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FINAL COMPLIANCE MONITORING REPORT

AS/SVE System Extension and Modification

8801 EAST MARGINAL WAY S., TUKWILA, WASHINGTON
AGREED ORDER NO. 6069

SHANNON & WILSON

September 26, 2023
Shannon & Wilson No: 108056-04

Submitted To: PACCAR Inc

Subject: FINAL COMPLIANCE MONITORING REPORT, AS/SVE SYSTEM EXTENSION AND MODIFICATION, 8801 EAST MARGINAL WAY S., TUKWILA, WASHINGTON
AGREED ORDER NO. 6069

Shannon & Wilson prepared this report and participated in this project as a consultant to PACCAR Inc. This submittal presents the Final Compliance Monitoring Report for the extension and modification of the AS/SVE system completed at 8801 East Marginal Way S., Tukwila, Washington. This report was prepared by the undersigned.

This report is one of multiple documents that fulfills the Compliance Monitoring Report requirements discussed in Task 4 of Exhibit C to Agreed Order No. 6069.

We appreciate the opportunity to be of service on this project. If you have questions concerning this report, or we may be of further service, please contact us.

Sincerely,

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EXECUTIVE SUMMARY

This Final Compliance Monitoring Report (CMR) summarizes the extension and modification of the existing air sparging (AS) and soil vapor extraction (SVE) system at 8801 East Marginal Way S., Tukwila, Washington (8801 property) undertaken in November 2021 through May 2023. The AS/SVE system activities were undertaken concurrently with separate property redevelopment activities performed by the property owner.

A plume of contaminated groundwater extends from the northern boundary of the 8801 property, downgradient (south and west), toward the Lower Duwamish Waterway (LDW). The primary contaminants of concern (COC) in the plume are trichloroethylene (TCE) and vinyl chloride (VC), which belong to a group of chemicals named halogenated volatile organic compounds (HVOCs). TCE is the predominant COC in the upgradient and central portions of the plume, while VC, a degradation product of TCE, is the predominant COC in the downgradient portion of the plume, where it intersects the AS/SVE system.

The AS system is designed to inject pressurized air below ground surface into the saturated zone, causing VC to volatilize and promoting in situ aerobic degradation of VC in groundwater. Vapors are extracted from the subsurface above the water table via negative pressure created by the SVE system. Groundwater monitoring has demonstrated that the existing AS/SVE system is effective at reducing the VC concentrations in groundwater.

The objective of the AS/SVE system extension is to reduce concentrations of VC in groundwater to the west (downgradient) of the existing AS/SVE system. Expansion of the AS/SVE system advances this objective by promoting in situ aerobic degradation of VC in groundwater. This objective is further advanced by other remedial actions that are described in separate CMRs, including the targeted excavation of TCE-impacted soil and groundwater treatment injections.

The extension to the AS/SVE system consists of 22 new AS wells and 3 new SVE screens in a north-south alignment to the west of the existing AS wells and SVE screens, all of which were connected to the existing aboveground AS/SVE infrastructure.

The AS/SVE system was modified to allow for redevelopment of the 8801 property. An 80-foot section of existing AS/SVE underground pipes was disconnected and reinstalled in an adjacent trench because the existing pipes were in the footprint of a proposed excavation.

The AS/SVE system extension and modification activities were undertaken in accordance with the engineering design except for minor deviations. Minor deviations from the

engineering design were necessary due to field conditions, availability of materials, and best practices. The deviations are unlikely to affect the efficacy of the AS/SVE system.

The success of the expansion and modification of the AS/SVE system will be assessed through the analysis of groundwater samples collected from monitoring wells located downgradient from the AS/SVE system. Performance groundwater monitoring commenced in August 2023, and results will be reported to Ecology in a separate document.

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ACRONYMS

AO	Agreed Order
AS/SVE	air sparging/soil vapor extraction
bgs	below ground surface
CenterPoint	CenterPoint 8801 Marginal LLC
COC	contaminant of concern
CMR	Compliance Monitoring Report
CUL	cleanup level
Ecology	Washington State Department of Ecology
EDR	Engineering Design Report
EPA	U.S. Environmental Protection Agency
FS	Feasibility Study
GCF	geosynthetic clay liner
HASP	Health and Safety Plan
HDPE	high-density polyethylene
HVOC	halogenated volatile organic compound
IAWP	Interim Action Work Plan
lb/yr	pounds per year
LDW	Lower Duwamish Waterway
MOU	Memorandum of Understanding
MTCA	Model Toxics Control Act
ORP	oxidation reduction potential
PCE	tetrachloroethene
PSCAA	Puget Sound Clean Air Agency
PVC	polyvinyl chloride
SSDS	sub-slab depressurization system
TCE	trichloroethylene
UIC	Underground Injection Control
VC	vinyl chloride
WAC	Washington Administrative Code

1 INTRODUCTION

This Final CMR was prepared by Shannon & Wilson on behalf of PACCAR Inc to summarize the expansion and modification of the AS/SVE system in November 2021 through May 2023 at the 8801 property. The work was undertaken in accordance with the AS/SVE Engineering Design Report (EDR) (Shannon & Wilson, 2021e).

1.1 Purpose of this Compliance Monitoring Report

The purpose of this CMR is to document the extension and modification of the existing AS/SVE system.

1.2 Physical Description and Use

The 8801 property occupies 24.30 acres on the east bank of the LDW and is relatively flat, with a ground surface elevation of approximately 20 feet above mean sea level. A vicinity map is provided as Figure 1.

The current owner of the 8801 property, CenterPoint 8801 Marginal LLC (CenterPoint), has redeveloped the 8801 property. CenterPoint's redevelopment activities were separate from the remedial activities described in this CMR except as noted in this CMR.

Between 2021 and early 2023, CenterPoint redeveloped the 8801 property, covering nearly all of it with a new warehouse, parking areas, driveways, and a landscaped berm. An approximately 414,400-square-foot warehouse was constructed in the central portion of the 8801 property for commercial use and trailer storage (Figure 2). A landscaped berm and underlying clay liner was constructed within the 100-foot river buffer located along the western edge of the 8801 property. Asphalt/concrete parking areas and driveways were constructed over the remainder of the 8801 property.

The AS/SVE system is located in the western portion of the 8801 property. The aboveground infrastructure for the AS/SVE system is in a small warehouse referred to as the AS/SVE building. Aboveground equipment include compressors, blowers, electrical control panels, and other equipment. The underground pipes, vaults, and wells are located near the AS/SVE building (Figures 2 and 3).

1.3 Geology

Due to the redevelopment of the 8801 property, the subsurface material in some areas was disturbed during demolition and replacement of utilities and foundations. Because the subsurface disturbance occurred in few discrete locations and at depths typically less than 10 feet, and historical fill material underlies the surface up to 10 feet thick in some locations, we assume that the geology of the 8801 property has remained generally consistent with the geology encountered during pre-development investigations.

Based on pre-development investigations, fill material underlies the ground surface and is up to 10 feet thick in some locations. Fill material includes gravelly structural fill beneath former buildings and paved areas, poorly graded sand to silty sand fill deposits, and gravelly backfill materials in historical excavations. Fill material at the 8801 property is underlain by a layer of fine-grained material, including silt, sandy silt, and silty sand that extends to a depth of 5 to 15 feet below ground surface (bgs). A poorly graded sand layer, which typically contains less than 10% silt, is generally present beneath the fine-grained layer beginning at 10 to 15 feet bgs, although at some locations it is present immediately beneath the pavement surface or the fill material. A layer of fine-grained materials, consisting mainly of silt and silty sand, is typically present beneath the poorly graded, sandy layer at depths of approximately 30 to 50 feet bgs. This fine-grained silty material acts as a confining layer to groundwater flow on the western portion of the 8801 property (Amec Earth & Environmental, 2011). The lower, fine-grained layer is typically underlain by poorly graded sand to the maximum depth explored at the 8801 property (60 feet bgs).

1.4 Hydrogeology

Results of pre-development groundwater monitoring at the 8801 property indicate that the shallow aquifer is typically 8 to 10 feet bgs. The hydraulic gradient of the shallow aquifer is generally toward the west. Groundwater velocity is estimated to be 40 feet per year.

1.5 Regulatory Framework

The 8801 site consists of both an upland portion (the 8801 property) and the adjoining sediments in the LDW that are part of a Superfund site designated by the U.S. Environmental Protection Agency (EPA). The 8801 site is subject to two separate Agreed Orders (AOs) with the Washington State Department of Ecology (Ecology): AO No. 6069, which applies to the 8801 property, and AO No. 3599, which applies to the sediments. Under a Memorandum of Understanding (MOU), Ecology is working with EPA to identify and remove sources of ongoing contamination to the LDW.

This CMR is one of multiple documents that fulfills the CMR requirements discussed in Task 4 of Exhibit C to AO No. 6069. Separate CMRs are being submitted for other remedial actions at the 8801 property as they are completed. Remedial actions required pursuant to AO No. 6069 and their status are shown in Exhibit 1-1.

Exhibit 1-1: Status of Remedial Actions

Interim Remedial Action	Status of Implementation
Removal of PCB-containing caulk in pavement expansion joints	Completed in January 2022. This action is described in a Draft CMR for Remedial Excavations, dated July 28, 2023.
Excavation of hotspots, placement of clay/asphalt/concrete covers, and implementation of institutional controls	The hotspots identified in the East Excavations EDR and West Excavations EDR (Shannon & Wilson, 2021c and 2021f) were excavated in September 2022. CenterPoint encountered impacted soil during redevelopment activities and some impacted soil was disposed of at an appropriately licensed facility. The hotspot excavation activities completed by PACCAR and the soil disposal activities completed by CenterPoint are described in the Draft CMR for Remedial Excavations, dated July 28, 2023. The foundation of the warehouse, the clay liner installed in the footprint of the landscaped berm, and the asphalt/concrete parking areas and driveways serve as a cap over the 8801 property. An environmental covenant will be imposed against the 8801 property to memorialize the institutional controls, which will include prohibitions on the use of groundwater and activities that could disturb or expose contamination that will remain under the cap. The environmental covenant will be submitted to Ecology for approval within 30 days after Ecology approval of the Final CMRs, in accordance with Task 5 of Exhibit C to AO No. 6069. The environmental covenant is anticipated to be imposed in late 2023.
Injection of remediation compounds to promote enhanced reductive dechlorination of VOCs across the HVOC groundwater plume and TPH-G in the Northwest Area	Completed as described in the Final CMR for Groundwater Treatment Injections, dated March 30, 2023.
Expansion and modification of the AS/SVE system	Expansion and modification of the AS/SVE system was completed in May 2023 as described in this CMR. Sampling to confirm the effectiveness of the system is anticipated to occur in Summer 2023.
Installation of a sub-slab depressurization system and implementation of institutional controls to restrict extraction of groundwater and protect indoor air from vapor	Installation of the sub-slab depressurization system was completed in April 2023 as described in the Final CMR for the Sub-Slab Depressurization System dated September 26, 2023. Sampling to confirm the effectiveness of the system commenced in July 2023 and results will be reported to Ecology in a separate document.
Groundwater performance monitoring	Monitoring wells throughout the 8801 property, except some near the western property boundary, were decommissioned in Spring 2021 in preparation for redevelopment. New monitoring wells were installed and developed on the 8801 property in May 2023. Groundwater performance monitoring commenced in August 2023 and results will be reported to Ecology in a separate document.

NOTES:

HVOC = halogenated volatile organic compound; PCB = polychlorinated biphenyls; TPH-G = total petroleum hydrocarbons as gasoline-range organics

Because the 8801 property is adjacent to the LDW, the remedial actions detailed in this CMR are designed to be protective of the sediments and surface water of the LDW, to achieve the source sufficiency requirements in the MOU, and meet Model Toxics Control Act (MTCA) requirements. This CMR was prepared in accordance with MTCA and Ecology's Cleanup Regulation (Washington Administrative Code [WAC] Chapter 173-340) (Ecology, 2013).

2 BACKGROUND

An HVOC groundwater plume extends from the northern boundary of the 8801 property, downgradient (south and west), toward the LDW. The approximate boundary of the groundwater plume is shown in Figure 2. The plume is intercepted by the existing AS/SVE system, which is about 130 to 200 feet upgradient of the LDW. VC is present in the plume as a degradation product of TCE and is the predominant COC in the plume as it intersects the AS/SVE system and extends downgradient past the AS/SVE system. Unlike TCE, VC in groundwater degrades more effectively in an aerobic environment.

The AS system is designed to inject pressurized air below ground surface into the saturated zone, causing VC to volatilize and promoting in situ aerobic degradation of VC in groundwater. Vapors are extracted from the subsurface above the water table via negative pressure created by the SVE system. Groundwater monitoring has demonstrated that the existing AS/SVE system is effective at reducing the VC concentrations in groundwater.

In addition to the AS/SVE system discussed in this CMR, other remedial actions designed to reduce concentrations in the HVOC groundwater plume are in various stages of completion but are not discussed in this CMR. These remedial actions include:

- A hotspot excavation at Area 1 to remove the TCE-impacted soil above the site-specific remediation levels was completed in fall 2021 and is reported in a separate CMR.
- Remediation compounds (bacteria, a food source, and pH buffer compound) were injected into the HVOC groundwater plume at locations upgradient of the AS/SVE system in August 2021 and December 2022 to promote enhanced reductive dechlorination of the groundwater plume. The injections are designed to complete the degradation of the HVOCs past VC through to ethene. The response time for the injections will be over a period of years. The injections are reported in a separate CMR (Shannon & Wilson, 2023).
- A sub-slab depressurization system (SSDS) was constructed under a portion of the new warehouse to limit the potential for migration of HVOCs from groundwater to indoor air. Construction of the SSDS was completed in April 2023 and is reported in a separate CMR.

3 PLANNING AND SELECTION OF REMEDIAL ACTIONS

In 2020, Ecology approved the Final Feasibility Study (FS) (Shannon & Wilson, 2020a) for the 8801 property. Analytical data from previous investigations at the 8801 property was screened against Ecology's LDW-specific preliminary cleanup levels (CULs) to establish COCs and areas of concern. The COCs and areas of concern were used as the basis for the remedial alternative analysis and selection presented in the Final FS.

In 2020, Ecology approved the Final Interim Action Work Plan (Shannon & Wilson, 2020b) for the 8801 property. The Final Interim Action Work Plan was based on the findings from the Final FS and detailed the cleanup standards, remedial action alternatives, rationale for the selected remedial actions, and the compliance monitoring requirements. The report was called an "Interim" Action Work Plan because it addressed only the upland portion of the 8801 site (i.e., the 8801 property), not the sediment portion of the 8801 site.

In 2020, Ecology approved an Addendum to the Final FS and Final Interim Action Work Plan (Addendum) (Shannon & Wilson, 2020c). The Final Interim Action Work Plan and the Addendum together constitute the Interim Action Work Plan (IAWP) for the 8801 property. The remedial actions described in the IAWP constitute the final cleanup action for the 8801 property.

In 2021, Ecology approved EDRs describing the selected remedial actions for the 8801 property. The AS/SVE System Modification and Extension EDR (Shannon & Wilson, 2021e) details the engineering design for the remedial actions discussed in this CMR. Requirements for protection monitoring, performance monitoring, and confirmation monitoring to be conducted during the remedial actions and thereafter, including those applicable to the AS/SVE system, are described in the Ecology-approved Compliance Monitoring Plan (Shannon & Wilson, 2021a).

