	12	0.5 - <1.0
Zinc	mg/kg	131	37.5	39.1	---	---	276	NE	NE	23,000	310,000	23,000	15 - 81

TABLE 2.3  
 SUMMARY OF METALS IN SOIL SAMPLES AND REGULATORY STANDARDS  
 ALLWYN PHASE II ENVIRONMENTAL SITE ASSESSMENT - 2016

Metals Analytes	Unit	Analytical Test Results						Residential SRLs			Non-Residential SRLs	Minimum GPL	Typical Natural Soil Background
		Sample Number						Carcinogen		Non-Carcinogen			
		B-7-2	B-8-1	B-8-2	B-9-1	B-9-2	B-10-1	10 <sup>-6</sup> Risk	10 <sup>-5</sup> Risk				
Antimony	mg/kg	<2.00	---	---	2.48	4.11	---	NE	NE	31	410	35	<0.4 - 3.8
Arsenic	mg/kg	4.17	19.9	51.1	49.9	92.9	104	10	10	10	10	290	3.1 - 24
Barium	mg/kg	---	130	129	---	---	144	NE	NE	15,000	170,000	12,000	72.6 - 230
Beryllium	mg/kg	0.300	---	---	0.718	0.490	---	NE	NE	150	1,900	23	0.3 - 2.0
Cadmium	mg/kg	<0.500	0.556	0.936	0.983	1.58	1.45	NE	NE	39	510	29	ND - 1.7
Chromium III <sup>1</sup>	mg/kg	7.92	53.0	155	127	184	118	NE	NE	120,000	1,000,000	590	5.4 - 34
Chromium VI <sup>1</sup>	mg/kg							30		NE	65		
Copper	mg/kg	13.6	---	---	29.1	18.1	NA	NE	NE	3,100	41,000	3,100	
Lead	mg/kg	14.4	78.3	66.6	45.4	53.0	80.9	NE	NE	400	800	290	ND - 24.5
Mercury	mg/kg	0.0294	0.0287	0.0291	0.0245	0.0203	0.0293	NE	NE	23	310	12	ND - 0.25
Nickel	mg/kg	12.1	---	---	116	172	---	5,200	NE	1,600	20,000	290	9.2 - 28
Selenium	mg/kg	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	NE	NE	390	5,100	290	<0.4 - 1.0
Silver	mg/kg	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	NE	NE	390	5,100	NE	<0.05 - 0.8
Thallium	mg/kg	<2.00	---	---	<2.00	<2.00	---	NE	NE	5.2	67	12	0.5 - <1.0
Zinc	mg/kg	42.1	---	---	156	258	---	NE	NE	23,000	310,000	23,000	15 - 81

TABLE 2.3  
 SUMMARY OF METALS IN SOIL SAMPLES AND REGULATORY STANDARDS  
 ALLWYN PHASE II ENVIRONMENTAL SITE ASSESSMENT - 2016

Metals Analytes	Unit	Analytical Test Results						Residential SRLs			Non-Residential SRLs	Minimum GPL	Typical Natural Soil Background
		Sample Number						Carcinogen		Non-Carcinogen			
		B-10-2	B-11-1	B-13	B-14	B-15	B-16	10 <sup>-6</sup> Risk	10 <sup>-5</sup> Risk				
Antimony	mg/kg	---	---	<2.00	---	<2.00	---	NE	NE	31	410	35	<0.4 - 3.8
Arsenic	mg/kg	<b>56.6</b>	<b>6.66</b>	<b>7.56</b>	<b>10.7</b>	<b>10.1</b>	<b>19.4</b>	10	10	10	10	290	3.1 - 24
Barium	mg/kg	<b>205</b>	<b>143</b>	---	163	---	<b>162</b>	NE	NE	15,000	170,000	12,000	72.6 - 230
Beryllium	mg/kg	---	---	<b>0.603</b>	---	<b>0.808</b>	---	NE	NE	150	1,900	23	0.3 - 2.0
Cadmium	mg/kg	<b>1.40</b>	<0.500	<0.500	<0.500	<0.500	<0.500	NE	NE	39	510	29	ND - 1.7
Chromium III <sup>1</sup>	mg/kg	<b>174</b>	<b>19.0</b>	<b>22.3</b>	<b>19.6</b>	<b>25.6</b>	<b>27.4</b>	NE	NE	120,000	1,000,000	590	5.4 - 34
Chromium VI <sup>1</sup>	mg/kg							30		NE	65		
Copper	mg/kg	---	---	<b>34.6</b>	---	<b>52.5</b>	---	NE	NE	3,100	41,000	3,100	
Lead	mg/kg	<b>163</b>	<b>13.7</b>	<b>84.1</b>	<b>97.9</b>	<b>82.2</b>	<b>145</b>	NE	NE	400	800	290	ND - 24.5
Mercury	mg/kg	<b>0.0349</b>	<b>0.0426</b>	<b>0.0285</b>	<b>0.0256</b>	<b>0.0247</b>	<b>0.0438</b>	NE	NE	23	310	12	ND - 0.25
Nickel	mg/kg	---	---	<b>20.7</b>	---	<b>22.3</b>	---	5,200	NE	1,600	20,000	290	9.2 - 28
Selenium	mg/kg	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	NE	NE	390	5,100	290	<0.4 - 1.0
Silver	mg/kg	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	NE	NE	390	5,100	NE	<0.05 - 0.8
Thallium	mg/kg	---	---	<2.00	---	<2.00	---	NE	NE	5.2	67	12	0.5 - <1.0
Zinc	mg/kg	---	---	<b>105</b>	---	<b>105</b>	---	NE	NE	23,000	310,000	23,000	15 - 81

**Notes:**

Resource Conservation and Recovery Act (RCRA) Metals and Priority Pollutant Metals analyzed using EPA Method 6010B or C, except RCRA Metal mercury analyzed using EPA Method 7471B. Result for chromium is total chromium.

Analytical results in **bold** exceed Laboratory Reporting Limit

SRLs - Soil Remediation Levels established by the Arizona Department of Environmental Quality, Arizona Administrative Code, Title 18, Chapter 7, Appendix A, January 19, 2007 2

Minimum GPL – Groundwater Protection Levels, established by the Arizona Department of Environmental Quality, *A Screening Method to Determine Soil Concentrations Protective of Groundwater Quality*, September 1996 and November 1, 2008 Minimum GPLs.

Typical natural soil background concentrations from Evaluation of Background Metals Concentrations in Arizona Soils, Prepared by The Earth Technology Corporation, June 1991.

mg/kg milligrams per kilogram

**TABLE 2.3**  
**SUMMARY OF METALS IN SOIL SAMPLES AND REGULATORY STANDARDS**  
**ALLWYN PHASE II ENVIRONMENTAL SITE ASSESSMENT - 2016**

NE Not Established

--- Not Analyzed

ND Not Detected

TCLP Toxicity Characteristic Leaching Procedure

I Arizona SRLs differentiate Chromium III and Chromium IV. Samples were analyzed for total Chromium. Minimum GPL, typical natural soil background levels, and 20 times TCLP levels are for Total Chromium.

**Shaded** cell value indicates sample result exceeds the residential SRL and non-residential SRL

**Shaded** cell value indicates sample results exceeds the residential SRL

**Shaded** cell value indicates sample result exceeds the residential SRL and minimum GPL

**Shaded** cell value indicates sample results exceeds the minimum GPL.

**TABLE 2.4**  
**SUMMARY OF CHROMIUM VI CONCENTRATIONS IN SOIL SAMPLES AND REGULATORY STANDARDS**  
**ALLWYN PHASE II ENVIRONMENTAL SITE ASSESSMENT - 2016**

Metal Analyte	Analytical Results (mg/kg)							Soil Remediation Levels (SRLs)		Typical Natural Soil Background
	Sample Number							Residential	Non-Residential	
	B4	B-1-2	B-3-1	B-8-2	B-9-2	B-10-2	C3A			
Chromium	<b>138</b>	<b>204</b>	<b>187</b>	<b>155</b>	<b>184</b>	<b>174</b>	<b>355</b>	120,000	1,000,000	5.4 – 34
Chromium VI	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	30	65	5.4 – 34

**Notes:**

Resource Conservation and Recovery Act (RCRA) Metals, RCRA Metal chromium analyzed using EPA Method 6010C. Result for chromium is total chromium.

Hexavalent Chromium or Chromium VI analyzed using EPA Methods 3060A / 7196A

Analytical results shown in **bold** exceed Laboratory Reporting Limit

mg/kg Milligrams per kilogram

--- Not Analyzed

**Shaded** cell value exceeds the residential and non-residential SRLs

**Shaded** cell value exceeds the residential SRL

**TABLE 2.5  
 SUMMARY OF LEACHABLE METALS CONCENTRATIONS IN SOIL SAMPLES AND REGULATORY STANDARDS  
 ALLWYN PHASE II ENVIRONMENTAL SITE ASSESSMENT – 2016**

Analyte	Analytical Results (mg/l)		Characteristic Hazardous Waste Levels (TCLP)	Aquifer Water Quality Standards (SPLP)
	Sample Number			
	B3			
Extraction	TCLP		NA	NA
Arsenic	---		5.0	0.050
Barium	---		100.0	2.0
Cadmium	---		1.0	0.0050
Chromium	---		5.0	0.10
Lead	<0.450		5.0	0.050
Mercury	---		0.20	0.0020
Selenium	---		1.0	0.050
Silver	---		5.0	NE

Analyte	Analytical Results (mg/l)					Characteristic Hazardous Waste Levels (TCLP)	Aquifer Water Quality Standards (SPLP)
	Sample Number						
	B-1-1	B-1-1	B-1-2	B-2-1	B-2-1		
Extraction	TCLP	SPLP	TCLP	TCLP	SPLP	NA	NA
Arsenic	---	<b>0.0363</b>	---	---	<b>0.122</b>	5.0	0.050
Barium	---	<b>0.150</b>	---	---	<b>0.360</b>	100.0	2.0
Cadmium	---	<0.00200	---	---	<0.00200	1.0	0.0050
Chromium	---	<b>0.0185</b>	<0.450	---	<b>0.0223</b>	5.0	0.10
Lead	<0.450	<b>0.0604</b>	---	<0.450	<b>1.07</b>	5.0	0.050
Mercury	---	<0.000200	---	---	<0.000200	0.20	0.0020
Selenium	---	<0.0100	---	---	<0.0100	1.0	0.050
Silver	---	<0.00500	---	---	<0.00500	5.0	NE

**TABLE 2.5  
 SUMMARY OF LEACHABLE METALS CONCENTRATIONS IN SOIL SAMPLES AND REGULATORY STANDARDS  
 ALLWYN PHASE II ENVIRONMENTAL SITE ASSESSMENT – 2016**

Analyte	Analytical Results (mg/kg)					Characteristic Hazardous Waste Levels (TCLP)	Aquifer Water Quality Standards (SPLP)
	Sample Number						
	B-2-2	B-3-1	B-3-1	B-3-2	B-6-1		
Extraction	TCLP	TCLP	SPLP	TCLP	TCLP	NA	NA
Arsenic	---	---	<b>0.0440</b>	---	---	5.0	0.050
Barium	---	---	<b>0.371</b>	---	---	100.0	2.0
Cadmium	---	---	<0.00200	---	---	1.0	0.0050
Chromium	---	<0.450	<b>0.218</b>	<0.450	---	5.0	0.10
Lead	<b>3.61</b>	---	<b>0.145</b>	---	<0.450	5.0	0.050
Mercury	---	---	<0.00020	---	---	0.20	0.0020
Selenium	---	---	<0.0100	---	---	1.0	0.050
Silver	---	---	<0.00500	---	---	5.0	NE

Analyte	Analytical Results (mg/kg)					Characteristic Hazardous Waste Levels (TCLP)	Aquifer Water Quality Standards (SPLP)
	Sample Number						
	B-8-2	B-9-1	B-9-2	B-10-1	B-10-2		
Extraction	TCLP	SPLP	TCLP	TCLP	TCLP	NA	NA
Arsenic	---	<b>0.0182</b>	<0.450	<0.450	---	5.0	0.050
Barium	---	<b>0.0995</b>	---	---	---	100.0	2.0
Cadmium	---	<0.00200	---	---	---	1.0	0.0050
Chromium	<0.450	<b>0.0138</b>	<0.450	---	<0.450	5.0	0.10
Lead	---	<b>0.0319</b>	---	---	<0.450	5.0	0.050
Mercury	---	<0.000200	---	---	---	0.20	0.0020
Selenium	---	<0.0100	---	---	---	1.0	0.050
Silver	---	<0.00500	---	---	---	5.0	NE

**TABLE 2.5**  
**SUMMARY OF LEACHABLE METALS CONCENTRATIONS IN SOIL SAMPLES AND REGULATORY STANDARDS**  
**ALLWYN PHASE II ENVIRONMENTAL SITE ASSESSMENT – 2016**

Notes:

TCLP – Toxicity Characteristic Lead Procedure

Toxicity characteristic established by 40 Code of Federal Regulations (CFR) §261.24

SPLP – Synthetic Precipitation Leaching Procedure

Samples prepared using EPA Methods 1311 for TCLP and analyzed using EPA Method 6010B

Samples prepared using EPA Methods 1311/1312 for SPLP and analyzed using EPA Methods 6010B and 7471A

Analytical results in bold exceed Laboratory Reporting Limit

mg/l – milligrams per kilogram

NA Not Applicable

--- Not Analyzed

NE Not Established

Analytical results shown in **bold** exceed Laboratory Reporting Limit

**Shaded** cell value exceeds the TCLP Level for hazardous waste

**Shaded** cell value exceeds the Aquifer Water Quality Standard for leachate

**TABLE 3**  
**SUMMARY OF RCRA METALS IN SOIL SAMPLES AND REGULATORY STANDARDS**  
**GTR ADDITIONAL ASSESSMENT - 2019**

Metals Analytes	Unit	Analytical Test Results					Residential SRLs			Non-Residential SRLs	Minimum GPL	Typical Natural Soil Background
		Sample Number					Carcinogen		Non-Carcinogen			
		G1	G2	G2-2	G3	G4	10 <sup>-6</sup> Risk	10 <sup>-5</sup> Risk				
Arsenic	mg/kg	9.64	239	42.2	104	18.4	10	10	10	10	290	3.1 – 24
Barium	mg/kg	142	1,560	243	102	158	NE	NE	15,000	170,000	12,000	72.6 – 230
Cadmium	mg/kg	<0.500	9.10	1.23	0.849	<0.500	NE	NE	39	510	29	ND – 1.7
Chromium III <sup>1</sup>	mg/kg	34.7	28.9	15.5	63.1	154	NE	NE	120,000	1,000,000	590	5.4 – 34
Chromium VI <sup>1</sup>	mg/kg						30		NE	65		
Lead	mg/kg	21.4	7,530	519	126	11.7	NE	NE	400	800	290	ND – 24.5
Mercury	mg/kg	0.0407	0.382	0.0246	0.104	0.0434	NE	NE	23	310	12	ND - 0.25
Selenium	mg/kg	<2.00	<2.00	<2.00	<2.00	<2.00	NE	NE	390	5,100	290	<0.4 - 1.0
Silver	mg/kg	<1.00	<1.00	<1.00	<1.00	<1.00	NE	NE	390	5,100	NE	<0.05 - 0.8

Metals Analytes	Unit	Analytical Test Results					Residential SRLs			Non-Residential SRLs	Minimum GPL	Typical Natural Soil Background
		Sample Number					Carcinogen		Non-Carcinogen			
		G5	G6	G7	G8	G9	10 <sup>-6</sup> Risk	10 <sup>-5</sup> Risk				
Arsenic	mg/kg	10.1	9.61	4.37	3.86	11.0	10	10	10	10	290	3.1 – 24
Barium	mg/kg	136	163	150	141	147	NE	NE	15,000	170,000	12,000	72.6 – 230
Cadmium	mg/kg	0.780	<0.500	<0.500	<0.500	2.06	NE	NE	39	510	29	ND – 1.7
Chromium III <sup>1</sup>	mg/kg	30.6	67.3	31.9	25.6	27.5	NE	NE	120,000	1,000,000	590	5.4 – 34
Chromium VI <sup>1</sup>	mg/kg						30		NE	65		
Lead	mg/kg	125	80.6	14.6	16.3	243	NE	NE	400	800	290	ND – 24.5
Mercury	mg/kg	<0.0200	0.025	0.0224	0.0374	<0.0200	NE	NE	23	310	12	ND - 0.25
Selenium	mg/kg	<2.00	<2.00	<2.00	<2.00	<2.00	NE	NE	390	5,100	290	<0.4 - 1.0
Silver	mg/kg	<1.00	<1.00	<1.00	<1.00	<1.00	NE	NE	390	5,100	NE	<0.05 - 0.8

**TABLE 3**  
**SUMMARY OF RCRA METALS IN SOIL SAMPLES AND REGULATORY STANDARDS**  
**GTR ADDITIONAL ASSESSMENT - 2019**

Metals Analytes	Unit	Analytical Test Results					Residential SRLs			Non-Residential SRLs	Minimum GPL	Typical Natural Soil Background
		Sample Number					Carcinogen		Non-Carcinogen			
		G10	G11	G12	G13	T1-S1	10 <sup>-6</sup> Risk	10 <sup>-5</sup> Risk				
Arsenic	mg/kg	52.9	3.83	4.34	41.7	22.6	10	10	10	10	290	3.1 – 24
Barium	mg/kg	318	122	85.8	178	170	NE	NE	15,000	170,000	12,000	72.6 – 230
Cadmium	mg/kg	4.64	<0.500	<0.500	<0.500	<0.500	NE	NE	39	510	29	ND – 1.7
Chromium III <sup>1</sup>	mg/kg	92.7	31.0	16.1	209	222	NE	NE	120,000	1,000,000	590	5.4 – 34
Chromium VI <sup>1</sup>	mg/kg						30		NE	65		
Lead	mg/kg	1,250	12.7	17.1	40.4	32.4	NE	NE	400	800	290	ND – 24.5
Mercury	mg/kg	0.0393	0.0311	<0.0200	0.0354	<0.0200	NE	NE	23	310	12	ND - 0.25
Selenium	mg/kg	<2.00	<2.00	<2.00	<2.00	<2.00	NE	NE	390	5,100	290	<0.4 - 1.0
Silver	mg/kg	<1.00	<1.00	<1.00	<1.00	<1.00	NE	NE	390	5,100	NE	<0.05 - 0.8

Metals Analytes	Unit	Analytical Test Results					Residential SRLs			Non-Residential SRLs	Minimum GPL	Typical Natural Soil Background
		Sample Number					Carcinogen		Non-Carcinogen			
		T2-S1	T3-S1	T4-S1	T5-S1	T7-S1	10 <sup>-6</sup> Risk	10 <sup>-5</sup> Risk				
Arsenic	mg/kg	33.2	3.16	24.6	33.3	3.82	10	10	10	10	290	3.1 – 24
Barium	mg/kg	92.9	156	168	258	132	NE	NE	15,000	170,000	12,000	72.6 – 230
Cadmium	mg/kg	<0.500	<0.500	0.520	0.992	<0.500	NE	NE	39	510	29	ND – 1.7
Chromium III <sup>1</sup>	mg/kg	232	13.5	101	158	21.3	NE	NE	120,000	1,000,000	590	5.4 – 34
Chromium VI <sup>1</sup>	mg/kg						30		NE	65		
Lead	mg/kg	11.3	14.9	52.7	45.4	84.5	NE	NE	400	800	290	ND – 24.5
Mercury	mg/kg	<0.0200	0.0216	<0.0200	<0.0200	0.0334	NE	NE	23	310	12	ND - 0.25
Selenium	mg/kg	<2.00	<2.00	<2.00	<2.00	<2.00	NE	NE	390	5,100	290	<0.4 - 1.0
Silver	mg/kg	<1.00	<1.00	<1.00	<1.00	<1.00	NE	NE	390	5,100	NE	<0.05 - 0.8

TABLE 3  
 SUMMARY OF RCRA METALS IN SOIL SAMPLES AND REGULATORY STANDARDS  
 GTR ADDITIONAL ASSESSMENT - 2019

Metals Analytes	Unit	Analytical Test Results					Residential SRLs			Non-Residential SRLs	Minimum GPL	Typical Natural Soil Background
		Sample Number					Carcinogen		Non-Carcinogen			
		T8-SI	T9-SI	T10-SI	T11-SI	AD-1	10 <sup>-6</sup> Risk	10 <sup>-5</sup> Risk				
Arsenic	mg/kg	2.95	24.7	7.35	51.8	33.0	10	10	10	10	290	3.1 – 24
Barium	mg/kg	88.6	140	160	175	178	NE	NE	15,000	170,000	12,000	72.6 – 230
Cadmium	mg/kg	<0.500	1.20	<5.00	2.00	1.57	NE	NE	39	510	29	ND – 1.7
Chromium III <sup>1</sup>	mg/kg	8.01	23.7	45.5	82.6	27.4	NE	NE	120,000	1,000,000	590	5.4 – 34
Chromium VI <sup>1</sup>	mg/kg						30		NE	65		
Lead	mg/kg	5.33	697	29.5	475	388	NE	NE	400	800	290	ND – 24.5
Mercury	mg/kg	0.0320	0.0423	<0.0200	0.0800	0.113	NE	NE	23	310	12	ND - 0.25
Selenium	mg/kg	<2.00	<2.00	<2.00	<2.00	<2.00	NE	NE	390	5,100	290	<0.4 - 1.0
Silver	mg/kg	<1.00	<1.00	<1.00	<1.00	<1.00	NE	NE	390	5,100	NE	<0.05 - 0.8

Metals Analytes	Unit	Analytical Test Results					Residential SRLs			Non-Residential SRLs	Minimum GPL	Typical Natural Soil Background
		Sample Number					Carcinogen		Non-Carcinogen			
		AD-1-1	AD-2	AD-3	AD-4	AD2-1	10 <sup>-6</sup> Risk	10 <sup>-5</sup> Risk				
Arsenic	mg/kg	69.0	43.6	5.41	197	5.86	10	10	10	10	290	3.1 – 24
Barium	mg/kg	114	492	176	175	120	NE	NE	15,000	170,000	12,000	72.6 – 230
Cadmium	mg/kg	<0.500	3.61	<0.500	<0.500	<0.500	NE	NE	39	510	29	ND – 1.7
Chromium III <sup>1</sup>	mg/kg	290	19.5	15.4	64.9	17.0	NE	NE	120,000	1,000,000	590	5.4 – 34
Chromium VI <sup>1</sup>	mg/kg						30		NE	65		
Lead	mg/kg	20.1	598	18.3	53.1	59.8	NE	NE	400	800	290	ND – 24.5
Mercury	mg/kg	0.0333	0.0780	0.0245	0.0992	0.0272	NE	NE	23	310	12	ND - 0.25
Selenium	mg/kg	<2.00	<2.00	<2.00	<2.00	<2.00	NE	NE	390	5,100	290	<0.4 - 1.0
Silver	mg/kg	<1.00	<1.00	<1.00	<1.00	<1.00	NE	NE	390	5,100	NE	<0.05 - 0.8

**TABLE 3**  
**SUMMARY OF RCRA METALS IN SOIL SAMPLES AND REGULATORY STANDARDS**  
**GTR ADDITIONAL ASSESSMENT - 2019**

Metals Analytes	Unit	Analytical Test Results					Residential SRLs			Non-Residential SRLs	Minimum GPL	Typical Natural Soil Background
		Sample Number					Carcinogen		Non-Carcinogen			
		AD2-2	AD2-3	AD2-4	AD2-5	AD2-6	10 <sup>-6</sup> Risk	10 <sup>-5</sup> Risk				
Arsenic	mg/kg	46.2	12.4	180	33.4	12.1	10	10	10	10	290	3.1 – 24
Barium	mg/kg	201	140	968	162	125	NE	NE	15,000	170,000	12,000	72.6 – 230
Cadmium	mg/kg	1.03	0.718	6.36	0.839	0.861	NE	NE	39	510	29	ND – 1.7
Chromium III <sup>1</sup>	mg/kg	14.3	22.0	26.1	19.3	18.1	NE	NE	120,000	1,000,000	590	5.4 – 34
Chromium VI <sup>1</sup>	mg/kg						30					
Lead	mg/kg	242	171	9,010	184	131	NE	NE	400	800	290	ND – 24.5
Mercury	mg/kg	0.0216	0.0247	0.175	<0.0200	0.0459	NE	NE	23	310	12	ND - 0.25
Selenium	mg/kg	<2.00	<2.00	<2.00	<2.00	<2.00	NE	NE	390	5,100	290	<0.4 - 1.0
Silver	mg/kg	<1.00	<1.00	1.54	<1.00	<1.00	NE	NE	390	5,100	NE	<0.05 - 0.8

Metals Analytes	Unit	Analytical Test Results			Residential SRLs			Non-Residential SRLs	Minimum GPL	Typical Natural Soil Background
		Sample Number			Carcinogen		Non-Carcinogen			
		AD2-7	AD2-8	AD2-9	10 <sup>-6</sup> Risk	10 <sup>-5</sup> Risk				
Arsenic	mg/kg	8.19	23.8	9.43	10	10	10	10	290	3.1 – 24
Barium	mg/kg	134	140	158	NE	NE	15,000	170,000	12,000	72.6 – 230
Cadmium	mg/kg	<0.500	1.13	<0.500	NE	NE	39	510	29	ND – 1.7
Chromium III <sup>1</sup>	mg/kg	24.9	25.9	52.5	NE	NE	120,000	1,000,000	590	5.4 – 34
Chromium VI <sup>1</sup>	mg/kg				30					
Lead	mg/kg	200	360	198	NE	NE	400	800	290	ND – 24.5
Mercury	mg/kg	0.0228	0.0362	<0.0200	NE	NE	23	310	12	ND - 0.25
Selenium	mg/kg	<2.00	<2.00	<2.00	NE	NE	390	5,100	290	<0.4 - 1.0
Silver	mg/kg	<1.00	<1.00	<1.00	NE	NE	390	5,100	NE	<0.05 - 0.8

TABLE 3  
SUMMARY OF RCRA METALS IN SOIL SAMPLES AND REGULATORY STANDARDS  
GTR ADDITIONAL ASSESSMENT - 2019

**Notes:**

Resource Conservation and Recovery Act (RCRA) Metals analyzed using EPA Methods 6010B / 7471A

SRLs - Soil Remediation Levels established by the Arizona Department of Environmental Quality, Arizona Administrative Code, Title 18, Chapter 7, Appendix A, January 19, 2007 2

Minimum GPL – Groundwater Protection Levels, established by the Arizona Department of Environmental Quality, *A Screening Method to Determine Soil Concentrations Protective of Groundwater Quality*, September 1996 and November 1, 2008 Minimum GPLs.

Typical natural soil background concentrations from Evaluation of Background Metals Concentrations in Arizona Soils, Prepared by The Earth Technology Corporation, June 1991.

mg/kg milligrams per kilogram

NE Not Established

ND Not Detected

TCLP Toxicity Characteristic Leaching Procedure

I Arizona SRLs differentiate Chromium III and Chromium IV. Samples were analyzed for total Chromium. Minimum GPL, typical natural soil background levels, and 20 times TCLP levels are for Total Chromium.

Analytical results in **bold** exceed Laboratory Reporting Limit

**Shaded** cell value indicates sample result exceeds the residential SRL and non-residential SRL

**Shaded** cell value indicates sample results exceeds the residential SRL

**Shaded** cell value indicates sample result exceeds the residential SRL and minimum GPL

**Shaded** cell value indicates sample results exceeds the minimum GPL.

**TABLE 4  
 ALTERNATIVE GPL CALCULATIONS FOR LEAD**

Sample ID	Total Lead Concentration (mg/kg)	Leachable Lead Concentration (mg/L)	R	C <sub>w</sub> AWQS (mg/L)	X <sub>s</sub> Alternative GPL (mg/kg)
B-1-1	292	0.0604	4,834.4	0.015	70,800.3
B-2-1	1,170	1.07	1,093.5	0.015	16013.7
<b>B-2-2</b>	<b>357</b>	<b>3.61</b>	<b>98.9</b>	<b>0.015</b>	<b>1,448.3</b>
B-3-1	57.4	0.145	395.9	0.015	5,797.4
B-6-1	215	<0.45	∞	0.015	N/A
B-8-2	66.6	<0.45	∞	0.015	N/A
B-9-1	45.4	0.0319	1,423.2	0.015	20,842.7
B-10-2	163	<0.45	∞	0.015	N/A

**Notes:**

Alternative GPL – Groundwater Protection Levels, Alternative GPL calculated using approach detailed in Arizona Department of Environmental Quality, *A Screening Method to Determine Soil Concentrations Protective of Groundwater Quality*, September 1996

mg/kg milligrams per kilogram

mg/L milligrams per Liter

N/A Not Applicable – Alternative GPL not calculated for samples with leachable lead concentrations not detected above laboratory reporting limits, resulting in R-value of ∞

R Ratio between the total lead concentration and the concentration of the leachable concentration of lead

C<sub>w</sub> Aquifer Water Quality Standard for lead

X<sub>s</sub> Calculated Alternative GPL for lead

Analytical results in **bold** exceed Laboratory Reporting Limit

**Shaded** cell value indicates Alternative GPL for Site. Sample with the lowest ratio (R) between total and leachable concentrations of lead was selected as the basis of the Site-specific Alternative GPL because it represents the most severe leaching potential for the Site soil.

# **APPENDIX A**

## **PREVIOUS REPORTS**

SEE PREVIOUS REPORTS ON CD

# **APPENDIX B**

## **SAMPLING AND ANALYSIS PLAN**

## TABLE OF CONTENTS

<b>1.0 INTRODUCTION</b> .....	<b>1</b>
1.1 PROJECT ORGANIZATION .....	1
1.2 PURPOSE OF THE SAP .....	2
<b>2.0 SUMMARY OF PREVIOUS CHARACTERIZATION</b> .....	<b>3</b>
2.1 FACILITY DESCRIPTION .....	3
2.2 OPERATIONAL HISTORY .....	3
2.3 PREVIOUS CHARACTERIZATION AND REMEDIAL ACTIONS .....	4
2.4 GEOLOGICAL INFORMATION .....	4
2.5 ENVIRONMENTAL AND/OR HUMAN IMPACT .....	5
<b>3.0 BACKGROUND AND REMEDIATION OPTIONS</b> .....	<b>6</b>
3.1 BACKGROUND .....	6
3.2 REMEDIATION ACTIVITIES .....	7
<b>4.0 SITE ASSESSMENT</b> .....	<b>8</b>
4.1 UTILITY CLEARANCE .....	8
4.2 ASSESSMENT AREAS .....	9
4.3 REPORTING .....	9
<b>5.0 SAMPLING RATIONALE AND METHODOLOGY</b> .....	<b>9</b>
5.1 SAMPLING METHODOLOGY AND ANALYSIS .....	9
5.2 SAMPLE DESIGNATION .....	10
5.3 POTENTIAL HAZARDOUS, SPECIAL, OR SUSPECT WASTE .....	11
5.4 DECONTAMINATION PROCEDURES .....	11
<b>6.0 REQUESTS FOR ANALYSIS</b> .....	<b>11</b>
<b>7.0 FIELD EQUIPMENT</b> .....	<b>11</b>
<b>8.0 SAMPLE CONTAINERS, PRESERVATION, AND STORAGE</b> .....	<b>12</b>
<b>9.0 DISPOSAL OF RESIDUAL MATERIALS</b> .....	<b>13</b>
<b>10.0 SAMPLE DOCUMENTATION AND DELIVERY</b> .....	<b>13</b>
10.1 FIELD NOTES .....	13
10.1.1 Field Logbooks .....	13
10.1.2 Photographs .....	14
10.2 LABELING .....	14
10.3 SAMPLE CHAIN-OF-CUSTODY FORMS AND CUSTODY SEALS .....	15
10.4 SAMPLE DELIVERY TO LABORATORY .....	15
<b>11.0 QUALITY CONTROL</b> .....	<b>15</b>
11.1 FIELD QUALITY CONTROL SAMPLES .....	15
11.1.1 Assessment of Field Contamination (Blanks) .....	16
11.1.2 Field Duplicate Samples .....	17
11.2 LABORATORY QUALITY CONTROL SAMPLES .....	17

**I 2.0 FIELD VARIANCES ..... 18**  
**I 3.0 FIELD HEALTH AND SAFETY PROCEDURES..... 18**

**ATTACHMENTS**

- A Sampling Standard Operating Procedures

## **I.0 INTRODUCTION**

This Sampling and Analysis Plan (SAP) was developed for the Former Mystic Mine Area Site located northeast of Lone Mountain Parkway and North Vistancia Boulevard in Peoria, Arizona (herein referred to as the Site). The Site and history are more fully discussed in the Work Plan. Lake Pleasant (Phoenix) ASLI VIII LLC (Avanti) is the current Site owner, and they plan to develop residential subdivisions in the Site vicinity. The current mine waste rock pile will be consolidated into a composite stockpile to be covered with soil and remain in place. The waste rock and underlying soil in the areas to be reclaimed for development (Areas A, B, and D) will be excavated to bedrock and be added to the consolidated stockpile. The consolidated mine waste area (Area C) will be capped using natural soils south of the mine site (e.g. soil from earthwork operations near the Central Arizona Project Canal south of the Site). The area cleared of the current waste rock will be available for residential development, and the composite stockpile will remain an undeveloped track area. The imported material to be used as the Cap of the consolidated stockpile will be assessed prior to placement as described in this SAP. Avanti submitted this project to the Arizona Department of Environmental Quality (ADEQ) Voluntary Remediation Program (VRP).

### **I.1 PROJECT ORGANIZATION**

<b>PROJECT ORGANIZATION</b>		
<b>TITLE/RESPONSIBILITY</b>	<b>NAME</b>	<b>CONTACT INFORMATION</b>
ADEQ Project Manager	Caitlin Burwell	(602) 771-4122 <a href="mailto:Burwell.Caitlin@azdeq.gov">Burwell.Caitlin@azdeq.gov</a> Arizona Department of Environmental Quality Remedial Projects Section, Voluntary Remediation Program 1110 West Washington Street, 6 <sup>th</sup> Floor Phoenix, Arizona 85007
Volunteer/Owner Representative	David Rogers	(480) 285-3060 <a href="mailto:drogers@voyagerproperties.com">drogers@voyagerproperties.com</a> Lake Pleasant (Phoenix) ASLI VIII LLC (Avanti) 4248 North Craftsman Court, Suite 100 Scottsdale, Arizona 85251
GeoTek Residential, LLC Environmental Consultant Project Manager/Quality Assurance Manager	Chet Pearson	(480) 848-6279 <a href="mailto:cpearson@geotekusa.com">cpearson@geotekusa.com</a> 4050 East Cotton Center Blvd., Suite 49 Phoenix, AZ 85040
Analytical Laboratory Subcontractor Staff	To Be Determined	To Be Determined

## **I.2 PURPOSE OF THE SAP**

This SAP, in conjunction with the Work Plan and Quality Assurance Project Plan (QAPP), presents the functions, procedures, and specific quality assurance (QA) and quality control (QC) activities designed to achieve the data quality objectives (DQOs) to support Avanti's request for a determination of No Further Action (NFA) for the Mystic at Lake Pleasant Heights Site. Guidelines followed in the preparation of this SAP include Environmental Protection Agency (EPA) *Region 9 Template for Sampling and Analysis Plan; Version 3 – Brownfields Projects (R9QA/006)*; United States Environmental Protection Agency; June 2004.

As discussed in the Work Plan, the data generated during the activities described in the Work Plan, QAPP, and this SAP will be used in conjunction with data collected during previous assessment and remediation activities to obtain an unconditional NFA determination from the ADEQ's VRP without an encumbrance (e.g. environmental use restriction or activity and use limitation) on the remediated portion of the Site and a conditional NFA on the planned consolidation stockpile area. The conditional NFA will use a Declaration of Environmental Use Restriction (DEUR) to restrict future residential usage of the planned stockpile area.

The foreseeable usage of the Site vicinity will be residential, with some limited commercial usages. Except for lead, the appropriate remedial goals are the ADEQ pre-determined  $10^{-5}$  residential soil remediation levels (SRLs) and the minimum groundwater protection levels (GPLs). For lead, GeoTek Residential, LLC (GTR) calculated a Site-specific Alternative GPL of 1,448.3 milligrams per kilogram (mg/kg). Therefore, the requested remediation goal for lead is the ADEQ pre-determined  $10^{-5}$  residential SRL of 400 mg/kg. The constituents of concern (COCs) include the Resource Conservation and Recovery Act (RCRA) Metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver).

GTR submitted an initial Remediation Work Plan dated April 2, 2020 which included options to remediate the areas to be reclaimed for development by excavating the soil to below the SRLs, minimum or alternative GPLs, except for arsenic. For arsenic, the remediation goal was to be either be the calculated, Site-specific background concentration or remediation to bedrock in the areas reclaimed for development whichever is most appropriate. However, as discussed in Section 3.4 of the Work Plan, the results of the background arsenic evaluation indicate excavation to bedrock in the areas to be reclaimed for development will be the most cost-effective option. Therefore, the revised Work Plan includes excavation to bedrock in the areas to be reclaimed for development. The excavated material will be placed into the consolidation pile with waste rock materials and covered with soil to provide a Cap over the waste rock materials. The compacted Cap soil should provide a physical barrier to human contact with the waste rock materials, and the compacted Cap soil and grading of the pile should promote runoff of stormwater off the pile to limit water infiltration into the waste rock materials in the future. A conditional NFA and a DEUR will be requested for the consolidation pile area. The primary purpose of this SAP is to adequately assess the imported soil to be used as Cap and cover materials.

The SAP will be distributed to those individuals who will participate in the project, including those with ADEQ, Avanti, GTR, and any other significant subcontractors involved in the project. Addenda and/or revisions to the SAP can be initiated by ADEQ, Avanti, or GTR. In general, an addendum will be written when unforeseen or significant changes have occurred. A revision will not be required for minor changes in scope.

## **2.0 SUMMARY OF PREVIOUS CHARACTERIZATION**

### **2.1 FACILITY DESCRIPTION**

The Mystic Mine area is located northeast of Lone Mountain Parkway and North Vistancia Boulevard in Peoria, Arizona. The approximate location of the Site is shown in Figure 1 of the Work Plan. The Site is identified as a portion of Maricopa County Assessor's Parcel Number (APN) 503-88-006G previously identified as portions of APNs 503-88-006A and 006B within the Lake Pleasant Heights Property and covers about 25 acres of land. The center of the Site was estimated to be located at a latitude of approximately 33.7881° North and a longitude of approximately -112.3236° West. The Site is located in Section 12, Township 5 North, Range 1 West of the Gila and Salt River Baseline and Meridian System.

### **2.2 OPERATIONAL HISTORY**

The Mystic Mine Site is part of the Lake Pleasant Heights Property comprised of three non-contiguous portions of land located north and south of the Central Arizona Project (CAP) Canal. The Property was mostly undeveloped native desert land with some unpaved roads and dirt trails traversing the land. GTR also observed wire fences in various locations across the Property. GTR observed remnants of previous mining activities on the northwest portion of APN 503-88-006A and on APN 503-88-006B of the Site. The remnants included an abandoned mine shaft, about 6 to 7 acres of mine waste materials spread across the ground surface, and some graded areas previously used by mining vehicles and equipment. Some mine leach pits were observed off the Site directly west of the northwest portion of APN 503-88-006A. We observed a groundwater monitoring well in the southwestern portion of APN 503-88-006E that was apparently installed for environmental permit compliance requirements for the off-site mining operations west of the northwest portion of APN 503-88-006A. GTR observed a second groundwater monitoring well located in the southwest corner of APN 503-88-008. This well was likely used for environmental permit compliance requirements for the off-site activities south of the Site.

GTR observed various areas of the Property used for recreational purposes such as camping, hiking, shooting, off-road driving, etc. There were numerous areas with shotgun shell casings, bullet casings, broken clay targets, and debris used for targets on the Property but we did not

find any areas that appeared to be regularly used for shooting on a consistent basis or significant accumulations of shell or bullet casings, shotgun pellets, or bullet fragments.

GTR observed some livestock facilities in the northern portion of APN 503-88-007G. There were some fenced livestock pens, a water aboveground storage tank (AST), two watering troughs, a ramada area, underground water lines, a large livestock pond, a canopy frame, and a groundwater well in this area. The water AST was labeled with "BO 9 RANCH". This area appeared to be periodically used to pen cattle grazing on the Site and vicinity. The groundwater well did not contain pump equipment, and we did not observe indications of a power source for the well. The underground water pipes appeared to be connected to the CAP Canal as the water source.

Based on GTR's review of aerial photographs and mining records, the entrance to the Mystic Mine was located in the north-central portion of the Site, and the inclined entrance extended westerly off the Site. The deeper portions of the underground mine were on and off the Site. In the 1990s, there were various piles of materials on the main portion of the Site. We found no records of mine leaching activities on the Site. There were leaching pits northwest of the Site. The Site was apparently used for the storage of rock materials excavated from the ground. In a 1996-1997 aerial photograph, we observed an apparent construction trailer and some equipment on this portion of the Site. East of construction trailer, we observed a ramp that descended approximately 20 feet into the ground to an apparent mine entrance. In a 2002 aerial photograph, the ramp and mine entrance were filled, and mining activities appeared to be abandoned. The mine waste rock materials were spread across approximately 6 to 7 acres of land located on the Site.

### **2.3 PREVIOUS CHARACTERIZATION AND REMEDIAL ACTIONS**

Site assessment and characterization activities were performed by Allwyn Consultants in 2016. In addition, GTR performed an additional assessment of the waste rock at the Site in 2019. These assessment activities are detailed in the reports listed in Section 1.3 of the Work Plan. Important details of the characterization activities are summarized in Sections 2.0 and 3.0 of the Work Plan.

### **2.4 GEOLOGICAL INFORMATION**

The Site is situated on mountainous land in the Salt River Valley. The Salt River Valley is located in the Basin and Range Province located in the southern and western portions of Arizona, as well as parts of southern Nevada, California, New Mexico, and northern Mexico. The Basin and Range Province is characterized by elongated mountain ranges trending northwest-southeast that are separated by broad alluvial valleys. The mountains in this Province consist of tilted blocks of Precambrian, Paleozoic, Mesozoic, and Cenozoic rocks that are bounded by faults and are usually severely eroded.

The Salt River Valley is an extensive basin containing alluvial soils often over 1,500 feet thick, as

well as numerous small mountains. The alluvial soils between the mountains are highly variable and range from dense sand, gravel, and cobbles to silts and clays. In many areas, deposits of heavily cemented sandy clay and clayey sand ("caliche") are encountered, often having the characteristics of soft rock. The alluvial soils are typically divided into three units based on lithographic changes. The Upper Alluvial Unit generally consists of coarse-grained deposits of sand, gravel, and cobbles extending as deep as 1,200 feet in some areas. This unit is underlain by the Middle Fine-Grained Unit composed primarily of silts and clays. The deepest unit is called the Lower Conglomerate Unit.

The major natural drainage feature nearest to the Site was the Agua Fria River, which was located approximately 3 miles east of the Site. The Agua Fria River is usually ephemeral, running only during excessive storms through Phoenix metropolitan.

The primary source of groundwater in the Salt River Valley is the alluvial soils between the mountain blocks. Groundwater in the Salt River Valley Basin is typically derived from the Upper Alluvial Unit and is usually unconfined. Based on a previous review of well records, groundwater levels were reported from 143 to 530 feet below the ground surface (bgs) in various years from 1994 to 2003 at the Property. Based on an Arizona Department of Water Resources (ADWR) map of groundwater levels from 2002-2003, the Property was located within the Hieroglyphic Mountains, and groundwater levels were not shown for the immediate Site vicinity. Groundwater was at a depth of about 452 feet bgs in a well southwest of the Property. The mining operations reportedly extended to a depth of about 300 feet at the mine in the past.

The bedrock that lies underneath the basin-fill sediments is composed of various metamorphic and igneous rocks. Bedrock has little groundwater storage or production capacity and therefore is not considered to be an aquifer.

## **2.5 ENVIRONMENTAL AND/OR HUMAN IMPACT**

The primary potential COCs are RCRA metals. The primary exposure routes of these constituents are:

- Inhalation of airborne particles containing contaminants, mists, or vapors
- Skin absorption
- Incidental ingestion through improper hygiene
- Skin contact

### 3.0 BACKGROUND AND REMEDIATION OPTIONS

#### 3.1 BACKGROUND

Site assessment and characterization activities were performed by Allwyn in 2016. In addition, GTR performed an additional assessment of the waste rock at the Site in 2019. These assessment activities are detailed in the reports listed in Section 1.3 of the Work Plan. Important details of the assessment activities are summarized below.

GTR reviewed the previous Allwyn data to aid in evaluation the potential need for any additional assessment work on the Site. The mine waste rock materials were assessed for a variety of contaminants including heavy metals, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), polynuclear aromatic hydrocarbons (PAHs), total cyanide, and free cyanide. Metals were the only identified COCs at concentrations above remedial standards. Based on our review of the previous Allwyn data, we believed that some additional backhoe exploratory excavation work was needed in order to further refine the volume estimate of the mine waste rock materials. For example, the mine entrance location was found after most of Allwyn's previous environmental assessment work, and there was likely a significant depth of waste rock at this location. To further assess the mine waste materials and the extent of underlying natural soils, GTR excavated through the mine waste materials and into the underlying natural soils to measure the thickness of the existing mine waste, and the test pits were extended to underlying rock if possible to measure the thickness of the natural soils. We also excavated test pits/trenches along the mine shaft entrance near the western portion of the mine waste area as a potential future storage area for the waste rock materials. In 2019, GTR obtained a total of 37 soil samples from areas within and around the mine waste materials to evaluate background concentrations of arsenic, lead, and chromium in the natural soils at the Site. ADEQ used an X-ray fluorescence (XRF) spectrometer to analyze the soil and sediment samples collected at the Site on October 25, 2019. During the Site walk on October 25 with GTR, ADEQ collected five (5) soil samples and three (3) sediment samples, and replicates were run on each media.

As shown on Figure 8 of the Work Plan, the Site was split into eight areas based on the depth of waste rock or additional assessment areas. Area 1 through Area 8 are summarized below:

- Area 1 is the location of previous mine inclined shaft entrance. GTR estimates there is likely about 30 feet of waste rock materials in Area 1.
- Area 2 has waste rock materials to a depth of approximately 8 feet.
- Area 3 has waste rock materials to a depth of approximately 3 feet.
- Area 4 has waste rock materials to a depth of approximately 2 feet.
- Area 5 is associated with previous exploration shaft was identified in historical aerial photographs and was added as an additional area for consideration. Based on the assessment results, this area was added as an area where remedial efforts will occur.
- Area 6 is the location of the mine incline shaft and will be included in the consolidated mine waste area (Cap Area).

- Area 7 in the southeastern portion with some minor mine waste rock materials spread across the ground surface at a lower elevation than the main pile and will be included in the consolidated mine waste area (Cap Area).
- Area 8 is associated with an area identified where additional assessment occurred and is included in the areas to be reclaimed for development. In addition, based on the assessment results, this area was added as an area where remedial efforts will occur.

GTR determined the most cost effective approach for the mine waste rock remediation is to remove the natural soils above the mine incline shaft (Area 6) and in Area 7, consolidate the waste rock materials from portions of Areas 2, 3, and 4, and all of Areas 5 and 8 into one composite pile extending from Area 6 to Area 7, and then cap the material with natural soils from areas south of the Site. The area of the consolidated mine waste area (Cap area) and areas reclaimed for development are shown on Figure 9 in the Work Plan. Under this remedial approach, mine waste rock materials will be consolidated in the northern portion of the existing mine waste area over the mine entrance and inclined shaft area. Stockpiled soils from previous phases of development will be used for the Cap material. Based on previous geotechnical evaluations, these soils are typically Clayey Sand (SC) soils, so these soils should provide a good Cap material for the desired engineering characteristics. Mine waste rock will also be placed into these newly excavated areas identified as Areas 6 and 7 as shown in Figure 8 in the Work Plan. The mine waste rock material will then be covered with about 2 feet of compacted natural soil to reduce water infiltration into these materials and reduce potential exposure issues.

For ease of discussion, the remedial action areas will be identified as follows (see Figure 9 of the Work Plan):

- Area A – Northern area reclaimed for development (previously Area 8)
- Area B – Southern area reclaimed for development (previously portions of Areas 2, 3, and 4)
- Area C – Consolidated Mine Waste Area (Cap Area)
- Area D – Previously Area 5 (will be under future North El Mirage Road).

The proposed remedial actions are detailed in Section 3.2.

### **3.2 REMEDIATION ACTIVITIES**

Remediation of the areas to be reclaimed for development (Areas A, B, and D) consists of removal of the waste rock materials and underlying soil to bedrock. The bedrock surface is probably irregular, but this option includes scraping the bedrock surface to generally remove most of the soil. As previously discussed, the previous assessments at the Site indicated approximately 1 to 2 feet of soil are present in the areas to be reclaimed for development (Areas A and B). Area D consists of the area previously identified as Area 5 and was previous exploration shaft area. The depth of broken rock and soil is unknown in the shaft area. For Area D, the overlying broken rock and soil will be removed until bedrock is encountered around the edges

of shaft. The depth of broken rock and soil inside the shaft will be further assessed by excavation. If the broken rock and soil extend below 2 feet below the surrounding bedrock level (likely outcome), then the shaft area will be covered with 1 foot of concrete to provide a permanent barrier over the underlying broken rock and soil materials. This concrete cap will be an environmental barrier. Area D will eventually be under the future El Mirage Road.

The waste rock and soil overlying the bedrock will be excavated and be placed in the consolidated mine waste area (Area C). As discussed above, the waste rock and the excavated soil will be capped using natural soils south of the mine site (e.g. soil from earthwork operations near the Central Arizona Project Canal south of the Site). Previous geotechnical evaluations in these areas indicated that these soils are typically well-graded Clayey Sand (SC) soils. These soils should compact well, have sufficient fines to limit water infiltration, and should not be susceptible to erosion in the future. Therefore, these soils should provide the desired engineering characteristics for the Cap soils.

There has been limited assessment of the surface soils south of the Site as part of the background soil sampling and testing to date (see Allwyn Phase II ESA data). However, prior to placement of the Cap material, the imported soil to be used for the Cap material will be sampled and analyzed for RCRA metals. An estimated 9,800 cubic yards of material will be used to cover the consolidation pile. It is anticipated that the Cap materials will consist of soil from earthwork operations near the Central Arizona Project Canal south of the Site. To assess the imported material, GTR will collect composite samples of imported Cap material at a rate of 1 composite sample per 2,000 cubic yards of Cap material. The samples will be submitted to an Arizona Department of Health Services (ADHS)-certified analytical laboratory and analyzed for total concentrations of the RCRA metals arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver using EPA Methods 6010/7471. The procedures used to collect the soil samples are outlined in Section 5.0 of this SAP. In addition, quality assurance/quality control (QA/QC) samples will be collected as described in the SAP and Quality Assurance Project Plan (QAPP) in Appendix D of this Work Plan. The results of the import material soil sampling will be compared to the  $10^{-5}$  residential SRLs, minimum GPLs or Alternative GPLs, whichever is lowest. If the analytical results are less than the applicable remediation level, the soil will be used as the Cap material covering the consolidation pile and covering the concrete cap over the exploratory shaft in Area D.

## **4.0 SITE ASSESSMENT**

### **4.1 UTILITY CLEARANCE**

Arizona 811 will be contacted prior to work described in the Work Plan to perform an underground utility location survey to mark and verify utilities in work areas have been disconnected. There will be no utility clearance required for the sampling in this SAP.

## 4.2 ASSESSMENT AREAS

Samples will be collected and analyzed as outlined in the following table:

Location	Sampling Description	Analysis
Imported Cap Soil	Composite soil samples will be collected from the imported soil to be used to cover the consolidated material stockpile and above the concrete Cap in Area D. GTR will collect composite samples of imported Cap material at a rate of 1 composite sample per 2,000 cubic yards of Cap material as discussed in Section 5.0 below.	RCRA metals

Sampling rationale and soil sampling locations are further discussed in Section 5.0 of this SAP.

## 4.3 REPORTING

Upon completion of field activities, GTR will incorporate the findings into a final report that will describe the rationale, methodology, and findings of the tasks outlined in the Work Plan, QAPP, and this SAP. The report will be sealed by a Professional Engineer or Geologist registered in the State of Arizona. The report will include photographs and one or more scaled maps detailing sampling and/or remediation locations.

## 5.0 SAMPLING RATIONALE AND METHODOLOGY

The sampling program outlined in this section of the SAP has been developed in conjunction with the Work Plan and QAPP (see Appendix C of the Work Plan). The objective of the sampling program is to present a technical protocol for soil sample collection and analysis that provides defensible and meaningful data to assess for the Cap and cover soil for RCRA metals prior to use. The results of the import material soil sampling will be compared to the  $10^{-5}$  residential SRLs, minimum GPLs or Alternative GPLs, whichever is lowest. If the analytical results are less than the applicable remediation level, the soil will be used as the Cap material covering the consolidation pile and covering the concrete cap over the exploratory shaft in Area D. Soil samples will be collected in general accordance with the soil sampling Standard Operating Procedures (SOPs) in Attachment A and as discussed below.

### 5.1 SAMPLING METHODOLOGY AND ANALYSIS

To assess the imported soils, composite soil samples will be collected from import soil stockpiles at a rate of 1 composite sample per 2,000 cubic yards of Cap material. The samples will be collected near where the imported material will be obtained prior to placement as the Cap/cover. Samples will be obtained from at least three locations at varying depths within the stockpiles using a hand auger or plastic scoop. A backhoe may be used to access sampling locations deeper within

the stockpile. The discrete soil samples collected from at least 3 locations within the 2,000 cubic yard stockpile(s) will be placed into a ziplock bag or glass bowl and homogenized. In addition, QA/QC samples will be collected as described in this SAP and QAPP in Appendix C of the Work Plan.

The samples to be submitted for laboratory analysis will be placed in laboratory-supplied, certified-clean, 4-ounce (oz) clear glass jar. The jar screw threads will be wiped with a clean, unused tissue to remove any sample residue that may adhere to the jar thread and that could affect the seal. The jar will be capped with a Teflon-lined cap (Teflon side down) or an appropriate lid provided by the analytical laboratory.

The jars containing the samples will be labeled with unique sample numbers. These identification numbers, sample date and time, selected analytical parameters, and the name of the sampling personnel will be recorded on a chain-of-custody record. The chain-of-custody record will accompany the samples from sample collection until the samples are transferred to the analytical laboratory representative. After the sample containers are labeled with the sample number, the sample containers will be stored in a cooler chilled with wet ice.

Non-disposable sampling equipment will be cleaned in an Alconox-potable water solution, rinsed with potable water, then given a final rinse in either distilled or deionized water and allowed to air dry. Equipment will be cleaned prior to obtaining each soil sample to limit the possibility of cross-contamination between samples. Spent wash waters used to clean sampling equipment, will be poured onto the Site and allowed to evaporate. Care will be taken not to allow this water to run off the Site.

The samples will be submitted to an ADHS-certified analytical laboratory and analyzed for total concentrations of the RCRA metals arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver using EPA Methods 6010/7471. The results of the import material soil sampling will be compared to the 10-5 residential SRLs, minimum GPLs or Alternative GPLs, whichever is lowest. If the analytical results are less than the applicable remediation level, the soil will be used as the Cap material covering the consolidation pile and covering the concrete cap over the exploratory shaft in Area D.

## **5.2 SAMPLE DESIGNATION**

In general, composite soil samples will be designated as follows:

Soil samples from the imported soil stockpiles will be designated as follows: CS-#

Where: CS – composite soil sample from import material stockpile  
# – sample identification number

### 5.3 POTENTIAL HAZARDOUS, SPECIAL, OR SUSPECT WASTE

The imported soil for the Cap will come from vacant desert areas being graded for residential subdivisions. Therefore, we do not expect any hazardous, special, or suspect waste issues. In addition, based on previous background soil sampling at the Property, the import soil is considered to be non-hazardous.

Work associated with potential hazardous or special waste will be conducted in accordance with the site and project-specific Health and Safety Plan (HASP), described in Section 13.0 and applicable local, state, and federal rules and regulations

### 5.4 DECONTAMINATION PROCEDURES

Decontamination procedures will be conducted in accordance with ASTM D5088-90, *Standard practice for Decontamination of Field Equipment Used at Nonradioactive Waste Sites*. All non-disposable sampling equipment will be decontaminated after each use by washing with non-phosphate detergent and tap water and rinsing with distilled or deionized water. Disposable gloves will be changed between each sample location.

## 6.0 REQUESTS FOR ANALYSIS

Assessment samples will be submitted to an ADHS-certified laboratory. A final analytical laboratory data package will be provided by the subcontracted analytical laboratory and will meet the applicable requirements of *Laboratory Documentation Required for Data Evaluation* (R9QA/004.2); EPA Region 9; August 2001. GTR will perform data verification of the entire data package. Data outliers and anomalies will be evaluated by the analytical laboratory and data flags and/or discussions will be placed in an analytical report in accordance with Arizona Laboratory Data Qualifiers, Revision 3.0 (September 20, 2007). After verification is completed, qualifiers will be assigned to the data points that are affected by the quality control outliers. The qualifiers will indicate the analyte concentrations that may be affected by laboratory or field contamination, unusable because of quality control deficiencies, and/or estimated due to possible bias or reduced confidence in the results.

## 7.0 FIELD EQUIPMENT

The following equipment, including decontamination equipment, will be used in the field to collect soil samples:

- Map/site plan
- Safety equipment
- GPS unit

- Tape measure
- Survey stakes and flags
- Camera
- 4-ounce clear glass jars
- Logbook
- Ball point pens
- Permanent marker pens
- Sample container labels
- Chain-of-custody forms and custody seals
- Trash bags
- Stainless steel trowels or spoons
- Ziplock bags
- Plastic lab spoons or equivalent

### **8.0 SAMPLE CONTAINERS, PRESERVATION, AND STORAGE**

The sample containers, volumes, and materials are listed in below. Sampling containers will be new and will not be rinsed prior to sample collection. Preservatives, if required, will be added by the subcontracted analytical laboratory to the containers prior to shipment to GTR. Based on the analytical testing for this project, nitric acid will be used for metals analysis for water samples (equipment blanks), if collected. As previously discussed, samples will be sealed, labeled, and stored until delivery to the subcontracted analytical laboratory.

<b>SAMPLE ANALYTICAL METHODS, CONTAINERS, PRESERVATIVES, AND HOLDING TIMES</b>				
<b>SOLID MEDIA</b>				
<b>CONTAMINANT</b>	<b>ANALYTICAL METHOD</b>	<b>CONTAINER</b>	<b>PRESERVATIVE</b>	<b>HOLDING TIME</b>
RCRA Metals (not including Mercury)	6010	4-ounce clear glass jar	Cool to 4° C	6 months
Mercury	7471	4-ounce clear glass jar	Cool to 4° C	28 days

<b>SAMPLE ANALYTICAL METHODS, CONTAINERS, PRESERVATIVES, AND HOLDING TIMES</b>				
<b>WATER MEDIA (EQUIPMENT BLANKS)</b>				
<b>CONTAMINANT</b>	<b>ANALYTICAL METHOD</b>	<b>CONTAINER</b>	<b>PRESERVATIVE</b>	<b>HOLDING TIME</b>
RCRA Metals	6010	500 mL plastic	Nitric Acid (HNO <sub>3</sub> ) to pH<2	6 months
Mercury	7470	500 mL plastic	Nitric Acid HNO <sub>3</sub> to pH<2	28 days

## 9.0 DISPOSAL OF RESIDUAL MATERIALS

In the process of collecting environmental samples during assessment of the imported material, the GTR sampling team will generate different types of potentially contaminated investigation-derived waste (IDW) that will include the following:

- Used personal protective equipment (PPE)
- Disposable sampling equipment

The EPA's National Contingency Plan (NCP) requires that management of IDW generated during sampling comply with all applicable or relevant and appropriate requirements (ARARs) to the extent practicable. The sampling plan will follow the *Office of Emergency and Remedial Response (OERR) Directive 9345.3-02* (May 1991), which provides the guidance for the management of IDW. In addition, other legal and practical considerations that may affect the handling of IDW will be considered. Used PPE and disposable equipment will be double bagged and placed in a municipal refuse dumpster. These wastes are not considered hazardous and can be sent to a municipal landfill. Any PPE and disposable equipment that is to be disposed that can still be reused will be rendered inoperable before disposal in the refuse dumpster.

## 10.0 SAMPLE DOCUMENTATION AND DELIVERY

### 10.1 FIELD NOTES

This section discusses recordkeeping in the field that may occur through a combination of logbooks, preprinted forms, photographs, or other documentation.

#### 10.1.1 Field Logbooks

Field logbooks will be used to document where, when, how, and from whom any vital project information is obtained. Documentation in the field logbook will be sufficient to reconstruct the field activities without relying on the memories of the field team members. Field notes will be kept in bound field logbooks. Logbooks will be used to record pertinent field activity information. A field logbook will be dedicated to this project and will not be used for other projects. Information recorded each day will include, but not be limited to the following:

- Project name
- Date and time
- Name and signature of field personnel entering information on each respective page
- Weather conditions
- Names of personnel on site, including subcontractors and site visitors
- Health and safety information, including PPE level

- GPS coordinates, including datum and accuracy
- Any deviations from the SAP, HASP, or QAPP procedures will be recorded in the logbook with an explanation of the reason for the deviation

Information recorded during each sampling point will include, as applicable, but not be limited to the following:

- Sampling location (sampling point identification)
- Sample identification
- Sample depth
- Sample media
- Description of sample
- Sampler name(s)
- Chemical analysis requested, sample container, and preservative
- Any modifications to the sampling plan
- Sampling observations (if applicable)
- QA/QC samples collected (if applicable)
- Field sketches, when appropriate

Entries will be made in blue or black indelible ink, and no erasures will be allowed. If an incorrect entry is made, the information will be crossed out with a single strike mark, and the change initialed and dated by the team member making the logbook change. Each page in the field logbook will be signed and dated at the bottom of the page by any team member making entries on the page. Pages in the logbook will be consecutively numbered.

The field logbooks will be identified on the cover by the project name, project number, and logbook number. The logbooks will be stored in the field project files when not in use. At completion of the field activities, the original field logbooks will be retained in the project file.

### **10.1.2 Photographs**

Photographs will be taken at the sampling locations and at other areas of interest on the Site. Photographs will serve to verify information entered in the field logbook. For each photograph taken, the following information will be written in the logbook or recorded in a separate field photography log:

- Time, date, and location
- Description of the subject photographed
- Name of person taking the photograph

### **10.2 LABELING**

All samples collected will be clearly and precisely labeled for proper identification in the field and for tracking in the analytical laboratory. The samples will have pre-assigned, identifiable, and

unique numbers. At a minimum, the sample labels will contain the following information: sample designation, date of collection, analytical parameter(s), and method of preservation.

### **10.3 SAMPLE CHAIN-OF-CUSTODY FORMS AND CUSTODY SEALS**

All samples will be accompanied by a chain-of-custody record. Forms will be completed and sent with the samples to the analytical laboratory and (i.e., each day).

The chain-of-custody forms will identify the contents and maintain the custodial integrity of the samples. Generally, a sample is considered to be in someone's custody if it is either in someone's physical possession, in someone's view, locked up, or kept in a secure area that is restricted to authorized personnel. Until the samples are delivered to the laboratory, the custody of the samples will be the responsibility of GTR. The sampling team leader or designee will sign the chain-of-custody form in the "Relinquished by" box and note date and time.

The sample numbers for all rinsate samples, reference samples, laboratory QC samples, and duplicates will be documented on the chain of custody. A photocopy will be made for the GTR master files. The cooler in which samples are stored will be sealed with self-adhesive custody seals any time the cooler is not in someone's possession or view before delivery to the laboratory. All custody seals will be signed and dated.

### **10.4 SAMPLE DELIVERY TO LABORATORY**

All sample containers will be placed in a secure location and delivered to the subcontracted analytical laboratory. At that time, GTR will sign over custody of the samples to selected analytical laboratory on the chain-of-custody form. The subcontracted analytical laboratory will then provide GTR with a copy of the chain-of-custody form for our records. The samples will be shipped per the subcontracted analytical laboratory Quality Assurance Manual and/or SOPs.

## **11.0 QUALITY CONTROL**

This section discusses the quality control samples that may be collected to support sampling activities. This includes field QC samples, confirmation samples and field and laboratory QC samples. The sample locations will be identified, and a rationale provided for the choice of location.

### **11.1 FIELD QUALITY CONTROL SAMPLES**

Field quality control samples are intended to help evaluate conditions resulting from field activities and are intended to accomplish two primary goals: assessment of field contamination and assessment of sampling variability. The former is used to evaluate whether substances are introduced in the field due to environmental or sampling equipment and is assessed using blanks of

different types. The latter is used to evaluate variability due to sampling technique and instrument performance as well as variability possibly caused by the heterogeneity of the matrix being sampled and are assessed using replicate sample collection. The following sections cover field QC.

### **11.1.1 Assessment of Field Contamination (Blanks)**

Field contamination is usually assessed through the collection of different types of blanks. Equipment blanks are obtained by passing deionized or distilled water over or through the decontaminated equipment used for sampling. They provide the best overall means of assessing contamination arising from the equipment, ambient conditions, sample containers, transit, and the laboratory. Field blanks are sample containers filled in the field. They help assess contamination from ambient conditions, sample containers, transit, and the laboratory. Trip blanks are prepared by the laboratory and shipped to and from the field. They help assess contamination from shipping and the laboratory and are for VOCs only. Because VOCs are not considered a COC and samples will not be collected for VOC analysis, trip blanks and field blanks will not be collected during this project.

EPA Region 9 recommends that equipment blanks be collected if non-disposable or dedicated sampling equipment is not used). Field blanks are next in priority and trip blanks next. Only one blank sample per matrix per day should be collected; therefore, if equipment blanks are collected, field blanks are not required under normal circumstances.

#### **Equipment Blanks**

Equipment rinsate blanks will be collected when reusable, non-disposable sampling equipment (e.g., trowels, spoons, and bowls) are used for the sampling event. If non-disposable sampling equipment is used, equipment blanks will be collected to evaluate field sampling and decontamination procedures by pouring distilled or deionized water over the decontaminated sampling equipment. Equipment rinsate blanks will be obtained by passing water through or over the decontaminated sampling devices used that day. Rinsate blank samples will be collected and analyzed for RCRA metals. Equipment blanks will be collected at a frequency of one equipment blank sample per every 20 samples of the primary composite samples collected or once per sampling day (when reusable, non-disposable sampling equipment is used), whichever is more frequent. A separate sample number will be assigned to each sample, and it will be submitted to the laboratory.

Equipment blank samples will be designated as follows: EB-#-mmddy

Where: EB – equipment blank sample  
# - sample identification number  
mmddy – month, day, and year of collection

### **Field Blanks**

Soil samples for VOC analysis will not be collected during this project; therefore, methanol field blanks are not required.

### **Trip Blanks**

Soil samples for VOC analysis will not be collected during this project; therefore, a trip blanks are not required.

### **11.1.2 Field Duplicate Samples**

A field duplicate is a second sample collected at the same location as the original (primary) sample. Duplicate samples are collected simultaneously or in immediate succession, following identical collection procedures, and treated in the same manner during sample shipment, storage, and analysis. The field duplicate samples are numbered such that they cannot be identified (blind duplicate) as duplicate samples by laboratory personnel.

Samples to be analyzed for RCRA metals will be homogenized in a plastic bag. Homogenized soil from the plastic bag will be transferred to the appropriate sample container for primary and duplicate sample analysis.

Field duplicate samples will be collected and analyzed to evaluate sampling and analytical precision. Agreement between duplicate sample results will indicate good sampling and analytical precision. Field duplicates will be collected at a frequency of one field duplicate sample per every 10 samples of the primary composite samples collected. The duplicate sample will be analyzed for all laboratory analyses requested for the primary sample collected.

### **11.2 LABORATORY QUALITY CONTROL SAMPLES**

Laboratory QC samples will be analyzed as part of standard laboratory practice. The laboratory monitors the precision and accuracy of the results of its analytical procedures through analysis of QC samples. In part, laboratory QC samples consist of matrix spike/matrix spike duplicate samples for organic analyses, and matrix spike and duplicate samples for inorganic analyses.

At a minimum, one laboratory QC sample is required per 14 days or one per 20 samples (including blanks and duplicates), whichever is greater. If the sample event lasts longer than 14 days or involves collection of more than 20 samples per matrix, additional QC samples will be designated. Samples to be the designated laboratory QC samples will be identified upon commencement of sampling activities.

## **12.0 FIELD VARIANCES**

As conditions in the field may vary, it may become necessary to implement minor modifications to sampling as presented in this SAP. When appropriate, the QA Manager will be notified, and a verbal approval will be obtained before implementing the changes. Modifications to the approved plan will be documented in the sampling project report.

## **13.0 FIELD HEALTH AND SAFETY PROCEDURES**

A site and project-specific HASP will be developed to assure Site activities detailed in this Work Plan are conducted in a safe manner and will be prepared in general accordance with Title 29 Code of Federal Regulations Part 1910 (29 CFR 1910). The purpose of the HASP is to assign responsibilities, to establish personnel protection standards and mandatory safety practices and procedures, and to provide for contingencies that may arise while operations are being conducted at the Site. The HASP will be developed by professionals experienced in health and safety requirements at sites where characterization and remediation activities are being conducted. Low-level contamination may be encountered in the areas where sampling is to be performed, requiring a personal protection equipment minimum of nitrile gloves, safety glasses, hard hat, and steel-toe boots. A copy of the HASP will be kept on the Site during site activities.

# **ATTACHMENT A**

## **SAMPLING STANDARD OPERATING PROCEDURES**



# GENERAL FIELD SAMPLING GUIDELINES

SOP#: 2001  
DATE: 08/11/94  
REV. #: 0.0

## 1.0 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to provide general field sampling guidelines that will assist REAC personnel in choosing sampling strategies, location, and frequency for proper assessment of site characteristics. This SOP is applicable to all field activities that involve sampling.

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent on site conditions, equipment limitations or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with the final report.

Mention of trade names or commercial products does not constitute U.S. EPA endorsement or recommendation for use.

## 2.0 METHOD SUMMARY

Sampling is the selection of a representative portion of a larger population, universe, or body. Through examination of a sample, the characteristics of the larger body from which the sample was drawn can be inferred. In this manner, sampling can be a valuable tool for determining the presence, type, and extent of contamination by hazardous substances in the environment.

The primary objective of all sampling activities is to characterize a hazardous waste site accurately so that its impact on human health and the environment can be properly evaluated. It is only through sampling and analysis that site hazards can be measured and the job of cleanup and restoration can be accomplished effectively with minimal risk. The sampling itself must be conducted so that every sample collected retains its original physical form and chemical composition. In this way, sample integrity is insured, quality assurance standards are maintained, and the sample can accurately represent the larger body of

material under investigation.

The extent to which valid inferences can be drawn from a sample depends on the degree to which the sampling effort conforms to the project's objectives. For example, as few as one sample may produce adequate, technically valid data to address the project's objectives. Meeting the project's objectives requires thorough planning of sampling activities, and implementation of the most appropriate sampling and analytical procedures. These issues will be discussed in this procedure.

## 3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

The amount of sample to be collected, and the proper sample container type (i.e., glass, plastic), chemical preservation, and storage requirements are dependent on the matrix being sampled and the parameter(s) of interest. Sample preservation, containers, handling, and storage for air and waste samples are discussed in the specific SOPs for air and waste sampling techniques.

## 4.0 INTERFERENCES AND POTENTIAL PROBLEMS

The nature of the object or materials being sampled may be a potential problem to the sampler. If a material is homogeneous, it will generally have a uniform composition throughout. In this case, any sample increment can be considered representative of the material. On the other hand, heterogeneous samples present problems to the sampler because of changes in the material over distance, both laterally and vertically.

Samples of hazardous materials may pose a safety threat to both field and laboratory personnel. Proper health and safety precautions should be implemented when handling this type of sample.

Environmental conditions, weather conditions, or non-target chemicals may cause problems and/or interferences when performing sampling activities or when sampling for a specific parameter. Refer to the specific SOPs for sampling techniques.

## **5.0 EQUIPMENT/APPARATUS**

The equipment/apparatus required to collect samples must be determined on a site specific basis. Due to the wide variety of sampling equipment available, refer to the specific SOPs for sampling techniques which include lists of the equipment/apparatus required for sampling.

## **6.0 REAGENTS**

Reagents may be utilized for preservation of samples and for decontamination of sampling equipment. The preservatives required are specified by the analysis to be performed. Decontamination solutions are specified in ERT SOP #2006, Sampling Equipment Decontamination.

## **7.0 PROCEDURE**

### **7.1 Types of Samples**

In relation to the media to be sampled, two basic types of samples can be considered: the environmental sample and the hazardous sample.

Environmental samples are those collected from streams, ponds, lakes, wells, and are off-site samples that are not expected to be contaminated with hazardous materials. They usually do not require the special handling procedures typically used for concentrated wastes. However, in certain instances, environmental samples can contain elevated concentrations of pollutants and in such cases would have to be handled as hazardous samples.

Hazardous or concentrated samples are those collected from drums, tanks, lagoons, pits, waste piles, fresh spills, or areas previously identified as contaminated, and require special handling procedures because of their potential toxicity or hazard. These samples can be further subdivided based on their degree of hazard; however, care should be taken when handling and shipping any wastes believed to be concentrated regardless of the degree.

The importance of making the distinction between environmental and hazardous samples is two-fold:

- (1) Personnel safety requirements: Any sample thought to contain enough hazardous materials to pose a safety threat should be designated as hazardous and handled in a manner which ensures the safety of both field and laboratory personnel.
- (2) Transportation requirements: Hazardous samples must be packaged, labeled, and shipped according to the International Air Transport Association (IATA) Dangerous Goods Regulations or Department of Transportation (DOT) regulations and U.S. EPA guidelines.

### **7.2 Sample Collection Techniques**

In general, two basic types of sample collection techniques are recognized, both of which can be used for either environmental or hazardous samples.

#### Grab Samples

A grab sample is defined as a discrete aliquot representative of a specific location at a given point in time. The sample is collected all at once at one particular point in the sample medium. The representativeness of such samples is defined by the nature of the materials being sampled. In general, as sources vary over time and distance, the representativeness of grab samples will decrease.

#### Composite Samples

Composites are nondiscrete samples composed of more than one specific aliquot collected at various sampling locations and/or different points in time. Analysis of this type of sample produces an average value and can in certain instances be used as an alternative to analyzing a number of individual grab samples and calculating an average value. It should be noted, however, that compositing can mask problems by diluting isolated concentrations of some hazardous compounds below detection limits.

Compositing is often used for environmental samples and may be used for hazardous samples under certain conditions. For example, compositing of hazardous waste is often performed after compatibility tests have

been completed to determine an average value over a number of different locations (group of drums). This procedure generates data that can be useful by providing an average concentration within a number of units, can serve to keep analytical costs down, and can provide information useful to transporters and waste disposal operations.