4 CLEANUP STANDARDS

Cleanup standards consist of site-specific concentrations of hazardous substances and points of compliance where the concentrations must be attained. A discussion about the development of cleanup standards for the 8801 property is provided in the IAWP (Shannon & Wilson, 2020b and 2020c).

The AS/SVE system was designed to achieve the CULs for TCE, tetrachloroethene (PCE), and VC, which are the primary COCs in the HVOC groundwater plume. The CULs apply to groundwater along the western boundary of the 8801 property, which is downgradient from the AS/SVE system. The CULs are shown in Exhibit 4-1 below.

Exhibit 4-1: Cleanup Levels for Groundwater at the Western Property Boundary

Analyte	Cleanup Level µg/L
PCE	2.9
TCE	0.7
VC	0.18

NOTE:
µg/L = micrograms per liter

5 IMPLEMENTATION

The objective of the AS/SVE system extension is to reduce concentrations of VC in groundwater to the west (downgradient) of the existing AS/SVE system. Expansion of the AS/SVE system advances this objective by promoting in situ aerobic degradation of VC in groundwater. This objective is further advanced by other remedial actions that are described in separate CMRs, including the targeted excavation of TCE-impacted soil and groundwater treatment injections.

The purpose of the AS/SVE system modification was to relocate a section of piping to accommodate CenterPoint's redevelopment activities.

Extension and modification of the AS/SVE system was undertaken in accordance with the engineering design (Shannon & Wilson, 2021e) except for minor deviations that are not expected to impact the efficacy of the system as discussed in Section 6. An overview of the AS/SVE system extension and modification is as follows:

- The extension to the AS/SVE system consists of 22 new AS wells and 3 new SVE screens in a north-south alignment to the west of the existing AS wells and SVE screens, all of which are connected to the existing aboveground AS/SVE infrastructure (Figure 2).
- The existing AS/SVE system was modified to allow for redevelopment of the 8801 property. An 80-foot section of existing AS/SVE underground pipes was disconnected and reinstalled in an adjacent trench because the existing pipes were in the footprint of a proposed excavation (Figure 2).
- The storage tank that stores groundwater extracted by the AS/SVE system was replaced due to damage during property development activities.

Further details of the extension and modification of the AS/SVE system are provided in Sections 5.1 through 5.4. Field methods (e.g., drilling, trenching, and waste disposal) are summarized in Appendix A.

5.1 Extension to the Air Sparging System

The extension to the AS system consists of 22 new vertical AS wells (named ASW-34 through ASW-55) that are connected to the existing AS system in the AS/SVE building. The wells consisted of 1-inch schedule 80 polyvinyl chloride (PVC) with a 1-foot-long, 0.020-inch slotted screen. No. 2x12 sand was used for the filter pack up to 2 feet above the screen, and hydrated bentonite chips were used to seal the remainder of the boring. Well construction details are provided in the boring logs (Appendix A) and tabulated in the Air Sparging Well Completion Details (Table 1).

The existing AS compressors direct pressurized air to the new AS wells. The AS wells are screened in the shallow perched aquifer. The injected air percolates through the groundwater and saturated soil creating aerobic conditions and volatilizing chemicals. The locations of the 22 new AS wells are shown in Figure 3 and connections to the existing system are shown in Figures 6 and 7. A photo of the aboveground components of the AS extension is shown in Exhibit 5-1 below.

Exhibit 5-1: View of the 22 AS Extension Lines Inside of the AS/SVE Building, Looking Southeast

Installation methods, selected materials, and testing methods are discussed in Appendix A. Product data sheets are provided in Appendix F.

Injection wells are required to be registered in the Underground Injection Control (UIC) program within Ecology's Water Quality Program in accordance with WAC Chapter 173-218. An application for registration of the AS wells was submitted to the UIC Program on April 24, 2023, under UIC Site 37530. The application is pending review by the UIC Program Coordinator.

5.2 Extension to the Soil Vapor Extraction System

The extension to the SVE system consisted of three new, horizontal 110-feet-long SVE screens. The SVE screens are installed above the new AS wells (discussed in Section 5.1) and within 1 foot under the clay liner. The SVE lines convey extracted soil vapor and volatile chemicals through the subsurface to the AS/SVE building. The SVE pipes connect to the existing SVE blowers that are used to draw a vacuum on the SVE screens. The extracted soil vapor and volatile chemicals are exhausted above the roof of the AS/SVE building. The location of the SVE extension is shown in Figure 3 and connections to the existing system are shown in Figures 6 and 8.

A photo of the point where the SVE screens are routed above the surface is provided as Exhibit 5-2 below.

Exhibit 5-2: View of the Three SVE Extension Pipes Inside of the AS/SVE Building, Looking East

Installation methods, selected materials, and testing methods are discussed in Appendix A. Product data sheets are provided in Appendix F.

5.3 Relocation of Existing Underground AS/SVE Lines

An approximately 80-foot section of underground AS/SVE lines to the south and east of the AS/SVE building were disconnected, capped, and abandoned in place because the excavation for the landscaped berm and associated drainage line to be constructed by CenterPoint would intercept the lines. The disconnection was completed prior to installation of the landscaped berm and associated drainage line. The AS/SVE lines were reinstalled in a new trench after the excavation for the landscaped berm was completed and the clay liner was installed. The location of the disconnection and replumbing is shown in Exhibit 5-3 below and Figure 3.

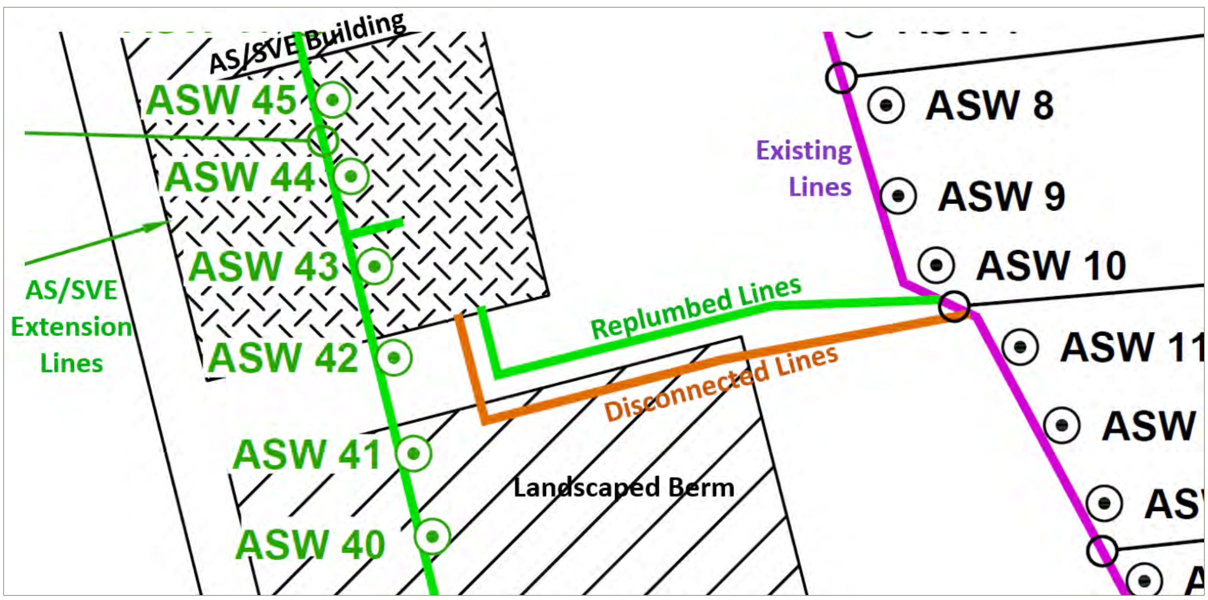

Exhibit 5-3: Replumbing of Existing AS/SVE Lines (North is Up)

The new AS/SVE lines were installed with equivalent materials to the lines that were abandoned in place. Installation methods, selected materials, and testing methods are discussed in Appendix A.

5.4 Replacement of Storage Tank

The existing 1,000-gallon aboveground storage tank used to store water extracted by the AS/SVE system was damaged during CenterPoint's redevelopment activities in approximately October 2021. The operational availability of the AS/SVE system was not impacted because the AS/SVE system was already offline due to the redevelopment activities.

Water extracted with soil vapor is separated in the AS/SVE knockout tank and then pumped to the storage tank. The storage tank is used to temporarily store water until it is disposed by a company at a licensed disposal or treatment facility.

The storage tank was replaced with materials and equipment to have equivalent functionality of the original tank. A photo of the new storage tank is provided below as Exhibit 5-4. A description of the installed components is provided in Appendix A. Product data sheets are provided in Appendix F.

Exhibit 5-4: View of the Storage Tank Inside of the AS/SVE Building, Looking East

6 DEVIATIONS FROM ENGINEERING DESIGN

Deviations from the engineering design, as detailed in the AS/SVE Extension and Modification EDR (Shannon & Wilson, 2021e), occurred due to field conditions, availability of materials, and best practices. In our opinion, the deviations are unlikely to affect the efficacy of the remedial action. The deviations are listed in Exhibit 6-1 below.

Exhibit 6-1: Deviations from the Engineering Design

Engineering Design Component	Deviation
Underground pipes for extension of the AS/SVE system were to be bedded in pea gravel and wrapped in a geotextile (Mirafi® 140N by Tencate Geosynthetics).	The pea gravel and geotextile as described in the AS/SVE Extension and Modification EDR were primarily meant for bedding of the SVE screens to extend the range of influence of the SVE vacuum and to prevent introduction of fines into the screens. The soil removed during trenching for the AS/SVE lines was found to be suitable for backfilling, therefore it was used as backfill in AS/SVE trenches that did not contain SVE screens. Pea gravel was placed around the screened portions of the SVE pipes and wrapped in a woven geotextile (WSF 200). The WSF 200 geotextile was substituted for the Mirafi® 140N geotextile due to availability of materials and is expected to perform equivalently. The WSF 200 is expected to perform equivalently to the Mirafi® 140N geotextile because it has a similar apparent opening size (No. 50 to No. 70, respectively) to limit the introduction of fines, and a significantly greater puncture strength (700 pounds to 310 pounds, respectively), which limits the likelihood of damage to the fabric during installation and compaction. The product data sheet for the WSF 200 geotextile is provided in Appendix F.
Air hoses connecting the 22 new AS wells (ASW-34 through ASW-55) to the existing aboveground infrastructure were to be routed underground in an 8-inch schedule 80 PVC conduit.	Instead of an 8-inch PVC conduit, the air hoses were routed in an 8-inch, double-walled HDPE conduit. A cross-section is shown in Figure 4. The field change was implemented due to the limited availability of 8-inch schedule 80 PVC and because the HDPE conduit is somewhat flexible. The flexible HDPE conduit allows for some differential movement as the landscaped berm settles (the berm is not compacted and therefore some settlement is expected) which will prevent damage to the conduit and prevent uncovering of the conduit. The HDPE conduit is designed for use as a culvert structure under roadways and should protect the air lines from the anticipated traffic in the berm (i.e., foot traffic and small work vehicles).
The monuments for the 22 new AS wells (ASW-34 through ASW-55) were to be constructed from 24-inch schedule 80 PVC well collar and cap.	Instead of a PVC well cover and cap, the AS well monuments in the landscaped berm (ASW-34 through ASW-41 and ASW-46 through ASW-55) were constructed of a vertical section of 24-inch double-walled HDPE conduit with a green HDPE cover. The remaining well monuments were in the AS/SVE building and adjacent driveway and were constructed as a concrete vault with a metal lid. The HDPE conduit and lids were used for air sparging wells because the 24" PVC wells collars and caps were not readily available, and the HDPE materials should perform equivalently. The concrete vault and metal lid were used instead of the PVC well collar and cap because the materials were more suitable for the anticipated traffic. The 24-inch HDPE conduit and HDPE cover are designed for use in landscaped areas and should protect the air lines from the anticipated traffic in the berm (i.e., foot traffic and small work vehicles). The concrete vaults with metal lids should protect the AS wellheads from the anticipated traffic in the AS/SVE building and driveway (i.e., light duty trucks and forklifts). The product data sheets for the HDPE conduit and concrete vaults are provided in Appendix F.
The replumbed air lines (80-foot section of pipes to the south and east of the AS/SVE building) were to be installed as 1-inch	Instead of the rubber pneumatic hoses and PVC conduit, due to availability of materials and to limit the vertical extent of the trench, the air lines were installed as individual 1¼-inch schedule 80 PVC pipes without a conduit

Engineering Design Component	Deviation
rubber pneumatic hoses and routed in several 8-inch schedule 80 PVC conduits.	(Figure 5). This field change was implemented because the selected materials were equivalent to the original installation and allowed for a shallow trench. A shallower trench was needed because electrical and stormwater utilities were directly under the replumbed pipes. As demonstrated by the previous installation, the PVC pipes and compacted backfill are expected to be sufficient to prevent breakage of the pipes.
The storage tank was not selected for replacement in the engineering design.	The storage tank required replacement because it was damaged during property redevelopment activities in approximately October 2021. The operational availability of the AS/SVE system was not impacted prior to replacement of the storage tank because the AS/SVE system was already offline due to the redevelopment activities. The storage tank was replaced with materials to have equivalent functionality of the original tank. The tank manufacturer's drawing and product data sheets are provided in Appendix F.
The horizontal SVE screens will be installed at approximately 3 feet below the clay liner.	The final design of the clay liner was not established when the EDR was approved. Per the final design of the clay liner, the depth of the clay liner was 5 to 6 feet above the water table, assuming a groundwater level of 8 feet below the previous ground surface based on previous sampling. The SVE screens were installed within 1 foot of the bottom of the clay liner instead of 3 feet. The SVE screens were installed at a higher elevation to increase the separation of the water table from the SVE screens, and therefore, limit the potential for the intake of water into the SVE system. The efficacy of the AS/SVE system is improved as a result of this deviation.

NOTES:

HDPE = high-density polyethylene; PVC = polyvinyl chloride

7 POST-IMPLEMENTATION MONITORING

Post-implementation monitoring will include performance monitoring and confirmation monitoring in accordance with the Compliance Monitoring Plan (Shannon & Wilson, 2021a). Performance monitoring is used to confirm that the remedial action has attained performance standards, such as flow rates and pressures. Confirmation monitoring is used to confirm the long-term effectiveness of the remedial action after performance standards have been attained.

7.1 Performance Monitoring

Performance monitoring will include:

- Monitoring of the AS/SVE system's operational parameters to ensure the system is functioning as designed and to inform adjustments to controls to increase the system's beneficial effects on groundwater quality. Procedures for monitoring of system parameters will be documented in an Operations and Maintenance Manual, which is anticipated to be prepared in Summer 2023. Performance monitoring is anticipated to commence in Summer 2023 and will include the following:

- AS line flowrates will be measured via the flowmeters and pressure gauges. Flowrates will be adjusted using the 1-inch gate valves with the goal of delivering at least 10 cubic feet per minute of pressurized air to each AS well.
- SVE system vacuum will be measured from a vacuum gauge at the SVE header. One or two SVE blowers will be operated to maintain adequate suction on the SVE screens.
- Dissolved oxygen and oxidation reduction potential (ORP) will be measured in nearby groundwater monitoring wells. Injection of pressurized air into the saturated zone will be indicated by increased concentrations of dissolved oxygen and increased ORP.