For sampling situations involving hazardous wastes, grab sampling techniques are generally preferred because grab sampling minimizes the amount of time sampling personnel must be in contact with the wastes, reduces risks associated with compositing unknowns, and eliminates chemical changes that might occur due to compositing.

### 7.3 Types of Sampling Strategies

The number of samples that should be collected and analyzed depends on the objective of the investigation. There are three basic sampling strategies: random, systematic, and judgmental sampling.

Random sampling involves collection of samples in a nonsystematic fashion from the entire site or a specific portion of a site. Systematic sampling involves collection of samples based on a grid or a pattern which has been previously established. When judgmental sampling is performed, samples are collected only from the portion(s) of the site most likely to be contaminated. Often, a combination of these strategies is the best approach depending on the type of the suspected/known contamination, the uniformity and size of the site, the level/type of information desired, etc.

### 7.4 QA Work Plans (QAWP)

A QAWP is required when it becomes evident that a field investigation is necessary. It should be initiated in conjunction with, or immediately following, notification of the field investigation. This plan should be clear and concise and should detail the following basic components, with regard to sampling activities:

- C Objective and purpose of the investigation.
- C Basis upon which data will be evaluated.
- C Information known about the site including location, type and size of the facility, and length of operations/abandonment.
- C Type and volume of contaminated material, contaminants of concern (including

concentration), and basis of the information/data.

- C Technical approach including media/matrix to be sampled, sampling equipment to be used, sample equipment decontamination (if necessary), sampling design and rationale, and SOPs or description of the procedure to be implemented.
- C Project management and reporting, schedule, project organization and responsibilities, manpower and cost projections, and required deliverables.
- C QA objectives and protocols including tables summarizing field sampling and QA/QC analysis and objectives.

Note that this list of QAWP components is not all-inclusive and that additional elements may be added or altered depending on the specific requirements of the field investigation. It should also be recognized that although a detailed QAWP is quite important, it may be impractical in some instances. Emergency responses and accidental spills are prime examples of such instances where time might prohibit the development of site-specific QAWPs prior to field activities. In such cases, investigators would have to rely on general guidelines and personal judgment, and the sampling or response plans might simply be a strategy based on preliminary information and finalized on site. In any event, a plan of action should be developed, no matter how concise or informal, to aid investigators in maintaining a logical and consistent order to the implementation of their task.

### 7.5 Legal Implications

The data derived from sampling activities are often introduced as critical evidence during litigation of a hazardous waste site cleanup. Legal issues in which sampling data are important may include cleanup cost recovery, identification of pollution sources and responsible parties, and technical validation of remedial design methodologies. Because of the potential for involvement in legal actions, strict adherence to technical and administrative SOPs is essential during both the development and implementation of sampling activities.

Technically valid sampling begins with thorough planning and continues through the sample collection and analytical procedures. Administrative requirements involve thorough, accurate

documentation of all sampling activities. Documentation requirements include maintenance of a chain of custody, as well as accurate records of field activities and analytical instructions. Failure to observe these procedures fully and consistently may result in data that are questionable, invalid and non-defensible in court, and the consequent loss of enforcement proceedings.

## **8.0 CALCULATIONS**

Refer to the specific SOPs for any calculations which are associated with sampling techniques.

## **9.0 QUALITY ASSURANCE/ QUALITY CONTROL**

Refer to the specific SOPs for the type and frequency of QA/QC samples to be analyzed, the acceptance criteria for the QA/QC samples, and any other QA/QC activities which are associated with sampling techniques.

## **10.0 DATA VALIDATION**

Refer to the specific SOPs for data validation activities that are associated with sampling techniques.

## **11.0 HEALTH AND SAFETY**

When working with potentially hazardous materials, follow U.S. EPA, OSHA, and corporate health and safety procedures.



# U. S. EPA ENVIRONMENTAL RESPONSE TEAM

## STANDARD OPERATING PROCEDURES

SOP: 2012  
PAGE: 1 of 13  
REV: 0.0  
DATE: 02/18/00

### SOIL SAMPLING

---

#### CONTENTS

- 1.0 SCOPE AND APPLICATION
- 2.0 METHOD SUMMARY
- 3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE
- 4.0 POTENTIAL PROBLEMS
- 5.0 EQUIPMENT
- 6.0 REAGENTS
- 7.0 PROCEDURES
  - 7.1 Preparation
  - 7.2 Sample Collection
    - 7.2.1 Surface Soil Samples
    - 7.2.2 Sampling at Depth with Augers and Thin Wall Tube Samplers
    - 7.2.3 Sampling at Depth with a Trier
    - 7.2.4 Sampling at Depth with a Split Spoon (Barrel) Sampler
    - 7.2.5 Test Pit/Trench Excavation
- 8.0 CALCULATIONS
- 9.0 QUALITY ASSURANCE/QUALITY CONTROL
- 10.0 DATA VALIDATION
- 11.0 HEALTH AND SAFETY
- 12.0 REFERENCES
- 13.0 APPENDIX
  - Figures



# U. S. EPA ENVIRONMENTAL RESPONSE TEAM

## STANDARD OPERATING PROCEDURES

SOP: 2012  
PAGE: 2 of 13  
REV: 0.0  
DATE: 02/18/00

### SOIL SAMPLING

---

#### 1.0 SCOPE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to describe the procedures for the collection of representative soil samples. Sampling depths are assumed to be those that can be reached without the use of a drill rig, direct-push, or other mechanized equipment (except for a back-hoe). Analysis of soil samples may determine whether concentrations of specific pollutants exceed established action levels, or if the concentrations of pollutants present a risk to public health, welfare, or the environment.

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent upon site conditions, equipment limitations or limitations imposed by the procedure. In all instances, the actual procedures used should be documented and described in an appropriate site report.

Mention of trade names or commercial products does not constitute U.S. Environmental Protection Agency (EPA) endorsement or recommendation for use.

#### 2.0 METHOD SUMMARY

Soil samples may be collected using a variety of methods and equipment depending on the depth of the desired sample, the type of sample required (disturbed vs. undisturbed), and the soil type. Near-surface soils may be easily sampled using a spade, trowel, and scoop. Sampling at greater depths may be performed using a hand auger, continuous flight auger, a trier, a split-spoon, or, if required, a backhoe.

#### 3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

Chemical preservation of solids is not generally recommended. Samples should, however, be cooled and protected from sunlight to minimize any potential reaction. The amount of sample to be collected and proper sample container type are discussed in ERT/REAC SOP #2003 Rev. 0.0 08/11/94, *Sample Storage, Preservation and Handling*.

#### 4.0 INTERFERENCES AND POTENTIAL PROBLEMS

There are two primary potential problems associated with soil sampling - cross contamination of samples and improper sample collection. Cross contamination problems can be eliminated or minimized through the use of dedicated sampling equipment. If this is not possible or practical, then decontamination of sampling equipment is necessary. Improper sample collection can involve using contaminated equipment, disturbance of the matrix resulting in compaction of the sample, or inadequate homogenization of the samples where required, resulting in variable, non-representative results.

#### 5.0 EQUIPMENT



# U. S. EPA ENVIRONMENTAL RESPONSE TEAM

## STANDARD OPERATING PROCEDURES

SOP: 2012  
PAGE: 3 of 13  
REV: 0.0  
DATE: 02/18/00

### SOIL SAMPLING

---

Soil sampling equipment includes the following:

- Maps/plot plan
- Safety equipment, as specified in the site-specific Health and Safety Plan
- Survey equipment or global positioning system (GPS) to locate sampling points
- Tape measure
- Survey stakes or flags
- Camera and film
- Stainless steel, plastic, or other appropriate homogenization bucket, bowl or pan
- Appropriate size sample containers
- Ziplock plastic bags
- Logbook
- Labels
- Chain of Custody records and custody seals
- Field data sheets and sample labels
- Cooler(s)
- Ice
- Vermiculite
- Decontamination supplies/equipment
- Canvas or plastic sheet
- Spade or shovel
- Spatula
- Scoop
- Plastic or stainless steel spoons
- Trowel(s)
- Continuous flight (screw) auger
- Bucket auger
- Post hole auger
- Extension rods
- T-handle
- Sampling trier
- Thin wall tube sampler
- Split spoons
- Vehimeyer soil sampler outfit
  - Tubes
  - Points
  - Drive head
  - Drop hammer
  - Puller jack and grip
- Backhoe



# U. S. EPA ENVIRONMENTAL RESPONSE TEAM

## STANDARD OPERATING PROCEDURES

SOP: 2012  
PAGE: 4 of 13  
REV: 0.0  
DATE: 02/18/00

### SOIL SAMPLING

---

Reagents are not used for the preservation of soil samples. Decontamination solutions are specified in ERT/REAC SOP #2006 Rev. 0.0 08/11/94, *Sampling Equipment Decontamination*, and the site specific work plan.

#### 7.0 PROCEDURES

##### 7.1 Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed, and the types and amounts of equipment and supplies required.
2. Obtain necessary sampling and monitoring equipment.
3. Decontaminate or pre-clean equipment, and ensure that it is in working order.
4. Prepare schedules and coordinate with staff, client, and regulatory agencies, if appropriate.
5. Perform a general site survey prior to site entry in accordance with the site specific Health and Safety Plan.
6. Use stakes, flagging, or buoys to identify and mark all sampling locations. Specific site factors, including extent and nature of contaminant, should be considered when selecting sample location. If required, the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions. All staked locations should be utility-cleared by the property owner or the On-Scene-Coordinator (OSC) prior to soil sampling; and utility clearance should always be confirmed before beginning work.

##### 7.2 Sample Collection

###### 7.2.1 Surface Soil Samples

Collection of samples from near-surface soil can be accomplished with tools such as spades, shovels, trowels, and scoops. Surface material is removed to the required depth and a stainless steel or plastic scoop is then used to collect the sample.

This method can be used in most soil types but is limited to sampling at or near the ground surface. Accurate, representative samples can be collected with this procedure depending on the care and precision demonstrated by the sample team member. A flat, pointed mason trowel to cut a block of the desired soil is helpful when undisturbed profiles are required. Tools plated with chrome or other materials should not be used. Plating is particularly common with garden implements such as potting trowels.

The following procedure is used to collect surface soil samples:



# U. S. EPA ENVIRONMENTAL RESPONSE TEAM

## STANDARD OPERATING PROCEDURES

SOP: 2012  
PAGE: 5 of 13  
REV: 0.0  
DATE: 02/18/00

### SOIL SAMPLING

---

1. Carefully remove the top layer of soil or debris to the desired sample depth with a pre-cleaned spade.
2. Using a pre-cleaned, stainless steel scoop, plastic spoon, or trowel, remove and discard a thin layer of soil from the area which came in contact with the spade.
3. If volatile organic analysis is to be performed, transfer the sample directly into an appropriate, labeled sample container with a stainless steel lab spoon, or equivalent and secure the cap tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval or location into the homogenization container and mix thoroughly. When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.

#### 7.2.2 Sampling at Depth with Augers and Thin Wall Tube Samplers

This system consists of an auger, or a thin-wall tube sampler, a series of extensions, and a "T" handle (Figure 1, Appendix A). The auger is used to bore a hole to a desired sampling depth, and is then withdrawn. The sample may be collected directly from the auger. If a core sample is to be collected, the auger tip is then replaced with a thin wall tube sampler. The system is then lowered down the borehole, and driven into the soil to the completion depth. The system is withdrawn and the core is collected from the thin wall tube sampler.

Several types of augers are available; these include: bucket type, continuous flight (screw), and post-hole augers. Bucket type augers are better for direct sample recovery because they provide a large volume of sample in a short time. When continuous flight augers are used, the sample can be collected directly from the flights. The continuous flight augers are satisfactory when a composite of the complete soil column is desired. Post-hole augers have limited utility for sample collection as they are designed to cut through fibrous, rooted, swampy soil and cannot be used below a depth of approximately three feet.

The following procedure is used for collecting soil samples with the auger:

1. Attach the auger bit to a drill rod extension, and attach the "T" handle to the drill rod.



# U. S. EPA ENVIRONMENTAL RESPONSE TEAM

## STANDARD OPERATING PROCEDURES

SOP: 2012  
PAGE: 6 of 13  
REV: 0.0  
DATE: 02/18/00

### SOIL SAMPLING

---

2. Clear the area to be sampled of any surface debris (e.g., twigs, rocks, litter). It may be advisable to remove the first three to six inches of surface soil for an area approximately six inches in radius around the drilling location.
3. Begin augering, periodically removing and depositing accumulated soils onto a plastic sheet spread near the hole. This prevents accidental brushing of loose material back down the borehole when removing the auger or adding drill rods. It also facilitates refilling the hole, and avoids possible contamination of the surrounding area.
4. After reaching the desired depth, slowly and carefully remove the auger from the hole. When sampling directly from the auger, collect the sample after the auger is removed from the hole and proceed to Step 10.
5. Remove auger tip from the extension rods and replace with a pre-cleaned thin wall tube sampler. Install the proper cutting tip.
6. Carefully lower the tube sampler down the borehole. Gradually force the tube sampler into the soil. Do not scrape the borehole sides. Avoid hammering the rods as the vibrations may cause the boring walls to collapse.
7. Remove the tube sampler, and unscrew the drill rods.
8. Remove the cutting tip and the core from the device.
9. Discard the top of the core (approximately 1 inch), as this possibly represents material collected before penetration of the layer of concern. Place the remaining core into the appropriate labeled sample container. Sample homogenization is not required.
10. If volatile organic analysis is to be performed, transfer the sample into an appropriate, labeled sample container with a stainless steel lab spoon, or equivalent and secure the cap tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly.

When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.



# U. S. EPA ENVIRONMENTAL RESPONSE TEAM

## STANDARD OPERATING PROCEDURES

SOP: 2012  
PAGE: 7 of 13  
REV: 0.0  
DATE: 02/18/00

### SOIL SAMPLING

---

11. If another sample is to be collected in the same hole, but at a greater depth, reattach the auger bit to the drill and assembly, and follow steps 3 through 11, making sure to decontaminate the auger and tube sampler between samples.
12. Abandon the hole according to applicable state regulations. Generally, shallow holes can simply be backfilled with the removed soil material.

#### 7.2.3 Sampling with a Trier

The system consists of a trier, and a "T" handle. The auger is driven into the soil to be sampled and used to extract a core sample from the appropriate depth.

The following procedure is used to collect soil samples with a sampling trier:

1. Insert the trier (Figure 2, Appendix A) into the material to be sampled at a 0° to 45° angle from horizontal. This orientation minimizes the spillage of sample.
2. Rotate the trier once or twice to cut a core of material.
3. Slowly withdraw the trier, making sure that the slot is facing upward.
4. If volatile organic analyses are required, transfer the sample into an appropriate, labeled sample container with a stainless steel lab spoon, or equivalent and secure the cap tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly. When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.

#### 7.2.4 Sampling at Depth with a Split Spoon (Barrel) Sampler

Split spoon sampling is generally used to collect undisturbed soil cores of 18 or 24 inches in length. A series of consecutive cores may be extracted with a split spoon sampler to give a complete soil column profile, or an auger may be used to drill down to the desired depth for sampling. The split spoon is then driven to its sampling depth through the bottom of the augured hole and the core extracted.

When split spoon sampling is performed to gain geologic information, all work should



# U. S. EPA ENVIRONMENTAL RESPONSE TEAM

## STANDARD OPERATING PROCEDURES

SOP: 2012  
PAGE: 8 of 13  
REV: 0.0  
DATE: 02/18/00

### SOIL SAMPLING

---

be performed in accordance with ASTM D1586-98, "Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils".

The following procedures are used for collecting soil samples with a split spoon:

1. Assemble the sampler by aligning both sides of barrel and then screwing the drive shoe on the bottom and the head piece on top.
2. Place the sampler in a perpendicular position on the sample material.
3. Using a well ring, drive the tube. Do not drive past the bottom of the head piece or compression of the sample will result.
4. Record in the site logbook or on field data sheets the length of the tube used to penetrate the material being sampled, and the number of blows required to obtain this depth.
5. Withdraw the sampler, and open by unscrewing the bit and head and splitting the barrel. The amount of recovery and soil type should be recorded on the boring log. If a split sample is desired, a cleaned, stainless steel knife should be used to divide the tube contents in half, longitudinally. This sampler is typically available in 2 and 3 1/2 inch diameters. A larger barrel may be necessary to obtain the required sample volume.
6. Without disturbing the core, transfer it to appropriate labeled sample container(s) and seal tightly.

#### 7.2.5 Test Pit/Trench Excavation

A backhoe can be used to remove sections of soil, when detailed examination of soil characteristics are required. This is probably the most expensive sampling method because of the relatively high cost of backhoe operation.

The following procedures are used for collecting soil samples from test pits or trenches:

1. Prior to any excavation with a backhoe, it is important to ensure that all sampling locations are clear of overhead and buried utilities.
2. Review the site specific Health & Safety plan and ensure that all safety precautions including appropriate monitoring equipment are installed as required.



# U. S. EPA ENVIRONMENTAL RESPONSE TEAM

## STANDARD OPERATING PROCEDURES

SOP: 2012  
PAGE: 9 of 13  
REV: 0.0  
DATE: 02/18/00

### SOIL SAMPLING

---

3. Using the backhoe, excavate a trench approximately three feet wide and approximately one foot deep below the cleared sampling location. Place excavated soils on plastic sheets. Trenches greater than five feet deep must be sloped or protected by a shoring system, as required by OSHA regulations.
4. A shovel is used to remove a one to two inch layer of soil from the vertical face of the pit where sampling is to be done.
5. Samples are taken using a trowel, scoop, or coring device at the desired intervals. Be sure to scrape the vertical face at the point of sampling to remove any soil that may have fallen from above, and to expose fresh soil for sampling. In many instances, samples can be collected directly from the backhoe bucket.
6. If volatile organic analyses are required, transfer the sample into an appropriate, labeled sample container with a stainless steel lab spoon, or equivalent and secure the cap tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly. When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.
7. Abandon the pit or excavation according to applicable state regulations. Generally, shallow excavations can simply be backfilled with the removed soil material.

#### 8.0 CALCULATIONS

This section is not applicable to this SOP.

#### 9.0 QUALITY ASSURANCE/QUALITY CONTROL

There are no specific quality assurance (QA) activities which apply to the implementation of these procedures. However, the following QA procedures apply:

1. All data must be documented on field data sheets or within site logbooks.
2. All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration



# U. S. EPA ENVIRONMENTAL RESPONSE TEAM

## STANDARD OPERATING PROCEDURES

SOP: 2012  
PAGE: 10 of 13  
REV: 0.0  
DATE: 02/18/00

### SOIL SAMPLING

---

activities must occur prior to sampling/operation, and they must be documented.

#### 10.0 DATA VALIDATION

This section is not applicable to this SOP.

#### 11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, OSHA and corporate health and safety procedures, in addition to the procedures specified in the site specific Health & Safety Plan..

#### 12.0 REFERENCES

Mason, B.J. 1983. Preparation of Soil Sampling Protocol: Technique and Strategies. EPA-600/4-83-020.

Barth, D.S. and B.J. Mason. 1984. Soil Sampling Quality Assurance User's Guide. EPA-600/4-84-043.

U.S. Environmental Protection Agency. 1984 Characterization of Hazardous Waste Sites - A Methods Manual: Volume II. Available Sampling Methods, Second Edition. EPA-600/4-84-076.

de Vera, E.R., B.P. Simmons, R.D. Stephen, and D.L. Storm. 1980. Samplers and Sampling Procedures for Hazardous Waste Streams. EPA-600/2-80-018.

ASTM D 1586-98, ASTM Committee on Standards, Philadelphia, PA.



# U. S. EPA ENVIRONMENTAL RESPONSE TEAM

## STANDARD OPERATING PROCEDURES

SOP: 2012  
PAGE: 11 of 13  
REV: 0.0  
DATE: 02/18/00

### SOIL SAMPLING

---

APPENDIX A  
Figures  
SOP #2012  
February 2000



# U. S. EPA ENVIRONMENTAL RESPONSE TEAM

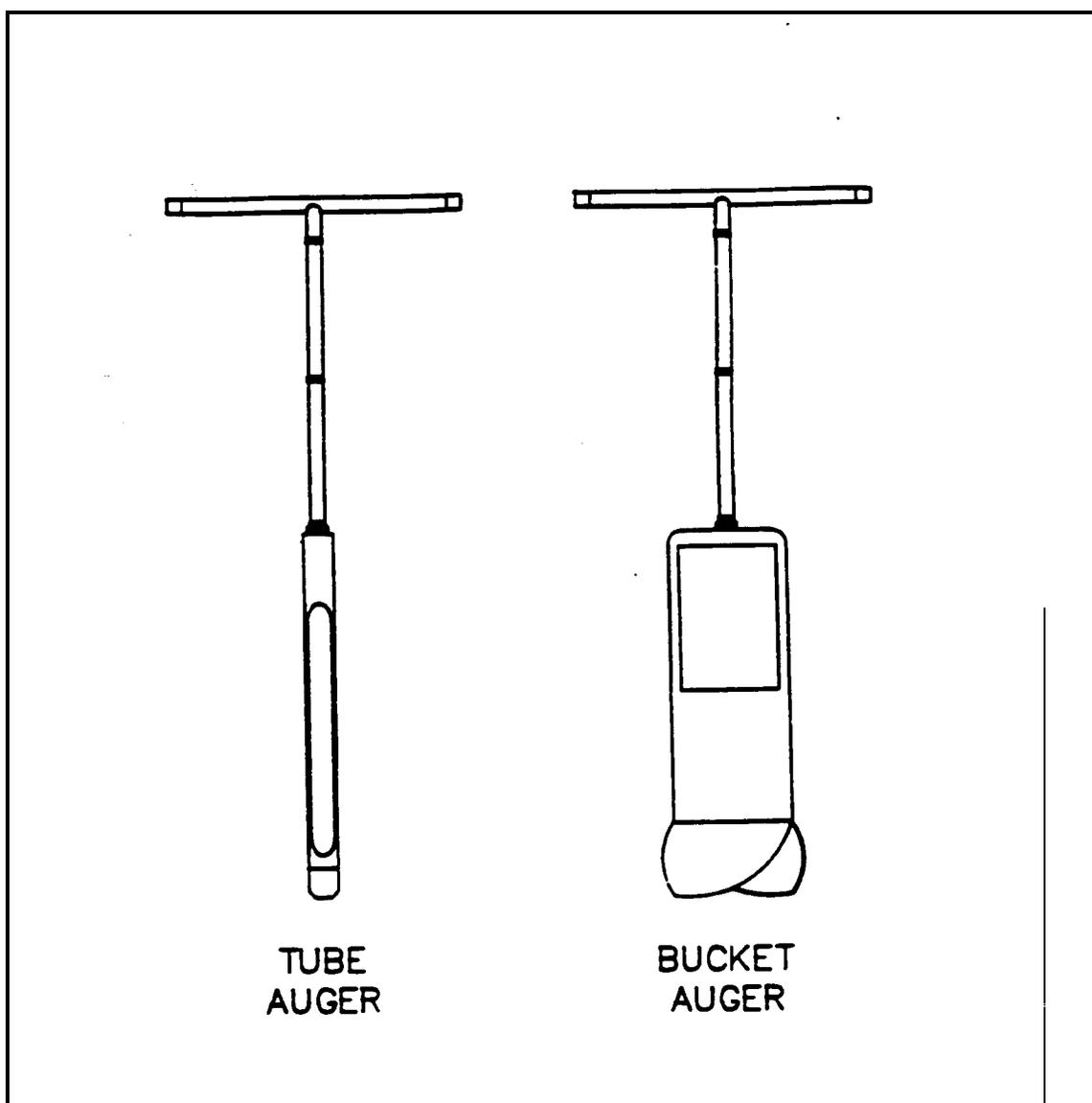
## STANDARD OPERATING PROCEDURES

SOP: 2012  
PAGE: 12 of 13  
REV: 0.0  
DATE: 02/18/00

### SOIL SAMPLING

---

FIGURE 1. Sampling Augers





# U. S. EPA ENVIRONMENTAL RESPONSE TEAM

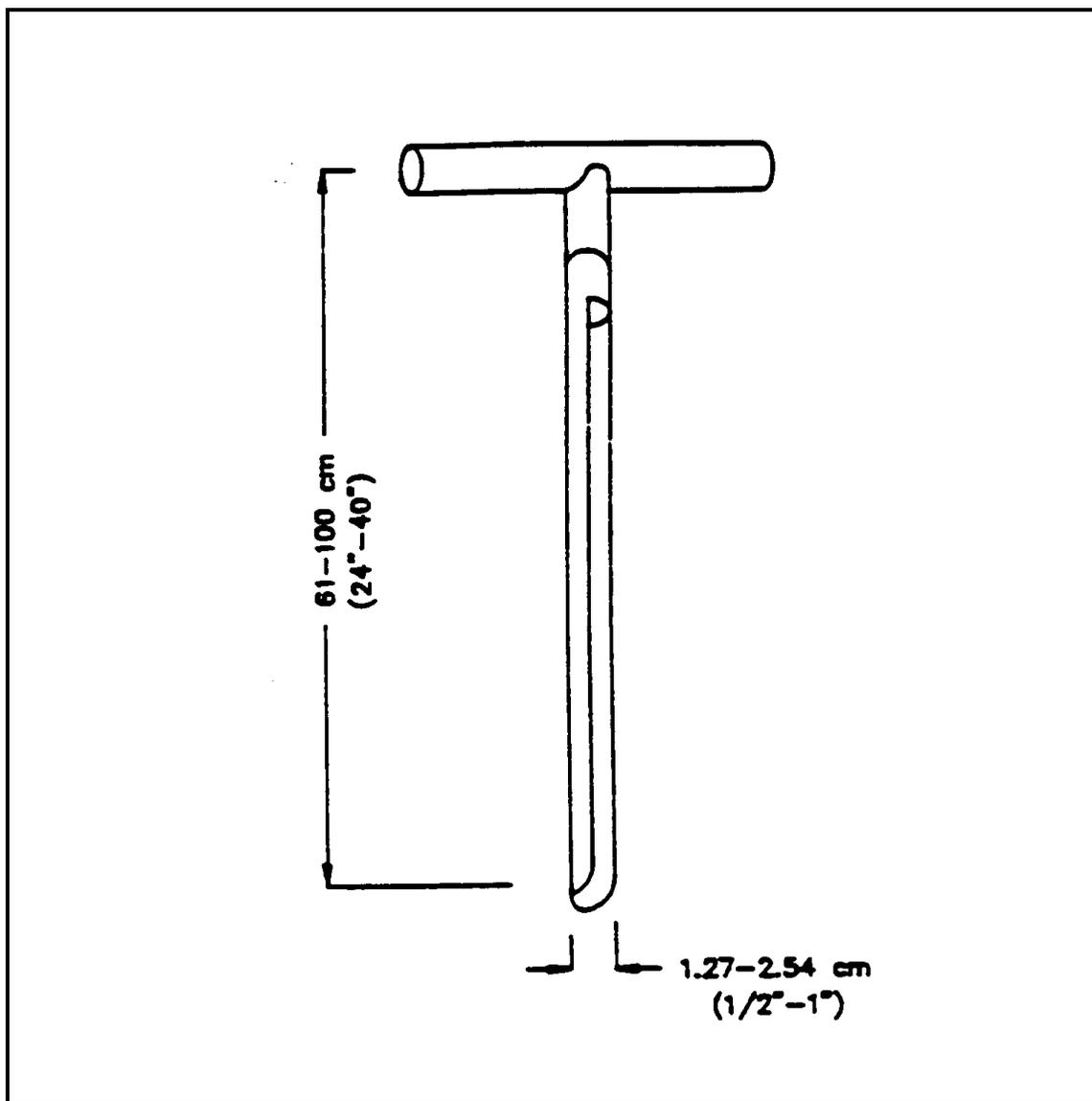
## STANDARD OPERATING PROCEDURES

SOP: 2012  
PAGE: 13 of 13  
REV: 0.0  
DATE: 02/18/00

### SOIL SAMPLING

---

FIGURE 2. Sampling Trier





# SAMPLING EQUIPMENT DECONTAMINATION

SOP#: 2006  
DATE: 08/11/94  
REV. #: 0.0

## 1.0 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to provide a description of the methods used for preventing, minimizing, or limiting cross-contamination of samples due to inappropriate or inadequate equipment decontamination and to provide general guidelines for developing decontamination procedures for sampling equipment to be used during hazardous waste operations as per 29 Code of Federal Regulations (CFR) 1910.120. This SOP does not address personnel decontamination.

These are standard (i.e. typically applicable) operating procedures which may be varied or changed as required, dependent upon site conditions, equipment limitation, or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with the final report.

Mention of trade names or commercial products does not constitute U.S. Environmental Protection Agency (U.S. EPA) endorsement or recommendation for use.

## 2.0 METHOD SUMMARY

Removing or neutralizing contaminants from equipment minimizes the likelihood of sample cross contamination, reduces or eliminates transfer of contaminants to clean areas, and prevents the mixing of incompatible substances.

Gross contamination can be removed by physical decontamination procedures. These abrasive and non-abrasive methods include the use of brushes, air and wet blasting, and high and low pressure water cleaning.

The first step, a soap and water wash, removes all visible particulate matter and residual oils and grease. This may be preceded by a steam or high pressure

water wash to facilitate residuals removal. The second step involves a tap water rinse and a distilled/deionized water rinse to remove the detergent. An acid rinse provides a low pH media for trace metals removal and is included in the decontamination process if metal samples are to be collected. It is followed by another distilled/deionized water rinse. If sample analysis does not include metals, the acid rinse step can be omitted. Next, a high purity solvent rinse is performed for trace organics removal if organics are a concern at the site. Typical solvents used for removal of organic contaminants include acetone, hexane, or water. Acetone is typically chosen because it is an excellent solvent, miscible in water, and not a target analyte on the Priority Pollutant List. If acetone is known to be a contaminant of concern at a given site or if Target Compound List analysis (which includes acetone) is to be performed, another solvent may be substituted. The solvent must be allowed to evaporate completely and then a final distilled/deionized water rinse is performed. This rinse removes any residual traces of the solvent.

The decontamination procedure described above may be summarized as follows:

1. Physical removal
2. Non-phosphate detergent wash
3. Tap water rinse
4. Distilled/deionized water rinse
5. 10% nitric acid rinse
6. Distilled/deionized water rinse
7. Solvent rinse (pesticide grade)
8. Air dry
9. Distilled/deionized water rinse

If a particular contaminant fraction is not present at the site, the nine (9) step decontamination procedure specified above may be modified for site specificity. For example, the nitric acid rinse may be eliminated if metals are not of concern at a site. Similarly, the solvent rinse may be eliminated if organics are not of

concern at a site. Modifications to the standard procedure should be documented in the site specific work plan or subsequent report.

### **3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE**

The amount of sample to be collected and the proper sample container type (i.e., glass, plastic), chemical preservation, and storage requirements are dependent on the matrix being sampled and the parameter(s) of interest.

More specifically, sample collection and analysis of decontamination waste may be required before beginning proper disposal of decontamination liquids and solids generated at a site. This should be determined prior to initiation of site activities.

### **4.0 INTERFERENCES AND POTENTIAL PROBLEMS**

C The use of distilled/deionized water commonly available from commercial vendors may be acceptable for decontamination of sampling equipment provided that it has been verified by laboratory analysis to be analyte free (specifically for the contaminants of concern).

C The use of an untreated potable water supply is not an acceptable substitute for tap water. Tap water may be used from any municipal or industrial water treatment system.

C If acids or solvents are utilized in decontamination they raise health and safety, and waste disposal concerns.

C Damage can be incurred by acid and solvent washing of complex and sophisticated sampling equipment.

### **5.0 EQUIPMENT/APPARATUS**

Decontamination equipment, materials, and supplies are generally selected based on availability. Other considerations include the ease of decontaminating or disposing of the equipment. Most equipment and supplies can be easily procured. For example, soft-

bristle scrub brushes or long-handled bottle brushes can be used to remove contaminants. Large galvanized wash tubs, stock tanks, or buckets can hold wash and rinse solutions. Children's wading pools can also be used. Large plastic garbage cans or other similar containers lined with plastic bags can help segregate contaminated equipment. Contaminated liquid can be stored temporarily in metal or plastic cans or drums.

The following standard materials and equipment are recommended for decontamination activities:

#### **5.1 Decontamination Solutions**

- C Non-phosphate detergent
- C Selected solvents (acetone, hexane, nitric acid, etc.)
- C Tap water
- C Distilled or deionized water

#### **5.2 Decontamination Tools/Supplies**

- C Long and short handled brushes
- C Bottle brushes
- C Drop cloth/plastic sheeting
- C Paper towels
- C Plastic or galvanized tubs or buckets
- C Pressurized sprayers (H<sub>2</sub>O)
- C Solvent sprayers
- C Aluminum foil

#### **5.3 Health and Safety Equipment**

Appropriate personal protective equipment (i.e., safety glasses or splash shield, appropriate gloves, aprons or coveralls, respirator, emergency eye wash)

#### **5.4 Waste Disposal**

- C Trash bags
- C Trash containers
- C 55-gallon drums
- C Metal/plastic buckets/containers for storage and disposal of decontamination solutions

### **6.0 REAGENTS**

There are no reagents used in this procedure aside from the actual decontamination solutions. Table 1 (Appendix A) lists solvent rinses which may be required for elimination of particular chemicals. In

general, the following solvents are typically utilized for decontamination purposes:

- C 10% nitric acid is typically used for inorganic compounds such as metals. An acid rinse may not be required if inorganics are not a contaminant of concern.
- C Acetone (pesticide grade)<sup>(1)</sup>
- C Hexane (pesticide grade)<sup>(1)</sup>
- C Methanol<sup>(1)</sup>

<sup>(1)</sup> - Only if sample is to be analyzed for organics.

## 7.0 PROCEDURES

As part of the health and safety plan, a decontamination plan should be developed and reviewed. The decontamination line should be set up before any personnel or equipment enter the areas of potential exposure. The equipment decontamination plan should include:

- C The number, location, and layout of decontamination stations.
- C Decontamination equipment needed.
- C Appropriate decontamination methods.
- C Methods for disposal of contaminated clothing, equipment, and solutions.
- C Procedures can be established to minimize the potential for contamination. This may include: (1) work practices that minimize contact with potential contaminants; (2) using remote sampling techniques; (3) covering monitoring and sampling equipment with plastic, aluminum foil, or other protective material; (4) watering down dusty areas; (5) avoiding laying down equipment in areas of obvious contamination; and (6) use of disposable sampling equipment.

### 7.1 Decontamination Methods

All samples and equipment leaving the contaminated area of a site must be decontaminated to remove any contamination that may have adhered to equipment. Various decontamination methods will remove contaminants by: (1) flushing or other physical action, or (2) chemical complexing to inactivate

contaminants by neutralization, chemical reaction, disinfection, or sterilization.

Physical decontamination techniques can be grouped into two categories: abrasive methods and non-abrasive methods, as follows:

#### 7.1.1 Abrasive Cleaning Methods

Abrasive cleaning methods work by rubbing and wearing away the top layer of the surface containing the contaminant. The mechanical abrasive cleaning methods are most commonly used at hazardous waste sites. The following abrasive methods are available:

##### Mechanical

Mechanical methods of decontamination include using metal or nylon brushes. The amount and type of contaminants removed will vary with the hardness of bristles, length of time brushed, degree of brush contact, degree of contamination, nature of the surface being cleaned, and degree of contaminant adherence to the surface.

##### Air Blasting

Air blasting equipment uses compressed air to force abrasive material through a nozzle at high velocities. The distance between nozzle and surface cleaned, air pressure, time of application, and angle at which the abrasive strikes the surface will dictate cleaning efficiency. Disadvantages of this method are the inability to control the amount of material removed and the large amount of waste generated.

##### Wet Blasting

Wet blast cleaning involves use of a suspended fine abrasive. The abrasive/water mixture is delivered by compressed air to the contaminated area. By using a very fine abrasive, the amount of materials removed can be carefully controlled.

#### 7.1.2 Non-Abrasive Cleaning Methods

Non-abrasive cleaning methods work by forcing the contaminant off a surface with pressure. In general, the equipment surface is not removed using non-abrasive methods.

### Low-Pressure Water

This method consists of a container which is filled with water. The user pumps air out of the container to create a vacuum. A slender nozzle and hose allow the user to spray in hard-to-reach places.

### High-Pressure Water

This method consists of a high-pressure pump, an operator controlled directional nozzle, and a high-pressure hose. Operating pressure usually ranges from 340 to 680 atmospheres (atm) and flow rates usually range from 20 to 140 liters per minute.

### Ultra-High-Pressure Water

This system produces a water jet that is pressured from 1,000 to 4,000 atmospheres. This ultra-high-pressure spray can remove tightly-adhered surface films. The water velocity ranges from 500 meters/second (m/s) (1,000 atm) to 900 m/s (4,000 atm). Additives can be used to enhance the cleaning action.

### Rinsing

Contaminants are removed by rinsing through dilution, physical attraction, and solubilization.

### Damp Cloth Removal

In some instances, due to sensitive, non-waterproof equipment or due to the unlikelihood of equipment being contaminated, it is not necessary to conduct an extensive decontamination procedure. For example, air sampling pumps hooked on a fence, placed on a drum, or wrapped in plastic bags are not likely to become heavily contaminated. A damp cloth should be used to wipe off contaminants which may have adhered to equipment through airborne contaminants or from surfaces upon which the equipment was set.

### Disinfection/Sterilization

Disinfectants are a practical means of inactivating infectious agents. Unfortunately, standard sterilization methods are impractical for large equipment. This method of decontamination is typically performed off-site.