7.2 Confirmation Monitoring

Confirmation monitoring will be conducted to confirm the long-term effectiveness of the remedial action after performance standards have been attained. Confirmation monitoring will consist of groundwater sampling from groundwater monitoring wells along the western boundary of the 8801 property to determine if CULs have been achieved. The locations of the monitoring wells, selected analyses, and schedule are established in the Compliance Monitoring Plan (Shannon & Wilson, 2021a).

Analytical data from the confirmational groundwater sampling will be submitted to Ecology after each event. Periodic memos detailing proposed activities, such as well sampling modifications based on the groundwater sampling results, will be submitted to Ecology.

8 SOIL VAPOR EMISSION SAMPLING

The Puget Sound Clean Air Agency (PSCAA) regulates business operations that have the potential to create air pollution and its jurisdiction includes the 8801 property. The soil vapor discharged from the AS/SVE system exhaust has concentrations of HVOCs. Sampling of the discharged soil vapor will be conducted to estimate the amount of chemicals present, if any, and to determine if additional measures are required to reduce the amount of chemicals being discharged.

After at least two weeks of continuous system operation, soil vapor samples will be collected from discharge sampling ports located in the existing SVE exhaust system. Samples will be analyzed for volatile organic compounds, including PCE, TCE, and VC, by EPA Method TO-15, using gas chromatography/mass spectrometry in full scan mode.

The detected concentrations of chemicals will be used to estimate the yearly discharge rates and compared to PSCAA discharge exemption limits. Groundwater remediation projects, such as the AS/SVE system, are exempt from new source registration requirements if the expected total removal of chemicals in the vapor phase is less than 15 pounds per year (lb/yr) of benzene or VC, less than 500 lb/yr of PCE, and less than 1,000 lb/yr of toxic air contaminants, such as TCE (PSCAA, Regulation 1, Section 6.03(c)(94)).

Based on sampling of the AS/SVE system exhaust prior to the expansion, it is anticipated that the expanded AS/SVE system will not exceed the discharge exemption limits and therefore the expanded AS/SVE system would be exempt from new source registration. If the exemption limits are exceeded, then next steps will be discussed with Ecology. Potential next steps may include additional measures to reduce the mass of chemicals being discharged to within the PSCAA exemption limits.

9 INSTITUTIONAL CONTROLS

Because COCs will remain on the 8801 property at concentrations greater than the CULs, institutional controls will be implemented using an environmental covenant developed in accordance with WAC 173-340-440 and Ecology's Toxics Cleanup Program Procedure 440A.

In general, the environmental covenant will restrict activities that could disturb or expose contaminated soil beneath the clay liner and asphalt/concrete pavement covers, require regular inspections of the clay liner and asphalt/concrete pavement covers, and restrict the use of groundwater on the property. The requirements for the environmental covenant are described in the East Excavations EDR and West Excavations EDR (Shannon & Wilson, 2021c and 2021f).

Because the remedial actions are substantially completed on the 8801 property and the 8801 property is paved and the landscaped berm is installed, an environmental covenant will be prepared. The environmental covenant will be submitted to Ecology for approval within 30 days after Ecology approval of the Final CMRs, in accordance with Task 5 of Exhibit C to AO No. 6069. The environmental covenant is anticipated to be imposed in late 2023.

10 LIMITATIONS

The findings and conclusions documented in this report have been prepared for specific application to this project and have been developed in a manner consistent with that level of care and skill normally exercised by members of the environmental science profession currently practicing under similar conditions in this area.

Site conditions, both surface and subsurface, may be affected because of natural processes or human influence. The conclusions presented are based on interpretation of information currently available to us and are made within the operational scope, budget, and schedule constraints of this project. No warranty, express or implied, is made.

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Table 1: Air Sparging Well Completion Details

Well No.	Ecology Tag	Install Date	Northing	Easting	Green HDPE Lid Elevation	Filter Pack Depth (feet bgs)	Screen Depth (feet bgs)	Total Depth of Boring (feet bgs)	Casing Materials
ASW-34	BNM-775	3/7/2023	193823.891	1276449.033	12.35	29 to 32.5	31 to 32	36	1-Inch Schedule 80 PVC with 1 Foot of 0.020-Inch Slotted Screen
ASW-35	BNM-776	3/7/2023	193838.633	1276445.799	12.37	29 to 32.5	31 to 32	36	
ASW-36	BNM-777	3/7/2023	193853.067	1276441.989	12.45	29 to 32.5	31 to 32	36	
ASW-37	BNM-778	3/7/2023	193867.905	1276438.501	12.39	29 to 32.5	31 to 32	36	
ASW-38	BNM-779	3/7/2023	193881.936	1276434.843	12.38	29 to 32.5	31 to 32	36	
ASW-39	BNM-780	3/7/2023	193896.345	1276431.091	12.39	29 to 32.5	31 to 32	36	
ASW-40	BNM-781	3/6/2023	193910.920	1276427.251	12.31	28 to 32.5	31 to 32	36	
ASW-41	BNM-782	3/6/2023	193925.098	1276424.013	10.53	28 to 31.1	30 to 31	36	
ASW-42	BNM-783	3/7/2023	193941.500	1276420.649	9.26	26 to 29.1	28 to 29	29.1	
ASW-43	BNM-784	3/7/2023	193957.102	1276417.336	9.31	26 to 29.1	28 to 29	29.1	
ASW-44	BNM-785	3/7/2023	193972.515	1276413.299	9.27	26 to 29.1	28 to 29	29.1	
ASW-45	BNM-786	3/7/2023	193985.587	1276410.157	9.17	26 to 29.1	28 to 29	29.1	
ASW-46	BNM-787	3/6/2023	193999.511	1276406.256	10.15	27 to 30.5	29 to 30	36	
ASW-47	BNM-788	3/6/2023	194012.628	1276401.338	12.17	29 to 32.5	31 to 32	36	
ASW-48	BNM-789	3/6/2023	194027.322	1276397.621	12.31	29 to 33	31 to 32	36	
ASW-49	BNM-790	3/3/2023	194042.350	1276394.037	12.34	30 to 35	32 to 33	36	
ASW-50	BNM-791	3/3/2023	194057.001	1276390.572	12.45	30 to 35	32 to 33	36	
ASW-51	BNM-792	3/3/2023	194071.439	1276387.129	12.42	30 to 34	32 to 33	36	
ASW-52	BNM-793	3/3/2023	194085.415	1276383.664	12.19	30 to 34	32 to 33	36	
ASW-53	BNM-794	3/3/2023	194099.850	1276380.236	12.34	30 to 34	32 to 33	36	
ASW-54	BNM-795	3/3/2023	194114.295	1276376.365	12.55	30 to 34	32 to 33	36	
ASW-55	BNM-796	3/2/2023	194128.555	1276372.334	12.47	30 to 34	32 to 33	41	

NOTES
1. Horizontal coordinates and the elevations were surveyed by Barghausen Consulting Engineers, Inc. of Kent, Washington.
2. Horizontal datum is State Plane of Washington Coordinate System of 1983, 2011 Adjustment (North American Datum of 1983 [NAD83/2011]).
3. Vertical datum is National Geodetic Vertical Datum of 1929 (NGVD 29).

bgs = below ground surface; HDPE = high-density polyethylene

0 500 1,000

Approximate Scale in Feet

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VICINITY MAP

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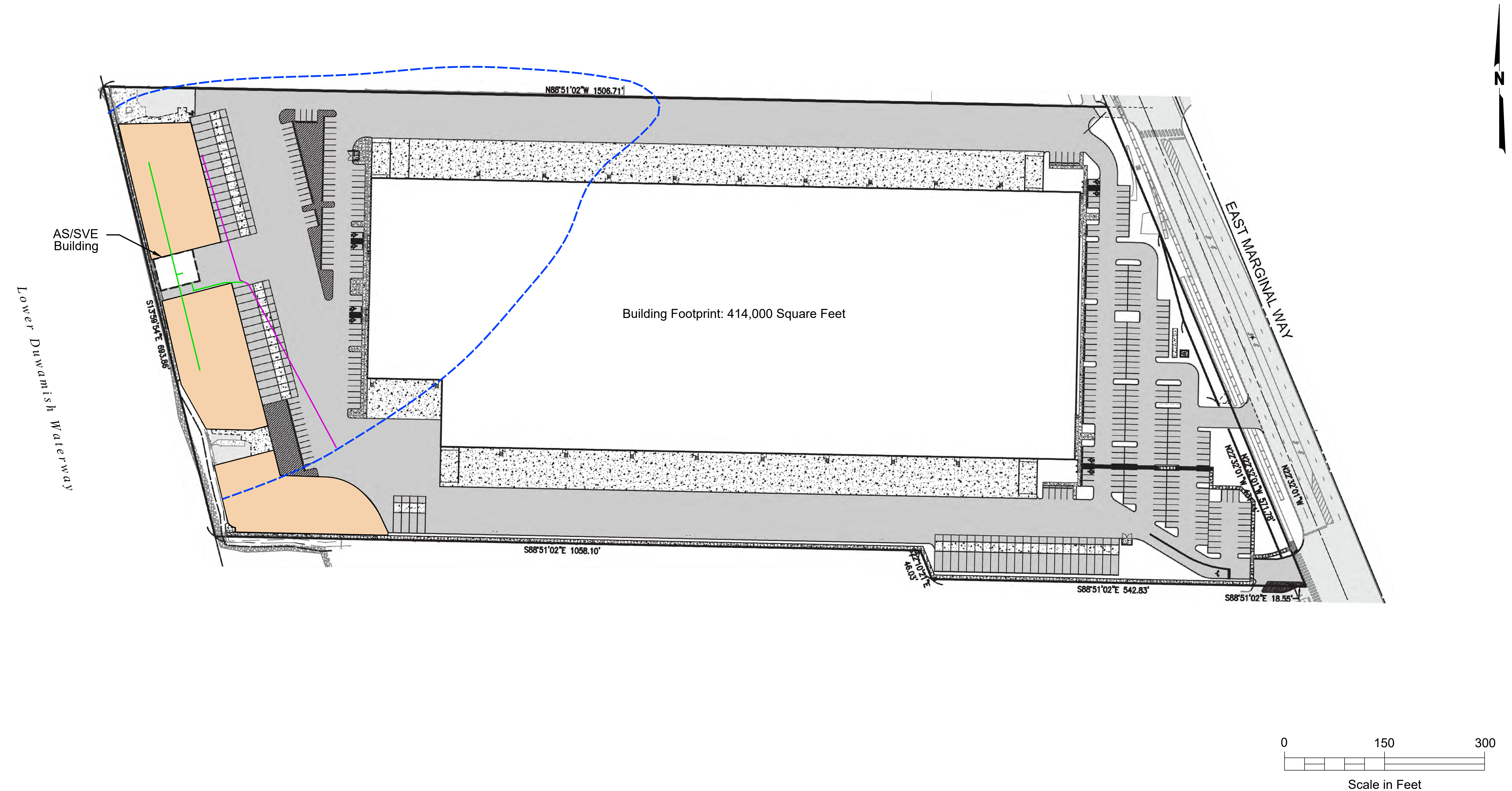
FIG. 1

Filename: C:\Users\jrs\CAD Group Dropbox\JDrive_SEA\108056\004\108056-004 Vicinity Map-.dwg Date: 09-25-2023 Login: JRS



LEGEND

Landscaped Berm

Existing AS/SVE System

Extended or Modified AS/SVE System

Approximate Limit of HVOC Groundwater Plume Prior to Commencement of 2021 Remedial Actions. Plume is mainly vinyl chloride downgradient of the AS/SVE system.

NOTE

Figure adapted from *Cover Sheet for Centerpoint Tukwila, 8801 East Marginal Way South, Tukwila, WA 98108*, "Sheet C1.0 of 19," dated 8/4/2022, by Barghausen Consulting Engineers, Inc.

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SITE PLAN

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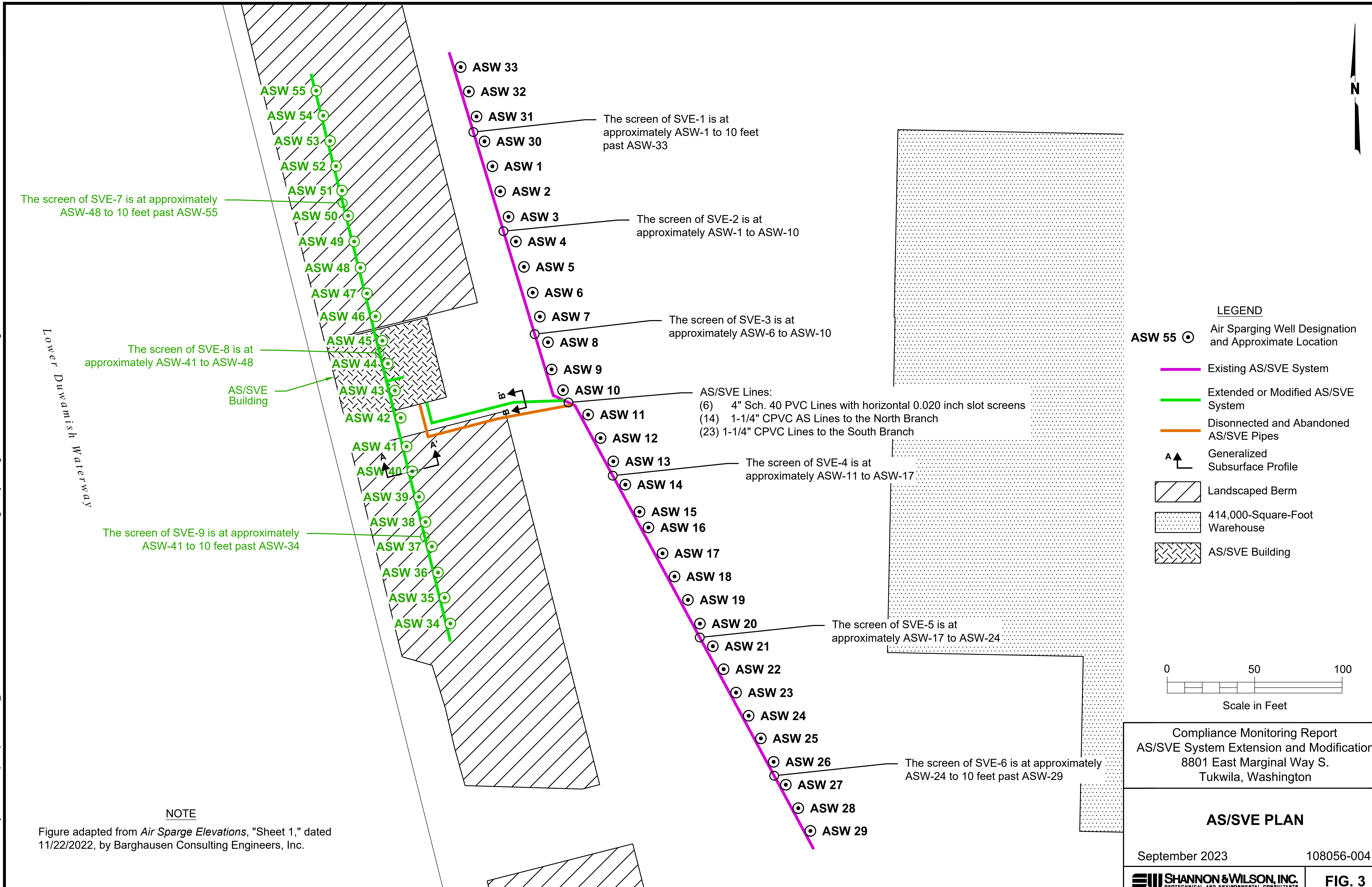
FIG. 2