## **7.2 Field Sampling Equipment Decontamination Procedures**

The decontamination line is setup so that the first station is used to clean the most contaminated item. It progresses to the last station where the least contaminated item is cleaned. The spread of contaminants is further reduced by separating each decontamination station by a minimum of three (3) feet. Ideally, the contamination should decrease as the equipment progresses from one station to another farther along in the line.

A site is typically divided up into the following boundaries: Hot Zone or Exclusion Zone (EZ), the Contamination Reduction Zone (CRZ), and the Support or Safe Zone (SZ). The decontamination line should be setup in the Contamination Reduction Corridor (CRC) which is in the CRZ. Figure 1 (Appendix B) shows a typical contaminant reduction zone layout. The CRC controls access into and out of the exclusion zone and confines decontamination activities to a limited area. The CRC boundaries should be conspicuously marked. The far end is the hotline, the boundary between the exclusion zone and the contamination reduction zone. The size of the decontamination corridor depends on the number of stations in the decontamination process, overall dimensions of the work zones, and amount of space available at the site. Whenever possible, it should be a straight line.

Anyone in the CRC should be wearing the level of protection designated for the decontamination crew. Another corridor may be required for the entry and exit of heavy equipment. Sampling and monitoring equipment and sampling supplies are all maintained outside of the CRC. Personnel don their equipment away from the CRC and enter the exclusion zone through a separate access control point at the hotline. One person (or more) dedicated to decontaminating equipment is recommended.

### **7.2.1 Decontamination Setup**

Starting with the most contaminated station, the decontamination setup should be as follows:

#### Station 1: Segregate Equipment Drop

Place plastic sheeting on the ground (Figure 2, Appendix B). Size will depend on amount of

equipment to be decontaminated. Provide containers lined with plastic if equipment is to be segregated. Segregation may be required if sensitive equipment or mildly contaminated equipment is used at the same time as equipment which is likely to be heavily contaminated.

#### Station 2: Physical Removal With A High-Pressure Washer (Optional)

As indicated in 7.1.2, a high-pressure wash may be required for compounds which are difficult to remove by washing with brushes. The elevated temperature of the water from the high-pressure washers is excellent at removing greasy/oily compounds. High pressure washers require water and electricity.

A decontamination pad may be required for the high-pressure wash area. An example of a wash pad may consist of an approximately 1 1/2 foot-deep basin lined with plastic sheeting and sloped to a sump at one corner. A layer of sand can be placed over the plastic and the basin is filled with gravel or shell. The sump is also lined with visqueen and a barrel is placed in the hole to prevent collapse. A sump pump is used to remove the water from the sump for transfer into a drum.

Typically heavy machinery is decontaminated at the end of the day unless site sampling requires that the machinery be decontaminated frequently. A separate decontamination pad may be required for heavy equipment.

#### Station 3: Physical Removal With Brushes And A Wash Basin

Prior to setting up Station 3, place plastic sheeting on the ground to cover areas under Station 3 through Station 10.

Fill a wash basin, a large bucket, or child's swimming pool with non-phosphate detergent and tap water. Several bottle and bristle brushes to physically remove contamination should be dedicated to this station. Approximately 10 - 50 gallons of water may be required initially depending upon the amount of equipment to decontaminate and the amount of gross contamination.

#### Station 4: Water Basin

Fill a wash basin, a large bucket, or child's swimming

pool with tap water. Several bottle and bristle brushes should be dedicated to this station. Approximately 10-50 gallons of water may be required initially depending upon the amount of equipment to decontaminate and the amount of gross contamination.

#### Station 5: Low-Pressure Sprayers

Fill a low-pressure sprayer with distilled/deionized water. Provide a 5-gallon bucket or basin to contain the water during the rinsing process. Approximately 10-20 gallons of water may be required initially depending upon the amount of equipment to decontaminate and the amount of gross contamination.

#### Station 6: Nitric Acid Sprayers

Fill a spray bottle with 10% nitric acid. An acid rinse may not be required if inorganics are not a contaminant of concern. The amount of acid will depend on the amount of equipment to be decontaminated. Provide a 5-gallon bucket or basin to collect acid during the rinsing process.

#### Station 7: Low-Pressure Sprayers

Fill a low-pressure sprayer with distilled/deionized water. Provide a 5-gallon bucket or basin to collect water during the rinsate process.

#### Station 8: Organic Solvent Sprayers

Fill a spray bottle with an organic solvent. After each solvent rinse, the equipment should be rinsed with distilled/deionized water and air dried. Amount of solvent will depend on the amount of equipment to decontaminate. Provide a 5-gallon bucket or basin to collect the solvent during the rinsing process.

Solvent rinses may not be required unless organics are a contaminant of concern, and may be eliminated from the station sequence.

#### Station 9: Low-Pressure Sprayers

Fill a low-pressure sprayer with distilled/deionized water. Provide a 5-gallon bucket or basin to collect water during the rinsate process.

#### Station 10: Clean Equipment Drop

Lay a clean piece of plastic sheeting over the bottom

plastic layer. This will allow easy removal of the plastic in the event that it becomes dirty. Provide aluminum foil, plastic, or other protective material to wrap clean equipment.

## 7.2.2 Decontamination Procedures

### Station 1: Segregate Equipment Drop

Deposit equipment used on-site (i.e., tools, sampling devices and containers, monitoring instruments radios, clipboards, etc.) on the plastic drop cloth/sheet or in different containers with plastic liners. Each will be contaminated to a different degree. Segregation at the drop reduces the probability of cross contamination. Loose leaf sampling data sheets or maps can be placed in plastic zip lock bags if contamination is evident.

### Station 2: Physical Removal With A High-Pressure Washer (Optional)

Use high pressure wash on grossly contaminated equipment. Do not use high- pressure wash on sensitive or non-waterproof equipment.

### Station 3: Physical Removal With Brushes And A Wash Basin

Scrub equipment with soap and water using bottle and bristle brushes. Only sensitive equipment (i.e., radios, air monitoring and sampling equipment) which is waterproof should be washed. Equipment which is not waterproof should have plastic bags removed and wiped down with a damp cloth. Acids and organic rinses may also ruin sensitive equipment. Consult the manufacturers for recommended decontamination solutions.

### Station 4: Equipment Rinse

Wash soap off of equipment with water by immersing the equipment in the water while brushing. Repeat as many times as necessary.

### Station 5: Low-Pressure Rinse

Rinse sampling equipment with distilled/deionized water with a low-pressure sprayer.

### Station 6: Nitric Acid Sprayers ( required only if metals are a contaminant of concern)

Using a spray bottle rinse sampling equipment with nitric acid. Begin spraying (inside and outside) at one end of the equipment allowing the acid to drip to the other end into a 5-gallon bucket. A rinsate blank may be required at this station. Refer to Section 9.

### Station 7: Low-Pressure Sprayers

Rinse sampling equipment with distilled/deionized water with a low-pressure sprayer.

### Station 8: Organic Solvent Sprayers

Rinse sampling equipment with a solvent. Begin spraying (inside and outside) at one end of the equipment allowing the solvent to drip to the other end into a 5-gallon bucket. Allow the solvent to evaporate from the equipment before going to the next station. A QC rinsate sample may be required at this station.

### Station 9: Low-Pressure Sprayers

Rinse sampling equipment with distilled/deionized water with a low-pressure washer.

### Station 10: Clean Equipment Drop

Lay clean equipment on plastic sheeting. Once air dried, wrap sampling equipment with aluminum foil, plastic, or other protective material.

## 7.2.3 Post Decontamination Procedures

1. Collect high-pressure pad and heavy equipment decontamination area liquid and waste and store in appropriate drum or container. A sump pump can aid in the collection process. Refer to the Department of Transportation (DOT) requirements for appropriate containers based on the contaminant of concern.
2. Collect high-pressure pad and heavy equipment decontamination area solid waste and store in appropriate drum or container. Refer to the DOT requirements for appropriate containers based on the contaminant of concern.
3. Empty soap and water liquid wastes from basins and buckets and store in appropriate

drum or container. Refer to the DOT requirements for appropriate containers based on the contaminant of concern.

4. Empty acid rinse waste and place in appropriate container or neutralize with a base and place in appropriate drum. pH paper or an equivalent pH test is required for neutralization. Consult DOT requirements for appropriate drum for acid rinse waste.
5. Empty solvent rinse sprayer and solvent waste into an appropriate container. Consult DOT requirements for appropriate drum for solvent rinse waste.
6. Using low-pressure sprayers, rinse basins, and brushes. Place liquid generated from this process into the wash water rinse container.
7. Empty low-pressure sprayer water onto the ground.
8. Place all solid waste materials generated from the decontamination area (i.e., gloves and plastic sheeting, etc.) in an approved DOT drum. Refer to the DOT requirements for appropriate containers based on the contaminant of concern.
9. Write appropriate labels for waste and make arrangements for disposal. Consult DOT regulations for the appropriate label for each drum generated from the decontamination process.

## **8.0 CALCULATIONS**

This section is not applicable to this SOP.

## **9.0 QUALITY ASSURANCE/ QUALITY CONTROL**

A rinsate blank is one specific type of quality control sample associated with the field decontamination process. This sample will provide information on the effectiveness of the decontamination process employed in the field.

Rinsate blanks are samples obtained by running analyte free water over decontaminated sampling

equipment to test for residual contamination. The blank water is collected in sample containers for handling, shipment, and analysis. These samples are treated identical to samples collected that day. A rinsate blank is used to assess cross contamination brought about by improper decontamination procedures. Where dedicated sampling equipment is not utilized, collect one rinsate blank per day per type of sampling device samples to meet QA2 and QA3 objectives.

If sampling equipment requires the use of plastic tubing it should be disposed of as contaminated and replaced with clean tubing before additional sampling occurs.

## **10.0 DATA VALIDATION**

Results of quality control samples will be evaluated for contamination. This information will be utilized to qualify the environmental sample results in accordance with the project's data quality objectives.

## **11.0 HEALTH AND SAFETY**

When working with potentially hazardous materials, follow OSHA, U.S. EPA, corporate, and other applicable health and safety procedures.

Decontamination can pose hazards under certain circumstances. Hazardous substances may be incompatible with decontamination materials. For example, the decontamination solution may react with contaminants to produce heat, explosion, or toxic products. Also, vapors from decontamination solutions may pose a direct health hazard to workers by inhalation, contact, fire, or explosion.

The decontamination solutions must be determined to be acceptable before use. Decontamination materials may degrade protective clothing or equipment; some solvents can permeate protective clothing. If decontamination materials do pose a health hazard, measures should be taken to protect personnel or substitutions should be made to eliminate the hazard. The choice of respiratory protection based on contaminants of concern from the site may not be appropriate for solvents used in the decontamination process.

Safety considerations should be addressed when using abrasive and non-abrasive decontamination

equipment. Maximum air pressure produced by abrasive equipment could cause physical injury. Displaced material requires control mechanisms.

Material generated from decontamination activities requires proper handling, storage, and disposal. Personal Protective Equipment may be required for these activities.

Material safety data sheets are required for all decontamination solvents or solutions as required by the Hazard Communication Standard (i.e., acetone, alcohol, and trisodiumphosphate).

In some jurisdictions, phosphate containing detergents (i.e., TSP) are banned.

## 12.0 REFERENCES

Field Sampling Procedures Manual, New Jersey Department of Environmental Protection, February, 1988.

A Compendium of Superfund Field Operations Methods, EPA 540/p-87/001.

Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual, USEPA Region IV, April 1, 1986.

Guidelines for the Selection of Chemical Protective Clothing, Volume 1, Third Edition, American Conference of Governmental Industrial Hygienists, Inc., February, 1987.

Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, NIOSH/OSHA/USCG/EPA, October, 1985.

## APPENDIX A

Table

Table 1. Soluble Contaminants and Recommended Solvent Rinse

TABLE 1 Soluble Contaminants and Recommended Solvent Rinse		
SOLVENT <sup>(1)</sup>	EXAMPLES OF SOLVENTS	SOLUBLE CONTAMINANTS
Water	Deionized water Tap water	Low-chain hydrocarbons Inorganic compounds Salts Some organic acids and other polar compounds
Dilute Acids	Nitric acid Acetic acid Boric acid	Basic (caustic) compounds (e.g., amines and hydrazines)
Dilute Bases	Sodium bicarbonate (e.g., soap detergent)	Acidic compounds Phenol Thiols Some nitro and sulfonic compounds
Organic Solvents <sup>(2)</sup>	Alcohols Ethers Ketones Aromatics Straight chain alkalines (e.g., hexane) Common petroleum products (e.g., fuel, oil, kerosene)	Nonpolar compounds (e.g., some organic compounds)
Organic Solvent <sup>(2)</sup>	Hexane	PCBs

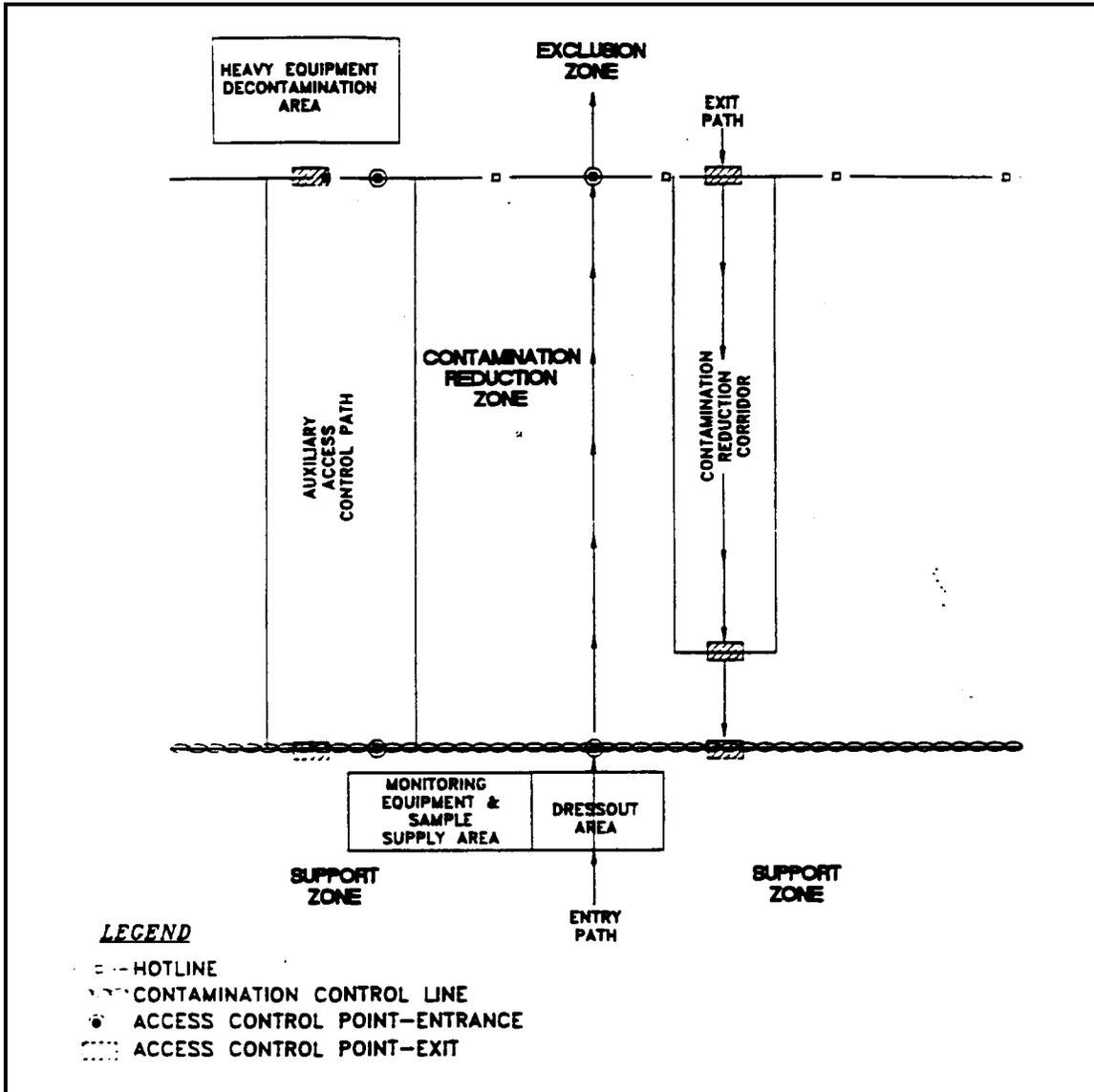
<sup>(1)</sup> - Material safety data sheets are required for all decontamination solvents or solutions as required by the Hazard Communication Standard

<sup>(2)</sup> - WARNING: Some organic solvents can permeate and/or degrade the protective clothing

# APPENDIX B

## Figures

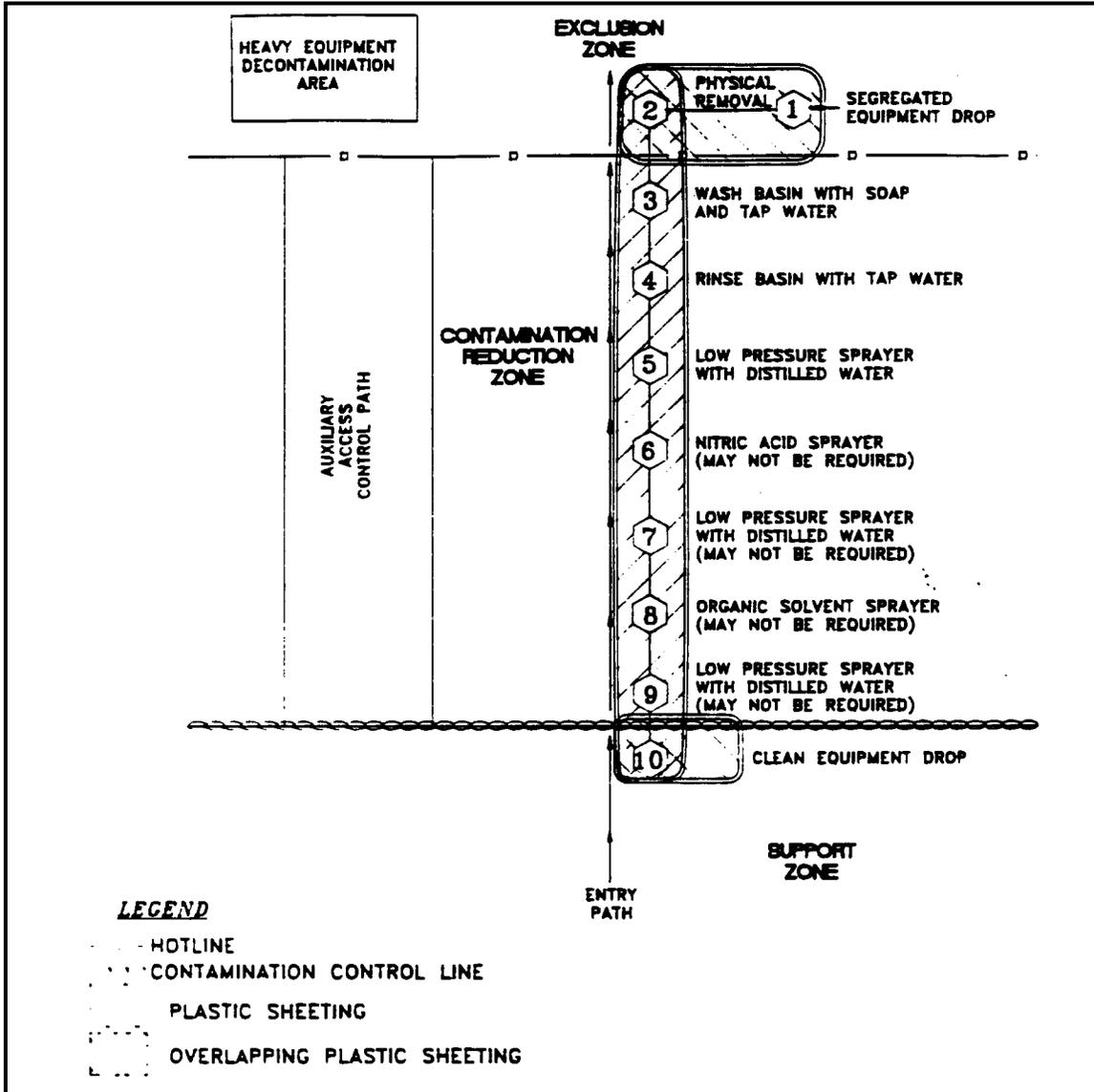
Figure 1. Contamination Reduction Zone Layout



# APPENDIX B (Cont'd.)

## Figures

Figure 2. Decontamination Layout



# **APPENDIX C**

## **QUALITY ASSURANCE PROJECT PLAN**

**TABLE OF CONTENTS**

<b>1.0 INTRODUCTION</b> .....	<b>1</b>
1.1 QUALITY ASSURANCE PROJECT PLAN (QAPP) PREPARATION .....	1
1.2 PROJECT ORGANIZATION .....	2
1.3 PROBLEM DEFINITION AND BACKGROUND .....	3
1.3.1 Problem Definition.....	3
1.3.2 Intended Usage of Data .....	3
1.4 DATA QUALITY OBJECTIVES (DQOS).....	3
1.5 DATA QUALITY INDICATORS FOR MEASUREMENT OF DATA.....	5
1.5.1 Precision .....	5
1.5.2 Accuracy .....	6
1.5.3 Completeness .....	6
1.5.4 Representativeness .....	7
1.5.5 Comparability.....	7
<b>2.0 DOCUMENTATION AND RECORDS</b> .....	<b>8</b>
2.1 QAPP DISTRIBUTION.....	8
2.2 ANALYTICAL LABORATORY DATA REPORT FORMAT AND CONTENT .....	8
2.3 FIELD OPERATION RECORDS .....	9
2.4 RECORDS DISPOSITION .....	9
<b>3.0 SAMPLING PROCESS DESIGN AND METHOD REQUIREMENTS</b> .....	<b>10</b>
3.1 SAMPLE COLLECTION.....	10
3.2 SAMPLE CHAIN-OF-CUSTODY PROCEDURES.....	11
3.2.1 Field Custody Procedures.....	11
3.2.2 Laboratory Custody Procedures.....	12
<b>4.0 QUALITY ASSESSMENT/QUALITY CONTROL MEASUREMENT</b> .....	<b>13</b>
4.1 FIELD QUALITY CONTROL CHECKS .....	13
4.1.1 Equipment Blanks .....	13
4.1.2 Field Blanks .....	13
4.1.3 Trip Blanks.....	14
4.1.4 Field Duplicate Samples .....	14
4.2 LABORATORY QUALITY CONTROL CHECKS.....	14
4.2.1 Method Blank .....	14
4.2.2 Instrument Blank .....	15
4.2.3 Surrogate Spikes.....	15
4.2.4 Internal Standards .....	15
4.2.5 Matrix Spikes (MSs) and Matrix Spike Duplicates (MSDs) .....	15
4.2.6 Matrix Duplicates .....	15
4.2.7 Laboratory Control Samples /Laboratory Control Sample Duplicates .....	15
4.2.8 Continuing Calibration Verification (CCV).....	16
4.2.9 Performance Evaluation Samples.....	16
4.3 DATA ANALYSIS.....	16
<b>5.0 PREVENTATIVE MAINTENANCE</b> .....	<b>17</b>
5.1 FIELD INSTRUMENT TESTING, INSPECTION, AND MAINTENANCE.....	17

5.2	LABORATORY INSTRUMENT PREVENTATIVE MAINTENANCE .....	17
<b>6.0</b>	<b>CALIBRATION PROCEDURES AND FREQUENCY .....</b>	<b>17</b>
6.1	FIELD INSTRUMENT CALIBRATION .....	17
6.2	LABORATORY INSTRUMENT CALIBRATION .....	17
6.3	STANDARD REAGENT PREPARATION .....	18
<b>7.0</b>	<b>ASSESSMENT AND OVERSIGHT .....</b>	<b>19</b>
7.1	PROCEDURES .....	19
7.2	REPORTS TO MANAGEMENT .....	19
<b>8.0</b>	<b>DATA MANAGEMENT .....</b>	<b>20</b>
8.1	FIELD DATA .....	20
8.2	LABORATORY DATA .....	20
<b>9.0</b>	<b>DATA REVIEW, VERIFICATION, AND REPORTING.....</b>	<b>21</b>
9.1	PROCEDURES TO CHECK DATA INTEGRITY .....	21
9.2	DATA REVIEW .....	21
9.3	DATA REVIEW VERIFICATION METHODS .....	22
9.3.1	Completeness Check .....	22
9.3.2	Data Verification Criteria .....	22
9.3.3	Data Qualifier Flags .....	23
9.3.4	Data Verification Reports .....	23
9.4	DATA QUALITY ASSESSMENT .....	24
9.5	DATA REPORTING .....	24
<b>10.0</b>	<b>CORRECTIVE ACTIONS .....</b>	<b>24</b>
10.1	FIELD CORRECTIVE ACTION .....	25
10.2	LABORATORY CORRECTIVE ACTION .....	25
10.3	CORRECTIVE ACTION DURING DATA REVIEW AND VERIFICATION .....	26
<b>11.0</b>	<b>PERFORMANCE AND SYSTEM AUDITS.....</b>	<b>26</b>
11.1	FIELD PERFORMANCE AND SYSTEMS AUDITS .....	26
11.2	LABORATORY PERFORMANCE AND SYSTEMS ASSESSMENTS .....	27
<b>12.0</b>	<b>TRAINING AND CERTIFICATION .....</b>	<b>27</b>

## **I.0 INTRODUCTION**

### **I.1 QUALITY ASSURANCE PROJECT PLAN (QAPP) PREPARATION**

Arizona Department of Environmental Quality (ADEQ) policy mandates that all environmental data collection activities and analytical results submitted to ADEQ for compliance or enforcement activities must be addressed in a Quality Assurance Project Plan (QAPP). This QAPP presents the functions, procedures, and specific quality assurance (QA) and quality control (QC) activities designed to achieve the data quality objectives (DQOs) to assess imported material and support a request for a determination that No Further Action (NFA) for the Former Mystic Mine Area Site located northeast of Lone Mountain Parkway and North Vistancia Boulevard in Peoria, Arizona (herein referred to as the Site).

The Site and history are more fully discussed in the Work Plan. Lake Pleasant (Phoenix) ASLI VIII LLC (Avanti) is the current Site owner, and they plan to develop residential subdivisions in the Site vicinity. The current mine waste rock pile will be consolidated into a consolidation stockpile to be covered with soil and remain in place. The waste rock and underlying soil in the areas to be reclaimed for development (Areas A, B, and D) will be excavated to bedrock and be added to the consolidated stockpile. The consolidated mine waste area (Area C) will be capped using natural soils south of the mine site (e.g. soil from earthwork operations near the Central Arizona Project Canal south of the Site). The area cleared of the current waste rock and soil overlying the bedrock in the areas reclaimed for development will be available for residential development, and the composite stockpile will remain an undeveloped track area. In addition, imported soil will cover the concrete cap in Area D as discussed in the Work Plan. The imported material to be used as the Cap of the consolidated stockpile will be assessed prior to placement as Cap/cover material. Avanti submitted this project to the Arizona Department of Environmental Quality (ADEQ) Voluntary Remediation Program (VRP). Avanti retained GeoTek Residential, LLC (GTR) to oversee this project. This QAPP has been developed to support the sampling activities outlined in the Work Plan and detailed in the Sampling and Analysis Plan (SAP) in Appendix B of the Work Plan. The primary goal of the sampling described in the SAP and this QAPP is to assess the imported soil to for metals to ensure the material is acceptable for use as Cap and cover material.

Guidelines followed in the preparation of this QAPP are described in the following documents:

- ADEQ Abbreviated Quality Assurance Project Plan; February 2014.
- Environmental Protection Agency (EPA) Requirements for Quality Assurance Project Plans, EPA QA/R-5 (EPA/240/B-01/003); Environmental Protection Agency; March 2001.
- EPA Guidance for Quality Assurance Project Plans, EPA QA/G-5 (EPA/240/R-02/009); Environmental Protection Agency; December 2002.
- Guidance on Systematic Planning Using the Data Quality Objective Process, EPA QA/G-4 (EPA/240/B-06/001); Environmental Protection Agency; February 2006.

**I.2 PROJECT ORGANIZATION**

PROJECT ORGANIZATION		
TITLE/RESPONSIBILITY	NAME	CONTACT INFORMATION
ADEQ Project Manager	Caitlin Burwell	(602) 771-4122 <a href="mailto:Burwell.Caitlin@azdeq.gov">Burwell.Caitlin@azdeq.gov</a> Arizona Department of Environmental Quality Remedial Projects Section, Voluntary Remediation Program 1110 West Washington Street, 6 <sup>th</sup> Floor Phoenix, Arizona 85007
Volunteer/Owner Representative	David Rogers	(480) 285-3060 <a href="mailto:drogers@voyagerproperties.com">drogers@voyagerproperties.com</a> Lake Pleasant (Phoenix) ASLI VIII LLC (Avanti) 4248 North Craftsman Court, Suite 100 Scottsdale, Arizona 85251
GeoTek Residential, LLC Environmental Consultant Project Manager/Quality Assurance Manager	Chet Pearson	(480) 848-6279 <a href="mailto:cpearson@geotekusa.com">cpearson@geotekusa.com</a> 4050 East Cotton Center Blvd., Suite 49 Phoenix, AZ 85040
Analytical Laboratory Subcontractor Staff	To Be Determined	To Be Determined

Mr. Chet Pearson, P.E. of GTR will serve as the Technical Director and Quality Assurance Manager. Mr. Pearson will oversee project activities and communicate regularly with Avanti regarding project activities and schedule. He will serve as the primary liaison between the Avanti and ADEQ and conduct final reviews of written correspondence. He will also review the laboratory data and project deliverables. He will document that required QA/QC activities have been completed and meet the project quality objectives.

Voluntary remediation projects are typically overseen by the ADEQ VRP staff. For this project, the ADEQ Project Manager will be Ms. Caitlin Burwell. Ms. Burwell will provide review and approval of project documents, reports, plans, schedules, and other communications submitted for the project. She will provide coordination of ADEQ’s activities related to project and consultant overview, and document reviews.

Laboratory analyses will be performed by one or more Arizona Department of Health Services (ADHS)-certified laboratory. Specific laboratories have not been identified as of the date of this QAPP. The assigned laboratory Project Manager will coordinate the analytical process, review analytical reports, and supervise chain-of-custody procedures.

The QAPP will be distributed to those individuals who will participate in the project, including those with ADEQ, Avanti, GTR, the selected analytical laboratory, and any other significant subcontractors involved in the project. Addenda and/or revisions to the QAPP can be initiated by ADEQ, Avanti, GTR, or the analytical laboratory. In general, an addendum will be written

when unforeseen or significant changes have occurred. A revision will not be required for minor changes in scope.

### **I.3 PROBLEM DEFINITION AND BACKGROUND**

#### **I.3.1 Problem Definition**

The Work Plan summarizes previous assessments of the Site. The mine waste rock materials were assessed for a variety of contaminants including heavy metals, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), polynuclear aromatic hydrocarbons (PAHs), total cyanide, and free cyanide. Metals were the only identified constituents of concern (COCs) at concentrations above remedial standards. The current mine waste rock piles and soil overlying the bedrock in the areas to be reclaimed for development (Areas A, B, and D) will be consolidated into a composite stockpile to be covered with soil Cap and remain in place. The area cleared of the current waste rock will be available for future residential development, and the consolidation stockpile will remain an undeveloped track area with a deed restriction. In addition, imported soil will cover the concrete cap in Area D as discussed in the Work Plan. There has been limited assessment of the surface soils south of the Site as part of the background soil sampling and testing to date (see Allwyn Phase II ESA data). However, prior to placement of the Cap material, the imported soil to be used for the Cap material will be sampled and analyzed for Resource Conservation and Recovery Act (RCRA) metals. If the analytical results are less than the applicable remediation level, the soil will be used as the Cap material covering the consolidation pile and covering the concrete cap over the exploratory shaft in Area D.

#### **I.3.2 Intended Usage of Data**

The foreseeable usage of the Site vicinity will be residential, with some limited commercial usages. Therefore, the appropriate remedial goals are the ADEQ pre-determined  $10^{-5}$  residential soil remediation levels (SRLs) and the minimum groundwater protection levels (GPLs) or Alternative GPLs. For lead, GTR calculated a Site-specific Alternative GPL of 1,448.3 milligrams per kilogram (mg/kg). Therefore, the requested remediation goal for lead is the ADEQ pre-determined  $10^{-5}$  residential soil remediation levels SRL of 400 mg/kg. The COCs include RCRA Metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver). The sampling effort will support the DQOs defined in Section I.4.

### **I.4 DATA QUALITY OBJECTIVES (DQOs)**

DQOs have been developed as part of the SAP and this QAPP to outline the overall purpose and approach that the analytical data are intended to support. DQOs have been prepared according to EPA “seven-step” process and are detailed below. To achieve these objectives, a data quality management program will be an integral part of the assessment and remediation activities.

**Step 1: Problem Statement**

- Composite soil samples will be collected to assess the imported soil to be used as a Cap/cover material. The results of the imported soil sampling will be compared to the  $10^{-5}$  residential SRLs, minimum GPLs or Alternative GPLs, whichever is lowest. If the analytical results are less than the applicable remediation level, the soil will be used as the Cap material covering the consolidation pile and covering the concrete cap over the exploratory shaft in Area D.

**Step 2: Identify the Decision**

- Define appropriate subsurface investigation procedures and soil sample collection methods to assess from the imported soil to be used to cover the consolidated material stockpile and above the concrete Cap in Area D.
- Evaluate whether from the imported soil used as Cap/cover material meet  $10^{-5}$  residential SRLs, minimum GPLs or Alternative GPLs, whichever is lowest for the COCs.

**Step 3: Identify Inputs to the Decision**

- Analytical results for RCRA Metals associated with imported fill material used to cover the consolidated pile and cover over the concrete cap in Area 5.

**Step 4: Define the Boundaries of the Study**

- Results from previous assessment activities will be used in conjunction with samples collected to assess from the imported soil to be used to cover the consolidated material stockpile and above the concrete Cap in Area D as described in the Work Plan, SAP, and this QAPP.
- Soil samples will be analyzed by an ADHS-certified laboratory using the analytical methods described in Section 5.0 of the SAP.

**Step 5: Develop a Decision Rule**

As discussed in Section 4.0 of the Work Plan, prior to placement of the Cap material, the imported soil to be used for the Cap material will be sampled and analyzed for RCRA metals. An estimated 9,800 cubic yards of material will be used to cover the consolidation pile. It is anticipated that the Cap materials will consist of soil from earthwork operations near the Central Arizona Project Canal south of the Site. The requested remediation levels are listed in Section 4.0 of the Work Plan. The results of the imported soil sampling will be compared to the  $10^{-5}$  residential SRLs, minimum GPLs or Alternative GPLs, whichever is lowest. If the analytical results are less than the applicable remediation level, the soil will be used as the Cap material covering the consolidation pile and covering the concrete cap over the exploratory shaft in Area D.

**Step 6: Specify Tolerable Limits on Decision Errors**

- If the imported soil is not adequately assessed, contaminants may pose a potential exposure issues and water infiltration into the materials below the Cap.
- A false negative is defined as considering soil remaining in the areas reclaimed for development to meet approved remediation levels, when one or more analytes are actually present above their applicable approved remediation levels. The false negative could lead to risk to human health and the environment.
- A false positive is defined as considering the soil to contain one or more analytes above their approved remediation levels, when the converse is true. This may result in additional expense for remedial activities and imported fill.

**Step 7: Optimize the Data**

The actions described in the Work Plan, SAP, and this QAPP will be taken to assess whether the imported soil is suitable as Cap and cover materials.

**I.5 DATA QUALITY INDICATORS FOR MEASUREMENT OF DATA**

This section identifies the data quality indicators for the DQOs; defines the elements of the QC program for field operations and laboratory analyses; and defines the requirements for precision, accuracy, completeness, representativeness, comparability, and sensitivity. Acceptable results are those values that fall within the acceptable range specified. Corrective actions for unacceptable results for specific testing methods are detailed in the SAP and this QAPP.

**I.5.1 Precision**

Precision measures the reproducibility of repetitive measurements. It is strictly defined as the degree of mutual agreement among independent measurements as the result of repeated application of the sample process under similar conditions. Precision is evaluated by measuring the agreement among individual measurements of the same site under similar conditions. Duplicate results are assessed using the relative percent difference (RPD) between duplicate measurements. The RPD will be calculated as follows:

$$\% RPD = \left( \frac{|X1 - X2|}{\bar{X}} \right) \times 100\%$$

where  $X1$  is the value of Sample 1,  $X2$  is the value of Sample 2, and  $\bar{X}$  is the mean value of  $X1$  and  $X2$ .

Field precision is measured through the collection and analysis of field duplicate samples. Field duplicates will be collected at a frequency of 10 percent of field samples. Water and soil gas matrix samples can be readily duplicated due to their homogeneous nature; however, the

duplication of solid (e.g., soil, fill, sediment) samples is much more difficult due to their non-homogeneous nature. Consequently, target soil (or other solids) RPDs will be within 50 percent, respectively, of the original result. Duplicate recoveries beyond these ranges may require further qualification of associated data, but data will not be rejected unless determined unusable by data verification.