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AS/SVE PLAN

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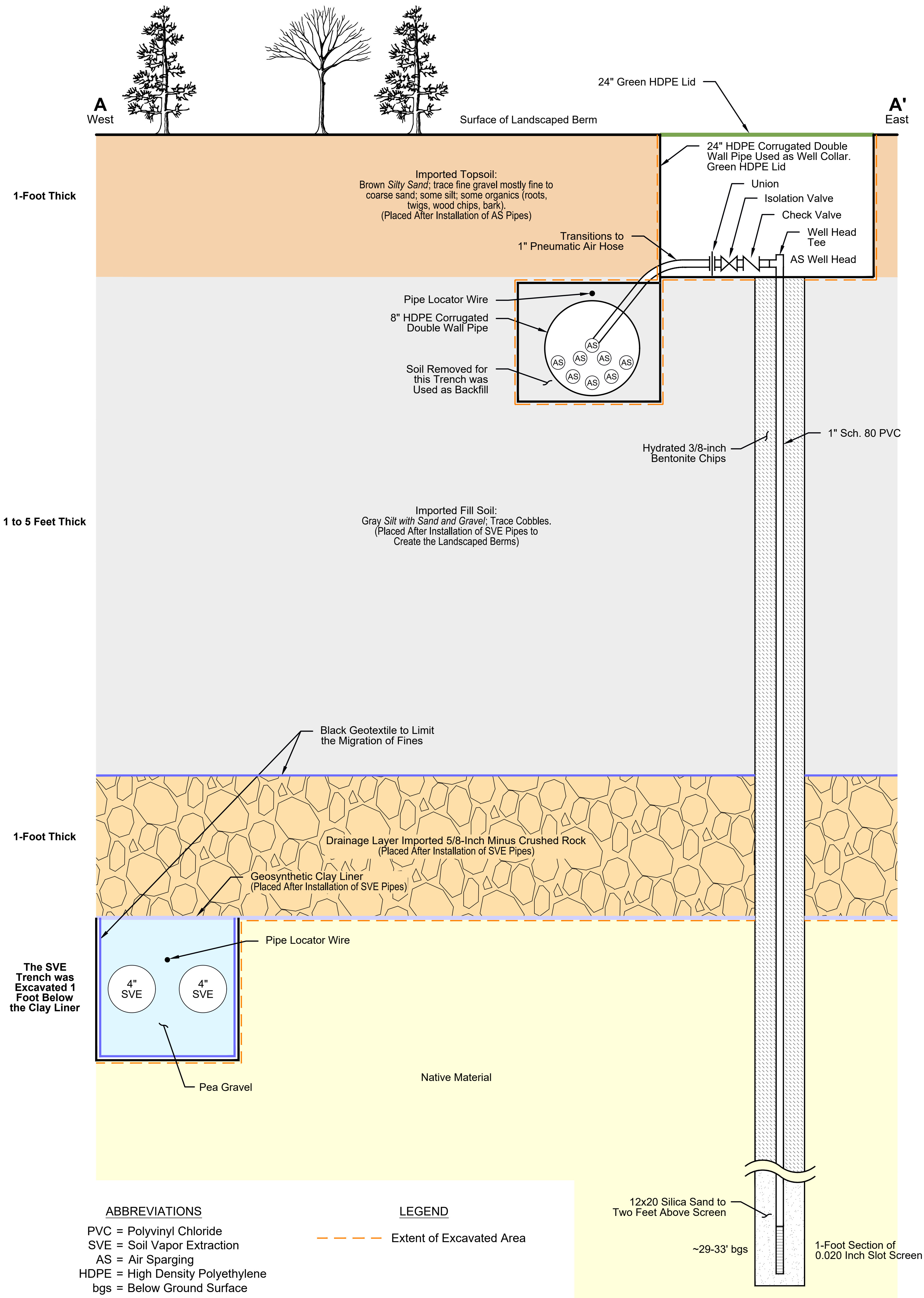
FIG. 3

Filename: C:\Users\jrs\CAD Group Dropbox\JDrive_SEA\108056\004\108056-004 Air Sparging Well.dwg   Layout: Figure 4   Date: 09-25-2023   Login: JRS



ABBREVIATIONS

PVC = Polyvinyl Chloride
SVE = Soil Vapor Extraction
AS = Air Sparging
HDPE = High Density Polyethylene
bgs = Below Ground Surface

LEGEND

— — — Extent of Excavated Area

NOTE

Figure is not to scale.

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TYPICAL AS/SVE PIPING IN THE LANDSCAPED BERM (CROSS SECTION A-A')

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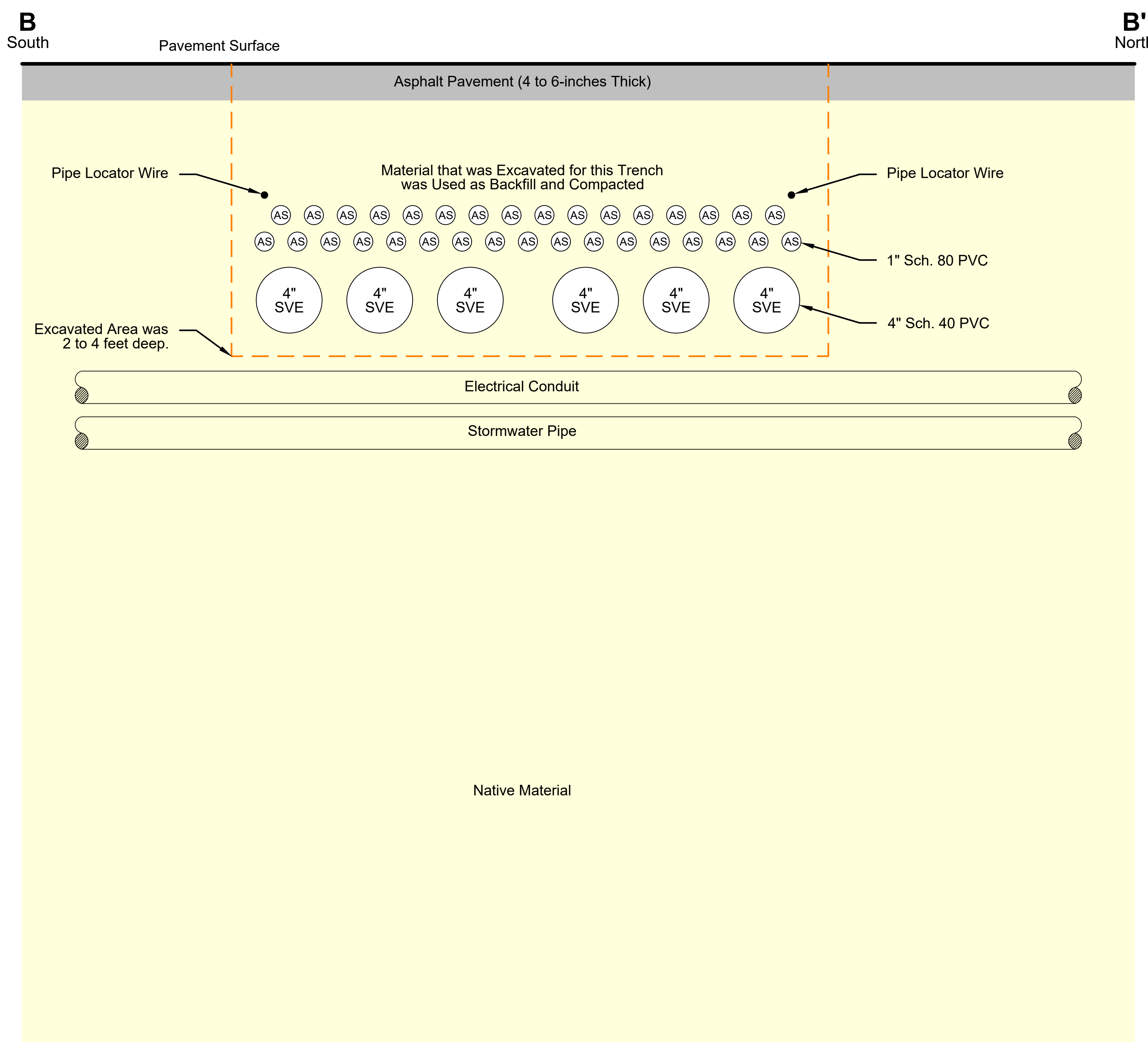
FIG. 4

FIG. 4



ABBREVIATIONS

PVC = Polyvinyl Chloride
SVE = Soil Vapor Extraction
AS = Air Sparging

LEGEND

Extent of Excavated Area

NOTE

Figure is not to scale.

FIG. 5

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TYPICAL REPLUMBED AS/SVE PIPING (CROSS SECTION B-B')

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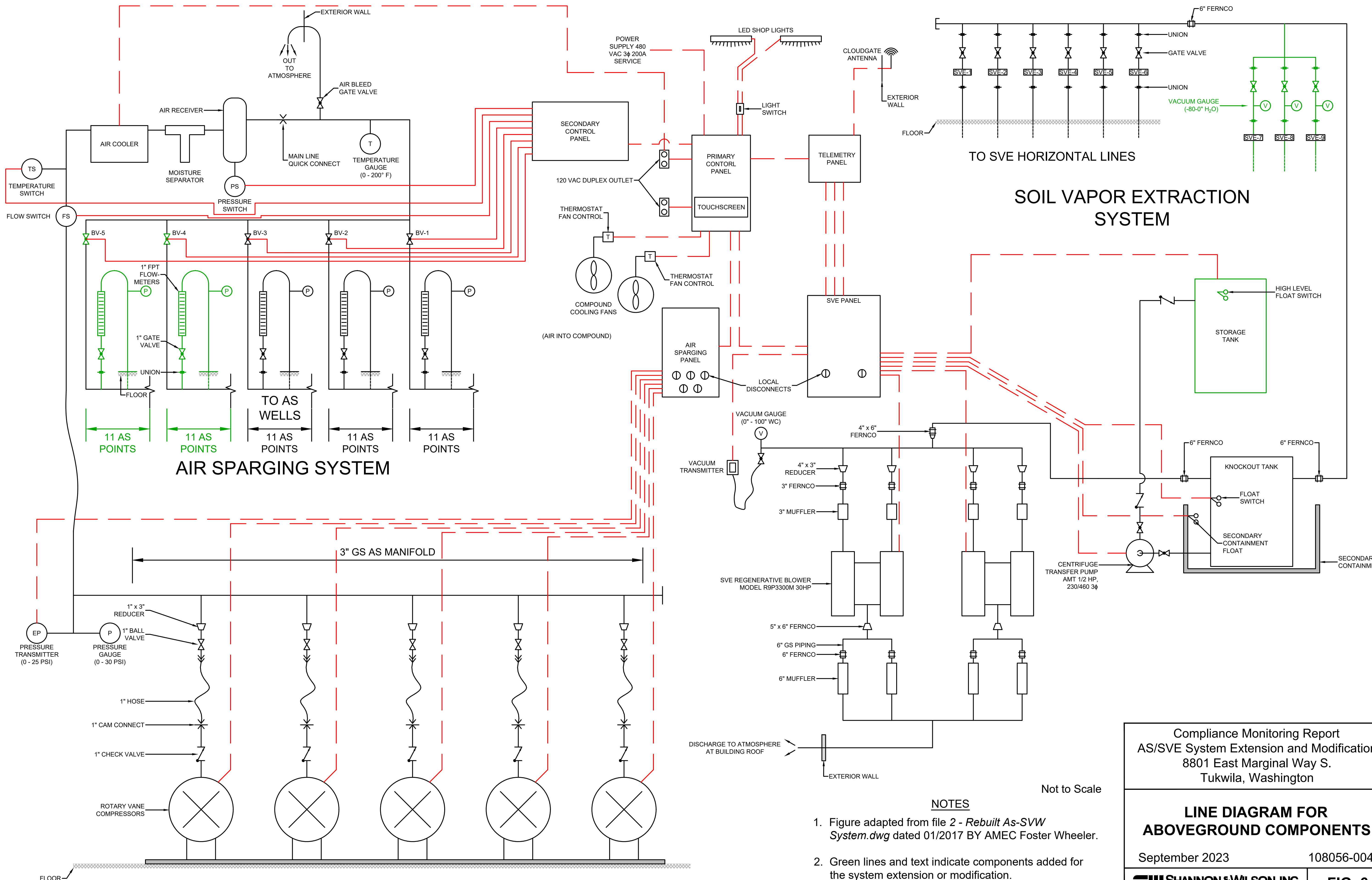
FIG. 5



Not to Scale

NOTES

1. Figure adapted from file *2 - Rebuilt As-SVW System.dwg* dated 01/2017 BY AMEC Foster Wheeler.
2. Green lines and text indicate components added for the system extension or modification.

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LINE DIAGRAM FOR ABOVEGROUND COMPONENTS

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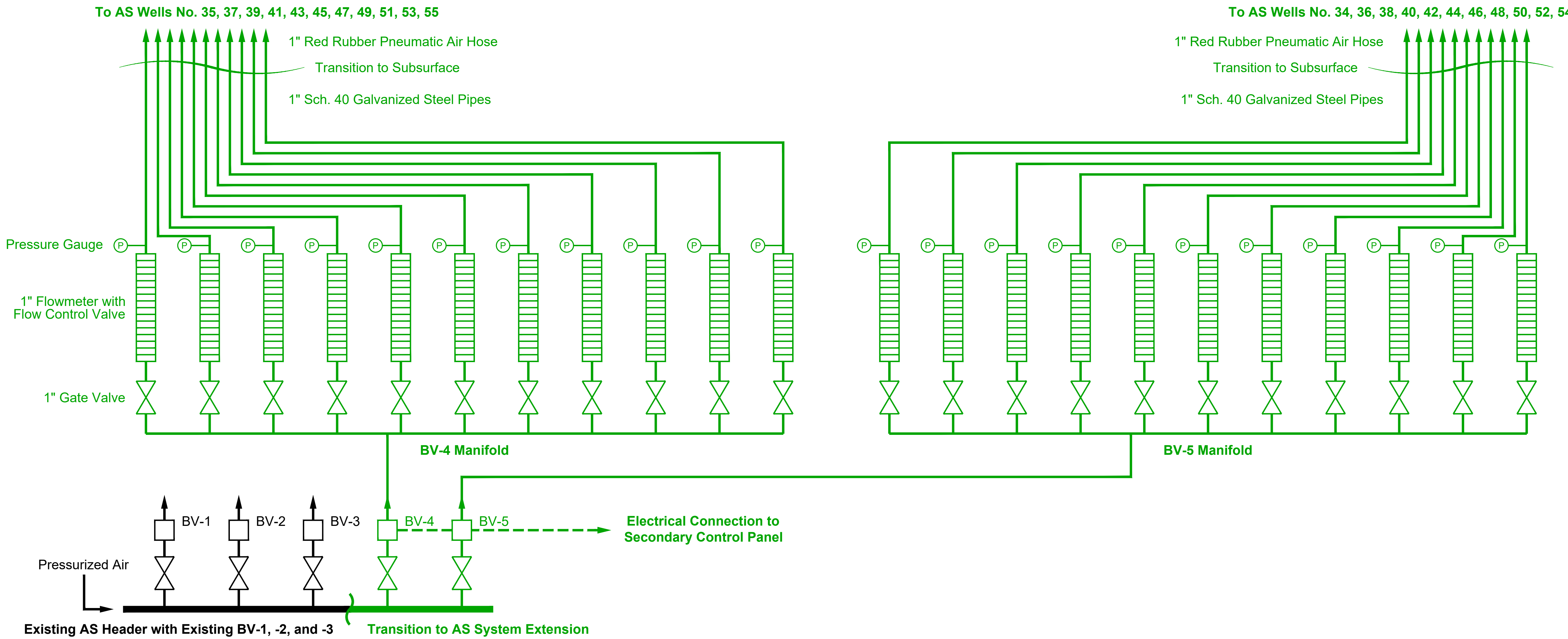
FIG. 6



NOTE

Green color indicates components installed as part of the AS system extension.

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LINE DIAGRAM OF EXTENSION AS SYSTEM DETAIL

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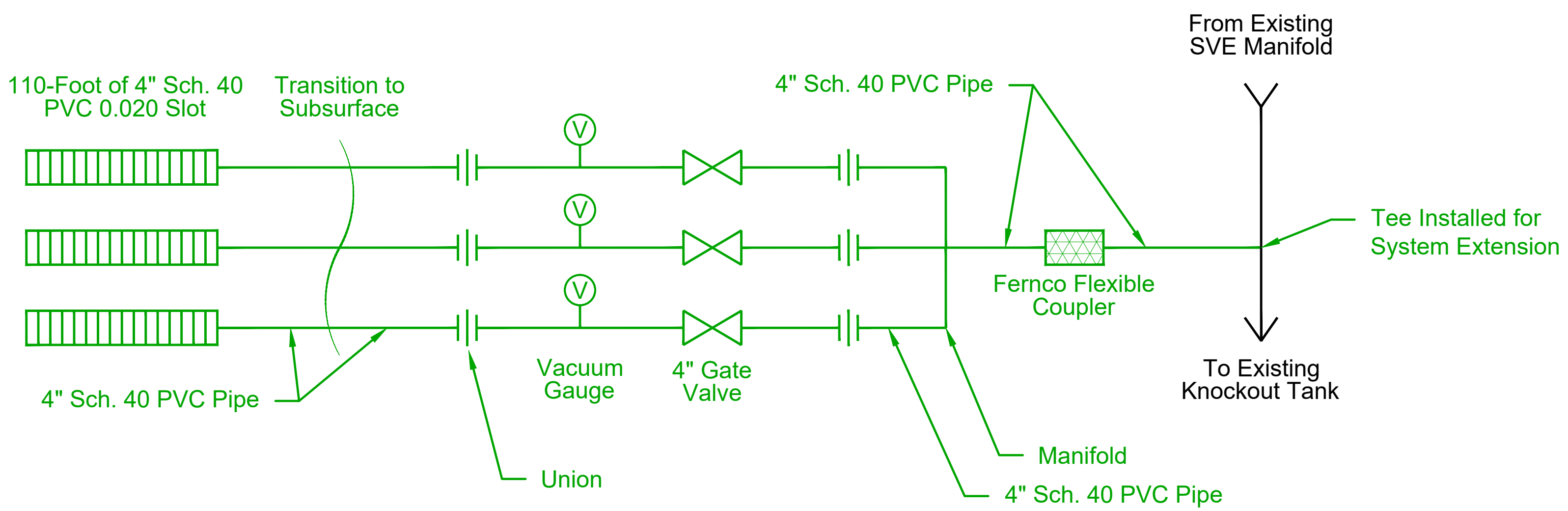
FIG. 7



NOTE

Green color indicates components installed as part of the AS system extension.

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LINE DIAGRAM OF EXTENSION SVE SYSTEM DETAIL

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FIG. 8

FIG. 8

APPENDIX A: FIELD METHODS

Appendix A

Field Methods

CONTENTS

Exhibits

APPENDIX A: FIELD METHODS

A.1 INTRODUCTION

This appendix summarizes field methods for the extension and modification to the air sparging/soil vapor extraction (AS/SVE) system undertaken in November 2021 through May 2023. Site redevelopment activities (conducted by the property owner, CenterPoint 8801 Marginal LLC (CenterPoint) occurred separate, and at times concurrent, with the AS/SVE activities and are discussed as they relate to the AS/SVE activities.

The following sections are organized by preparation activities and implementation activities.

A.2 PREPARATION ACTIVITIES

Actions undertaken prior to mobilization are summarized below.

A.2.1 Health and Safety Plan

A Health and Safety Plan (HASP) was prepared to address health and safety considerations for the proposed remedial activities and meet requirements in federal (29 Code of Federal Regulations 1910.120 and 1926) and state (Washington Administrative Code 296) regulations. The HASP was submitted and accepted by Washington State Department of Ecology (Ecology) as an appendix in the Compliance Monitoring Plan (Shannon & Wilson, 2021a). The remediation contractor (Anderson Environmental Contracting) prepared a supplemental HASP that discussed health and safety considerations that were specific to the means and methods.

During fieldwork, planned field activities and relevant health and safety topics were discussed during daily tailgate meetings. Health and safety topics included, but were not limited to, action levels and proper use of personal protective equipment, working near heavy equipment, handling contaminated material, decontamination procedures, and spill response.

No significant adverse health and safety events occurred during fieldwork.

A.2.2 Utility Locating

Shannon & Wilson notified the Washington Underground Utilities Location Center (1-800-424-5555) at least 48 hours before the start of subsurface work at the 8801 property. Additionally, Shannon & Wilson contracted a private utility locator (APS Locates and

Utilities Plus) to identify potential utilities in the drilling and trenching areas using conductible methods and ground-penetrating radar.

A.2.3 Waste Profiling of Drill Cuttings and Trenching Spoils

Disposed soil from drill cuttings and trenching was accepted under Waste Management's profile 135321OR as non-hazardous waste. The approved waste profile is provided in Appendix B. The soil was profiled prior to the start of subsurface work as described below.

In July and September 2019, soil samples were collected from the central north portion of the 8801 property, in the footprint of the proposed Area 1 excavation, and analyzed for trichloroethylene (TCE). Soil samples were collected at two borings (B1 and B6) near a historical boring G0 where elevated TCE had been previously detected. Soil samples at boring B1 were collected at 4 and 8 feet below ground surface (bgs). Soil samples at boring B6 were collected at 6 to 9 feet and 11 to 14 feet bgs. Soil samples were submitted to Analytical Resources, Incorporated in Tukwila, Washington for analysis of halogenated volatile organic compounds (VOCs). The results were below the remediation levels and TCE values were less than 5 milligrams per kilogram A sample was later analyzed using the Toxicity Characteristic Leaching Procedure (TCLP) per U.S. Environmental Protection Agency (EPA) Method 1311. The TCE value was non detect at the laboratory detection value. The samples were named B-1:4, B-1:8, B-6:6-9, and B-6:11-14. The lab reports are provided in Appendix B.

In 2021, representative soil from the proposed remedial excavation areas was collected via drilling and analyzed for waste characterization purposes prior to the start of excavation work. Several borings were advanced within the proposed Excavation Areas 4, 5, 7, and 8 during February 25 and March 1, 2021. Soil cuttings from the borings were composited based on the excavation area, except for Areas 7 and 8, which were composited together. The composite samples were named A4-WA, A5-WA, and A7A8-WA.

The composite samples were submitted to Fremont Analytical of Seattle, Washington, for analysis of VOCs; polycyclic aromatic hydrocarbons (PAHs); polychlorinated biphenyls (PCBs); Resource Conservation and Recovery Act 8 metals; and copper, nickel, and zinc.

Based on the chemical results, the concentration of one analyte (lead in the composite sample from Area 5, A5-WA) exceeded the "Rule of 20". The exceedance of the "Rule of 20" indicated the waste had the potential to exceed the dangerous waste toxicity characteristic for lead based on the mass of lead in the sample. To evaluate the lead toxicity in sample A5-WA, the sample was analyzed using the TCLP per EPA Method 1311. The leachate from the TCLP had 1.23 milligrams per liter (mg/L) of lead that was below the dangerous waste toxicity characteristic threshold of 5 mg/L. The lab report is available in Appendix B.

Based on the results of chemical and TCLP analyses in 2021, a separate sample of drill cuttings from Areas 4 and 5 was composited (one composite sample in total) and submitted for a hazardous waste fish bioassay. Rainier Environmental of Tacoma, Washington, performed the bioassay in accordance with the Ecology's Publication 80-12.[1] The bioassay consisted of exposure of juvenile rainbow trout to the composite sample for 96 hours. Three replicates of the test were performed concurrently.

No mortality was observed during the fish bioassay and the sample was not designated as dangerous waste. The bioassay report is provided in Appendix B.

A.2.4 Temporary Erosion and Sediment Control

In accordance with the Compliance Monitoring Plan, Best Management Practices (BMPs) were implemented during remedial excavation activities to limit the potential from erosion and sediment transport, including:

- Placement of silt fences around the perimeter of the 8801 property.
- Covering of soil stockpiles with plastic sheets secured by sandbags.
- Covering of trench sidewalls with plastic sheets secured by sandbags.

BMPs were inspected daily before remedial work commenced to check the integrity. If any deficiency was observed, a repair or replacement was made immediately.

A.2.5 Cultural Resources Monitoring

A Cultural Resources Monitoring and Inadvertent Discovery Plan (MIDP) was approved by the Washington Department of Archaeology and Historic Preservation and was included as an appendix in the approved Compliance Monitoring Plan.

Archeological monitoring of ground-disturbing activities was undertaken by professional archeologists from Stell in accordance with the approved MIDP. The archeologists reviewed subsurface material for indications of potential archeological materials and prepared a monitoring report summarizing their findings, which is attached as Appendix D. No significant archeological materials were identified during site work.

[1] Washington State Department of Ecology (Ecology), 2020, Biological Testing Methods 80-12 for the Designation of Dangerous Waste: Washington State Department of Ecology, Hazardous Waste and Toxics Reduction Program, Olympia, Wash., publication no. 80-12, revised September 2020.

A.3 IMPLEMENTATION ACTIVITIES

The AS/SVE extension and modification activities took place during the following mobilizations:

- November 2021: An 80-foot-long section of existing AS/SVE lines to the south and east of the AS/SVE building were disconnected, capped, and abandoned in place prior to construction of the landscaped berm.
- January 2023 through May 2023: The extension AS/SVE was constructed, and the electrical service connection was installed concurrent with the construction of the landscaped berm undertaken by the property owner (CenterPoint).
- March 2023: The 80-foot-length section of disconnected AS/SVE lines to the south and east of the AS/SVE building were reconnected in a new trench.
- April 2023 through May 2023: The replacement storage tank was installed.

A summary of the field methods is provided in this section.

A.3.1 Decontamination Methods

Equipment that contacted contaminated soil was decontaminated. The decontamination procedure was as follows:

- Removal of gross contamination and particulate matter,
- Wash with a mixture of tap water and non-phosphate detergent (Alconox™),
- Rinse with tap water,
- Rinse with distilled water rinse, and
- A final rinse with distilled water.

Decontamination water was disposed of with the excavated soil.

A.3.2 Extension to the Air Sparging System

The extension to the AS system consisted of 22 new vertical AS wells connected to the existing AS system. The AS wells were named ASW-34 through ASW-55 (Figure 3). The AS wells were installed in the footprint of the landscaped berm and footprint of the AS/SVE building. The AS lines were underground and emerged to the surface in the AS/SVE building to connect to the existing AS/SVE system.

The AS system extension wells, trench, and aboveground features are described in the following sections.

A.3.2.1 Air Sparging Wells

The AS wells were installed in the footprint of the landscaped berm and in the AS/SVE building. The wells were drilled after placement of fill soil (by CenterPoint) used to construct the landscaped berm and before the final one foot of topsoil was placed over the berm (by CenterPoint). A cross section of the placement of the AS wells within the landscaped berm is provided in Figure 4. Drilling methods are described in Section A.3.4.

The wells consisted of 1-inch schedule 80 polyvinyl chloride (PVC) with a 1-foot-length 0.020-inch slotted screen. No. 2x12 sand was used for the filter pack. A photo of a well screen is provided below.

Exhibit A-1: Photo of an Air Sparging Well Screen

The wells were screened in the shallow perched aquifer above the apparent transition from Poorly Graded Sand to Silty Sand, which was observed at approximately 29 to 33 feet bgs. The well casing was sealed using hydrated bentonite ship, including the portion of the casing that penetrated the geosynthetic clay liner (GCL). The screen depths and other well characteristics are provided in the boring logs (Appendix E). A cross section of an AS well is provided in Figure 4.

At each AS wellhead, the well casing was connected to a tee-fitting, check valve, and union. The wellhead was placed inside of the 24-inch double-wall corrugated high-density polyethylene (HDPE) collar with a green HDPE lid, except wells ASW 42 through ASW-45. Wells ASW-42 and ASW-45 were inside of the AS/SVE building and in the adjacent driveway and were placed in concrete vaults with metal lids to protect components from vehicle traffic. Photos of the well monuments are provided as Exhibits A-2 and A-3 below.

Exhibit A-2: Photo of an AS Well Monument in the Landscaped Berm

Exhibit A-3: Photo of an AS Wellhead Concrete Vault to the South of the AS/SVE Building, Looking West

A.3.2.2 Air Sparging Lines Trench

The AS wells were connected to the existing AS infrastructure in the AS/SVE building using 1-inch pneumatic hoses placed in an 8-inch double-walled HDPE conduit. The conduit was placed in a trench adjacent to the AS wells. Trenched soil was used as backfill around the AS conduit. A photo of the conduit in the trench is provided as Exhibit A-4.

Exhibit A-4: Photo of the AS Conduit to the South of the AS/SVE Building, Looking North

A.3.2.3 Air Sparging Aboveground Features

In the AS/SVE building, the 1-inch rubber hoses transitioned to 1-inch metal pipes and surfaced through the concrete floor. A photo of the aboveground AS extension components is provided as Exhibit A-5.

Exhibit A-5: View of the Aboveground AS Extension Components Inside of the AS/SVE Building

Above the concrete floor, the AS pipes were connected to gate valves, pressure gauges, and flowmeters. Thereafter, 11 of the AS lines were connected to one manifold and the other 11 AS lines were connected to a second manifold. The manifolds were separately connected to electrical-operated ball valves (BV-4 and BV-5) that were connected to the main pressurized air header (Exhibit A-6). A line diagram showing AS components and connections to the existing AS system is provided in Figure 6 with further detail in Figure 7.

Exhibit A-6: View of Ball Valves BV-4 and BV-5 Connected to the Main AS Header

The AS wells connected to BV-4 and BV-5 were sequentially alternated (i.e., grouped as odd numbers and even numbers) to distribute the aeration effects in the groundwater plume. The existing AS wells were previously assigned to the existing ball valves (BV-1, BV-2, and BV-3) in a similar method such that every third AS wells is assigned to a group. The assigned AS wells and associated ball valves are listed in Exhibit A-7 and a map of the wells is provided as Figure 3.