### **1.5.2 Accuracy**

Accuracy is a statistical measurement of correctness and includes components of random error (variability due to imprecision) and systematic error. It reflects the total error associated with a measurement. Simply put, accuracy is the measure of closeness of data to their true values. A measurement is accurate when the value reported does not differ beyond acceptable limits from the true value or known concentration of the spike or standard. Laboratory accuracy is expressed as the percent recovery (%R), which is calculated as follows:

$$\% R = \left( \frac{X_s - X_u}{T} \right) \times 100\%$$

where  $X_s$  is the measured value of the spiked sample,  $X_u$  is the measured value of the unspiked sample, and  $T$  is the true value of the spike solution added.

Sampling field accuracy is generally assessed through the analysis of equipment blanks, field blanks, and trip blanks. Equipment blanks will be collected at a frequency of one equipment blank sample per every 20 samples of the primary samples collected or once per sampling day, whichever is more frequent, if non-disposable sampling equipment is used. Field blanks are sample containers filled in the field. They help assess contamination from ambient conditions, sample containers, transit, and the laboratory. Trip blanks are prepared by the laboratory and shipped to and from the field. They help assess contamination from shipping and the laboratory and are for VOCs only. Unless high levels of VOCs are anticipated, trip blanks are not expected to provide useful information. Because VOCs are not considered COCs for this project, trip and field blanks will not be collected during this project.

Accuracy of laboratory analyses will be assessed by laboratory control sample (LCS), surrogate standards (where applicable), matrix spike (MS), and initial and continuing calibration of instruments. Where applicable, evaluation of the %R for the MS/matrix spike duplicate (MSD), LCS/Laboratory Control Sample Duplicate (LCSD), and surrogate will be based on the historical statistical lab data or guidelines within the methods for organic and inorganic analyses.

### **1.5.3 Completeness**

Completeness is the amount of valid data obtained compared to the amount that could be expected under ideal conditions. The number of valid results divided by the number of possible results, expressed as a percentage, determines the completeness of the data set. The formula for calculation of completeness is, as follows:

$$\% \text{ Completeness} = \left( \frac{\text{Number of Valid Results}}{\text{Number of Possible Results}} \right)$$

Acquiring 100 percent of the data planned is difficult due to unexpected circumstances, adverse weather conditions, equipment problems, laboratory error, and loss of samples or samples that are invalid because they do not meet all of the laboratory sample acceptance criteria. Field completeness will be 90 percent or better for field samples. The laboratory completeness objective is for 100 percent of the field samples to be analyzed, with greater than 90 percent meeting QA/QC objectives.

#### **1.5.4 Representativeness**

Representativeness is the degree to which data accurately and precisely represent selected characteristics of the media sampled. The following factors determine the representativeness of the data: sampling location, sampling frequency, sample type, sample collection methods, sample preservation, sample holding times, and analytical methods used. Representativeness of data collection is addressed by careful preparation of sampling and analysis programs.

This QAPP, together with the Site-specific SAP, address representativeness of field data by specifying sufficient and proper numbers and locations of samples incorporating appropriate sampling methodologies specifying proper sample collection techniques and decontamination procedures and establishing proper field QA/QC procedures. Proper field techniques and procedures will be adhered to. Any deviation from the SAP will be documented in the field notes.

Representativeness in the laboratory is ensured by using proper analytical procedures and appropriate methods, meeting analytical holding times, and meeting QC criteria for each method. It is the laboratory project and QA manager's responsibility to ensure the proper methods and criteria are employed by the laboratory. Any deviation from the QAPP or laboratory standard operating procedures (SOPs) will be documented in the laboratory case narrative.

#### **1.5.5 Comparability**

Comparability is an expression of confidence with which one data set can be compared to another. The objective of comparability is to ensure data developed during the investigation are comparable to site knowledge and adequately address applicable criteria or standards established by the appropriate regulatory agency.

The comparability goal is achieved through the use of standard field techniques. These include, but are not limited to, the project prescribed techniques for sample collection and field parameter measurements. A detailed description of field techniques is described in the SAP. Proper field techniques and procedures will be adhered to, and deviations from the SAP will be documented in the field notes.

The comparability of laboratory data will be ensured by the laboratory personnel having reviewed the QAPP and having a working knowledge of the analytical SOPs. The laboratory QA manager (or designee) will also ensure comparable data by reviewing data generated and verifying the correct methods have been used. The data reviewer will also review the data to ensure compliance with the various method requirements.

## **2.0 DOCUMENTATION AND RECORDS**

This section identifies the process and responsibilities for ensuring the appropriate project personnel have the most current approved version of the QAPP and other project documents noted, including revisions and addenda.

### **2.1 QAPP DISTRIBUTION**

GTR is responsible for ensuring each project member has access to the most current version of this QAPP, including subsequent addenda or revisions. The project members include, but may not be limited to: ADEQ, Avanti, GTR, and the analytical laboratory QA manager.

### **2.2 ANALYTICAL LABORATORY DATA REPORT FORMAT AND CONTENT**

Analytical data will contain the necessary sample results and QC data to evaluate the DQOs defined for the project. Data generated by the analytical laboratory will be retained in electronic format at the laboratory. Data generated by the analytical laboratory will be submitted to GTR in electronic format. Analytical results will include appropriate elements identified in the EPA Region 9 January 1990 document entitled Laboratory Documentation Requirements for Data Validation (QA-07-097) and will include, at a minimum, the following:

- Analytical laboratory name and ADHS license number
- Case narrative
  - Cross-reference of sample identification number and analytical laboratory number
  - Chain of custody
  - Dates of sample collection and analysis
  - Analytical results and method references
  - Analytical laboratory reporting limits
  - Surrogate recoveries (as applicable), method blanks, laboratory duplicates
  - Calibration summary
  - MS/MSD, LCS, and blank spike references
  - Data outlier summary
  - Analytical laboratory approval

The analytical laboratory will typically provide the analytical reports within 15 working days of sample receipt. Omissions or insufficient levels of detail will be corrected by the analytical laboratory.

### **2.3 FIELD OPERATION RECORDS**

Field notes will be kept in bound field logbooks. Logbooks will be used to record pertinent field activity information. GTR will have a dedicated field logbook that will not be used for other projects. Documentation in the field logbook will be sufficient to reconstruct the sampling situation without relying on the memories of the field team members. Information recorded at the beginning of the day will include, but not be limited to the following:

- Project name
- Date and time
- Name and signature of field personnel entering information on each respective page
- Weather conditions
- Names of personnel on the site, including subcontractors and site visitors
- Health and safety information, including personal protective equipment (PPE) level
- Field calibration information
- Deviations from SAP, QAPP, or Health and Safety Plan (HASP)

Information recorded during sampling will include, as applicable, but not be limited to the following:

- Sample identification/location
- Sample depth
- Sample media
- Description of sample
- Chemical analysis requested, sample container, and preservative
- Any modifications to the sampling plan
- Sampling observations (if applicable)
- Field equipment readings (if applicable)
- QC samples collected (if applicable)
- Field sketches or maps, when appropriate
- Photographic log

Entries in the logbook will be made in blue or black indelible ink and no erasures will be allowed. If an incorrect entry is made, the information will be crossed out with a single strike mark and the change initialed and dated by the team member making the logbook change. Each page in the field logbook will be signed and dated at the bottom of the page by any team member making entries on the page. The field logbooks will be identified on the cover by the project name, project number, and logbook number. The logbooks will be stored in the field project files when not in use. At completion of the field activities, the original field logbooks will be retained in the project file. Office data management will involve establishing and maintaining a project file.

### **2.4 RECORDS DISPOSITION**

All project files and records will be stored at the GTR office until the NFA determination has

been issued by ADEQ. GTR will maintain records for at least one year. The project files will be maintained by Avanti.

The analytical laboratory will store the electronic raw data of the analytical data packages produced for this project for five years. The level of information regarding sample analyses (calibration records, run logs, etc.) will be such that the analytical processes can be reconstructed within that time.

### **3.0 SAMPLING PROCESS DESIGN AND METHOD REQUIREMENTS**

#### **3.1 SAMPLE COLLECTION**

Soil samples will be collected in general accordance with the procedures described in the Work Plan, SAP, and this QAPP to meet the project DQOs. The sample locations will be determined in the field. It is anticipated soil samples will be analyzed for total RCRA Metals. The analytical methods, sample container, preservative, and holding times for these analytical parameters are presented in the table below. The analytical laboratory will provide new, pre-preserved sample bottles as needed for sample collection. In addition, the analytical laboratory will maintain the "certificate of cleanliness" for the containers should questions arise in the future with regards the samples.

Samples that require preservation will be preserved according to established EPA requirements for each EPA method used for analysis. Suitable measures will be taken to ensure storage requirements (i.e., temperature) are maintained in the field, during transport to the laboratory, and during storage at the laboratory. Sample temperature will be recorded by the laboratory upon receipt.

<b>SAMPLE ANALYTICAL METHODS, CONTAINERS, PRESERVATIVES, AND HOLDING TIMES</b>				
<b>SOLID MEDIA</b>				
<b>CONTAMINANT</b>	<b>ANALYTICAL METHOD</b>	<b>CONTAINER</b>	<b>PRESERVATIVE</b>	<b>HOLDING TIME</b>
RCRA Metals (not including Mercury)	6010	4-ounce clear glass jar	Cool to 4° C	6 months
Mercury	7471	4-ounce clear glass jar	Cool to 4° C	28 days

<b>SAMPLE ANALYTICAL METHODS, CONTAINERS, PRESERVATIVES, AND HOLDING TIMES</b>				
<b>WATER MEDIA (EQUIPMENT BLANKS)</b>				
<b>CONTAMINANT</b>	<b>ANALYTICAL METHOD</b>	<b>CONTAINER</b>	<b>PRESERVATIVE</b>	<b>HOLDING TIME</b>
RCRA Metals	6010	500 mL plastic	Nitric Acid (HNO <sub>3</sub> ) to pH<2	6 months
Mercury	7470	500 mL plastic	Nitric Acid HNO <sub>3</sub> to pH<2	28 days

### **3.2 SAMPLE CHAIN-OF-CUSTODY PROCEDURES**

This section describes the procedures for field and laboratory sample custody, requirements, and provisions for sample handling and transport, and sample disposal criteria.

#### **3.2.1 Field Custody Procedures**

Custody of samples will be maintained and documented from the time of sample collection to completion of the analyses. A sample is considered to be under a person's custody if one or more of the following conditions are met, if the sample is:

- In the person's physical possession
- In view of the person after that person has taken possession
- Secured by that person so that no one can tamper with the sample
- Secured by that person in an area that is restricted to authorized personnel

Upon collection, samples will be considered to be in the sampler's custody. The sampler will be responsible for the care and custody of the samples until they are relinquished for delivery to the laboratory or accepted by the laboratory.

The analytical laboratory will provide chain-of-custody forms, cooler custody seals, and sample labels, which will be completed by the field technician.

Samples will be accompanied to the laboratory by chain-of-custody form, which will contain the following information:

- Project name
- Date and time of sample collection
- Sample matrix description
- Analyses requested for each sample
- Preservation method, if applicable
- Number and type of containers used
- Any special handling or analysis requirements
- Signature of person collecting the samples
- Signature(s) of persons involved in the sample custody
- Sample numbers

The chain-of-custody form will be filled out in indelible ink. When the samples are transferred from one party to another, the individuals will sign, date, and note the time on the form. The original form will accompany the sample delivery to the laboratory in the shipping cooler. The sampling personnel will retain a copy of the form.

The following procedures will be used (as applicable) when packing and transporting samples to the laboratory:

- Use of waterproof ice chests and coolers
- Use of frozen water (e.g., cubes, shaved) to maintain proper refrigeration of the samples (4° C)
- Cushioning material placed within the cooler
- Paperwork placed inside a waterproof bag inside the cooler
- Cooler lid taped closed with packaging tape

Samples will be transported after sample collection to the laboratory for analysis. The analytical laboratory will be notified in advance of sample delivery. Sample coolers will be delivered to the laboratory or sent via commercial carrier. A copy of the chain-of-custody will be retained by the environmental consultant performing the sample collection.

The chain-of-custody will identify all collected samples and QC samples. For field duplicates and co-located samples, a separate sample number will be assigned and submitted blind to the analytical laboratory, which will be correlated in the field logbook. Equipment blank samples will be designated as follows: EB-#-mmddyy

Where: EB – equipment blank sample  
# - sample identification number  
mmddyy – month, day, and year of collection

Soil samples collected for QC purposes will be specified for QC analysis by a notation on the sample container label and the chain-of-custody.

### **3.2.2 Laboratory Custody Procedures**

Upon arrival at the analytical laboratory, the analytical laboratory will check samples for label identifications and complete, accurate chain-of-custody documentation. The sample condition will be checked, and the temperature will be measured immediately after the cooler is opened and recorded on the chain-of-custody. Any discrepancies between the chain-of-custody documentation and sample labels, or any problem encountered that may affect a sample's integrity must be noted and communicated to the person delivering the samples. Problems that may affect the sample integrity include:

- Inaccurate or incomplete sample preservation
- Sample containers broken, leaking, or containing insufficient volume

- Holding time exceeded
- Cooler temperature above 10° C
- Temperature blank less than 2° C or greater than 6° C (when time since sample was collected is greater than 2 hours)

A unique laboratory identification (ID) number will be assigned. This number will be cross-referenced to the field sample ID to deter the possibility of mislabeling. Analytical reports will contain both ID numbers for sample results. Access to the sample control area will be restricted to prevent unauthorized contact with samples, extracts, or documentation. Samples and sample extracts will be maintained by the analytical laboratory until 30 days following the release of the final laboratory analytical report.

#### **4.0 QUALITY ASSESSMENT/QUALITY CONTROL MEASUREMENT**

The overall QA objective is to implement QC procedures during field and laboratory activities that will provide data with the degree of quality consistent with the intended use. Internal QC checks are used to determine if analytical activities are in control and to determine the effect a sample matrix may have on data being collected. This section describes both the field and laboratory QC checks that will be used for the evaluation of data collected.

##### **4.1 FIELD QUALITY CONTROL CHECKS**

The data quality indicators for the measurement of field data including the field objectives for precision, accuracy, completeness, representativeness, comparability, and sensitivity are outlined in Section 1.5. Field QC samples are described below.

###### **4.1.1 Equipment Blanks**

Equipment rinsate blanks will be collected when reusable, non-disposable sampling equipment (e.g., trowels, spoons, and bowls) are used for the sampling event. Equipment blanks will be collected to evaluate field sampling and decontamination procedures by pouring distilled or deionized water over the decontaminated sampling equipment. Equipment rinsate blanks will be obtained by passing water through or over the decontaminated sampling devices used that day. Rinsate blank samples will be collected and analyzed for RCRA metals.

Equipment blanks will be collected at a frequency of one equipment blank sample per every 20 samples of the primary samples collected or once per sampling day (when reusable, non-disposable sampling equipment is used), whichever is more frequent. A separate sample number will be assigned to each sample, and it will be submitted to the laboratory.

###### **4.1.2 Field Blanks**

Soil samples for VOC analysis will not be collected during this project; therefore, methanol field blanks are not required.

### **4.1.3 Trip Blanks**

Soil samples for VOC analysis will not be collected during this project; therefore, a trip blanks are not required.

### **4.1.4 Field Duplicate Samples**

A field duplicate is a second sample collected at the same location as the original (primary) sample. Duplicate samples are collected simultaneously or in immediate succession, following identical collection procedures, and treated in the same manner during sample shipment, storage, and analysis. The field duplicate samples are numbered such that they cannot be identified (blind duplicate) as duplicate samples by laboratory personnel. Duplicate samples will be correlated in the field logbook.

Samples to be analyzed for RCRA metals will be homogenized in a plastic. Homogenized soil from the plastic bag will be transferred to the appropriate sample container for primary and duplicate sample analysis.

Field duplicate samples will be collected and analyzed to evaluate sampling and analytical precision. Agreement between duplicate sample results will indicate good sampling and analytical precision. Specific locations will be designated for collection of field duplicates prior to the start of field activities. Field duplicates will be collected at a frequency of 10 percent of the primary samples collected. The duplicate sample will be analyzed for all laboratory analyses requested for the primary sample collected.

The duplicate and original samples will be compared and the RPD will be calculated. The RPD will then be compared to the RPD for each analyte. If the RPD is exceeded, corrective action will be conducted by reviewing the field logbook to evaluate whether the soil was heterogeneous and reviewing the analytical laboratory quality control data. The higher result will be used for assessment activities.

## **4.2 LABORATORY QUALITY CONTROL CHECKS**

The data quality indicators for the measurement of laboratory data including the objectives for precision, accuracy, completeness, representativeness, comparability, and sensitivity are outlined in Section 1.5. The laboratory QC samples have been selected based on the DQOs for this project and the established analytical method requirements. The required laboratory QC samples are outlined below. However, additional QC samples may be required by the analytical laboratory to satisfy the laboratory internal QC policies.

### **4.2.1 Method Blank**

A method blank is a sample of ASTM Type II or analyte-free (deionized) water that is carried through each step of the preparation and analytical method. Method blank samples are used to

assess potential contamination attributed to laboratory operations during sample preparation and analysis. A method blank sample is required for each analytical batch of 20 or fewer samples.

#### **4.2.2 Instrument Blank**

An instrument blank is a sample of ASTM Type H or analyte-free (deionized) water or non-contaminated solid that is analyzed with associated calibrations of laboratory instruments. Instrument blank results are used to assess potential contamination attributed to specific instrument calibration procedures.

#### **4.2.3 Surrogate Spikes**

Surrogate spikes (also known as System Monitoring Compounds) are compounds added to every blank, standard, sample, and MS sample as specified in the analytical methodology. Surrogate compounds are generally brominated, fluorinated, or isotopically labeled compounds not expected to be present in environmental samples. The results of the surrogate spike compounds are used to evaluate the accuracy of the analytical measurement on a sample-specific basis. Surrogate spikes are generally added for organic analyses only.

#### **4.2.4 Internal Standards**

An internal standard is a standard of known concentration added to each sample and carried through the entire determination procedure as a reference for calibrating and controlling the precision bias of the analytical method. Internal standards are generally used for organic analyses only.

#### **4.2.5 Matrix Spikes (MSs) and Matrix Spike Duplicates (MSDs)**

MSs are known concentrations of analytes added to a sample and carried through each step of the preparation and analytical method. MSs are typically analyzed in duplicate for organic analyses. The results of MSs are reported in %R and are evaluated to assess potential matrix interferences. The results of MSDs are reported as RPD and are evaluated to assess laboratory and method precision.

#### **4.2.6 Matrix Duplicates**

A matrix duplicate (or laboratory duplicate) is a separate aliquot of a sample taken from the sample container and carried through each step of the preparation and analytical method. The results of matrix duplicates are reported as RPD and are evaluated to assess laboratory and method precision.

#### **4.2.7 Laboratory Control Samples /Laboratory Control Sample Duplicates**

LCSs and LCSDs are well-characterized, laboratory-generated samples used to monitor the

laboratory's day-to-day performance of analytical methods (sensitivity, calibration, and memory effects). An LCS may be a purchased standard or a method blank spiked with known concentrations of target analytes. The LCS is carried through each step of the preparation and analytical method. LCSs should be reported in %R and used to assess the accuracy and precision (use of LCSDs) of the analytical process independent of matrix effects. Controlling lab operations with LCSs (rather than surrogates or matrix spikes) offers the advantage of being able to differentiate low recoveries due to procedural errors with those due to matrix effects.

#### **4.2.8 Continuing Calibration Verification (CCV)**

CCV is achieved by the routine analysis of a standard of known concentration. The verification standard concentration is usually at or near the midpoint of the linear calibration curve. CCV for linear calibrations involves the calculation of the percent drift or percent difference of the instrument response between the initial calibration and each subsequent analysis of the verification standard.

#### **4.2.9 Performance Evaluation Samples**

Double blind performance evaluation (PE) samples may be submitted to the analytical laboratory at the direction of ADEQ or Avanti. QC issues that may trigger the need for the submission of PE samples include confirmed quality issues detected through the data verification process or unexpected or unexplained sample results.

If requested, double blind PE samples will be prepared in similar sample containers as the project field samples and shipped from the field to the laboratory for analysis. The double-blind PE samples will be prepared using National Institute of Standards and Technology (NIST) and/or EPA certified standards. The project-specific PE samples will contain known concentrations of the analytes of interest. Laboratory results will be evaluated against the original Certificates of Analyses for precision and accuracy.

### **4.3 DATA ANALYSIS**

Final analytical laboratory data packages will be provided by an ADHS-certified laboratory and will meet the applicable requirements of *Laboratory Documentation Required for Data Evaluation* (R9/QA004.2); EPA Region 9; August 2001.

Data verification will be performed by GTR, consisting of a Tier IA evaluation. Data verification will be used to evaluate whether the project data satisfy the projects DQOs and data use requirements. Data verification will be performed after the analytical laboratory has completed its own in-house quality control checks. Data outliers and anomalies will be evaluated by the analytical laboratory and data flags and/or discussions will be placed in the analytical report in accordance with *Arizona Laboratory Data Qualifiers, Revision 3.0 (September 20, 2007)*. After verification is completed, qualifiers will be assigned to the data points that are affected by the quality control outliers. The qualifiers will indicate the analyte concentrations may be affected by the laboratory or field contamination, unusable because of quality control

deficiencies, and/or estimated due to possible bias or reduced confidence in the results.

## **5.0 PREVENTATIVE MAINTENANCE**

Preventative maintenance of field and laboratory equipment and instrumentation is completed to prevent loss of data due to malfunctions or delay, and to ensure analytical data is reliable.

### **5.1 FIELD INSTRUMENT TESTING, INSPECTION, AND MAINTENANCE**

Field screening of imported Cap/cover material is not anticipated.

### **5.2 LABORATORY INSTRUMENT PREVENTATIVE MAINTENANCE**

The Quality Assurance Manual and laboratory SOPs for the selected analytical laboratory will outline a formal preventative maintenance program. Preventative maintenance will be performed for each analytical instrument to minimize improper performance or interruption of the analytical process. General inspection and maintenance will be conducted in accordance with manufacturer's recommendations. Designated laboratory personnel or outside service contracted firms will be responsible for this maintenance. The laboratory will maintain a stock of spare parts and consumables for analytical equipment. Routine maintenance and specialized repairs will be documented in a bound maintenance notebook with sequentially numbered pages. Each analytical instrument will have its own maintenance notebook. Entries will be initialed, dated, and periodically reviewed.

## **6.0 CALIBRATION PROCEDURES AND FREQUENCY**

### **6.1 FIELD INSTRUMENT CALIBRATION**

Field screening of imported Cap/cover material is not anticipated.

### **6.2 LABORATORY INSTRUMENT CALIBRATION**

Instrumentation and equipment used during sample analysis will be operated, calibrated, and maintained according to the manufacturer's guidelines and recommendations, as well as criteria set forth in the applicable analytical methodology references. Operation, calibration, and maintenance will be performed by personnel properly trained in these procedures. Analytical laboratory capabilities will be demonstrated initially for instrument and reagent/standards performance as well as accuracy and precision of analytical methodology.

Calibration will be required to ensure the analytical system is operating correctly and functioning at the proper sensitivity to meet required reporting limits. Instruments will be calibrated with standard solutions appropriate to the type of instrument and the linear range required for the DQOs of this project. The frequency of initial calibration and calibration

verification will meet the requirements of the analytical method. Samples must be bracketed by passing calibration check standards where required by the method.

Calibration standards and acceptance criteria vary depending on the instrument and analytical method. The general principles of calibration will apply uniformly. Initial calibration will demonstrate the reporting limits, the dynamic range of the detection system, and the retention windows. EPA procedures outline each system's acceptance criteria for calibration prior to analyses. Initial calibration consists of the analysis of at least five calibration standards at varying concentrations. The low calibration standard will be at a concentration below or at the reporting limit. The other standards will be at concentrations in the expected range of the detection system. The results will be used to determine a calibration curve and response factors for each analyte. The sample concentration (diluted or undiluted) will not exceed the linear range determined by the initial calibration.

CCV standards are analyzed before analysis of field samples and after every 10 samples to verify the initial calibration curve and response factors or at a frequency as required in the method. Initial calibration and CCV standards will contain all analytes of interest and must meet all calibration criteria. The ending or bracketing calibration standards also must meet the criteria where required by the method.

### **6.3 STANDARD REAGENT PREPARATION**

A critical element in the generation of quality data is the purity/quality and traceability of the standard solutions and reagents used in the analytical operations. The preparation and maintenance of standards and reagents will be performed per the analytical methods requirements and those described below. Standards preparation will incorporate the following items:

- Documentation and labeling of date received, lot number, date opened, and expiration date
- Documentation of traceability certificates
- Preparation, storage, and labeling of stock and working solutions
- Establishing and documenting expiration dates and disposal of unusable standards

Primary reference standards and initial calibration standard solutions used by the laboratory will be obtained from commercial sources supplying a high purity (i.e., NIST traceable with Certificates of Analysis). Standards and standard solutions will be catalogued to identify the supplier, lot number, purity/concentration, receipt/preparation date, preparer's name, method of preparation, expiration date, and other pertinent information.

## **7.0 ASSESSMENT AND OVERSIGHT**

### **7.1 PROCEDURES**

Prior to the beginning of fieldwork, the Project Manager will review the Work Plan, SAP, HASP, and this QAPP and will assemble the necessary field gear, including the field logbook and other field logs, one copy of the Work Plan, SAP, and HASP, field screening instruments, sampling and decontamination equipment, sample containers and labels, chain-of-custody forms and seals, sample shipping coolers and materials, and other equipment and materials necessary for the fieldwork. The Project Manager will contact the analytical laboratory in advance to schedule sample analyses and will arrange for shipping or delivery of samples to the fixed-base laboratory.

The Project Manager will be responsible for ensuring fieldwork is performed in general accordance with the Work Plan, SAP, and this QAPP, including sampling activities; documentation accuracy, completeness, and consistency; packaging and shipping of samples to the laboratory; and field instrument monitoring and calibration.

The Project Manager will communicate daily with the field team regarding field activities, and changes or corrections will be implemented as needed. During and following the fieldwork, the Project Manager will review field documentation and laboratory data for accuracy and completeness.

### **7.2 REPORTS TO MANAGEMENT**

The Volunteer/Site Owner and VRP Project Manager may request status reports on the performance of project as necessary during performance of these tasks. Report contents may include, as applicable:

- Changes to the QAPP
- Summary of QA/QC programs, training, and accomplishments
- Results of technical systems and performance evaluation audits
- Significant QA/QC problems, recommended solutions, and results of corrective actions
- Summary of data quality assessment for precision, accuracy, representativeness, completeness, comparability, and laboratory reporting limits
- Discussion of whether QA objectives were met and the resulting impact on technical and enforcement issues
- Limitations on data use and discussion of the effects of such limitations on defensibility of the data

## **8.0 DATA MANAGEMENT**

### **8.1 FIELD DATA**

Data measured by field instruments will be recorded in field notebooks and/or on required field forms. The field data will be reviewed to evaluate completeness of the field records and appropriateness of the field methods employed. All field records will be retained in the project files for the required length of time.

### **8.2 LABORATORY DATA**

Data generated by the analytical laboratory will be retained in electronic format at the laboratory. Data generated by the analytical laboratory will be submitted to GTR in electronic format. The following sections outline the requirements for their submission and the handling of these deliverables.

Analytical data will contain the necessary sample results and quality control data to evaluate the DQOs defined for this project. The analytical laboratory report will be submitted to GTR for use in the data verification process. The analytical laboratory report will include, at a minimum the following:

- Analytical laboratory name and Arizona Department of Health Services license number
- Case narrative
- Cross-reference of sample identification number and analytical laboratory number
- Chain-of-custody
- Dates of sample collection and analysis
- Analytical results and method references
- Analytical method detection limits (MDLs) and laboratory reporting limits
- Surrogate recoveries (as applicable), method blanks, laboratory duplicates
- Calibration summary
- MS/MSDs, LCS/LCSDs, and blank spike references
- Data outlier summary
- Analytical laboratory approval

The analytical laboratory will typically provide the analytical reports within 15 working days of sample receipt. Omissions or insufficient levels of detail will be corrected by the analytical laboratory.

For analytes that are assigned an "R" or rejected validation code, the numeric fields containing concentration and detection limit information are assigned a null value. This is to ensure rejected data are not inadvertently used during future data analyses. In addition to changes based on rejected results as described above, other changes to the reported laboratory results (detection limits, concentrations, etc.) may be required as a result of data validation activities. For example, detection limits reported by the laboratory may be increased during data validation for some results that do not meet specific quality assurance guidelines. In these

cases, changes to the database will be performed in accordance with the data validation report during data validation entry. After required changes are completed, 100 percent of the changes will be quality checked.

## **9.0 DATA REVIEW, VERIFICATION, AND REPORTING**

### **9.1 PROCEDURES TO CHECK DATA INTEGRITY**

The principal criteria used to check data integrity during field activities are inspection and calibration of sampling equipment, supervision of field personnel and subcontractors by qualified staff, adherence to specifications, completion and review of daily field reports in field notebooks, and proper completion of the chain-of-custodies associated with this project.

The principal criteria to assure data integrity during analytical laboratory and report activities are those detailed in this QAPP. These criteria include, but are not limited to:

- Verbal and written communication between GTR and the analytical laboratory
- Completion and review of the Quality Control Summary Report
- Review and verification of the data generated from the sample analysis
- Referencing of the chain-of-custodies with the associated data package to check the appropriate analysis was performed

### **9.2 DATA REVIEW**

The analytical laboratory data will be reviewed for compliance with meeting the QA/QC specifications outlined in the analytical methods and this QAPP. The review of data packages will include an evaluation of the information provided on the analytical data sheets and required sample documentation of all sample analysis and the supporting sample collection documentation, including chain-of-custody documentation. Data will be accepted, rejected, or qualified based on the data review. The following summarizes the areas of data review, where applicable:

- Data completeness including chain-of-custody documentation
- Holding times and sample preservation
- Blanks
- LCS
- MS/MSD
- Laboratory duplicates
- Surrogates
- Field duplicate samples
- Other QA/QC issues documented in the data deliverable

The review of field data will include an evaluation of the information provided in the field logbook and required support documentation for all sample analyses, including chain-of-custody

and field instrument calibration and/or performance check documentation.

### **9.3 DATA REVIEW VERIFICATION METHODS**

The analytical laboratory will internally perform data review and reporting. Due to the limited scope and limited duration, data validation is not expected to be performed for this project. Data verification will be performed by a qualified member of GTR. The data verification will consist of the elements discussed below and will be performed on 100 percent of the data. Other QA/QC assessments (such as surveillance, peer review, management systems review, readiness review, technical systems audit, performance evaluation, etc.) will not be performed for this project since sampling activities are of limited scope and duration.

#### **9.3.1 Completeness Check**

A completeness check will be performed upon receipt of the laboratory analytical data and will include a review of:

- Case narrative
- Chain-of-custody documentation
- Sample condition upon receipt

The completeness check will ensure that:

- All compounds and environmental samples are present
- QC is present for every environmental sample
- The most technically valid result is reported for each compound

#### **9.3.2 Data Verification Criteria**

Data verification will include, but is not limited to, reviewing the:

- Completeness, as defined above
- Case narrative, including but not limited to, a description of non-conformances and corrective actions that were taken, plus anomalies, deficiencies, and QC problems that have been identified
- Chain-of-custody documentation and original chain-of-custody forms with identification numbers and laboratory receipt signatures, dates, and times
- Sample condition upon receipt, including cooler temperature, and shipping documentation
- Timeliness and a check for errors, including requested deliverables, preservation, and holding times
- Sample analysis results, with quantitation limits and checking that reporting limits are checked against the contract required limits, and verifying dry weights and dilutions
- QC summary including but not limited to, method blanks, continuing calibration blanks, and preparation blanks, surrogate percent recoveries, spike percent recoveries and relative percent differences, and laboratory QC check sample and LCS recoveries
- Field duplicates, for which reproducibility will be evaluated

- Reporting Limits
- Laboratory duplicates

### **9.3.3 Data Qualifier Flags**

The guidance used for data verification is taken from the USEPA Contract Laboratory Program National Function Guidelines for Organic Data Review, as revised, and USEPA Contract Laboratory Program National Function Guidelines for Inorganic Data Review, as revised. The data qualification scheme is the basis for determining whether sample results should be qualified, but the reviewer's judgment is also critical in determining whether data quality and usability have been systematically influenced and whether data points require qualification. The staff performing the assessment must understand the analytical procedures being reviewed, understand how the data will be used, and be an experienced chemist. If QC results are out of criteria, the data will be qualified using the standard Contract Laboratory Program data flags, i.e., B, J, UJ, NJ and R.

Problems or questions about analytical data quality that may require corrective action will be brought to the attention of the laboratory in writing from the consultant or the data reviewer. The data verification reviewer may initiate the request if QC results exceed method or project criteria, if reporting or flagging errors are identified, or to request information that has not been reported. The laboratory's response will include a written explanation of the problem, a plan and a schedule for corrective action, and/or a re-issuance of laboratory reports or electronic data files. If significant data quality problems have occurred and the data are critical to decision making, samples may be required to be reanalyzed, or recollected and reanalyzed at the discretion of the consultant.

The ADHS has published standardized data qualifier flags identified in the document *Arizona Laboratory Data Qualifiers, Revision 3.0 (September 20, 2007)* that will be used by the laboratory in qualifying analytical results for use in Arizona, as appropriate. Data associated with a QC exceedance must be designated by the laboratory using the Arizona Data Qualifier flags to flag the sample results associated with the exceedance. For example, if a LCS is out of criteria for iron, then, in addition to the LCS result being flagged, iron in the samples associated with that LCS must also be flagged.

### **9.3.4 Data Verification Reports**

The reviewer will prepare a data review report for each sample delivery group that will include:

- A case narrative, including but not limited to, a list of recommended flags; a listing of the items reviewed, and the criteria used to evaluate them; a discussion of problems or QC exceedances associated with the actual analysis which might impact the sample integrity or data quality; and a summary of laboratory contacts in which communications with the laboratory, if any; and
- The marking of recommended qualifier flags on the laboratory reports and/or in electronic data deliverables. Flags that are marked on hard copy will be marked directly

on copies of the laboratory reports in a contrasting color for ease in performing data entry.

#### **9.4 DATA QUALITY ASSESSMENT**

Based upon the data verification, an evaluation of the project may be performed to determine if the data satisfy the DQOs and are usable for the purposes for which they were intended.

#### **9.5 DATA REPORTING**

The results of the data review and verification will be documented and summarized in the final Site Remediation Report. Data reporting will be in a clear format and will contain the following information:

- A general discussion of the sample types received, tests performed, problems encountered, and general comments, along with a table of sample data and any failed QC parameters
- Analytical data, presented by sample number or by test
- Calibration verification information
- Laboratory performance and matrix-specific information including surrogates, MS/MSD results, LCSs, and LCSDs
- Other pertinent information, including cooler receipt forms and corrective action forms

Raw data will be stored in the analytical laboratory according to the requirements of its QC Manual. Raw data will be made available upon request by ADEQ.

### **10.0 CORRECTIVE ACTIONS**

The following section identifies the corrective actions necessary to address field, laboratory, and data verification/validation problems. In general, corrective actions will be initiated whenever data quality indicators suggest that DQOs have not been met. Corrective actions will begin with identifying the source of the problem. Potential problem sources include failure to adhere to method procedures, improper data reduction, equipment malfunctions, or systemic contamination. The first level of responsibility for identifying the problems and initiating corrective action lies with the analyst/field personnel. The second level of responsibility lies with any person reviewing the data. Corrective actions may include more intensive staff training, equipment repair followed by a more intensive preventive maintenance program, or removal of the source of systemic contamination. Once resolved, the corrective action procedure will be fully documented, and if DQOs were not met, the samples in question may need to be recollected and/or reanalyzed using a properly functioning system.

Any corrective action that requires changes to the Work Plan, SAP, or this QAPP are defined as major corrective actions. Major corrective actions include, but are not limited to, measures that change the number of samples collected, alter previously selected sampling locations, or

impact the project QC objectives. In addition, some re-sampling activities may be considered a major corrective action (e.g., re-sampling of a complete monitoring round). GTR will be responsible for contacting the ADEQ VRP Project Manager and discuss major corrective actions. Major corrective actions will be approved by the ADEQ VRP Project Manager before implementation by GTR.

## **10.1 FIELD CORRECTIVE ACTION**

Corrective action in the field relates to inspection of equipment, procedures, and problems found during data review. GTR is responsible for the initiation and implementation of corrective actions with respect to the field sampling operations and is responsible for assuring that field sampling procedures are followed. Corrective actions may include training field personnel, modifying field procedures, and/or and re-sampling project sample locations.

## **10.2 LABORATORY CORRECTIVE ACTION**

Corrective action will be taken in the analytical laboratory if method-specific QC or project-specific DQOs are not met or as a result of problems identified during data review. The analytical laboratory will notify GTR if a transportation problem (e.g., broken sample container, nonconforming temperature blanks) has occurred. The analytical laboratory's QA officer, in consultation with GTR, is responsible for implementing corrective actions in the laboratory (from sample receipt to final data deliverable). It is their combined responsibility to see that analytical and sampling procedures are followed as specified and the data generated meet the acceptance criteria. Corrective actions for the laboratory may include the following:

- Reanalyzing and/or re-extracting samples
- Correcting laboratory procedures
- Recalibrating instruments using freshly prepared standards
- Replacing solvents or other reagents that give unacceptable blank values
- Training laboratory personnel in correct sample preparation and analysis procedures

Whenever corrective action is deemed necessary, the analytical laboratory will check that the following steps are taken:

- The problem is defined
- The cause of the problem is investigated and determined
- Appropriate corrective action is determined
- Corrective action is implemented, and its effectiveness verified
- Control is reestablished to the noncompliant QC parameter(s)

The corrective actions will be documented according to the analytical laboratory's Quality Assurance Manual and SOPs.