Exhibit A-7: List of Air Sparging Wells Connected to Electric Ball Valves

BV-1	BV-2	BV-3	BV-4	BV-5
ASW-3	ASW-1	ASW-2	ASW-35	ASW-34
ASW-6	ASW-4	ASW-5	ASW-37	ASW-36
ASW-9	ASW-7	ASW-8	ASW-39	ASW-38
ASW-12	ASW-10	ASW-11	ASW-41	ASW-40
ASW-15	ASW-13	ASW-14	ASW-43	ASW-42
ASW-18	ASW-16	ASW-17	ASW-45	ASW-44
ASW-21	ASW-19	ASW-20	ASW-47	ASW-46
ASW-24	ASW-22	ASW-23	ASW-49	ASW-48
ASW-27	ASW-25	ASW-26	ASW-51	ASW-50
ASW-30	ASW-28	ASW-29	ASW-53	ASW-52
ASW-33	ASW-32	ASW-31	ASW-55	ASW-54

BV-4 and BV-5 were electrically connected to the Secondary Control Panel. The panel was programmed to cycle open the five ball valves (three existing valves and two new valves) such that one valve is open at a given time. The open ball valve will charge every four hours such that the next ball valve in the sequence will be open for the next four hours. The cycle sequence ensures that each AS well will receive four hours of pressurized air during every 20-hour period. The cycle should be sufficient to aerate the groundwater plume, given the groundwater velocity is estimated to be 40 feet per year.

The new AS wells were tested for proper sealing as described in Section A.3.8.

A.3.3 Extension to the Soil Vapor Extraction System

The extension to the SVE system consisted of three horizontal screens, each approximately 110 feet long. The SVE screens are composed of 4-inch schedule 40 PVC with 0.020-inch slotted horizontal screens. The screens were placed in a single trench within 1 foot under the clay liner. The screens were bedded in pea gravel and wrapped in a geotextile to prevent the introduction of fines into the SVE system.

The screens (SVE-7, -8, and -9) were installed in a single trench extending in an approximate north/south alignment (Exhibit A-8). The screened sections of the SVE pipe were offset, such that SVE-7 was farthest north in the trench, SVE-8 was in the middle, and SVE-9 was farthest south. Figure 3 shows the approximate location of each screen.

Exhibit A-8: Photo of Construction of the SVE Extension Located North of the AS/SVE Building, Looking North

The trench was within the footprint of the landscaped berm and the AS/SVE building. In the footprint of the landscaped berm, the trench was excavated prior to placement of the overlaying geosynthetic clay liner (GCL) by CenterPoint. The SVE screens were installed beneath the GCL because the GCL would likely restrict the vertical migration air injected to the groundwater from the AS wells. In the footprint of the AS/SVE building, a portion of the concrete floor slab was removed to excavate the SVE trench. A locator tracing wire was placed in the SVE trench to allow for future location. A cross section showing the placement of the SVE screens and GCL is provided in Figure 4.

The new SVE lines were routed aboveground inside of the AS/SVE building and connected to a gate valve, vacuum gauge, and union. Then the SVE lines were connected the existing SVE vacuum header. A photo of the aboveground SVE extension components is provided as Exhibit A-9. A line diagram showing SVE components and connections to the existing SVE system is provided as Figure 6 and further detail is shown in Figure 8.

Exhibit A-9: View of the Three SVE Extension Pipes Inside of the AS/SVE Building, Looking East

The new SVE lines were tested for proper sealing as described in Section A.3.8.

A.3.4 Relocation of the Existing AS/SVE System

An approximately 80-foot section of AS/SVE lines to the south and east of the AS/SVE building were disconnected and capped, and the pipes were abandoned in place because the excavation for the landscaped berm and associated drainage line to be constructed by CenterPoint would intercept the existing lines. The disconnection was completed prior to installation of the landscaped berm and drainage line (by CenterPoint). The replumbing of the AS/SVE lines was undertaken after the excavation for the landscaped berm was completed and the clay liner was installed. The location of the disconnection and replumbing is shown in Exhibit A-10 below and Figure 3. A cross section of the replumbed lines is provided as Figure 5.

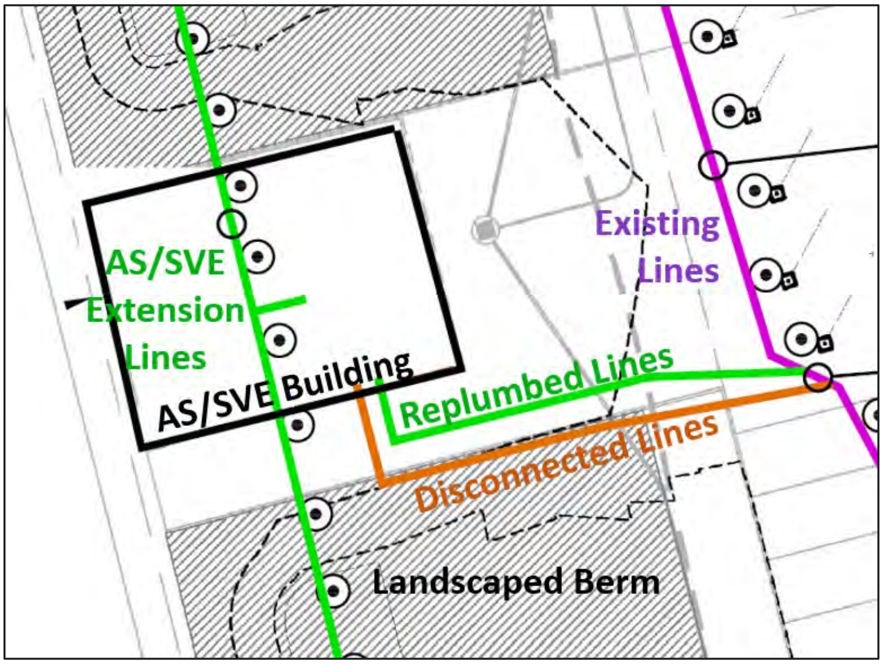

Exhibit A-10: Replumbing of Existing AS/SVE Lines (North is Up)

Photos of the capped pipe ends are provided as Exhibits A-11 and A-12 below.

Exhibit A-11: View of the East Terminus of the Disconnected and Capped AS/SVE Pipes, Looking East

Exhibit A-12: View of the West Terminus of the Disconnected and Capped AS/SVE Pipes, Looking North

The new AS lines consisted of 1-inch schedule 80 PVC and the new SVE lines consisted of 4-inch schedule 40 PVC as shown in Exhibit A-13 below. The new AS/SVE lines were tested for proper sealing as described in Section A.3.8.

Exhibit A-13: New Replumbed AS/SVE Lines, Looking East

Excavation spoils from the trench were used as backfill around the new AS/SVE pipes. Approximately 8-inch-thick lifts were compacted with a walk-behind vibrating plate compactor until the soil was firm and unyielding. The area was then paved with asphalt for a driveway.

A.3.5 Replacement of the Storage Tank

The storage tank was replaced with materials and equipment to have equivalent functionality of the original tank. A line diagram showing the connections of the AS/SVE system to the storage tank is provided in Figure 6. Sideview and top-view photos of the storage tank are provided as Exhibits A-14 and A-15 below.

Exhibit A-14: View of the Storage Tank Inside of the AS/SVE Building, Looking East

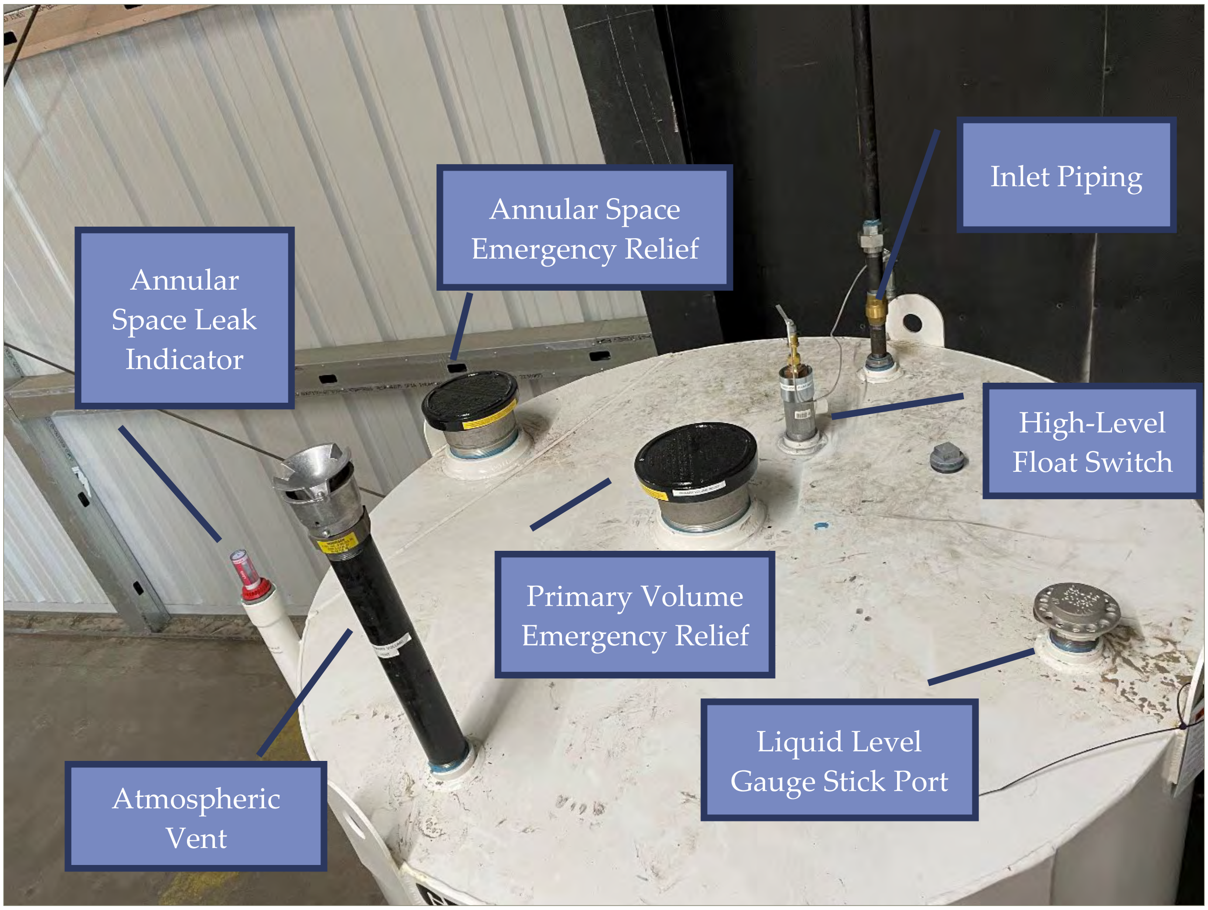

Exhibit A-15: View of the Top of the Storage Tank Inside of the AS/SVE Building, Looking East

The storage tank has the following components:

- An inlet pipe was routed from the existing transfer pump to the storage tank.
- The storage tank consists of a double-walled metal tank with 1,000-gallon capacity. The annular space capacity is 10 gallons.
- The storage tank is designed to operate at atmospheric pressure. An atmospheric vent was installed for the primary volume.
- Water levels inside of the primary volume are measured using a manual gauging stick.
- An annular space leak indicator is used to detect leaks from the primary volume to the annular space.
- Two emergency overpressure relief valves (one connected to the primary volume and the other connected to the annular space) provide overpressure protection.
- A high-level float switch was installed in the primary volume and connected to the Primary Control Panel. The float switch is designed to shut down the AS/SVE system when the primary volume reaches approximately 95% capacity.
- The contents of the storage tank are pumped out via the outlet at the base of the tank.

The tank manufacturer's drawing and product spec sheets are provided in Appendix F.

A.3.6 Drilling Methods

Drilling of AS wells was completed using sonic drilling methods and direct push drilling methods. Sonic drilling was employed at borings located in the footprint of the landscaped berm to drill through the coarse crushed rock was used as a drainage layer in the berm. Sonic drilling can penetrate coarse crushed rock more effectively than direct push drilling. Direct push drilling was used at locations outside of the landscaped berm. Boring logs are provided in Appendix E. Descriptions of the drilling methods are provided below.

A.3.6.1 Sonic Drilling

Sonic drilling methods utilize a hollow metal tube with a cutting head. The metal tube is connected to oscillators at the drill rig. The oscillators transmit high-frequency, resonant sonic energy through the drill string, which causes the surrounding material to fluidize and reduces friction. Once the cutting head is advanced for an interval (typically 5 feet), a larger diameter hollow metal casing is advanced around the cutting head. Then the cutting head and 5 feet of soil core are retrieved from the borehole. The soil core is vibrated from the metal tube into a cylindrical PVC bag. The cutting head is then advanced further in the borehole to thew next deeper interval. The process repeats until the total depth of the borehole is achieved.

Soil from the PVC core bags were cut open and the soil was logged. A photo of the sonic drill rig is provided in Exhibit A-16 below.

Exhibit A-16: Photo of the Sonic Drill Rig to the South of the AS/SVE Building, Looking Northwest

A.3.6.2 Direct-Push Drilling

At direct-push locations, the static weight of the hydraulic probe rig combined with percussive energy were used to advance a series of hollow metal rods. To collect soil from the borehole, a 2-inch-diameter, 5-foot-long hollow metal rod fitted with a removable PVC liner was driven into undisturbed soil continuously from the ground surface to the desired depth of the boring.

Upon retrieval of the metal probe, the PVC liner and entrained soil were extruded from the metal tube, the PVC liner was then sliced open, and the soil was logged. A photo of the direct-push drill rig is provided in Exhibit A-17 below.

Exhibit A-17: Photo of the Direct-Push Drill Rig Inside of the AS/SVE Building, Looking Northeast

A.3.7 Soil Disposal

Excavated soil was reused as backfill in the same trench where it originated, except imported pea gravel was used for backfill around the SVE screens. Soil that was not reused as backfill was disposed under Waste Management's profile 135321OR as non-hazardous waste.

Approximately 20.91 tons of soil was hauled to Waste Management's 8th Avenue Reload Facility at 7400 8th Avenue S., Seattle, Washington 98108. The soil was then transported for final disposition as non-hazardous waste at Waste Management's Columbia Ridge Landfill at 18177 Cedar Springs Lane, Arlington, Oregon 97812. Disposal certificates and truck tickets are provided as Appendix C.

Soil was directly loaded into trucks for hauling offsite when practicable, otherwise the soil was stockpiled until being hauled offsite.

A.3.8 Pipe Leak Testing

The new AS and SVE lines were pneumatically tested for indications of leaks. The passing criteria for AS lines was 30 pounds per square inch gauge (psig) for 15 minutes. The passing criteria for SVE lines was 5 psig for 15 minutes.

To perform the tests, the tested section of the pipes was isolated using valves and/or temporary plugs. A test pressure gauge was attached to the section or pipe, then compressed air was injected into the pipes until the test pressure was achieved. Photos of the testing apparatus are provided below as Exhibits A-18 through A-20.

Exhibit A-18: Photo of Test Gauges Attached to AS Lines in the Replumbed AS/SVE Trench

Exhibit A-19: Photo of Temporary Manifold and Test Gauges Attached to SVE Lines in the Replumbed AS/SVE Trench

Exhibit A-20: Photo of Temporary Plugs Attached to SVE Lines in the Replumbed AS/SVE Trench

Several leaks were encountered at the connection to the test gauge. The connections were tightened and the tests reperformed until the passing criteria were achieved. Logs of the tests are provided in Appendix G.