### **10.3 CORRECTIVE ACTION DURING DATA REVIEW AND VERIFICATION**

During data review, results may be encountered that do not correlate well with expectations, with other results, or with results from other methods performed on the same samples. Such situations may trigger inquiries into raw data. GTR is responsible for initiating, overseeing implementation, and documenting corrective actions required during the data verification process. Some examples of discrepancies during data verification include missed holding time, QC samples outside evaluation criteria, and sample dilution problems. Corrective actions may require re-sampling by field personnel or re-extraction/re-analysis by the laboratory. Each corrective action must be documented.

## **11.0 PERFORMANCE AND SYSTEM AUDITS**

Audit activities are established and directed by GTR to ensure field and laboratory activities are performed in compliance with project controlling documents. This section describes responsibilities, requirements, and methods for scheduling, conducting, and documenting audits of field and laboratory activities.

### **11.1 FIELD PERFORMANCE AND SYSTEMS AUDITS**

GTR will be responsible for data integrity during field sampling activities. Corrective actions and the results (effectiveness) of those actions will be documented in the field logbook. The logbook will be stored in the project files.

Principal criteria to ensure data integrity during field sampling events are those detailed in this QAPP. The field assessment activities include, but are not limited to, the following inspections:

- Field analytical activities
- Contamination procedures and appropriate frequency of decontamination
- Sample collection and handling (e.g., method of collecting samples, use of PPE, sample packing)
- Chain-of-custody documents for completeness

Field audits are not required but may be performed in the event significant discrepancies are identified that warrant evaluation of field practices. These discrepancies may include continued field contamination problems and/or continued sample handling (i.e., elevated temperature upon receipt) problems.

Assessment activities and associated corrective action, if any, will be documented by GTR. ADEQ may elect, at their discretion, to inspect and/or assess field activities performed during this Site investigation and remediation.

## **11.2 LABORATORY PERFORMANCE AND SYSTEMS ASSESSMENTS**

Analytical laboratory audits generally include reviews of sample handling procedures, internal sample tracking, SOPs, analytical data documentation, QA/QC protocols, and data reporting. The analytical laboratory will be responsible for the policy, procedure, and documentation of internal assessment conducted by the analytical laboratory, including data review procedures. The analytical laboratory's QA manager is responsible for the initiation, implementation, and documenting of internal assessment activities and the associated corrective actions, if any. It is not anticipated a project-specific analytical laboratory audit will be performed as a function of this project.

## **12.0 TRAINING AND CERTIFICATION**

Sample collectors are required to successfully complete a 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) site safety course in general accordance with Title 40 Code of Federal Regulations Part 311 (40 CFR 311), which references 29 CFR 1910.120. Staff are also expected to be trained on sampling for hazardous materials as well as read and be familiar with this QAPP and the Work Plan and SAP prior to performing actual sample collection. Personnel will ensure and provide for the protection of the personal safety and health of workers on the Site, including the selection, provision, testing, decontamination, and disposal of PPE and required medical monitoring. Personnel will comply with applicable worker safety and health laws and regulations. During the performance of field activities, personnel will exercise reasonable professional judgment regarding safety and will use professional judgment as a criterion for cessation of services for safety reasons.

Documents containing interpretation of results and conclusions will be sealed by an Arizona-registered professional engineer qualified to perform the subject work.

Specific training requirements may be necessary for personnel operating field analytical or sampling equipment or specialized equipment, such as a global positioning system (GPS) or other instruments. Manufacturer's requirements and recommendations should be followed.

# **APPENDIX D**

## **ANALYTICAL LABORATORY REPORTS**

## GeoTek

Sample Delivery Group: L1079721  
Samples Received: 03/16/2019  
Project Number: 1795.1-PHR  
Description:

Report To: Adriane Gora  
4050 Cotton Center Blvd  
Phoenix, AZ 85282

Entire Report Reviewed By:



Daphne Richards  
Project Manager

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by Pace Analytical National is performed per guidance provided in laboratory standard operating procedures ENV-SOP-MTJL-0067 and ENV-SOP-MTJL-0068. Where sampling conducted by the customer, results relate to the accuracy of the information provided, and as the samples are received.



<b>Cp: Cover Page</b>	<b>1</b>	<b><sup>1</sup>Cp</b>
<b>Tc: Table of Contents</b>	<b>2</b>	
<b>Ss: Sample Summary</b>	<b>3</b>	<b><sup>2</sup>Tc</b>
<b>Cn: Case Narrative</b>	<b>7</b>	
<b>Sr: Sample Results</b>	<b>8</b>	<b><sup>3</sup>Ss</b>
G1 L1079721-01	8	
G2 L1079721-02	9	<b><sup>4</sup>Cn</b>
G3 L1079721-03	10	<b><sup>5</sup>Sr</b>
T1-S1 L1079721-04	11	
T2-S1 L1079721-05	12	<b><sup>6</sup>Qc</b>
T3-S1 L1079721-06	13	
G4 L1079721-07	14	<b><sup>7</sup>Gl</b>
T4-S1 L1079721-08	15	<b><sup>8</sup>Al</b>
G5 L1079721-09	16	
T5-S1 L1079721-10	17	<b><sup>9</sup>Sc</b>
AD-1 L1079721-11	18	
AD-2 L1079721-12	19	
G6 L1079721-13	20	
G7 L1079721-14	21	
G8 L1079721-15	22	
T7-S1 L1079721-16	23	
T8-S1 L1079721-17	24	
T9-S1 L1079721-18	25	
T10-S1 L1079721-19	26	
G9 L1079721-20	27	
T11-S1 L1079721-21	28	
G11 L1079721-22	29	
G12 L1079721-23	30	
G13 L1079721-24	31	
G10 L1079721-25	32	
<b>Qc: Quality Control Summary</b>	<b>33</b>	
Mercury by Method 7471B	33	
Metals (ICP) by Method 6010C	35	
<b>Gl: Glossary of Terms</b>	<b>37</b>	
<b>Al: Accreditations &amp; Locations</b>	<b>38</b>	
<b>Sc: Sample Chain of Custody</b>	<b>39</b>	

# SAMPLE SUMMARY



				Collected by	Collected date/time	Received date/time
<b>G1 L1079721-01 Solid</b>				Adriana Gora	03/15/19 07:43	03/16/19 12:30
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471B	WG1252344	1	03/19/19 17:15	03/20/19 07:39	TRB	Mt. Juliet, TN
Metals (ICP) by Method 6010C	WG1252940	1	03/21/19 12:01	03/23/19 16:33	WBD	Mt. Juliet, TN
				Collected by	Collected date/time	Received date/time
				Adriana Gora	03/15/19 07:49	03/16/19 12:30
<b>G2 L1079721-02 Solid</b>				Adriana Gora	03/15/19 07:49	03/16/19 12:30
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471B	WG1252344	1	03/19/19 17:15	03/20/19 07:47	TRB	Mt. Juliet, TN
Metals (ICP) by Method 6010C	WG1252940	5	03/21/19 12:01	03/25/19 10:01	CCE	Mt. Juliet, TN
				Collected by	Collected date/time	Received date/time
				Adriana Gora	03/15/19 07:56	03/16/19 12:30
<b>G3 L1079721-03 Solid</b>				Adriana Gora	03/15/19 07:56	03/16/19 12:30
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471B	WG1252344	1	03/19/19 17:15	03/20/19 07:49	TRB	Mt. Juliet, TN
Metals (ICP) by Method 6010C	WG1252940	1	03/21/19 12:01	03/23/19 16:49	WBD	Mt. Juliet, TN
				Collected by	Collected date/time	Received date/time
				Adriana Gora	03/15/19 08:09	03/16/19 12:30
<b>T1-S1 L1079721-04 Solid</b>				Adriana Gora	03/15/19 08:09	03/16/19 12:30
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471B	WG1252344	1	03/19/19 17:15	03/20/19 07:52	TRB	Mt. Juliet, TN
Metals (ICP) by Method 6010C	WG1252940	1	03/21/19 12:01	03/23/19 16:57	WBD	Mt. Juliet, TN
				Collected by	Collected date/time	Received date/time
				Adriana Gora	03/15/19 08:31	03/16/19 12:30
<b>T2-S1 L1079721-05 Solid</b>				Adriana Gora	03/15/19 08:31	03/16/19 12:30
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471B	WG1252344	1	03/19/19 17:15	03/20/19 07:54	TRB	Mt. Juliet, TN
Metals (ICP) by Method 6010C	WG1252940	1	03/21/19 12:01	03/23/19 17:00	WBD	Mt. Juliet, TN
				Collected by	Collected date/time	Received date/time
				Adriana Gora	03/15/19 08:58	03/16/19 12:30
<b>T3-S1 L1079721-06 Solid</b>				Adriana Gora	03/15/19 08:58	03/16/19 12:30
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471B	WG1252344	1	03/19/19 17:15	03/20/19 08:02	TRB	Mt. Juliet, TN
Metals (ICP) by Method 6010C	WG1252940	1	03/21/19 12:01	03/23/19 17:02	WBD	Mt. Juliet, TN
				Collected by	Collected date/time	Received date/time
				Adriana Gora	03/15/19 09:08	03/16/19 12:30
<b>G4 L1079721-07 Solid</b>				Adriana Gora	03/15/19 09:08	03/16/19 12:30
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471B	WG1252344	1	03/19/19 17:15	03/20/19 08:05	TRB	Mt. Juliet, TN
Metals (ICP) by Method 6010C	WG1252940	1	03/21/19 12:01	03/23/19 17:05	WBD	Mt. Juliet, TN

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc

# SAMPLE SUMMARY



## T4-S1 L1079721-08 Solid

Collected by  
Adriana Gora  
Collected date/time  
03/15/19 09:14  
Received date/time  
03/16/19 12:30

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471B	WG1252344	1	03/19/19 17:15	03/20/19 08:07	TRB	Mt. Juliet, TN
Metals (ICP) by Method 6010C	WG1252940	1	03/21/19 12:01	03/23/19 17:08	WBD	Mt. Juliet, TN

1  
Cp

2  
Tc

3  
Ss

4  
Cn

5  
Sr

6  
Qc

7  
Gl

8  
Al

9  
Sc

## G5 L1079721-09 Solid

Collected by  
Adriana Gora  
Collected date/time  
03/15/19 09:25  
Received date/time  
03/16/19 12:30

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471B	WG1252344	1	03/19/19 17:15	03/20/19 08:10	TRB	Mt. Juliet, TN
Metals (ICP) by Method 6010C	WG1252940	1	03/21/19 12:01	03/23/19 17:11	WBD	Mt. Juliet, TN

## T5-S1 L1079721-10 Solid

Collected by  
Adriana Gora  
Collected date/time  
03/15/19 10:39  
Received date/time  
03/16/19 12:30

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471B	WG1252344	1	03/19/19 17:15	03/20/19 08:12	TRB	Mt. Juliet, TN
Metals (ICP) by Method 6010C	WG1252940	1	03/21/19 12:01	03/23/19 17:14	WBD	Mt. Juliet, TN

## AD-1 L1079721-11 Solid

Collected by  
Adriana Gora  
Collected date/time  
03/15/19 10:45  
Received date/time  
03/16/19 12:30

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471B	WG1252344	1	03/19/19 17:15	03/20/19 08:15	TRB	Mt. Juliet, TN
Metals (ICP) by Method 6010C	WG1252940	1	03/21/19 12:01	03/23/19 17:16	WBD	Mt. Juliet, TN

## AD-2 L1079721-12 Solid

Collected by  
Adriana Gora  
Collected date/time  
03/15/19 10:48  
Received date/time  
03/16/19 12:30

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471B	WG1252344	1	03/19/19 17:15	03/20/19 08:17	TRB	Mt. Juliet, TN
Metals (ICP) by Method 6010C	WG1252940	1	03/21/19 12:01	03/23/19 17:19	WBD	Mt. Juliet, TN

## G6 L1079721-13 Solid

Collected by  
Adriana Gora  
Collected date/time  
03/15/19 11:16  
Received date/time  
03/16/19 12:30

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471B	WG1252344	1	03/19/19 17:15	03/20/19 08:20	TRB	Mt. Juliet, TN
Metals (ICP) by Method 6010C	WG1252940	1	03/21/19 12:01	03/23/19 17:22	WBD	Mt. Juliet, TN

## G7 L1079721-14 Solid

Collected by  
Adriana Gora  
Collected date/time  
03/15/19 11:20  
Received date/time  
03/16/19 12:30

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471B	WG1252344	1	03/19/19 17:15	03/20/19 08:22	TRB	Mt. Juliet, TN
Metals (ICP) by Method 6010C	WG1252940	1	03/21/19 12:01	03/23/19 17:30	WBD	Mt. Juliet, TN

# SAMPLE SUMMARY

## G8 L1079721-15 Solid

Collected by  
Adriana Gora  
Collected date/time  
03/15/19 11:23  
Received date/time  
03/16/19 12:30

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471B	WG1252344	1	03/19/19 17:15	03/20/19 08:25	TRB	Mt. Juliet, TN
Metals (ICP) by Method 6010C	WG1252940	1	03/21/19 12:01	03/23/19 17:33	WBD	Mt. Juliet, TN

1  
Cp

2  
Tc

3  
Ss

4  
Cn

5  
Sr

6  
Qc

7  
Gl

8  
Al

9  
Sc

## T7-S1 L1079721-16 Solid

Collected by  
Adriana Gora  
Collected date/time  
03/15/19 11:48  
Received date/time  
03/16/19 12:30

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471B	WG1252344	1	03/19/19 17:15	03/20/19 08:32	TRB	Mt. Juliet, TN
Metals (ICP) by Method 6010C	WG1252940	1	03/21/19 12:01	03/23/19 17:36	WBD	Mt. Juliet, TN

## T8-S1 L1079721-17 Solid

Collected by  
Adriana Gora  
Collected date/time  
03/15/19 11:53  
Received date/time  
03/16/19 12:30

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471B	WG1252344	1	03/19/19 17:15	03/20/19 08:35	TRB	Mt. Juliet, TN
Metals (ICP) by Method 6010C	WG1252940	1	03/21/19 12:01	03/23/19 17:38	WBD	Mt. Juliet, TN

## T9-S1 L1079721-18 Solid

Collected by  
Adriana Gora  
Collected date/time  
03/15/19 12:11  
Received date/time  
03/16/19 12:30

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471B	WG1252344	1	03/19/19 17:15	03/20/19 08:38	TRB	Mt. Juliet, TN
Metals (ICP) by Method 6010C	WG1252940	1	03/21/19 12:01	03/23/19 17:41	WBD	Mt. Juliet, TN

## T10-S1 L1079721-19 Solid

Collected by  
Adriana Gora  
Collected date/time  
03/15/19 12:33  
Received date/time  
03/16/19 12:30

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471B	WG1252344	1	03/19/19 17:15	03/20/19 08:40	TRB	Mt. Juliet, TN
Metals (ICP) by Method 6010C	WG1252940	1	03/21/19 12:01	03/23/19 17:44	WBD	Mt. Juliet, TN

## G9 L1079721-20 Solid

Collected by  
Adriana Gora  
Collected date/time  
03/15/19 13:04  
Received date/time  
03/16/19 12:30

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471B	WG1252344	1	03/19/19 17:15	03/20/19 08:43	TRB	Mt. Juliet, TN
Metals (ICP) by Method 6010C	WG1252940	1	03/21/19 12:01	03/23/19 17:47	WBD	Mt. Juliet, TN

## T11-S1 L1079721-21 Solid

Collected by  
Adriana Gora  
Collected date/time  
03/15/19 13:08  
Received date/time  
03/16/19 12:30

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471B	WG1252346	1	03/19/19 17:10	03/20/19 09:08	TRB	Mt. Juliet, TN
Metals (ICP) by Method 6010C	WG1252971	1	03/21/19 07:45	03/22/19 00:52	TRB	Mt. Juliet, TN

# SAMPLE SUMMARY



## G11 L1079721-22 Solid

Collected by  
Adriana Gora  
Collected date/time  
03/15/19 13:16  
Received date/time  
03/16/19 12:30

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471B	WG1252346	1	03/19/19 17:10	03/20/19 09:11	TRB	Mt. Juliet, TN
Metals (ICP) by Method 6010C	WG1252971	1	03/21/19 07:45	03/22/19 00:54	TRB	Mt. Juliet, TN

1  
Cp

2  
Tc

3  
Ss

## G12 L1079721-23 Solid

Collected by  
Adriana Gora  
Collected date/time  
03/15/19 13:20  
Received date/time  
03/16/19 12:30

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471B	WG1252346	1	03/19/19 17:10	03/20/19 09:13	TRB	Mt. Juliet, TN
Metals (ICP) by Method 6010C	WG1252971	1	03/21/19 07:45	03/22/19 00:57	TRB	Mt. Juliet, TN

4  
Cn

5  
Sr

6  
Qc

## G13 L1079721-24 Solid

Collected by  
Adriana Gora  
Collected date/time  
03/15/19 13:30  
Received date/time  
03/16/19 12:30

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471B	WG1252346	1	03/19/19 17:10	03/20/19 09:16	TRB	Mt. Juliet, TN
Metals (ICP) by Method 6010C	WG1252971	1	03/21/19 07:45	03/22/19 01:00	TRB	Mt. Juliet, TN

7  
Gl

8  
Al

## G10 L1079721-25 Solid

Collected by  
Adriana Gora  
Collected date/time  
03/15/19 13:12  
Received date/time  
03/16/19 12:30

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471B	WG1252346	1	03/19/19 17:10	03/20/19 09:18	TRB	Mt. Juliet, TN
Metals (ICP) by Method 6010C	WG1252971	1	03/21/19 07:45	03/22/19 01:03	TRB	Mt. Juliet, TN

9  
Sc



All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times, unless qualified or notated within the report. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.

Daphne Richards  
Project Manager

- <sup>1</sup> Cp
- <sup>2</sup> Tc
- <sup>3</sup> Ss
- <sup>4</sup> Cn
- <sup>5</sup> Sr
- <sup>6</sup> Qc
- <sup>7</sup> Gl
- <sup>8</sup> Al
- <sup>9</sup> Sc

### Report Revision History

---

Level II Report - Version 1: 03/25/19 14:20



## Mercury by Method 7471B

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Mercury	0.0407		0.0200	1	03/20/2019 07:39	<a href="#">WG1252344</a>

## Metals (ICP) by Method 6010C

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Arsenic	9.64		2.00	1	03/23/2019 16:33	<a href="#">WG1252940</a>
Barium	142	M1 R5	0.500	1	03/23/2019 16:33	<a href="#">WG1252940</a>
Cadmium	ND		0.500	1	03/23/2019 16:33	<a href="#">WG1252940</a>
Chromium	34.7		1.00	1	03/23/2019 16:33	<a href="#">WG1252940</a>
Lead	21.4	M1 R5	0.500	1	03/23/2019 16:33	<a href="#">WG1252940</a>
Selenium	ND		2.00	1	03/23/2019 16:33	<a href="#">WG1252940</a>
Silver	ND		1.00	1	03/23/2019 16:33	<a href="#">WG1252940</a>

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc



## Mercury by Method 7471B

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Mercury	0.382		0.0200	1	03/20/2019 07:47	<a href="#">WG1252344</a>

## Metals (ICP) by Method 6010C

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Arsenic	239		10.0	5	03/25/2019 10:01	<a href="#">WG1252940</a>
Barium	1560		2.50	5	03/25/2019 10:01	<a href="#">WG1252940</a>
Cadmium	9.10		2.50	5	03/25/2019 10:01	<a href="#">WG1252940</a>
Chromium	28.9		5.00	5	03/25/2019 10:01	<a href="#">WG1252940</a>
Lead	7530		2.50	5	03/25/2019 10:01	<a href="#">WG1252940</a>
Selenium	ND		10.0	5	03/25/2019 10:01	<a href="#">WG1252940</a>
Silver	ND		5.00	5	03/25/2019 10:01	<a href="#">WG1252940</a>

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc



## Mercury by Method 7471B

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Mercury	0.104		0.0200	1	03/20/2019 07:49	<a href="#">WG1252344</a>

## Metals (ICP) by Method 6010C

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Arsenic	104		2.00	1	03/23/2019 16:49	<a href="#">WG1252940</a>
Barium	102		0.500	1	03/23/2019 16:49	<a href="#">WG1252940</a>
Cadmium	0.849		0.500	1	03/23/2019 16:49	<a href="#">WG1252940</a>
Chromium	63.1		1.00	1	03/23/2019 16:49	<a href="#">WG1252940</a>
Lead	126		0.500	1	03/23/2019 16:49	<a href="#">WG1252940</a>
Selenium	ND		2.00	1	03/23/2019 16:49	<a href="#">WG1252940</a>
Silver	ND		1.00	1	03/23/2019 16:49	<a href="#">WG1252940</a>

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc



Mercury by Method 7471B

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Mercury	ND		0.0200	1	03/20/2019 07:52	<a href="#">WG1252344</a>

Metals (ICP) by Method 6010C

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Arsenic	22.6		2.00	1	03/23/2019 16:57	<a href="#">WG1252940</a>
Barium	170		0.500	1	03/23/2019 16:57	<a href="#">WG1252940</a>
Cadmium	ND		0.500	1	03/23/2019 16:57	<a href="#">WG1252940</a>
Chromium	222		1.00	1	03/23/2019 16:57	<a href="#">WG1252940</a>
Lead	32.4		0.500	1	03/23/2019 16:57	<a href="#">WG1252940</a>
Selenium	ND		2.00	1	03/23/2019 16:57	<a href="#">WG1252940</a>
Silver	ND		1.00	1	03/23/2019 16:57	<a href="#">WG1252940</a>

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc



Mercury by Method 7471B

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Mercury	ND		0.0200	1	03/20/2019 07:54	<a href="#">WG1252344</a>

Metals (ICP) by Method 6010C

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Arsenic	33.2		2.00	1	03/23/2019 17:00	<a href="#">WG1252940</a>
Barium	92.9		0.500	1	03/23/2019 17:00	<a href="#">WG1252940</a>
Cadmium	ND		0.500	1	03/23/2019 17:00	<a href="#">WG1252940</a>
Chromium	232		1.00	1	03/23/2019 17:00	<a href="#">WG1252940</a>
Lead	11.3		0.500	1	03/23/2019 17:00	<a href="#">WG1252940</a>
Selenium	ND		2.00	1	03/23/2019 17:00	<a href="#">WG1252940</a>
Silver	ND		1.00	1	03/23/2019 17:00	<a href="#">WG1252940</a>

- 1 Cp
- 2 Tc
- 3 Ss
- 4 Cn
- 5 Sr
- 6 Qc
- 7 Gl
- 8 Al
- 9 Sc



Mercury by Method 7471B

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Mercury	0.0216		0.0200	1	03/20/2019 08:02	<a href="#">WG1252344</a>

1 Cp

2 Tc

Metals (ICP) by Method 6010C

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Arsenic	3.16		2.00	1	03/23/2019 17:02	<a href="#">WG1252940</a>
Barium	156		0.500	1	03/23/2019 17:02	<a href="#">WG1252940</a>
Cadmium	ND		0.500	1	03/23/2019 17:02	<a href="#">WG1252940</a>
Chromium	13.5		1.00	1	03/23/2019 17:02	<a href="#">WG1252940</a>
Lead	14.9		0.500	1	03/23/2019 17:02	<a href="#">WG1252940</a>
Selenium	ND		2.00	1	03/23/2019 17:02	<a href="#">WG1252940</a>
Silver	ND		1.00	1	03/23/2019 17:02	<a href="#">WG1252940</a>

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc



## Mercury by Method 7471B

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Mercury	0.0434		0.0200	1	03/20/2019 08:05	<a href="#">WG1252344</a>

## Metals (ICP) by Method 6010C

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Arsenic	18.4		2.00	1	03/23/2019 17:05	<a href="#">WG1252940</a>
Barium	158		0.500	1	03/23/2019 17:05	<a href="#">WG1252940</a>
Cadmium	ND		0.500	1	03/23/2019 17:05	<a href="#">WG1252940</a>
Chromium	154		1.00	1	03/23/2019 17:05	<a href="#">WG1252940</a>
Lead	11.7		0.500	1	03/23/2019 17:05	<a href="#">WG1252940</a>
Selenium	ND		2.00	1	03/23/2019 17:05	<a href="#">WG1252940</a>
Silver	ND		1.00	1	03/23/2019 17:05	<a href="#">WG1252940</a>

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc



Mercury by Method 7471B

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Mercury	ND		0.0200	1	03/20/2019 08:07	<a href="#">WG1252344</a>

Metals (ICP) by Method 6010C

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Arsenic	24.6		2.00	1	03/23/2019 17:08	<a href="#">WG1252940</a>
Barium	168		0.500	1	03/23/2019 17:08	<a href="#">WG1252940</a>
Cadmium	0.520		0.500	1	03/23/2019 17:08	<a href="#">WG1252940</a>
Chromium	101		1.00	1	03/23/2019 17:08	<a href="#">WG1252940</a>
Lead	52.7		0.500	1	03/23/2019 17:08	<a href="#">WG1252940</a>
Selenium	ND		2.00	1	03/23/2019 17:08	<a href="#">WG1252940</a>
Silver	ND		1.00	1	03/23/2019 17:08	<a href="#">WG1252940</a>

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc



## Mercury by Method 7471B

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Mercury	ND		0.0200	1	03/20/2019 08:10	<a href="#">WG1252344</a>

## Metals (ICP) by Method 6010C

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Arsenic	10.1		2.00	1	03/23/2019 17:11	<a href="#">WG1252940</a>
Barium	136		0.500	1	03/23/2019 17:11	<a href="#">WG1252940</a>
Cadmium	0.780		0.500	1	03/23/2019 17:11	<a href="#">WG1252940</a>
Chromium	30.6		1.00	1	03/23/2019 17:11	<a href="#">WG1252940</a>
Lead	125		0.500	1	03/23/2019 17:11	<a href="#">WG1252940</a>
Selenium	ND		2.00	1	03/23/2019 17:11	<a href="#">WG1252940</a>
Silver	ND		1.00	1	03/23/2019 17:11	<a href="#">WG1252940</a>

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc



Mercury by Method 7471B

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Mercury	ND		0.0200	1	03/20/2019 08:12	<a href="#">WG1252344</a>

Metals (ICP) by Method 6010C

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Arsenic	33.3		2.00	1	03/23/2019 17:14	<a href="#">WG1252940</a>
Barium	258		0.500	1	03/23/2019 17:14	<a href="#">WG1252940</a>
Cadmium	0.992		0.500	1	03/23/2019 17:14	<a href="#">WG1252940</a>
Chromium	158		1.00	1	03/23/2019 17:14	<a href="#">WG1252940</a>
Lead	45.4		0.500	1	03/23/2019 17:14	<a href="#">WG1252940</a>
Selenium	ND		2.00	1	03/23/2019 17:14	<a href="#">WG1252940</a>
Silver	ND		1.00	1	03/23/2019 17:14	<a href="#">WG1252940</a>

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc



Mercury by Method 7471B

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Mercury	0.113		0.0200	1	03/20/2019 08:15	<a href="#">WG1252344</a>

Metals (ICP) by Method 6010C

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Arsenic	33.0		2.00	1	03/23/2019 17:16	<a href="#">WG1252940</a>
Barium	178		0.500	1	03/23/2019 17:16	<a href="#">WG1252940</a>
Cadmium	1.57		0.500	1	03/23/2019 17:16	<a href="#">WG1252940</a>
Chromium	27.4		1.00	1	03/23/2019 17:16	<a href="#">WG1252940</a>
Lead	388		0.500	1	03/23/2019 17:16	<a href="#">WG1252940</a>
Selenium	ND		2.00	1	03/23/2019 17:16	<a href="#">WG1252940</a>
Silver	ND		1.00	1	03/23/2019 17:16	<a href="#">WG1252940</a>

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc



Mercury by Method 7471B

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Mercury	0.0780		0.0200	1	03/20/2019 08:17	<a href="#">WG1252344</a>

1 Cp

2 Tc

Metals (ICP) by Method 6010C

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Arsenic	43.6		2.00	1	03/23/2019 17:19	<a href="#">WG1252940</a>
Barium	492		0.500	1	03/23/2019 17:19	<a href="#">WG1252940</a>
Cadmium	3.61		0.500	1	03/23/2019 17:19	<a href="#">WG1252940</a>
Chromium	19.5		1.00	1	03/23/2019 17:19	<a href="#">WG1252940</a>
Lead	598		0.500	1	03/23/2019 17:19	<a href="#">WG1252940</a>
Selenium	ND		2.00	1	03/23/2019 17:19	<a href="#">WG1252940</a>
Silver	ND		1.00	1	03/23/2019 17:19	<a href="#">WG1252940</a>

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc



## Mercury by Method 7471B

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Mercury	0.0250		0.0200	1	03/20/2019 08:20	<a href="#">WG1252344</a>

## Metals (ICP) by Method 6010C

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Arsenic	9.61		2.00	1	03/23/2019 17:22	<a href="#">WG1252940</a>
Barium	163		0.500	1	03/23/2019 17:22	<a href="#">WG1252940</a>
Cadmium	ND		0.500	1	03/23/2019 17:22	<a href="#">WG1252940</a>
Chromium	67.3		1.00	1	03/23/2019 17:22	<a href="#">WG1252940</a>
Lead	80.6		0.500	1	03/23/2019 17:22	<a href="#">WG1252940</a>
Selenium	ND		2.00	1	03/23/2019 17:22	<a href="#">WG1252940</a>
Silver	ND		1.00	1	03/23/2019 17:22	<a href="#">WG1252940</a>

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc



## Mercury by Method 7471B

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Mercury	0.0224		0.0200	1	03/20/2019 08:22	<a href="#">WG1252344</a>

## Metals (ICP) by Method 6010C

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Arsenic	4.37		2.00	1	03/23/2019 17:30	<a href="#">WG1252940</a>
Barium	150		0.500	1	03/23/2019 17:30	<a href="#">WG1252940</a>
Cadmium	ND		0.500	1	03/23/2019 17:30	<a href="#">WG1252940</a>
Chromium	31.9		1.00	1	03/23/2019 17:30	<a href="#">WG1252940</a>
Lead	14.6		0.500	1	03/23/2019 17:30	<a href="#">WG1252940</a>
Selenium	ND		2.00	1	03/23/2019 17:30	<a href="#">WG1252940</a>
Silver	ND		1.00	1	03/23/2019 17:30	<a href="#">WG1252940</a>

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc



## Mercury by Method 7471B

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
Mercury	0.0374		0.0200	1	03/20/2019 08:25	<a href="#">WG1252344</a>

## Metals (ICP) by Method 6010C

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
Arsenic	3.86		2.00	1	03/23/2019 17:33	<a href="#">WG1252940</a>
Barium	141		0.500	1	03/23/2019 17:33	<a href="#">WG1252940</a>
Cadmium	ND		0.500	1	03/23/2019 17:33	<a href="#">WG1252940</a>
Chromium	25.6		1.00	1	03/23/2019 17:33	<a href="#">WG1252940</a>
Lead	16.3		0.500	1	03/23/2019 17:33	<a href="#">WG1252940</a>
Selenium	ND		2.00	1	03/23/2019 17:33	<a href="#">WG1252940</a>
Silver	ND		1.00	1	03/23/2019 17:33	<a href="#">WG1252940</a>

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc



Mercury by Method 7471B

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Mercury	0.0334		0.0200	1	03/20/2019 08:32	<a href="#">WG1252344</a>

1 Cp

2 Tc

Metals (ICP) by Method 6010C

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Arsenic	3.82		2.00	1	03/23/2019 17:36	<a href="#">WG1252940</a>
Barium	132		0.500	1	03/23/2019 17:36	<a href="#">WG1252940</a>
Cadmium	ND		0.500	1	03/23/2019 17:36	<a href="#">WG1252940</a>
Chromium	21.3		1.00	1	03/23/2019 17:36	<a href="#">WG1252940</a>
Lead	84.5		0.500	1	03/23/2019 17:36	<a href="#">WG1252940</a>
Selenium	ND		2.00	1	03/23/2019 17:36	<a href="#">WG1252940</a>
Silver	ND		1.00	1	03/23/2019 17:36	<a href="#">WG1252940</a>

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc



Mercury by Method 7471B

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Mercury	0.0320		0.0200	1	03/20/2019 08:35	<a href="#">WG1252344</a>

1 Cp

2 Tc

Metals (ICP) by Method 6010C

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Arsenic	2.95		2.00	1	03/23/2019 17:38	<a href="#">WG1252940</a>
Barium	88.6		0.500	1	03/23/2019 17:38	<a href="#">WG1252940</a>
Cadmium	ND		0.500	1	03/23/2019 17:38	<a href="#">WG1252940</a>
Chromium	8.01		1.00	1	03/23/2019 17:38	<a href="#">WG1252940</a>
Lead	5.33		0.500	1	03/23/2019 17:38	<a href="#">WG1252940</a>
Selenium	ND		2.00	1	03/23/2019 17:38	<a href="#">WG1252940</a>
Silver	ND		1.00	1	03/23/2019 17:38	<a href="#">WG1252940</a>

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc



Mercury by Method 7471B

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Mercury	0.0423		0.0200	1	03/20/2019 08:38	<a href="#">WG1252344</a>

Metals (ICP) by Method 6010C

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Arsenic	24.7		2.00	1	03/23/2019 17:41	<a href="#">WG1252940</a>
Barium	140		0.500	1	03/23/2019 17:41	<a href="#">WG1252940</a>
Cadmium	1.20		0.500	1	03/23/2019 17:41	<a href="#">WG1252940</a>
Chromium	23.7		1.00	1	03/23/2019 17:41	<a href="#">WG1252940</a>
Lead	697		0.500	1	03/23/2019 17:41	<a href="#">WG1252940</a>
Selenium	ND		2.00	1	03/23/2019 17:41	<a href="#">WG1252940</a>
Silver	ND		1.00	1	03/23/2019 17:41	<a href="#">WG1252940</a>

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc



Mercury by Method 7471B

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Mercury	ND		0.0200	1	03/20/2019 08:40	<a href="#">WG1252344</a>

Metals (ICP) by Method 6010C

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Arsenic	7.35		2.00	1	03/23/2019 17:44	<a href="#">WG1252940</a>
Barium	160		0.500	1	03/23/2019 17:44	<a href="#">WG1252940</a>
Cadmium	ND		0.500	1	03/23/2019 17:44	<a href="#">WG1252940</a>
Chromium	45.5		1.00	1	03/23/2019 17:44	<a href="#">WG1252940</a>
Lead	29.5		0.500	1	03/23/2019 17:44	<a href="#">WG1252940</a>
Selenium	ND		2.00	1	03/23/2019 17:44	<a href="#">WG1252940</a>
Silver	ND		1.00	1	03/23/2019 17:44	<a href="#">WG1252940</a>

- 1 Cp
- 2 Tc
- 3 Ss
- 4 Cn
- 5 Sr
- 6 Qc
- 7 Gl
- 8 Al
- 9 Sc



## Mercury by Method 7471B

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Mercury	ND		0.0200	1	03/20/2019 08:43	<a href="#">WG1252344</a>

## Metals (ICP) by Method 6010C

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Arsenic	11.0		2.00	1	03/23/2019 17:47	<a href="#">WG1252940</a>
Barium	147		0.500	1	03/23/2019 17:47	<a href="#">WG1252940</a>
Cadmium	2.06		0.500	1	03/23/2019 17:47	<a href="#">WG1252940</a>
Chromium	27.5		1.00	1	03/23/2019 17:47	<a href="#">WG1252940</a>
Lead	243		0.500	1	03/23/2019 17:47	<a href="#">WG1252940</a>
Selenium	ND		2.00	1	03/23/2019 17:47	<a href="#">WG1252940</a>
Silver	ND		1.00	1	03/23/2019 17:47	<a href="#">WG1252940</a>

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc



Mercury by Method 7471B

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Mercury	0.0800		0.0200	1	03/20/2019 09:08	<a href="#">WG1252346</a>

1 Cp

2 Tc

Metals (ICP) by Method 6010C

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Arsenic	51.8		2.00	1	03/22/2019 00:52	<a href="#">WG1252971</a>
Barium	175		0.500	1	03/22/2019 00:52	<a href="#">WG1252971</a>
Cadmium	2.00		0.500	1	03/22/2019 00:52	<a href="#">WG1252971</a>
Chromium	82.6		1.00	1	03/22/2019 00:52	<a href="#">WG1252971</a>
Lead	475		0.500	1	03/22/2019 00:52	<a href="#">WG1252971</a>
Selenium	ND		2.00	1	03/22/2019 00:52	<a href="#">WG1252971</a>
Silver	ND		1.00	1	03/22/2019 00:52	<a href="#">WG1252971</a>

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc



Mercury by Method 7471B

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Mercury	0.0311		0.0200	1	03/20/2019 09:11	<a href="#">WG1252346</a>

1 Cp

2 Tc

Metals (ICP) by Method 6010C

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Arsenic	3.83		2.00	1	03/22/2019 00:54	<a href="#">WG1252971</a>
Barium	122		0.500	1	03/22/2019 00:54	<a href="#">WG1252971</a>
Cadmium	ND		0.500	1	03/22/2019 00:54	<a href="#">WG1252971</a>
Chromium	31.0		1.00	1	03/22/2019 00:54	<a href="#">WG1252971</a>
Lead	12.7		0.500	1	03/22/2019 00:54	<a href="#">WG1252971</a>
Selenium	ND		2.00	1	03/22/2019 00:54	<a href="#">WG1252971</a>
Silver	ND		1.00	1	03/22/2019 00:54	<a href="#">WG1252971</a>