A.3.9 Surveying

Surveys of AS wells and subsurface pipes were undertaken by Barghausen Consulting Engineers. The surveyed features are incorporated into the figures in the main report.

APPENDIX B: WASTE PROFILING DOCUMENTS

Appendix B

Waste Profiling Documents

CONTENTS

- Analytical Resources Inc., Work Order 19G0302, July 30, 2019
- Analytical Resources, Inc., Work Order 20B0027, February 17, 2020
- Fremont Analytical, Lab Report, Work Order No. 2103041, March 17, 2021
- Rainier Environmental, Dangerous Waste Characterization, May 24, 2021, Sample ID: A4+A5:C
- Waste Management, Non-Hazardous WAM Approval, Profile No. 135321OR, Expiration Date May 27, 2022
- Waste Management, Non-Hazardous WAM Approval, Profile No. 135321OR, Expiration Date June 8, 2023

Analytical Resources, Incorporated
Analytical Chemists and Consultants

30 July 2019

Joseph Sawdey
Shannon & Wilson, Inc
400 N 34th St., Suite 100
Seattle, WA 98103-8636

RE: 8801 E Marginal Way S

Please find enclosed sample receipt documentation and analytical results for samples from the project referenced above.

Sample analyses were performed according to ARI's Quality Assurance Plan and any provided project specific Quality Assurance Plan. Each analytical section of this report has been approved and reviewed by an analytical peer, the appropriate Laboratory Supervisor or qualified substitute, and a technical reviewer.

Should you have any questions or problems, please feel free to contact us at your convenience.

Associated Work Order(s)	Associated SDG ID(s)
19G0302	N/A

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed in the enclose Narrative. ARI, an accredited laboratory, certifies that the report results for which ARI is accredited meets all the requirements of the accrediting body. A list of certified analyses, accreditations, and expiration dates is included in this report.

Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or his/her designee, as verified by the following signature.

Analytical Resources, Inc.

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

ACCREDITED IN ACCORDANCE WITH nelac
Cert# 100006

PJLA Testing
Accreditation # 66169

Chain of Custody Record & Laboratory Analysis Request

ARI Assigned Number: 19G0302	Turn-around Requested: Standard	Page: 1	of 1
ARI Client Company: Shannon & Wilson	Phone: (206) 695-6907	Date: 7/23	Ice Present? Yes
Client Contact: Joe Sawdey		No. of Coolers: 1	Cooler Temps: 4.4°C
Client Project Name: 8801 Remediation			
Client Project #: 103485	Samplers: Joe Sawdey		

Analytical Resources, Incorporated
Analytical Chemists and Consultants
4611 South 134th Place, Suite 100
Tukwila, WA 98168
206-695-6200 206-695-6201 (fax)
www.arilabs.com

Sample ID	Date	Time	Matrix	No. Containers	HVOCs by EPA 8260C *	Trichloroethene by EPA 8260C							Notes/Comments
RGW-01	7/23	0915	Water	3	X								
RGW-02	↓	1015	↓	↓	X								
RGW-03	↓	1120	↓	↓	X								
B-1:4	↓	1215	Soil	↓		X							
B-1:8	↓	12:25	↓	↓		X							
Trip Blank													

Comments/Special Instructions	Relinquished by:	Received by:	Relinquished by:	Received by:
*Vinyl chloride by 8260C-SIM	(Signature) [signature]	(Signature) [signature]	(Signature)	(Signature)
	Printed Name: Joe Sawdey	Printed Name: Jacob Walter	Printed Name:	Printed Name:
	Company: Shannon & Wilson	Company: ARI	Company:	Company:
	Date & Time: 7/23/19 16:25	Date & Time: 07/23/19 1625	Date & Time:	Date & Time:

Limits of Liability: ARI will perform all requested services in accordance with appropriate methodology following ARI Standard Operating Procedures and the ARI Quality Assurance Program. This program meets standards for the industry. The total liability of ARI, its officers, agents, employees, or successors, arising out of or in connection with the requested services, shall not exceed the Invoiced amount for said services. The acceptance by the client of a proposal for services by ARI release ARI from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order or co-signed agreement between ARI and the Client.

Sample Retention Policy: All samples submitted to ARI will be appropriately discarded no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alternate retention schedules have been established by work-order or contract.

Shannon & Wilson, Inc	Project: 8801 E Marginal Way S	
400 N 34th St., Suite 100	Project Number: 103485	**Reported:**
Seattle WA, 98103-8636	Project Manager: Joseph Sawdey	30-Jul-2019 13:50

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
RGW-01	19G0302-01	Water	23-Jul-2019 09:15	23-Jul-2019 16:25
RGW-02	19G0302-02	Water	23-Jul-2019 10:15	23-Jul-2019 16:25
RGW-03	19G0302-03	Water	23-Jul-2019 11:20	23-Jul-2019 16:25
B-1:4	19G0302-04	Solid	23-Jul-2019 12:15	23-Jul-2019 16:25
B-1:8	19G0302-05	Solid	23-Jul-2019 12:25	23-Jul-2019 16:25
Trip Blank	19G0302-06	Water	23-Jul-2019 09:15	23-Jul-2019 16:25

Shannon & Wilson, Inc	Project: 8801 E Marginal Way S	
400 N 34th St., Suite 100	Project Number: 103485	**Reported:**
Seattle WA, 98103-8636	Project Manager: Joseph Sawdey	30-Jul-2019 13:50

Work Order Case Narrative

Sample receipt

Samples as listed on the preceding page were received July 23, 2019 under ARI work order 19G0302. For details regarding sample receipt, please refer to the Cooler Receipt Form.

Volatiles - EPA Method SW8260C

The samples were analyzed within the recommended holding times.

The total solids percent is based on an assumed 100% solids. This can bias the reporting limits low.

The solid samples were reanalyzed at medium levels due to the Trichloroethene concentrations exceeding the upper calibration range. The initial analyses have been flagged with "E" qualifiers.

Initial and continuing calibrations were within method requirements.

Internal standard areas were within limits.

The surrogate percent recoveries were within control limits.

The method blanks were clean at the reporting limits.

The LCS/LCSD percent recoveries and RPD were within control limits.

Volatiles - EPA Method 8260C-SIM (Selected Ion Monitoring)

The samples were analyzed within the recommended holding times.

Initial and continuing calibrations were within method requirements.

Internal standard areas were within limits.

The surrogate percent recoveries were within control limits.

The method blank was clean at the reporting limits.

The LCS/LCSD percent recoveries and RPD were within control limits.

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Printed: 7/24/2019 7:41:39AM

WORK ORDER

19G0302

Client: Shannon & Wilson, Inc	**Project Manager: Amanda Volgardsen**
Project: 8801 E Marginal Way S	**Project Number: 103485**

Report To:
Shannon & Wilson, Inc
Joseph Sawdey
400 N 34th St., Suite 100
Seattle, WA 98103-8636
Phone: 206-632-8020
Fax: -

Invoice To:
Shannon & Wilson, Inc
Meg Strong
400 N 34th St., Suite 100
Seattle, WA 98103-8636
Phone :(206) 695-6787
Fax: -

Date Due:	07-Aug-2019 18:00 (10 day TAT)		
Received By:	Jacob Walter	Date Received:	23-Jul-2019 16:25
Logged In By:	Erin I. Salle	Date Logged In:	24-Jul-2019 07:19

Samples Received at:**4.4°C**

Intact, properly signed and dated custody seals attached to outside of cooler(s).....No
Custody papers properly filled out (in, signed, analyses requested, etc)..................Yes
Was sufficient ice used (if appropriate)..Yes
All bottles arrived in good condition (unbroken)..Yes
Number of containers listed on COC match number received..................................Yes
Correct bottles used for the requested analyses..Yes
Analyses/bottles require preservation (attach preservation sheet excluding VOC).No
Sample split at ARI..No

Custody papers included with the cooler.. Yes
Was a temperature blank included in the cooler............................. No
All bottles sealed in individual plastic bags.................................... No
All bottle labels complete and legible... Yes
Bottle labels and tags agree with COC... Yes
All VOC vials free of air bubbles... Yes
Sufficient amount of sample sent in each bottle............................. Yes

Analysis	Due	TAT	Expires	Comments

Analytical Resources, Incorporated
Analytical Chemists and Consultants

WORK ORDER

19G0302

Client: Shannon & Wilson, Inc
Project: 8801 E Marginal Way S
Project Manager: Amanda Volgardsen
Project Number: 103485

Analysis	Due	TAT	Expires	Comments
19G0302-01 RGW-01 [Water] Sampled 23-Jul-2019 09:15 (GMT-08:00) Pacific Time (US & Canada)				
A = VOA Vial, Amber, 40 mL, HCL B = VOA Vial, Amber, 40 mL, HCL C = VOA Vial, Amber, 40 mL, HCL				
8260C VOA	07-Aug-2019 15:00	10	06-Aug-2019 09:15	
19G0302-02 RGW-02 [Water] Sampled 23-Jul-2019 10:15 (GMT-08:00) Pacific Time (US & Canada)				
A = VOA Vial, Amber, 40 mL, HCL B = VOA Vial, Amber, 40 mL, HCL C = VOA Vial, Amber, 40 mL, HCL				
8260C VOA	07-Aug-2019 15:00	10	06-Aug-2019 10:15	
19G0302-03 RGW-03 [Water] Sampled 23-Jul-2019 11:20 (GMT-08:00) Pacific Time (US & Canada)				
A = VOA Vial, Amber, 40 mL, HCL B = VOA Vial, Amber, 40 mL, HCL C = VOA Vial, Amber, 40 mL, HCL				
8260C VOA	07-Aug-2019 15:00	10	06-Aug-2019 11:20	
19G0302-04 B-1:4 [Solid] Sampled 23-Jul-2019 12:15 (GMT-08:00) Pacific Time (US & Canada)				
A = VOA Vial, Clear, 40 mL, MeOH B = VOA Vial, Clear, 40 mL, NaHSO4 C = VOA Vial, Clear, 40 mL, NaHSO4				
Solids, Total, Dried at 103 -105 °C, Soli	07-Aug-2019 15:00	10	20-Aug-2019 12:15	
8260C VOA	07-Aug-2019 15:00	10	06-Aug-2019 12:15	
19G0302-05 B-1:8 [Solid] Sampled 23-Jul-2019 12:25 (GMT-08:00) Pacific Time (US & Canada)				
A = VOA Vial, Clear, 40 mL, MeOH B = VOA Vial, Clear, 40 mL, NaHSO4 C = VOA Vial, Clear, 40 mL, NaHSO4				
Solids, Total, Dried at 103 -105 °C, Soli	07-Aug-2019 15:00	10	20-Aug-2019 12:25	
8260C VOA	07-Aug-2019 15:00	10	06-Aug-2019 12:25	
19G0302-06 Trip Blank [Water] Sampled 23-Jul-2019 09:15 (GMT-08:00) Pacific Time (US & Canada)				
A = VOA Vial, Amber, 40 mL, HCL B = VOA Vial, Amber, 40 mL, HCL				
8260C VOA	07-Aug-2019 15:00	10	06-Aug-2019 09:15	

Reviewed By

Date

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Cooler Receipt Form

ARI Client: Shannon & Wilson

Project Name: 8801 Remediation

COC No(s): NA

Delivered by: Fed-Ex UPS Courier Hand Delivered Other:

Assigned ARI Job No: 19G0302

Tracking No: NA

Preliminary Examination Phase:

Were intact, properly signed and dated custody seals attached to the outside of the cooler?	YES	NO
Were custody papers included with the cooler?	YES	NO
Were custody papers properly filled out (ink, signed, etc.)	YES	NO

Temperature of Cooler(s) (°C) (recommended 2.0-6.0 °C for chemistry)

Time 1625 4.4°C

If cooler temperature is out of compliance fill out form 00070F

Temp Gun ID#: D005206

Cooler Accepted by: JDL Date: 07/23/19 Time: 1625

Complete custody forms and attach all shipping documents

Log-In Phase:

Was a temperature blank included in the cooler?		YES	NO
What kind of packing material was used? ... Bubble Wrap Wet Ice Gel Packs Baggies Foam Block Paper Other:			
Was sufficient ice used (if appropriate)?	NA	YES	NO
How were bottles sealed in plastic bags?	Individually	Grouped	Not
Did all bottles arrive in good condition (unbroken)?		YES	NO
Were all bottle labels complete and legible?		YES	NO
Did the number of containers listed on COC match with the number of containers received?		YES	NO
Did all bottle labels and tags agree with custody papers?		YES	NO
Were all bottles used correct for the requested analyses?		YES	NO
Do any of the analyses (bottles) require preservation? (attach preservation sheet, excluding VOCs)	NA	YES	NO
Were all VOC vials free of air bubbles?	NA	YES	NO
Was sufficient amount of sample sent in each bottle?		YES	NO
Date VOC Trip Blank was made at ARI	NA	7/16/19	

Were the sample(s) split by ARI? NA YES Date/Time: Equipment: Split by:

Samples Logged by: GBM Date: 7/24/19 Time: 0719 Labels checked by: GS

***** Notify Project Manager of discrepancies or concerns *****

Sample ID on Bottle	Sample ID on COC	Sample ID on Bottle	Sample ID on COC

Additional Notes, Discrepancies, & Resolutions:

By: Date:

Shannon & Wilson, Inc	Project: 8801 E Marginal Way S	
400 N 34th St., Suite 100	Project Number: 103485	**Reported:**
Seattle WA, 98103-8636	Project Manager: Joseph Sawdey	30-Jul-2019 13:50

RGW-01

19G0302-01 (Water)

Volatile Organic Compounds

Method: EPA 8260C — Sampled: 07/23/2019 09:15

Instrument: NT3 Analyst: PKC — Analyzed: 07/24/2019 17:42

Sample Preparation: Preparation Method: EPA 5030 (Purge and Trap) — Extract ID: 19G0302-01 A

Preparation Batch: BHG0569 — Sample Size: 10 mL

Prepared: 24-Jul-2019 — Final Volume: 10 mL

Analyte	CAS Number	Dilution	Detection Limit	Reporting Limit	Result	Units	Notes
1,1-Dichloroethene	75-35-4	1	0.05	0.20	ND	ug/L	U
1,1-Dichloroethane	75-34-3	1	0.05	0.20	**0.23**	ug/L	
cis-1,2-Dichloroethene	156-59-2	1	0.04	0.20	**1.36**	ug/L	
Trichloroethene	79-01-6	1	0.05	0.20	**0.35**	ug/L	
Tetrachloroethene	127-18-4	1	0.05	0.20	ND	ug/L	U
Surrogate: Dibromofluoromethane				*80-120 %*	*110*	*%*	
Surrogate: 1,2-Dichloroethane-d4				*80-129 %*	*109*	*%*	
Surrogate: Toluene-d8				*80-120 %*	*98.4*	*%*	
Surrogate: 4-Bromofluorobenzene				*80-120 %*	*89.3*	*%*	

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Analytical Report

Shannon & Wilson, Inc	Project: 8801 E Marginal Way S	
400 N 34th St., Suite 100	Project Number: 103485	**Reported:**
Seattle WA, 98103-8636	Project Manager: Joseph Sawdey	30-Jul-2019 13:50