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc



## Mercury by Method 7471B

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Mercury	ND		0.0200	1	03/20/2019 09:13	<a href="#">WG1252346</a>

## Metals (ICP) by Method 6010C

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Arsenic	4.34		2.00	1	03/22/2019 00:57	<a href="#">WG1252971</a>
Barium	85.8		0.500	1	03/22/2019 00:57	<a href="#">WG1252971</a>
Cadmium	ND		0.500	1	03/22/2019 00:57	<a href="#">WG1252971</a>
Chromium	16.1		1.00	1	03/22/2019 00:57	<a href="#">WG1252971</a>
Lead	17.1		0.500	1	03/22/2019 00:57	<a href="#">WG1252971</a>
Selenium	ND		2.00	1	03/22/2019 00:57	<a href="#">WG1252971</a>
Silver	ND		1.00	1	03/22/2019 00:57	<a href="#">WG1252971</a>

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc



## Mercury by Method 7471B

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Mercury	0.0354		0.0200	1	03/20/2019 09:16	<a href="#">WG1252346</a>

## Metals (ICP) by Method 6010C

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Arsenic	41.7		2.00	1	03/22/2019 01:00	<a href="#">WG1252971</a>
Barium	178		0.500	1	03/22/2019 01:00	<a href="#">WG1252971</a>
Cadmium	ND		0.500	1	03/22/2019 01:00	<a href="#">WG1252971</a>
Chromium	209		1.00	1	03/22/2019 01:00	<a href="#">WG1252971</a>
Lead	40.4		0.500	1	03/22/2019 01:00	<a href="#">WG1252971</a>
Selenium	ND		2.00	1	03/22/2019 01:00	<a href="#">WG1252971</a>
Silver	ND		1.00	1	03/22/2019 01:00	<a href="#">WG1252971</a>

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc



Mercury by Method 7471B

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Mercury	0.0393		0.0200	1	03/20/2019 09:18	<a href="#">WG1252346</a>

1 Cp

2 Tc

Metals (ICP) by Method 6010C

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Arsenic	52.9		2.00	1	03/22/2019 01:03	<a href="#">WG1252971</a>
Barium	318		0.500	1	03/22/2019 01:03	<a href="#">WG1252971</a>
Cadmium	4.64		0.500	1	03/22/2019 01:03	<a href="#">WG1252971</a>
Chromium	92.7		1.00	1	03/22/2019 01:03	<a href="#">WG1252971</a>
Lead	1250		0.500	1	03/22/2019 01:03	<a href="#">WG1252971</a>
Selenium	ND		2.00	1	03/22/2019 01:03	<a href="#">WG1252971</a>
Silver	ND		1.00	1	03/22/2019 01:03	<a href="#">WG1252971</a>

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc



Method Blank (MB)

(MB) R3393310-1 03/20/19 07:32

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
Mercury	U		0.00280	0.0200

<sup>1</sup>Cp

<sup>2</sup>Tc

<sup>3</sup>Ss

<sup>4</sup>Cn

<sup>5</sup>Sr

<sup>6</sup>Qc

<sup>7</sup>Gl

<sup>8</sup>Al

<sup>9</sup>Sc

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3393310-2 03/20/19 07:34 • (LCSD) R3393310-3 03/20/19 07:37

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Mercury	0.500	0.547	0.548	109	110	80.0-120			0.0716	20

L1079721-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1079721-01 03/20/19 07:39 • (MS) R3393310-4 03/20/19 07:42 • (MSD) R3393310-5 03/20/19 07:44

Analyte	Spike Amount mg/kg	Original Result mg/kg	MS Result mg/kg	MSD Result mg/kg	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Mercury	0.500	0.0407	0.507	0.539	93.3	99.7	1	75.0-125			6.15	20



Method Blank (MB)

(MB) R3393311-1 03/20/19 08:45

Analyte	MB Result	MB Qualifier	MB MDL	MB RDL
Mercury	U		0.00280	0.0200

<sup>1</sup> Cp

<sup>2</sup> Tc

<sup>3</sup> Ss

<sup>4</sup> Cn

<sup>5</sup> Sr

<sup>6</sup> Qc

<sup>7</sup> Gl

<sup>8</sup> Al

<sup>9</sup> Sc

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3393311-2 03/20/19 08:48 • (LCSD) R3393311-3 03/20/19 08:50

Analyte	Spike Amount	LCS Result	LCSD Result	LCS Rec.	LCSD Rec.	Rec. Limits	LCS Qualifier	LCSD Qualifier	RPD	RPD Limits
Mercury	0.500	0.551	0.555	110	111	80.0-120			0.784	20

L1079734-04 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1079734-04 03/20/19 08:53 • (MS) R3393311-4 03/20/19 08:55 • (MSD) R3393311-5 03/20/19 09:06

Analyte	Spike Amount (dry)	Original Result (dry)	MS Result (dry)	MSD Result (dry)	MS Rec.	MSD Rec.	Dilution	Rec. Limits	MS Qualifier	MSD Qualifier	RPD	RPD Limits
Mercury	0.592	U	0.590	0.555	99.7	93.7	1	75.0-125			6.16	20



Method Blank (MB)

(MB) R3394594-1 03/23/19 16:26

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
Arsenic	U		0.460	2.00
Barium	U		0.170	0.500
Cadmium	U		0.0700	0.500
Chromium	U		0.140	1.00
Lead	U		0.190	0.500
Selenium	U		0.620	2.00
Silver	U		0.120	1.00

<sup>1</sup> Cp

<sup>2</sup> Tc

<sup>3</sup> Ss

<sup>4</sup> Cn

<sup>5</sup> Sr

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3394594-2 03/23/19 16:28 • (LCSD) R3394594-3 03/23/19 16:31

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Arsenic	100	97.2	95.5	97.2	95.5	80.0-120			1.73	20
Barium	100	105	103	105	103	80.0-120			1.72	20
Cadmium	100	98.1	96.6	98.1	96.6	80.0-120			1.52	20
Chromium	100	99.8	98.4	99.8	98.4	80.0-120			1.37	20
Lead	100	99.7	97.3	99.7	97.3	80.0-120			2.42	20
Selenium	100	103	101	103	101	80.0-120			2.39	20
Silver	20.0	19.1	18.8	95.3	93.9	80.0-120			1.49	20

<sup>6</sup> Qc

<sup>7</sup> Gl

<sup>8</sup> Al

<sup>9</sup> Sc

L1079721-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1079721-01 03/23/19 16:33 • (MS) R3394594-6 03/23/19 16:41 • (MSD) R3394594-7 03/23/19 16:44

Analyte	Spike Amount mg/kg	Original Result mg/kg	MS Result mg/kg	MSD Result mg/kg	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Arsenic	100	9.64	106	98.8	96.0	89.2	1	75.0-125			6.70	20
Barium	100	142	299	242	156	99.9	1	75.0-125	M1	R5	20.9	20
Cadmium	100	ND	96.9	94.4	96.9	94.4	1	75.0-125			2.62	20
Chromium	100	34.7	127	122	92.4	87.1	1	75.0-125			4.32	20
Lead	100	21.4	243	127	222	106	1	75.0-125	M1	R5	62.6	20
Selenium	100	ND	92.3	89.1	92.3	89.1	1	75.0-125			3.47	20
Silver	20.0	ND	19.0	18.5	94.9	92.3	1	75.0-125			2.77	20



Method Blank (MB)

(MB) R3394021-1 03/22/19 00:06

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
Arsenic	U		0.460	2.00
Barium	U		0.170	0.500
Cadmium	U		0.0700	0.500
Chromium	U		0.140	1.00
Lead	U		0.190	0.500
Selenium	U		0.620	2.00
Silver	U		0.120	1.00

<sup>1</sup> Cp

<sup>2</sup> Tc

<sup>3</sup> Ss

<sup>4</sup> Cn

<sup>5</sup> Sr

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3394021-2 03/22/19 00:08 • (LCSD) R3394021-3 03/22/19 00:11

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Arsenic	100	94.7	95.0	94.7	95.0	80.0-120			0.390	20
Barium	100	103	104	103	104	80.0-120			0.683	20
Cadmium	100	97.1	97.4	97.1	97.4	80.0-120			0.290	20
Chromium	100	99.7	100	99.7	100	80.0-120			0.504	20
Lead	100	97.3	97.8	97.3	97.8	80.0-120			0.459	20
Selenium	100	94.8	95.9	94.8	95.9	80.0-120			1.17	20
Silver	20.0	19.1	19.3	95.7	96.4	80.0-120			0.721	20

<sup>6</sup> Qc

<sup>7</sup> Gl

<sup>8</sup> Al

<sup>9</sup> Sc

L1080275-07 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1080275-07 03/22/19 00:14 • (MS) R3394021-6 03/22/19 00:21 • (MSD) R3394021-7 03/22/19 00:24

Analyte	Spike Amount (dry) mg/kg	Original Result (dry) mg/kg	MS Result (dry) mg/kg	MSD Result (dry) mg/kg	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Arsenic	121	2.50	116	101	93.8	81.8	1	75.0-125			13.4	20
Barium	121	90.2	204	197	94.2	88.5	1	75.0-125			3.45	20
Cadmium	121	ND	118	103	98.2	85.6	1	75.0-125			13.6	20
Chromium	121	17.7	133	117	95.6	82.8	1	75.0-125			12.4	20
Lead	121	13.7	132	117	98.1	85.4	1	75.0-125			12.3	20
Selenium	121	ND	113	99.7	94.0	82.7	1	75.0-125			12.8	20
Silver	24.1	ND	23.6	20.4	97.9	84.7	1	75.0-125			14.4	20



Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

(dry)	Results are reported based on the dry weight of the sample. [this will only be present on a dry report basis for soils].
MDL	Method Detection Limit.
ND	Not detected at the Reporting Limit (or MDL where applicable).
RDL	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
U	Not detected at the Reporting Limit (or MDL where applicable).
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state "ND" (Not Detected) or "BDL" (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

- 1 Cp
- 2 Tc
- 3 Ss
- 4 Cn
- 5 Sr
- 6 Qc
- 7 Gl
- 8 Al
- 9 Sc

Qualifier Description

M1	Matrix spike recovery was high, the method control sample recovery was acceptable.
R5	MS/MSD RPD exceeded the laboratory acceptance limit. Recovery met acceptance criteria.



Pace National is the only environmental laboratory accredited/certified to support your work nationwide from one location. One phone call, one point of contact, one laboratory. No other lab is as accessible or prepared to handle your needs throughout the country. Our capacity and capability from our single location laboratory is comparable to the collective totals of the network laboratories in our industry. The most significant benefit to our one location design is the design of our laboratory campus. The model is conducive to accelerated productivity, decreasing turn-around time, and preventing cross contamination, thus protecting sample integrity. Our focus on premium quality and prompt service allows us to be YOUR LAB OF CHOICE.

\* Not all certifications held by the laboratory are applicable to the results reported in the attached report.  
 \* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace National.

## State Accreditations

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN-03-2002-34
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey-NELAP	TN002
California	2932	New Mexico <sup>1</sup>	n/a
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina <sup>1</sup>	DW21704
Georgia	NELAP	North Carolina <sup>3</sup>	41
Georgia <sup>1</sup>	923	North Dakota	R-140
Idaho	TN00003	Ohio-VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LA000356
Kentucky <sup>1,6</sup>	90010	South Carolina	84004
Kentucky <sup>2</sup>	16	South Dakota	n/a
Louisiana	AI30792	Tennessee <sup>1,4</sup>	2006
Louisiana <sup>1</sup>	LA180010	Texas	T104704245-18-15
Maine	TN0002	Texas <sup>5</sup>	LAB0152
Maryland	324	Utah	TN00003
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	460132
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	9980939910
Montana	CERT0086	Wyoming	A2LA

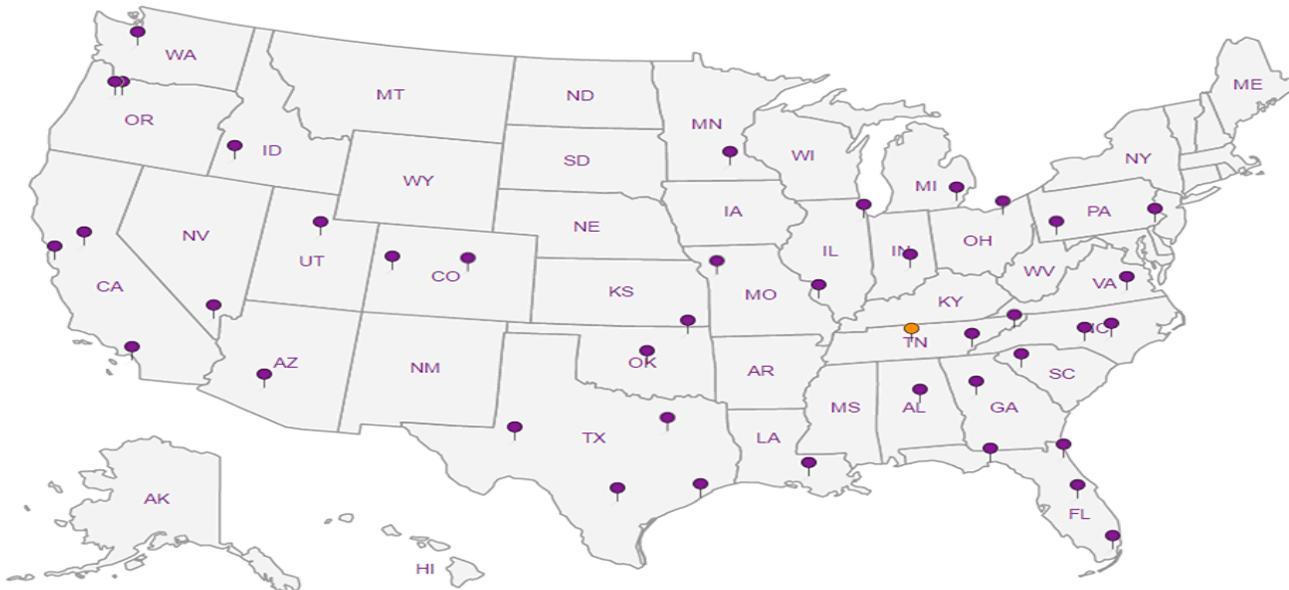
## Third Party Federal Accreditations

A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 <sup>5</sup>	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA-Crypto	TN00003		

<sup>1</sup> Drinking Water <sup>2</sup> Underground Storage Tanks <sup>3</sup> Aquatic Toxicity <sup>4</sup> Chemical/Microbiological <sup>5</sup> Mold <sup>6</sup> Wastewater n/a Accreditation not applicable

## Our Locations

Pace National has sixty-four client support centers that provide sample pickup and/or the delivery of sampling supplies. If you would like assistance from one of our support offices, please contact our main office. Pace National performs all testing at our central laboratory.



1 Cp

2 Tc

3 Ss

4 Cn

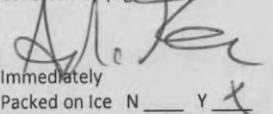
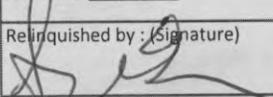
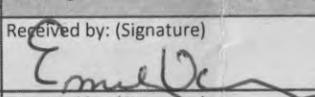
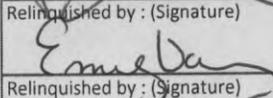
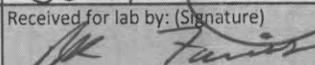
5 Sr

6 Qc

7 Gl

8 Al

9 Sc

<b>GeoTEK</b> 4050 E. Cotton Center Blvd Suite 49 Phoenix, AZ 85040		Billing Information:		Pres Chk		Analysis / Container / Preservative										Chain of Custody Page 1 of 3									
Report to: <b>Adriane Gora</b>		Email To: <b>agora@geotekusa.com</b>		<b>BCCA METALS 60187471B</b>																					
Project Description:		City/State Collected: <b>Peoria AZ</b>														Lab Project #:		12065 Lebanon Rd Mount Juliet, TN 37122 Phone: 615-758-5858 Phone: 800-767-5859 Fax: 615-758-5859							
Phone: Fax:		Client Project # <b>1795.1-PHR</b>														Lab Project #:		L# <b>1079721</b>		<b>H246</b>					
Collected by (print): <b>Adriane Gora</b>		Site/Facility ID #														P.O. #		Acctnum: <b>GEOTEKTA2</b>		Template:					
Collected by (signature): 		<b>Rush?</b> (Lab MUST Be Notified) <input type="checkbox"/> Same Day <input type="checkbox"/> Five Day <input type="checkbox"/> Next Day <input type="checkbox"/> 5 Day (Rad Only) <input type="checkbox"/> Two Day <input type="checkbox"/> 10 Day (Rad Only) <input type="checkbox"/> Three Day														Quote #		Date Results Needed <b>5/11</b>		Prelogin:					
Immediately Packed on Ice N <input type="checkbox"/> Y <input checked="" type="checkbox"/>																No. of Cntrs		TSR:		PB:					
Sample ID		Comp/Grab														Matrix *		Depth		Date		Time		Shipped Via:	
G1		grab														SS		0-3in		0-3in		7:43		Remarks Sample # (lab only)	
G2																		0-3in		0-3in		7:49		01	
G3																		0-3in		0-3in		7:56		02	
T1-S1						2-3ft		2-3ft		8:09		03													
T2-S1						7-8ft		7-8ft		8:31		04													
T3-S1						7-8ft		7-8ft		8:58		05													
G4						0-3in		0-3in		9:08		06													
T4-S1						2-3ft		2-3ft		9:14		07													
G5						0-3in		0-3in		9:25		08													
T5-S1						1-2ft		1-2ft		10:39		09													
* Matrix: SS - Soil AIR - Air F - Filter GW - Groundwater B - Bioassay WW - WasteWater DW - Drinking Water OT - Other		Remarks: <b>RAD SCREEN: &lt;0.5 mR/hr</b>		Samples returned via: <input type="checkbox"/> UPS <input type="checkbox"/> FedEx <input type="checkbox"/> Courier <input checked="" type="checkbox"/> <b>SWA</b>		Tracking #		pH _____ Temp _____ Flow _____ Other _____		Sample Receipt Checklist COC Seal Present/Intact: <input type="checkbox"/> NP <input checked="" type="checkbox"/> Y <input type="checkbox"/> N COC Signed/Accurate: <input checked="" type="checkbox"/> Y <input type="checkbox"/> N Bottles arrive intact: <input checked="" type="checkbox"/> Y <input type="checkbox"/> N Correct bottles used: <input checked="" type="checkbox"/> Y <input type="checkbox"/> N Sufficient volume sent: <input checked="" type="checkbox"/> Y <input type="checkbox"/> N If Applicable VOA Zero Headspace: <input type="checkbox"/> Y <input checked="" type="checkbox"/> N Preservation Correct/Checked: <input type="checkbox"/> Y <input checked="" type="checkbox"/> N															
Relinquished by: (Signature) 		Date: <b>3-15-19</b>		Time: <b>3:49</b>		Received by: (Signature) 		Trip Blank Received: Yes (No) <input checked="" type="checkbox"/> HCL/MeOH TBR		If preservation required by Login: Date/Time															
Relinquished by: (Signature) 		Date: <b>3/15/19</b>		Time: <b>1800</b>		Received by: (Signature) <b>SWA</b>		Temp: °C <b>5.2-0.1-5.1</b> <b>25</b>		Hold:		Condition: <b>NCF / OK</b>													
Relinquished by: (Signature) 		Date:		Time:		Received for lab by: (Signature) 		Date: <b>3/16/19</b>		Time: <b>0230</b>		Condition:													

ESCAZ

QCOTek  
4050 E. Cotton Center Blvd  
Suite 49 Phoenix AZ  
85040

Billing Information:

Analysis / Container / Preservative

Chain of Custody Page 2 of 3

Pres Chk



12065 Lebanon Rd  
Mount Juliet, TN 37122  
Phone: 615-758-5858  
Phone: 800-767-5859  
Fax: 615-758-5859



Report to: **Adriane Gora**

Email To: **agora@qcotekusa.com**

Project Description:

City/State Collected: **Peoria AZ**

Phone:  
Fax:

Client Project #  
**1795.1-PHR**

Lab Project #

Collected by (print): **Adriane Gora**

Site/Facility ID #

P.O. #

Collected by (signature): *Adriane Gora*

**Rush?** (Lab MUST Be Notified)  
 Same Day  Five Day  
 Next Day  5 Day (Rad Only)  
 Two Day  10 Day (Rad Only)  
 Three Day

Quote #

Immediately Packed on Ice N  Y

Date Results Needed  
**5/11**

No. of Cntrs

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	Remarks	Sample # (lab only)
AD-1	Grab	SS	0-3in	3-15-19	10:45	1		11
AD-2			0-3in		10:48	1		12
G6			0-3in		11:14	1		13
G7			0-3in		11:26	1		14
G8			0-3in		11:23	1		15
T7-S1			2ft		11:48	1		16
T8-S1			1ft		11:53	1		17
T9-S1			4ft		12:11	1		18
T10-S1			4ft		12:33	1		19
G9			0-3in		1304	1		20

BCCA Metals 601B/771A

\* Matrix:  
 SS - Soil AIR - Air F - Filter  
 GW - Groundwater B - Bioassay  
 WW - WasteWater  
 DW - Drinking Water  
 OT - Other

Remarks:

**RAD SCREEN: <0.5 mR/hr**

Samples returned via: SWA  
 UPS  FedEx  Courier

Tracking #

**Sample Receipt Checklist**

COC Seal Present/Intact:  NP  Y  N  
 COC Signed/Accurate:  Y  N  
 Bottles arrive intact:  Y  N  
 Correct bottles used:  Y  N  
 Sufficient volume sent:  Y  N  
 If Applicable  
 VOA Zero Headpace:  Y  N  
 Preservation Correct/Checked:  Y  N

Relinquished by (Signature): *Adriane Gora*

Date: **3-15-19** Time: **3:49**

Received by (Signature): *Emmett*

Trip Blank Received: Yes  No   
 HCL / MeOH  
 TBR

Relinquished by (Signature): *Emmett*

Date: **3/15/19** Time: **1800**

Received by (Signature): *SWA*

Temp: **5.2-0.1 = 5.1** °C  
 Bottles Received: **25**

If preservation required by Login: Date/Time

Relinquished by (Signature): *ESCAZ*

Date: **3/16/19** Time: **1230**

Received for lab by (Signature): *ESCAZ*

Date: **3/16/19** Time: **1230**

Hold: Condition: **NCF / OK**

Geotek  
4050 E. Cotton Center Blvd  
Suite 49 Phoenix AZ 85040

Billing Information:

Pres  
Chk

Analysis / Container / Preservative

Chain of Custody Page 2 of 3



12065 Lebanon Rd  
Mount Juliet, TN 37122  
Phone: 615-758-5858  
Phone: 800-767-5859  
Fax: 615-758-5859



Report to: Adriane Gora

Email To: agora@geotekusa.com

Project Description:

City/State Collected: Peoria AZ

Phone:  
Fax:

Client Project #  
1795.1-PHR

Lab Project #

Collected by (print):  
Adriane Gora

Site/Facility ID #

P.O. #

Collected by (signature):  
[Signature]  
Immediately Packed on Ice N  Y

Rush? (Lab MUST Be Notified)  
 Same Day  Five Day  
 Next Day  5 Day (Rad Only)  
 Two Day  10 Day (Rad Only)  
 Three Day

Quote #  
Date Results Needed  
STT

No. of  
Cntrs

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs
T11-S1	grab	SS	8-9ft	3-15-17	B08	1
G11	↓	↓	0-3in	↓	1316	1
G12	↓	↓	0-3in	↓	1320	1
G13	↓	↓	0-3in	↓	1330	1
G10	↓	↓	0-3in	↓	1312	1

BCCRA Metals Lab/HTIA

L# 1079721

Table #

Acctnum: GGOTEKTAZ

Template:

Prelogin:

TSR:

PB:

Shipped Via:

\* Matrix:  
 SS - Soil AIR - Air F - Filter  
 GW - Groundwater B - Bioassay  
 WW - WasteWater  
 DW - Drinking Water  
 OT - Other

Remarks:  
 Samples returned via: SWA  
 Tracking #  
 RAD SCREEN: 0.5 mB/hr

Sample Receipt Checklist  
 COC Seal Present/Intact:  NP  Y  N  
 COC Signed/Accurate:  Y  N  
 Bottles arrive intact:  Y  N  
 Correct bottles used:  Y  N  
 Sufficient volume sent:  Y  N  
 If Applicable  
 VOA Zero Headspace:  Y  N  
 Preservation Correct/Checked:  Y  N

Relinquished by: (Signature)  
[Signature]

Date: 3-15-19  
Time: 3:49

Received by: (Signature)  
[Signature]

Trip Blank Received: Yes  No   
HCL/MeOH  
TBR

Relinquished by: (Signature)  
[Signature]

Date: 3/15/19  
Time: 1800

Received by: (Signature)  
SWA

Temp: °C 5.2-0.1-5.5  
Bottles Received: 25

If preservation required by Login: Date/Time

Relinquished by: (Signature)  
[Signature]

Date: 3/16/19  
Time: 1230

Received for lab by: (Signature)  
[Signature]

Date: 3/16/19  
Time: 1230

Hold:  
Condition: NCF 10X

SSCAZ

April 09, 2019

## GeoTek

Sample Delivery Group: L1084153  
Samples Received: 03/30/2019  
Project Number: 1795.1-PHR  
Description:

Report To: Adriane Gora  
4050 Cotton Center Blvd  
Phoenix, AZ 85282

Entire Report Reviewed By:



Daphne Richards  
Project Manager

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by Pace National is performed per guidance provided in laboratory standard operating procedures: 060302, 060303, and 060304.



<b>Cp: Cover Page</b>	<b>1</b>	
<b>Tc: Table of Contents</b>	<b>2</b>	
<b>Ss: Sample Summary</b>	<b>3</b>	
<b>Cn: Case Narrative</b>	<b>5</b>	
<b>Sr: Sample Results</b>	<b>6</b>	
G2-2 L1084153-01	6	
AD2-1 L1084153-02	7	
AD2-2 L1084153-03	8	
AD2-3 L1084153-04	9	
AD2-4 L1084153-05	10	
AD2-5 L1084153-06	11	
AD2-6 L1084153-07	12	
AD-3 L1084153-08	13	
AD-1-1 L1084153-09	14	
AD-4 L1084153-10	15	
<b>Qc: Quality Control Summary</b>	<b>16</b>	
Mercury by Method 7471B	16	
Metals (ICP) by Method 6010C	17	
<b>Gl: Glossary of Terms</b>	<b>18</b>	
<b>Al: Accreditations &amp; Locations</b>	<b>19</b>	
<b>Sc: Sample Chain of Custody</b>	<b>20</b>	

# SAMPLE SUMMARY



## G2-2 L1084153-01 Solid

Collected by  
Adriana Gora  
Collected date/time  
03/29/19 10:04  
Received date/time  
03/30/19 08:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471B	WG1259976	1	04/03/19 09:43	04/03/19 19:22	TCT	Mt. Juliet, TN
Metals (ICP) by Method 6010C	WG1260055	1	04/03/19 13:06	04/08/19 12:59	CCE	Mt. Juliet, TN

1  
Cp

2  
Tc

3  
Ss

4  
Cn

5  
Sr

6  
Qc

7  
Gl

8  
Al

9  
Sc

## AD2-1 L1084153-02 Solid

Collected by  
Adriana Gora  
Collected date/time  
03/29/19 10:12  
Received date/time  
03/30/19 08:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471B	WG1259976	1	04/03/19 09:43	04/03/19 19:24	TCT	Mt. Juliet, TN
Metals (ICP) by Method 6010C	WG1260055	1	04/03/19 13:06	04/08/19 13:01	CCE	Mt. Juliet, TN

## AD2-2 L1084153-03 Solid

Collected by  
Adriana Gora  
Collected date/time  
03/29/19 10:15  
Received date/time  
03/30/19 08:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471B	WG1259976	1	04/03/19 09:43	04/03/19 19:27	TCT	Mt. Juliet, TN
Metals (ICP) by Method 6010C	WG1260055	1	04/03/19 13:06	04/08/19 13:04	CCE	Mt. Juliet, TN

## AD2-3 L1084153-04 Solid

Collected by  
Adriana Gora  
Collected date/time  
03/29/19 10:20  
Received date/time  
03/30/19 08:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471B	WG1259976	1	04/03/19 09:43	04/03/19 19:29	TCT	Mt. Juliet, TN
Metals (ICP) by Method 6010C	WG1260055	1	04/03/19 13:06	04/08/19 13:07	CCE	Mt. Juliet, TN

## AD2-4 L1084153-05 Solid

Collected by  
Adriana Gora  
Collected date/time  
03/29/19 10:24  
Received date/time  
03/30/19 08:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471B	WG1259976	1	04/03/19 09:43	04/03/19 19:14	TCT	Mt. Juliet, TN
Metals (ICP) by Method 6010C	WG1260055	1	04/03/19 13:06	04/08/19 13:10	CCE	Mt. Juliet, TN

## AD2-5 L1084153-06 Solid

Collected by  
Adriana Gora  
Collected date/time  
03/29/19 10:28  
Received date/time  
03/30/19 08:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471B	WG1259976	1	04/03/19 09:43	04/03/19 19:32	TCT	Mt. Juliet, TN
Metals (ICP) by Method 6010C	WG1260055	1	04/03/19 13:06	04/08/19 13:12	CCE	Mt. Juliet, TN

## AD2-6 L1084153-07 Solid

Collected by  
Adriana Gora  
Collected date/time  
03/29/19 10:36  
Received date/time  
03/30/19 08:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471B	WG1259976	1	04/03/19 09:43	04/03/19 19:47	TCT	Mt. Juliet, TN
Metals (ICP) by Method 6010C	WG1260055	1	04/03/19 13:06	04/08/19 13:15	CCE	Mt. Juliet, TN

# SAMPLE SUMMARY



## AD-3 L1084153-08 Solid

Collected by: Adriana Gora  
 Collected date/time: 03/29/19 10:53  
 Received date/time: 03/30/19 08:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471B	WG1259976	1	04/03/19 09:43	04/03/19 19:50	TCT	Mt. Juliet, TN
Metals (ICP) by Method 6010C	WG1260055	1	04/03/19 13:06	04/08/19 13:18	CCE	Mt. Juliet, TN

<sup>1</sup> Cp

<sup>2</sup> Tc

<sup>3</sup> Ss

## AD-1-1 L1084153-09 Solid

Collected by: Adriana Gora  
 Collected date/time: 03/29/19 11:07  
 Received date/time: 03/30/19 08:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471B	WG1259976	1	04/03/19 09:43	04/03/19 19:52	TCT	Mt. Juliet, TN
Metals (ICP) by Method 6010C	WG1260055	1	04/03/19 13:06	04/08/19 13:21	CCE	Mt. Juliet, TN

<sup>4</sup> Cn

<sup>5</sup> Sr

<sup>6</sup> Qc

## AD-4 L1084153-10 Solid

Collected by: Adriana Gora  
 Collected date/time: 03/29/19 11:12  
 Received date/time: 03/30/19 08:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471B	WG1259976	1	04/03/19 09:43	04/03/19 19:55	TCT	Mt. Juliet, TN
Metals (ICP) by Method 6010C	WG1260055	1	04/03/19 13:06	04/08/19 13:23	CCE	Mt. Juliet, TN

<sup>7</sup> Gl

<sup>8</sup> Al

<sup>9</sup> Sc



All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times, unless qualified or notated within the report. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.

Daphne Richards  
Project Manager

- <sup>1</sup> Cp
- <sup>2</sup> Tc
- <sup>3</sup> Ss
- <sup>4</sup> Cn
- <sup>5</sup> Sr
- <sup>6</sup> Qc
- <sup>7</sup> Gl
- <sup>8</sup> Al
- <sup>9</sup> Sc



Mercury by Method 7471B

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Mercury	0.0246	B1	0.0200	1	04/03/2019 19:22	<a href="#">WG1259976</a>

Metals (ICP) by Method 6010C

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Arsenic	42.2		2.00	1	04/08/2019 12:59	<a href="#">WG1260055</a>
Barium	243		0.500	1	04/08/2019 12:59	<a href="#">WG1260055</a>
Cadmium	1.23		0.500	1	04/08/2019 12:59	<a href="#">WG1260055</a>
Chromium	15.5		1.00	1	04/08/2019 12:59	<a href="#">WG1260055</a>
Lead	519		0.500	1	04/08/2019 12:59	<a href="#">WG1260055</a>
Selenium	ND		2.00	1	04/08/2019 12:59	<a href="#">WG1260055</a>
Silver	ND		1.00	1	04/08/2019 12:59	<a href="#">WG1260055</a>

- 1 Cp
- 2 Tc
- 3 Ss
- 4 Cn
- 5 Sr
- 6 Qc
- 7 Gl
- 8 Al
- 9 Sc



Mercury by Method 7471B

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Mercury	0.0272	B1	0.0200	1	04/03/2019 19:24	<a href="#">WG1259976</a>

Metals (ICP) by Method 6010C

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Arsenic	5.86		2.00	1	04/08/2019 13:01	<a href="#">WG1260055</a>
Barium	120		0.500	1	04/08/2019 13:01	<a href="#">WG1260055</a>
Cadmium	ND		0.500	1	04/08/2019 13:01	<a href="#">WG1260055</a>
Chromium	17.0		1.00	1	04/08/2019 13:01	<a href="#">WG1260055</a>
Lead	59.8		0.500	1	04/08/2019 13:01	<a href="#">WG1260055</a>
Selenium	ND		2.00	1	04/08/2019 13:01	<a href="#">WG1260055</a>
Silver	ND		1.00	1	04/08/2019 13:01	<a href="#">WG1260055</a>

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc



Mercury by Method 7471B

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Mercury	0.0216	B1	0.0200	1	04/03/2019 19:27	<a href="#">WG1259976</a>

Metals (ICP) by Method 6010C

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Arsenic	46.2		2.00	1	04/08/2019 13:04	<a href="#">WG1260055</a>
Barium	201		0.500	1	04/08/2019 13:04	<a href="#">WG1260055</a>
Cadmium	1.03		0.500	1	04/08/2019 13:04	<a href="#">WG1260055</a>
Chromium	14.3		1.00	1	04/08/2019 13:04	<a href="#">WG1260055</a>
Lead	242		0.500	1	04/08/2019 13:04	<a href="#">WG1260055</a>
Selenium	ND		2.00	1	04/08/2019 13:04	<a href="#">WG1260055</a>
Silver	ND		1.00	1	04/08/2019 13:04	<a href="#">WG1260055</a>

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc



Mercury by Method 7471B

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Mercury	0.0247	B1	0.0200	1	04/03/2019 19:29	<a href="#">WG1259976</a>

Metals (ICP) by Method 6010C

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Arsenic	12.4		2.00	1	04/08/2019 13:07	<a href="#">WG1260055</a>
Barium	140		0.500	1	04/08/2019 13:07	<a href="#">WG1260055</a>
Cadmium	0.718		0.500	1	04/08/2019 13:07	<a href="#">WG1260055</a>
Chromium	22.0		1.00	1	04/08/2019 13:07	<a href="#">WG1260055</a>
Lead	171		0.500	1	04/08/2019 13:07	<a href="#">WG1260055</a>
Selenium	ND		2.00	1	04/08/2019 13:07	<a href="#">WG1260055</a>
Silver	ND		1.00	1	04/08/2019 13:07	<a href="#">WG1260055</a>

- 1 Cp
- 2 Tc
- 3 Ss
- 4 Cn
- 5 Sr
- 6 Qc
- 7 Gl
- 8 Al
- 9 Sc



Mercury by Method 7471B

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Mercury	0.175	M1 R5	0.0200	1	04/03/2019 19:14	<a href="#">WG1259976</a>

Metals (ICP) by Method 6010C

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Arsenic	180		2.00	1	04/08/2019 13:10	<a href="#">WG1260055</a>
Barium	968		0.500	1	04/08/2019 13:10	<a href="#">WG1260055</a>
Cadmium	6.36		0.500	1	04/08/2019 13:10	<a href="#">WG1260055</a>
Chromium	26.1		1.00	1	04/08/2019 13:10	<a href="#">WG1260055</a>
Lead	9010		0.500	1	04/08/2019 13:10	<a href="#">WG1260055</a>
Selenium	ND		2.00	1	04/08/2019 13:10	<a href="#">WG1260055</a>
Silver	1.54		1.00	1	04/08/2019 13:10	<a href="#">WG1260055</a>

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc



Mercury by Method 7471B

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Mercury	ND		0.0200	1	04/03/2019 19:32	<a href="#">WG1259976</a>

Metals (ICP) by Method 6010C

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Arsenic	33.4		2.00	1	04/08/2019 13:12	<a href="#">WG1260055</a>
Barium	162		0.500	1	04/08/2019 13:12	<a href="#">WG1260055</a>
Cadmium	0.839		0.500	1	04/08/2019 13:12	<a href="#">WG1260055</a>
Chromium	19.3		1.00	1	04/08/2019 13:12	<a href="#">WG1260055</a>
Lead	184		0.500	1	04/08/2019 13:12	<a href="#">WG1260055</a>
Selenium	ND		2.00	1	04/08/2019 13:12	<a href="#">WG1260055</a>
Silver	ND		1.00	1	04/08/2019 13:12	<a href="#">WG1260055</a>

- 1 Cp
- 2 Tc
- 3 Ss
- 4 Cn
- 5 Sr
- 6 Qc
- 7 Gl
- 8 Al
- 9 Sc



Mercury by Method 7471B

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Mercury	0.0459	B1	0.0200	1	04/03/2019 19:47	<a href="#">WG1259976</a>

1 Cp

2 Tc

Metals (ICP) by Method 6010C

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Arsenic	12.1		2.00	1	04/08/2019 13:15	<a href="#">WG1260055</a>
Barium	125		0.500	1	04/08/2019 13:15	<a href="#">WG1260055</a>
Cadmium	0.861		0.500	1	04/08/2019 13:15	<a href="#">WG1260055</a>
Chromium	18.1		1.00	1	04/08/2019 13:15	<a href="#">WG1260055</a>
Lead	131		0.500	1	04/08/2019 13:15	<a href="#">WG1260055</a>
Selenium	ND		2.00	1	04/08/2019 13:15	<a href="#">WG1260055</a>
Silver	ND		1.00	1	04/08/2019 13:15	<a href="#">WG1260055</a>

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc



Mercury by Method 7471B

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Mercury	0.0245	B1	0.0200	1	04/03/2019 19:50	<a href="#">WG1259976</a>

1 Cp

2 Tc

Metals (ICP) by Method 6010C

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Arsenic	5.41		2.00	1	04/08/2019 13:18	<a href="#">WG1260055</a>
Barium	176		0.500	1	04/08/2019 13:18	<a href="#">WG1260055</a>
Cadmium	ND		0.500	1	04/08/2019 13:18	<a href="#">WG1260055</a>
Chromium	15.4		1.00	1	04/08/2019 13:18	<a href="#">WG1260055</a>
Lead	18.3		0.500	1	04/08/2019 13:18	<a href="#">WG1260055</a>
Selenium	ND		2.00	1	04/08/2019 13:18	<a href="#">WG1260055</a>
Silver	ND		1.00	1	04/08/2019 13:18	<a href="#">WG1260055</a>

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc



Mercury by Method 7471B

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Mercury	0.0333	B1	0.0200	1	04/03/2019 19:52	<a href="#">WG1259976</a>

Metals (ICP) by Method 6010C

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Arsenic	69.0		2.00	1	04/08/2019 13:21	<a href="#">WG1260055</a>
Barium	114		0.500	1	04/08/2019 13:21	<a href="#">WG1260055</a>
Cadmium	ND		0.500	1	04/08/2019 13:21	<a href="#">WG1260055</a>
Chromium	290		1.00	1	04/08/2019 13:21	<a href="#">WG1260055</a>
Lead	20.1		0.500	1	04/08/2019 13:21	<a href="#">WG1260055</a>
Selenium	ND		2.00	1	04/08/2019 13:21	<a href="#">WG1260055</a>
Silver	ND		1.00	1	04/08/2019 13:21	<a href="#">WG1260055</a>

- 1 Cp
- 2 Tc
- 3 Ss
- 4 Cn
- 5 Sr
- 6 Qc
- 7 Gl
- 8 Al
- 9 Sc



Mercury by Method 7471B

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Mercury	0.0992		0.0200	1	04/03/2019 19:55	<a href="#">WG1259976</a>

1 Cp

2 Tc

Metals (ICP) by Method 6010C

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Arsenic	197		2.00	1	04/08/2019 13:23	<a href="#">WG1260055</a>
Barium	175		0.500	1	04/08/2019 13:23	<a href="#">WG1260055</a>
Cadmium	ND		0.500	1	04/08/2019 13:23	<a href="#">WG1260055</a>
Chromium	64.9		1.00	1	04/08/2019 13:23	<a href="#">WG1260055</a>
Lead	53.1		0.500	1	04/08/2019 13:23	<a href="#">WG1260055</a>
Selenium	ND		2.00	1	04/08/2019 13:23	<a href="#">WG1260055</a>
Silver	ND		1.00	1	04/08/2019 13:23	<a href="#">WG1260055</a>

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc



Method Blank (MB)

(MB) R3398184-1 04/03/19 19:01

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
Mercury	0.00472	E4	0.00280	0.0200

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Qc

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3398184-2 04/03/19 19:09 • (LCSD) R3398184-3 04/03/19 19:12

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Mercury	0.300	0.282	0.287	94.0	95.6	80.0-120			1.67	20

L1084153-05 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1084153-05 04/03/19 19:14 • (MS) R3398184-4 04/03/19 19:17 • (MSD) R3398184-5 04/03/19 19:19

Analyte	Spike Amount mg/kg	Original Result mg/kg	MS Result mg/kg	MSD Result mg/kg	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Mercury	0.300	0.175	0.724	0.965	183	263	1	75.0-125	M1	E1 M1 R5	28.6	20

7 Gl

8 Al

9 Sc



Method Blank (MB)

(MB) R3399557-1 04/08/19 12:26

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
Arsenic	U		0.460	2.00
Barium	U		0.170	0.500
Cadmium	U		0.0700	0.500
Chromium	U		0.140	1.00
Lead	U		0.190	0.500
Selenium	U		0.620	2.00
Silver	U		0.120	1.00



Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3399557-2 04/08/19 12:29 • (LCSD) R3399557-3 04/08/19 12:31

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Arsenic	100	95.9	94.3	95.9	94.3	80.0-120			1.66	20
Barium	100	107	105	107	105	80.0-120			1.85	20
Cadmium	100	97.4	96.0	97.4	96.0	80.0-120			1.48	20
Chromium	100	99.3	98.3	99.3	98.3	80.0-120			1.01	20
Lead	100	99.7	97.9	99.7	97.9	80.0-120			1.80	20
Selenium	100	96.4	94.6	96.4	94.6	80.0-120			1.83	20
Silver	20.0	18.9	18.8	94.7	94.0	80.0-120			0.797	20



L1084206-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1084206-01 04/08/19 12:34 • (MS) R3399557-6 04/08/19 12:42 • (MSD) R3399557-7 04/08/19 12:45

Analyte	Spike Amount (dry) mg/kg	Original Result (dry) mg/kg	MS Result (dry) mg/kg	MSD Result (dry) mg/kg	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Arsenic	111	4.89	113	117	97.0	101	1	75.0-125			3.58	20
Barium	111	18.7	121	137	92.1	106	1	75.0-125			12.3	20
Cadmium	111	U	111	115	100	103	1	75.0-125			3.02	20
Chromium	111	9.31	102	112	83.1	92.6	1	75.0-125			9.85	20
Lead	111	5.23	113	122	97.1	105	1	75.0-125			7.34	20
Selenium	111	U	108	114	97.0	103	1	75.0-125			5.59	20
Silver	22.3	U	22.2	23.0	99.7	103	1	75.0-125			3.53	20



Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Abbreviations and Definitions

(dry)	Results are reported based on the dry weight of the sample. [this will only be present on a dry report basis for soils].
MDL	Method Detection Limit.
ND	Not detected at the Reporting Limit (or MDL where applicable).
RDL	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
U	Not detected at the Reporting Limit (or MDL where applicable).
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state "ND" (Not Detected) or "BDL" (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

- 1 Cp
- 2 Tc
- 3 Ss
- 4 Cn
- 5 Sr
- 6 Qc
- 7 Gl
- 8 Al
- 9 Sc

Qualifier	Description
B1	Target analyte detected in method blank at or above the method reporting limit.
E1	Concentration estimated. Analyte exceeded calibration range. Reanalysis not possible due to insufficient sample.
E4	Concentration estimated. Analyte was detected below laboratory minimum reporting level (MRL) but above MDL.
M1	Matrix spike recovery was high, the method control sample recovery was acceptable.
R5	MS/MSD RPD exceeded the laboratory acceptance limit. Recovery met acceptance criteria.



Pace National is the only environmental laboratory accredited/certified to support your work nationwide from one location. One phone call, one point of contact, one laboratory. No other lab is as accessible or prepared to handle your needs throughout the country. Our capacity and capability from our single location laboratory is comparable to the collective totals of the network laboratories in our industry. The most significant benefit to our one location design is the design of our laboratory campus. The model is conducive to accelerated productivity, decreasing turn-around time, and preventing cross contamination, thus protecting sample integrity. Our focus on premium quality and prompt service allows us to be YOUR LAB OF CHOICE.

\* Not all certifications held by the laboratory are applicable to the results reported in the attached report.  
 \* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace National.

## State Accreditations

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN-03-2002-34
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey-NELAP	TN002
California	2932	New Mexico <sup>1</sup>	n/a
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina <sup>1</sup>	DW21704
Georgia	NELAP	North Carolina <sup>3</sup>	41
Georgia <sup>1</sup>	923	North Dakota	R-140
Idaho	TN00003	Ohio-VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LA000356
Kentucky <sup>1,6</sup>	90010	South Carolina	84004
Kentucky <sup>2</sup>	16	South Dakota	n/a
Louisiana	AI30792	Tennessee <sup>1,4</sup>	2006
Louisiana <sup>1</sup>	LA180010	Texas	T104704245-18-15
Maine	TN0002	Texas <sup>5</sup>	LAB0152
Maryland	324	Utah	TN00003
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	460132
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	9980939910
Montana	CERT0086	Wyoming	A2LA

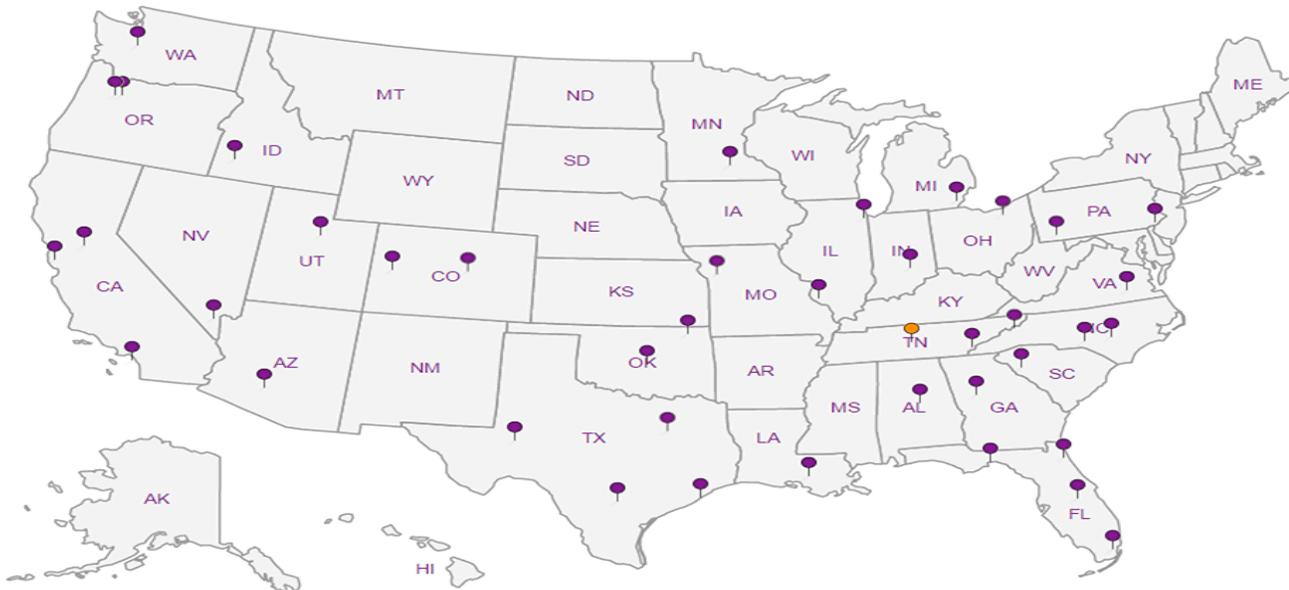
## Third Party Federal Accreditations

A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 <sup>5</sup>	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA-Crypto	TN00003		

<sup>1</sup> Drinking Water <sup>2</sup> Underground Storage Tanks <sup>3</sup> Aquatic Toxicity <sup>4</sup> Chemical/Microbiological <sup>5</sup> Mold <sup>6</sup> Wastewater n/a Accreditation not applicable

## Our Locations

Pace National has sixty-four client support centers that provide sample pickup and/or the delivery of sampling supplies. If you would like assistance from one of our support offices, please contact our main office. Pace National performs all testing at our central laboratory.



1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc



April 25, 2019

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc

## GeoTek

Sample Delivery Group: L1091528  
Samples Received: 04/23/2019  
Project Number: 1795.1-PHR  
Description:

Report To: Adriane Gora  
4050 Cotton Center Blvd  
Phoenix, AZ 85282

Entire Report Reviewed By:



Daphne Richards  
Project Manager

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by Pace National is performed per guidance provided in laboratory standard operating procedures: 060302, 060303, and 060304.



<b>Cp: Cover Page</b>	<b>1</b>	<b><sup>1</sup>Cp</b>
<b>Tc: Table of Contents</b>	<b>2</b>	<b><sup>2</sup>Tc</b>
<b>Ss: Sample Summary</b>	<b>3</b>	<b><sup>3</sup>Ss</b>
<b>Cn: Case Narrative</b>	<b>4</b>	<b><sup>4</sup>Cn</b>
<b>Sr: Sample Results</b>	<b>5</b>	<b><sup>5</sup>Sr</b>
AD2-9 L1091528-01	<b>5</b>	
AD2-7 L1091528-02	<b>6</b>	
AD2-8 L1091528-03	<b>7</b>	
<b>Qc: Quality Control Summary</b>	<b>8</b>	<b><sup>6</sup>Qc</b>
Mercury by Method 7471B	<b>8</b>	
Metals (ICP) by Method 6010C	<b>9</b>	
<b>Gl: Glossary of Terms</b>	<b>10</b>	<b><sup>7</sup>Gl</b>
<b>Al: Accreditations &amp; Locations</b>	<b>11</b>	<b><sup>8</sup>Al</b>
<b>Sc: Sample Chain of Custody</b>	<b>12</b>	<b><sup>9</sup>Sc</b>

# SAMPLE SUMMARY



## AD2-9 L1091528-01 Solid

Collected by: Adriane Gora  
 Collected date/time: 04/22/19 09:17  
 Received date/time: 04/23/19 08:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471B	WG1270653	1	04/23/19 16:19	04/24/19 11:12	ABL	Mt. Juliet, TN
Metals (ICP) by Method 6010C	WG1270953	1	04/24/19 09:18	04/24/19 21:09	TRB	Mt. Juliet, TN

<sup>1</sup> Cp

<sup>2</sup> Tc

<sup>3</sup> Ss

## AD2-7 L1091528-02 Solid

Collected by: Adriane Gora  
 Collected date/time: 04/22/19 09:43  
 Received date/time: 04/23/19 08:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471B	WG1270653	1	04/23/19 16:19	04/24/19 11:14	ABL	Mt. Juliet, TN
Metals (ICP) by Method 6010C	WG1270953	1	04/24/19 09:18	04/24/19 21:11	TRB	Mt. Juliet, TN

<sup>4</sup> Cn

<sup>5</sup> Sr

<sup>6</sup> Qc

## AD2-8 L1091528-03 Solid

Collected by: Adriane Gora  
 Collected date/time: 04/22/19 09:48  
 Received date/time: 04/23/19 08:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Mercury by Method 7471B	WG1270653	1	04/23/19 16:19	04/24/19 11:17	ABL	Mt. Juliet, TN
Metals (ICP) by Method 6010C	WG1270953	1	04/24/19 09:18	04/24/19 21:14	TRB	Mt. Juliet, TN

<sup>7</sup> Gl

<sup>8</sup> Al

<sup>9</sup> Sc



All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times, unless qualified or notated within the report. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.

Daphne Richards  
Project Manager

- <sup>1</sup> Cp
- <sup>2</sup> Tc
- <sup>3</sup> Ss
- <sup>4</sup> Cn
- <sup>5</sup> Sr
- <sup>6</sup> Qc
- <sup>7</sup> Gl
- <sup>8</sup> Al
- <sup>9</sup> Sc



Mercury by Method 7471B

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Mercury	0.0310		0.0200	1	04/24/2019 11:12	<a href="#">WG1270653</a>

1 Cp

2 Tc

Metals (ICP) by Method 6010C

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Arsenic	9.43		2.00	1	04/24/2019 21:09	<a href="#">WG1270953</a>
Barium	158		0.500	1	04/24/2019 21:09	<a href="#">WG1270953</a>
Cadmium	ND		0.500	1	04/24/2019 21:09	<a href="#">WG1270953</a>
Chromium	52.5		1.00	1	04/24/2019 21:09	<a href="#">WG1270953</a>
Lead	198		0.500	1	04/24/2019 21:09	<a href="#">WG1270953</a>
Selenium	ND		2.00	1	04/24/2019 21:09	<a href="#">WG1270953</a>
Silver	ND		1.00	1	04/24/2019 21:09	<a href="#">WG1270953</a>

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc



Mercury by Method 7471B

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Mercury	0.0228		0.0200	1	04/24/2019 11:14	<a href="#">WG1270653</a>

1 Cp

2 Tc

Metals (ICP) by Method 6010C

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Arsenic	8.19		2.00	1	04/24/2019 21:11	<a href="#">WG1270953</a>
Barium	134		0.500	1	04/24/2019 21:11	<a href="#">WG1270953</a>
Cadmium	ND		0.500	1	04/24/2019 21:11	<a href="#">WG1270953</a>
Chromium	24.9		1.00	1	04/24/2019 21:11	<a href="#">WG1270953</a>
Lead	200		0.500	1	04/24/2019 21:11	<a href="#">WG1270953</a>
Selenium	ND		2.00	1	04/24/2019 21:11	<a href="#">WG1270953</a>
Silver	ND		1.00	1	04/24/2019 21:11	<a href="#">WG1270953</a>

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc



Mercury by Method 7471B

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Mercury	0.0362		0.0200	1	04/24/2019 11:17	<a href="#">WG1270653</a>

1 Cp

2 Tc

Metals (ICP) by Method 6010C

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Arsenic	23.8		2.00	1	04/24/2019 21:14	<a href="#">WG1270953</a>
Barium	140		0.500	1	04/24/2019 21:14	<a href="#">WG1270953</a>
Cadmium	1.13		0.500	1	04/24/2019 21:14	<a href="#">WG1270953</a>
Chromium	25.9		1.00	1	04/24/2019 21:14	<a href="#">WG1270953</a>
Lead	360		0.500	1	04/24/2019 21:14	<a href="#">WG1270953</a>
Selenium	ND		2.00	1	04/24/2019 21:14	<a href="#">WG1270953</a>
Silver	ND		1.00	1	04/24/2019 21:14	<a href="#">WG1270953</a>

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc



Method Blank (MB)

(MB) R3404946-1 04/24/19 10:10

Analyte	MB Result	MB Qualifier	MB MDL	MB RDL
Mercury	U		0.00280	0.0200

<sup>1</sup> Cp

<sup>2</sup> Tc

<sup>3</sup> Ss

<sup>4</sup> Cn

<sup>5</sup> Sr

<sup>6</sup> Qc

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3404946-2 04/24/19 10:13 • (LCSD) R3404946-3 04/24/19 10:16

Analyte	Spike Amount	LCS Result	LCSD Result	LCS Rec.	LCSD Rec.	Rec. Limits	LCS Qualifier	LCSD Qualifier	RPD	RPD Limits
Mercury	0.300	0.359	0.298	120	99.3	80.0-120			18.6	20

L1091521-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1091521-01 04/24/19 10:18 • (MS) R3404946-4 04/24/19 10:21 • (MSD) R3404946-5 04/24/19 10:31

Analyte	Spike Amount	Original Result	MS Result	MSD Result	MS Rec.	MSD Rec.	Dilution	Rec. Limits	MS Qualifier	MSD Qualifier	RPD	RPD Limits
Mercury	0.300	ND	0.332	0.322	107	103	1	75.0-125			3.08	20

<sup>7</sup> Gl

<sup>8</sup> Al

<sup>9</sup> Sc



Method Blank (MB)

(MB) R3405156-1 04/24/19 20:08

Analyte	MB Result	MB Qualifier	MB MDL	MB RDL
	mg/kg		mg/kg	mg/kg
Arsenic	U		0.460	2.00
Barium	U		0.170	0.500
Cadmium	U		0.0700	0.500
Chromium	U		0.140	1.00
Lead	U		0.190	0.500
Selenium	0.654	E4	0.620	2.00
Silver	U		0.120	1.00

<sup>1</sup> Cp

<sup>2</sup> Tc

<sup>3</sup> Ss

<sup>4</sup> Cn

<sup>5</sup> Sr

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3405156-2 04/24/19 20:10 • (LCSD) R3405156-3 04/24/19 20:13

Analyte	Spike Amount	LCS Result	LCSD Result	LCS Rec.	LCSD Rec.	Rec. Limits	LCS Qualifier	LCSD Qualifier	RPD	RPD Limits
	mg/kg	mg/kg	mg/kg	%	%	%			%	%
Arsenic	100	97.6	96.8	97.6	96.8	80.0-120			0.819	20
Barium	100	106	105	106	105	80.0-120			1.00	20
Cadmium	100	99.4	98.4	99.4	98.4	80.0-120			1.06	20
Chromium	100	101	100	101	100	80.0-120			0.568	20
Lead	100	99.7	98.8	99.7	98.8	80.0-120			0.852	20
Selenium	100	95.8	95.0	95.8	95.0	80.0-120			0.888	20
Silver	20.0	19.3	19.1	96.4	95.7	80.0-120			0.728	20

<sup>6</sup> Qc

<sup>7</sup> Gl

<sup>8</sup> Al

<sup>9</sup> Sc

L1090856-06 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1090856-06 04/24/19 20:15 • (MS) R3405156-6 04/24/19 20:22 • (MSD) R3405156-7 04/24/19 20:25

Analyte	Spike Amount	Original Result	MS Result	MSD Result	MS Rec.	MSD Rec.	Dilution	Rec. Limits	MS Qualifier	MSD Qualifier	RPD	RPD Limits
	mg/kg	mg/kg	mg/kg	mg/kg	%	%		%			%	%
Arsenic	100	2.26	99.9	95.3	97.6	93.1	1	75.0-125			4.66	20
Barium	100	175	243	427	68.0	251	1	75.0-125	M2	M1 R5	54.8	20
Cadmium	100	U	99.2	96.4	99.2	96.4	1	75.0-125			2.85	20
Chromium	100	57.5	149	180	91.8	122	1	75.0-125			18.5	20
Lead	100	38.9	136	136	96.6	97.0	1	75.0-125			0.301	20
Selenium	100	U	92.8	89.0	92.8	89.0	1	75.0-125			4.20	20
Silver	20.0	U	19.2	18.6	96.2	93.2	1	75.0-125			3.22	20



## Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

## Abbreviations and Definitions

MDL	Method Detection Limit.
ND	Not detected at the Reporting Limit (or MDL where applicable).
RDL	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
U	Not detected at the Reporting Limit (or MDL where applicable).
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state "ND" (Not Detected) or "BDL" (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc

## Qualifier Description

E4	Concentration estimated. Analyte was detected below laboratory minimum reporting level (MRL) but above MDL.
M1	Matrix spike recovery was high, the method control sample recovery was acceptable.
M2	Matrix spike recovery was low, the method control sample recovery was acceptable.
R5	MS/MSD RPD exceeded the laboratory acceptance limit. Recovery met acceptance criteria.



Pace National is the only environmental laboratory accredited/certified to support your work nationwide from one location. One phone call, one point of contact, one laboratory. No other lab is as accessible or prepared to handle your needs throughout the country. Our capacity and capability from our single location laboratory is comparable to the collective totals of the network laboratories in our industry. The most significant benefit to our one location design is the design of our laboratory campus. The model is conducive to accelerated productivity, decreasing turn-around time, and preventing cross contamination, thus protecting sample integrity. Our focus on premium quality and prompt service allows us to be YOUR LAB OF CHOICE.

\* Not all certifications held by the laboratory are applicable to the results reported in the attached report.  
 \* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace National.

## State Accreditations

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN-03-2002-34
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey-NELAP	TN002
California	2932	New Mexico <sup>1</sup>	n/a
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina <sup>1</sup>	DW21704
Georgia	NELAP	North Carolina <sup>3</sup>	41
Georgia <sup>1</sup>	923	North Dakota	R-140
Idaho	TN00003	Ohio-VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LA000356
Kentucky <sup>1,6</sup>	90010	South Carolina	84004
Kentucky <sup>2</sup>	16	South Dakota	n/a
Louisiana	AI30792	Tennessee <sup>1,4</sup>	2006
Louisiana <sup>1</sup>	LA180010	Texas	T104704245-18-15
Maine	TN0002	Texas <sup>5</sup>	LAB0152
Maryland	324	Utah	TN00003
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	460132
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	9980939910
Montana	CERT0086	Wyoming	A2LA

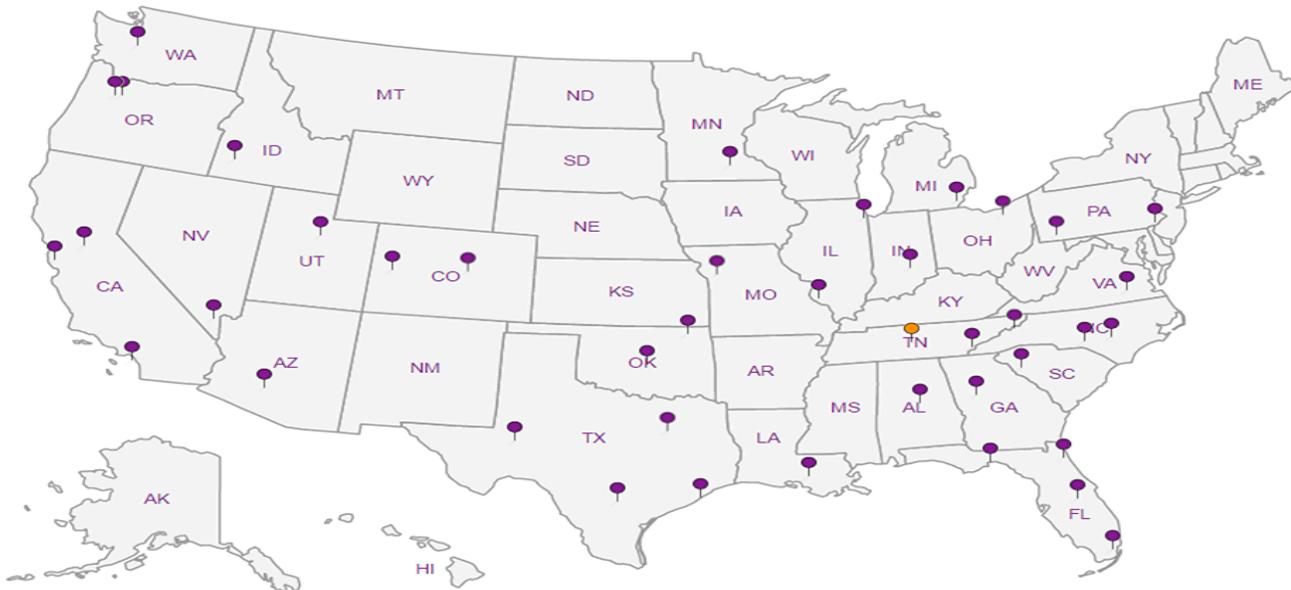
## Third Party Federal Accreditations

A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 <sup>5</sup>	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA-Crypto	TN00003		

<sup>1</sup> Drinking Water <sup>2</sup> Underground Storage Tanks <sup>3</sup> Aquatic Toxicity <sup>4</sup> Chemical/Microbiological <sup>5</sup> Mold <sup>6</sup> Wastewater n/a Accreditation not applicable

## Our Locations

Pace National has sixty-four client support centers that provide sample pickup and/or the delivery of sampling supplies. If you would like assistance from one of our support offices, please contact our main office. Pace National performs all testing at our central laboratory.



1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc

GeoTek, Inc.

Billing Information:

Pres  
Chk

Analysis / Container / Preservative

Chain of Custody Page 1 of 1



12065 Lebanon Rd  
Mount Juliet, TN 37122  
Phone: 615-758-5858  
Phone: 800-767-5859  
Fax: 615-758-5859



Report to:  
Adriane Gora

Email To:  
agora@geotekusa.com

Project Description:  
City/State Collected: Peoria

Client Project #  
1795.1-PHR

Collected by (print):  
Adriane Gora

Collected by (signature):  
[Signature]  
Immediately Packed on Ice N Y X

Rush? (Lab MUST Be Notified)  
 Same Day  Five Day  
 Next Day  5 Day (Rad Only)  
 Two Day  10 Day (Rad Only)  
 Three Day

Lab Project #  
P.O. #  
Quote #  
Date Results Needed  
SJT

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs
AD2-9	grab	SS	0-3in	4-22-19	9:17	1
AD2-7	↓	↓	0-3in	↓	9:43	1
AD2-8	↓	↓	0-3in	↓	9:49	1

8 RCRA Metals Method 8010B/7471A

L# 1091528  
T# E002  
Acctnum:  
Template:  
Prelogin:  
TSR:  
PB:  
Shipped Via:  
Remarks Sample # (lab only)

-01  
-02  
-03

\* Matrix:  
SS - Soil AIR - Air F - Filter  
GW - Groundwater B - Bioassay  
WW - WasteWater  
DW - Drinking Water  
OT - Other

Remarks:  
pH \_\_\_\_\_ Temp \_\_\_\_\_  
Flow \_\_\_\_\_ Other \_\_\_\_\_  
Samples returned via:  
 UPS  FedEx  Courier \_\_\_\_\_  
 Tracking # \_\_\_\_\_

Sample Receipt Checklist  
 COC Seal Present/Intact: NP Y N  
 COC Signed/Accurate: Y N  
 Bottles arrive intact: Y N  
 Correct bottles used: Y N  
 Sufficient volume sent: Y N  
 If Applicable  
 VOA Zero Headspace: Y N  
 Preservation Correct/Checked: Y N

Relinquished by: (Signature) Date: 4-22-19 Time: 1:48 Received by: (Signature) Trip Blank Received: Yes No HCL/MeOH TBR  
 Relinquished by: (Signature) Date: 4/22/19 Time: 1:00 Received by: (Signature) Temp: 15.5°C Bottles Received: 3  
 Relinquished by: (Signature) Date: 4/23/19 Time: 0800 Received for lab by: (Signature) B-Maxwell Date: 4/23/19 Time: 0800

RAD SCREEN: <0.5 mR/hr  
 If preservation required by Login: Date/Time  
 Hold: Condition: NCF OK

GAZ

# **APPENDIX E**

## **ADEQ XRF SAMPLING AND TESTING**



Sample ID	As	Ba	Cd	Cu	Cr**	Hg	Mn	Ni	Pb	Sb	Se	U	V	Zn	S
S-1	69.32	1,118.04	36.86	74.17	63.30	0.00	2,495.81	70.51	383.50	57.09	0.00	0.00	92.13	938.99	582.27
S-2	35.85	900.51	25.53	85.10	122.79	0.00	1,315.76	63.40	178.76	58.74	0.00	0.00	93.92	446.94	475.54
S-3	50.30	807.96	16.46	40.61	231.67	0.00	1,045.00	139.61	125.32	28.41	0.00	8.20	141.02	238.85	0.00
S-4	41.58	713.80	0.00	97.66	107.93	13.18	2,437.75	57.51	750.97	0.00	0.00	0.00	145.80	813.32	
S-4 Dup	61.02	747.04	19.00	87.21	64.76	0.00	1,836.82	53.97	347.30	47.26	0.00	0.00	113.84	556.01	474.23
S-4 Repl	53.99	792.19	0.00	92.85	140.47	0.00	2,544.92	80.04	403.81	0.00	0.00	0.00	156.00	537.03	
S-5	8.79	716.46	26.49	39.84	68.44	0.00	762.84	46.16	35.87	49.19	0.00	0.00	93.92	109.84	0.00
S-5 Dup	12.06	682.82	23.20	54.58	67.89	0.00	790.30	64.00	30.69	47.47	0.00	0.00	103.73	113.06	0.00
S-5 Rep	9.32	672.96	24.66	56.64	55.31	0.00	859.84	72.63	32.58	43.75	0.00	6.73	95.15	100.50	0.00
SS-1	65.96	993.14	21.65	118.27	98.67	0.00	11,075.55	72.60	195.66	51.22	0.00	0.00	104.39	323.15	478.25
SS-2	12.76	877.84	25.64	54.61	74.24	0.00	1,252.45	75.15	95.30	58.62	0.00	0.00	104.98	751.70	0.00
SS-3	27.95	751.06	17.03	68.09	75.12	0.00	782.76	82.31	297.23	50.78	0.00	0.00	95.04	716.98	0.00
SS-3 Dup	22.43	773.53	19.81	65.79	60.70	0.00	888.89	69.20	155.38	42.41	0.00	0.00	112.90	279.19	328.85
rSRLs	10	15,000	39	3,100	120,000	23	3,300	1,600	400	31	390	16	78	23,000	NE
nr-SRLs	10	170,000	510	41,000	1,000,000	310	32,000	20,000	800	410	5,100	200	1,000	310,000	NE
GPLs	290	12,000	29	NE	590	12	NE	590	290	35	290	NE	NE	NE	NE

Notes:

All units in parts per million (mg/kg)

rSRL Exceedence

GPL Exceedence

Non-Res SRL Exceedence

GPL and rSRL Exceedence

"0.00" Replaces <LOD (less than detection limit)

Black cell is an analyte that did not return a result

\*\*Volunteer has speciated Cr. Assume Cr+3.

	Lat	Lon
S-1	33.788453	-112.322453
S-2	33.787856	-112.322361
S-3	33.786794	-112.321767
S-4	33.788678	-112.323206
S-5	33.788828	-112.323758
SS-1	33.788344	-112.321775
SS-2	33.788278	-112.321617
SS-3	33.788267	-112.321639

Sample ID	K	Ca	Sc scandium	Th thorium	Ti	Fe	Co	Rb	Sr	Mo	Pd	Ag	Sn	Te tellurium	Cs	W	Au
S-1	10,664.35	12,270.00	42.14	6.44	1,385.63	49,236.75	0.00	52.64	184.16	4.87	11.84	19.38	38.86	140.62	98.87	0.00	0.00
S-2	13,375.28	11,812.11	38.42	5.36	1,714.23	43,738.32	0.00	59.04	285.52	4.94	0.00	16.11	34.14	148.86	98.00	0.00	0.00
S-3	11,071.12	6,750.41	36.80	3.91	4,383.56	48,830.05	0.00	50.16	189.71	8.17	0.00	0.00	18.27	84.05	72.14	0.00	0.00
S-4	13,155.24	16,735.03	0.00	6.16	1,981.06	54,244.31	0.00	57.36	304.53	5.73	0.00	0.00	0.00			0.00	0.00
S-4 Dup	12,448.87	15,456.40	58.35	6.35	2,103.25	50,975.84	0.00	60.14	271.69	6.20	0.00	11.09	21.04	131.98	87.79	0.00	0.00
S-4 Repl	12,869.51	19,291.90	0.00	6.77	1,939.16	51,431.82	0.00	60.79	287.84	4.19	0.00	0.00	0.00			0.00	0.00
S-5	8,368.36	23,551.14	61.96	3.04	2,339.03	41,010.80	165.55	29.66	208.39	4.89	0.00	14.47	30.21	129.91	84.78	0.00	0.00
S-5 Dup	10,299.51	32,445.21	144.32	2.94	2,454.18	40,848.70	0.00	29.65	218.81	0.00	0.00	10.97	24.91	123.11	82.83	0.00	0.00
S-5 Rep	9,650.00	28,308.71	130.40	2.95	2,263.30	41,922.50	0.00	30.85	196.41	0.00	0.00	12.25	20.54	120.16	89.01	0.00	0.00
SS-1	8,969.52	23,569.15	52.33	5.92	2,026.36	44,420.11	0.00	41.33	438.01	4.90	0.00	9.99	31.43	144.18	93.80	78.09	0.00
SS-2	8,957.50	55,994.82	184.18	4.89	2,232.85	40,353.75	0.00	35.96	261.90	0.00	14.11	12.18	37.49	162.64	102.20	0.00	7.56
SS-3	10,084.23	39,868.73	181.22	4.03	2,235.91	39,190.86	0.00	36.87	262.00	4.01	0.00	11.21	18.64	123.71	78.17	0.00	0.00
SS-3 Dup	11,748.54	25,637.63	102.73	3.66	2,502.52	41,869.11	0.00	49.11	340.36	0.00	0.00	13.82	22.63	125.32	75.07	0.00	0.00
rSRLs	NE	NE	NE	NE	310,000	NE	1,400	NE	47,000	390	NE	390	47,000	NE	NE	NE	NE
nr-SRLs	NE	NE	NE	NE	1,000,000	NE	13,000	NE	610,000	5,100	NE	5,100	610,000	NE	NE	NE	NE
GPLs	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE

Notes:

All units in parts per million (mg/kg)

rSRL Exceedence

GPL Exceedence

Non-Res SRL Exceedence

GPL and rSRL Exceedence

"0.00" Replaces <LOD (less than detection limit)

Black cell is an analyte that did not return a result

\*\*Volunteer has speciated Cr. Assume Cr+3.

	Lat	Lon
S-1	33.788453	-112.322453
S-2	33.787856	-112.322361
S-3	33.786794	-112.321767
S-4	33.788678	-112.323206
S-5	33.788828	-112.323758
SS-1	33.788344	-112.321775
SS-2	33.788278	-112.321617
SS-3	33.788267	-112.321639

# **APPENDIX F**

## **PRELIMINARY GRADING PLAN**







# **APPENDIX G**

## **COMMUNITY INVOLVEMENT**

# **Voluntary Remediation Program Site**

**Site Code: 513298-00**

**The Site Owner, Avanti, will be conducting Site Characterization and Soil Remediation**

**This work will be performed under the Arizona Department of Environmental Quality (ADEQ)**

**Voluntary Remediation Program**

**For more Information please contact:**

**Site Contact: Chet Pearson (480) 505-9422**

**ADEQ Contact: Caitlin Burwell (602) 771-4122**