RGW-01

19G0302-01 (Water)

Volatile Organic Compounds - SIM

Method: EPA 8260C-SIM — Sampled: 07/23/2019 09:15

Instrument: NT7 Analyst: PB — Analyzed: 07/29/2019 16:05

Sample Preparation: Preparation Method: EPA 5030 (Purge and Trap) — Extract ID: 19G0302-01 B

Preparation Batch: BHG0680 — Sample Size: 10 mL

Prepared: 29-Jul-2019 — Final Volume: 10 mL

Analyte	CAS Number	Dilution	Detection Limit	Reporting Limit	Result	Units	Notes
Vinyl chloride	75-01-4	1	5.01	20.0	**1520**	ng/L	
Surrogate: 1,2-Dichloroethane-d4				*80-129 %*	*117*	*%*	

Shannon & Wilson, Inc	Project: 8801 E Marginal Way S	
400 N 34th St., Suite 100	Project Number: 103485	**Reported:**
Seattle WA, 98103-8636	Project Manager: Joseph Sawdey	30-Jul-2019 13:50

RGW-02

19G0302-02 (Water)

Volatile Organic Compounds

Method: EPA 8260C — Sampled: 07/23/2019 10:15

Instrument: NT3 Analyst: PKC — Analyzed: 07/24/2019 18:09

Sample Preparation: Preparation Method: EPA 5030 (Purge and Trap) — Extract ID: 19G0302-02 A

Preparation Batch: BHG0569 — Sample Size: 10 mL

Prepared: 24-Jul-2019 — Final Volume: 10 mL

Analyte	CAS Number	Dilution	Detection Limit	Reporting Limit	Result	Units	Notes
1,1-Dichloroethene	75-35-4	1	0.05	0.20	ND	ug/L	U
1,1-Dichloroethane	75-34-3	1	0.05	0.20	**0.15**	ug/L	J
cis-1,2-Dichloroethene	156-59-2	1	0.04	0.20	ND	ug/L	U
Trichloroethene	79-01-6	1	0.05	0.20	**0.13**	ug/L	J
Tetrachloroethene	127-18-4	1	0.05	0.20	ND	ug/L	U
Surrogate: Dibromofluoromethane				*80-120 %*	*112*	*%*	
Surrogate: 1,2-Dichloroethane-d4				*80-129 %*	*106*	*%*	
Surrogate: Toluene-d8				*80-120 %*	*98.3*	*%*	
Surrogate: 4-Bromofluorobenzene				*80-120 %*	*93.5*	*%*	

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Analytical Report

Shannon & Wilson, Inc	Project: 8801 E Marginal Way S	
400 N 34th St., Suite 100	Project Number: 103485	**Reported:**
Seattle WA, 98103-8636	Project Manager: Joseph Sawdey	30-Jul-2019 13:50

RGW-02

19G0302-02 (Water)

Volatile Organic Compounds - SIM

Method: EPA 8260C-SIM — Sampled: 07/23/2019 10:15

Instrument: NT7 Analyst: PB — Analyzed: 07/29/2019 16:31

Sample Preparation: Preparation Method: EPA 5030 (Purge and Trap) — Extract ID: 19G0302-02 C

Preparation Batch: BHG0680 — Sample Size: 10 mL

Prepared: 29-Jul-2019 — Final Volume: 10 mL

Analyte	CAS Number	Dilution	Detection Limit	Reporting Limit	Result	Units	Notes
Vinyl chloride	75-01-4	1	5.01	20.0	**74.5**	ng/L	
Surrogate: 1,2-Dichloroethane-d4				*80-129 %*	*115*	*%*	

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Seattle WA, 98103-8636	Project Manager: Joseph Sawdey	30-Jul-2019 13:50

RGW-03

19G0302-03 (Water)

Volatile Organic Compounds

Method: EPA 8260C — Sampled: 07/23/2019 11:20

Instrument: NT3 Analyst: PKC — Analyzed: 07/24/2019 18:35

Sample Preparation: Preparation Method: EPA 5030 (Purge and Trap) — Extract ID: 19G0302-03 A

Preparation Batch: BHG0569 — Sample Size: 10 mL

Prepared: 24-Jul-2019 — Final Volume: 10 mL

Analyte	CAS Number	Dilution	Detection Limit	Reporting Limit	Result	Units	Notes
1,1-Dichloroethene	75-35-4	1	0.05	0.20	**0.43**	ug/L	
1,1-Dichloroethane	75-34-3	1	0.05	0.20	**0.79**	ug/L	
cis-1,2-Dichloroethene	156-59-2	1	0.04	0.20	**0.61**	ug/L	
Trichloroethene	79-01-6	1	0.05	0.20	**0.28**	ug/L	
Tetrachloroethene	127-18-4	1	0.05	0.20	ND	ug/L	U
Surrogate: Dibromofluoromethane				*80-120 %*	*110*	*%*	
Surrogate: 1,2-Dichloroethane-d4				*80-129 %*	*110*	*%*	
Surrogate: Toluene-d8				*80-120 %*	*96.7*	*%*	
Surrogate: 4-Bromofluorobenzene				*80-120 %*	*88.2*	*%*	

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Seattle WA, 98103-8636	Project Manager: Joseph Sawdey	30-Jul-2019 13:50

RGW-03

19G0302-03 (Water)

Volatile Organic Compounds - SIM

Method: EPA 8260C-SIM — Sampled: 07/23/2019 11:20

Instrument: NT7 Analyst: PB — Analyzed: 07/29/2019 16:56

Sample Preparation: Preparation Method: EPA 5030 (Purge and Trap) — Extract ID: 19G0302-03 B

Preparation Batch: BHG0680 — Sample Size: 10 mL

Prepared: 29-Jul-2019 — Final Volume: 10 mL

Analyte	CAS Number	Dilution	Detection Limit	Reporting Limit	Result	Units	Notes
Vinyl chloride	75-01-4	1	5.01	20.0	**235**	ng/L	
Surrogate: 1,2-Dichloroethane-d4				*80-129 %*	*118*	*%*	

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Seattle WA, 98103-8636	Project Manager: Joseph Sawdey	30-Jul-2019 13:50

B-1:4

19G0302-04 (Solid)

Volatile Organic Compounds

Method: EPA 8260C — Sampled: 07/23/2019 12:15

Instrument: NT5 Analyst: PB — Analyzed: 07/25/2019 17:14

Sample Preparation: Preparation Method: EPA 5035 (Sodium Bisulfate) — Extract ID: 19G0302-04 C

Preparation Batch: BHG0619 — Sample Size: 5.08 g (wet) — Dry Weight:5.08 g

Prepared: 25-Jul-2019 — Final Volume: 5 mL — % Solids: 100.00

Analyte	CAS Number	Dilution	Detection Limit	Reporting Limit	Result	Units	Notes
Trichloroethene	79-01-6	1	0.21	0.98	**762**	ug/kg	E
Surrogate: Toluene-d8				*77-120 %*	*107*	*%*	

Sample Preparation: Preparation Method: EPA 5035 (Methanol Extraction) — Extract ID: 19G0302-04 A

Preparation Batch: BHG0646 — Sample Size: 4.836 g (wet) — Dry Weight:4.84 g

Prepared: 25-Jul-2019 — Final Volume: 5 mL — % Solids: 100.00

Analyte	CAS Number	Dilution	Detection Limit	Reporting Limit	Result	Units	Notes
Trichloroethene	79-01-6	50	9.31	51.7	**1150**	ug/kg	
Surrogate: Toluene-d8				*80-120 %*	*107*	*%*	

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B-1:8

19G0302-05 (Solid)

Volatile Organic Compounds

Method: EPA 8260C — Sampled: 07/23/2019 12:25

Instrument: NT5 Analyst: PB — Analyzed: 07/25/2019 17:36

Sample Preparation: Preparation Method: EPA 5035 (Sodium Bisulfate) — Extract ID: 19G0302-05 B
Preparation Batch: BHG0619 — Sample Size: 5.26 g (wet) — Dry Weight:5.26 g
Prepared: 25-Jul-2019 — Final Volume: 5 mL — % Solids: 100.00

Analyte	CAS Number	Dilution	Detection Limit	Reporting Limit	Result	Units	Notes
Trichloroethene	79-01-6	1	0.20	0.95	**1010**	ug/kg	E
Surrogate: Toluene-d8				*77-120 %*	*108*	*%*	

Sample Preparation: Preparation Method: EPA 5035 (Methanol Extraction) — Extract ID: 19G0302-05 A
Preparation Batch: BHG0646 — Sample Size: 5.25 g (wet) — Dry Weight:5.25 g
Prepared: 25-Jul-2019 — Final Volume: 5 mL — % Solids: 100.00

Analyte	CAS Number	Dilution	Detection Limit	Reporting Limit	Result	Units	Notes
Trichloroethene	79-01-6	50	8.57	47.6	**4300**	ug/kg	
Surrogate: Toluene-d8				*80-120 %*	*108*	*%*	

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Trip Blank

19G0302-06 (Water)

Volatile Organic Compounds

Method: EPA 8260C — Sampled: 07/23/2019 09:15

Instrument: NT3 Analyst: PKC — Analyzed: 07/24/2019 17:15

Sample Preparation: Preparation Method: EPA 5030 (Purge and Trap) — Extract ID: 19G0302-06 A

Preparation Batch: BHG0569 — Sample Size: 10 mL

Prepared: 24-Jul-2019 — Final Volume: 10 mL

Analyte	CAS Number	Dilution	Detection Limit	Reporting Limit	Result	Units	Notes
1,1-Dichloroethene	75-35-4	1	0.05	0.20	ND	ug/L	U
1,1-Dichloroethane	75-34-3	1	0.05	0.20	ND	ug/L	U
cis-1,2-Dichloroethene	156-59-2	1	0.04	0.20	ND	ug/L	U
Trichloroethene	79-01-6	1	0.05	0.20	ND	ug/L	U
Tetrachloroethene	127-18-4	1	0.05	0.20	ND	ug/L	U
Surrogate: Dibromofluoromethane				*80-120 %*	*107*	*%*	
Surrogate: 1,2-Dichloroethane-d4				*80-129 %*	*104*	*%*	
Surrogate: Toluene-d8				*80-120 %*	*96.6*	*%*	
Surrogate: 4-Bromofluorobenzene				*80-120 %*	*93.2*	*%*	

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Trip Blank

19G0302-06 (Water)

Volatile Organic Compounds - SIM

Method: EPA 8260C-SIM — Sampled: 07/23/2019 09:15

Instrument: NT7 Analyst: PB — Analyzed: 07/29/2019 17:22

Sample Preparation: Preparation Method: EPA 5030 (Purge and Trap) — Extract ID: 19G0302-06 B

Preparation Batch: BHG0680 — Sample Size: 10 mL

Prepared: 29-Jul-2019 — Final Volume: 10 mL

Analyte	CAS Number	Dilution	Detection Limit	Reporting Limit	Result	Units	Notes
Vinyl chloride	75-01-4	1	5.01	20.0	ND	ng/L	U
Surrogate: 1,2-Dichloroethane-d4				*80-129 %*	*117*	*%*	

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Seattle WA, 98103-8636	Project Manager: Joseph Sawdey	30-Jul-2019 13:50

Volatile Organic Compounds - Quality Control

Batch BHG0569 - EPA 5030 (Purge and Trap)

Instrument: NT3 Analyst: PKC

QC Sample/Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Blank (BHG0569-BLK1)					Prepared: 24-Jul-2019 Analyzed: 24-Jul-2019 12:34						
1,1-Dichloroethene	ND	0.05	0.20	ug/L							U
1,1-Dichloroethane	ND	0.05	0.20	ug/L							U
cis-1,2-Dichloroethene	ND	0.04	0.20	ug/L							U
Trichloroethene	ND	0.05	0.20	ug/L							U
Tetrachloroethene	ND	0.05	0.20	ug/L							U
Surrogate: Dibromofluoromethane	5.04			ug/L	*5.00*		*101*	*80-120*			
Surrogate: 1,2-Dichloroethane-d4	5.11			ug/L	*5.00*		*102*	*80-129*			
Surrogate: Toluene-d8	5.05			ug/L	*5.00*		*101*	*80-120*			
Surrogate: 4-Bromofluorobenzene	4.80			ug/L	*5.00*		*96.1*	*80-120*			
LCS (BHG0569-BS1)					Prepared: 24-Jul-2019 Analyzed: 24-Jul-2019 10:21						
1,1-Dichloroethene	10.5	0.05	0.20	ug/L	10.0		105	69-135			
1,1-Dichloroethane	10.6	0.05	0.20	ug/L	10.0		106	76-124			
cis-1,2-Dichloroethene	11.1	0.04	0.20	ug/L	10.0		111	80-121			
Trichloroethene	11.3	0.05	0.20	ug/L	10.0		113	80-120			
Tetrachloroethene	11.5	0.05	0.20	ug/L	10.0		115	80-120			
Surrogate: Dibromofluoromethane	5.04			ug/L	*5.00*		*101*	*80-120*			
Surrogate: 1,2-Dichloroethane-d4	4.57			ug/L	*5.00*		*91.4*	*80-129*			
Surrogate: Toluene-d8	5.17			ug/L	*5.00*		*103*	*80-120*			
Surrogate: 4-Bromofluorobenzene	5.07			ug/L	*5.00*		*101*	*80-120*			
LCS Dup (BHG0569-BSD1)					Prepared: 24-Jul-2019 Analyzed: 24-Jul-2019 10:48						
1,1-Dichloroethene	9.87	0.05	0.20	ug/L	10.0		98.7	69-135	6.59	30	
1,1-Dichloroethane	10.2	0.05	0.20	ug/L	10.0		102	76-124	3.66	30	
cis-1,2-Dichloroethene	10.2	0.04	0.20	ug/L	10.0		102	80-121	8.48	30	
Trichloroethene	10.9	0.05	0.20	ug/L	10.0		109	80-120	3.70	30	
Tetrachloroethene	10.3	0.05	0.20	ug/L	10.0		103	80-120	11.20	30	
Surrogate: Dibromofluoromethane	4.72			ug/L	*5.00*		*94.5*	*80-120*			
Surrogate: 1,2-Dichloroethane-d4	4.58			ug/L	*5.00*		*91.6*	*80-129*			
Surrogate: Toluene-d8	5.14			ug/L	*5.00*		*103*	*80-120*			
Surrogate: 4-Bromofluorobenzene	5.06			ug/L	*5.00*		*101*	*80-120*			

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Volatile Organic Compounds - Quality Control

Batch BHG0619 - EPA 5035 (Sodium Bisulfate)

Instrument: NT5 Analyst: PB

QC Sample/Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Blank (BHG0619-BLK1)					Prepared: 25-Jul-2019 Analyzed: 25-Jul-2019 11:25						
Trichloroethene	ND	0.21	1.00	ug/kg							U
Surrogate: Toluene-d8	53.1			ug/kg	*50.0*		*106*	*77-120*			
LCS (BHG0619-BS1)					Prepared: 25-Jul-2019 Analyzed: 25-Jul-2019 10:24						
Trichloroethene	50.2			ug/kg	50.0		100	80-120			
Surrogate: Toluene-d8	52.8			ug/kg	*50.0*		*106*	*77-120*			
LCS Dup (BHG0619-BSD1)					Prepared: 25-Jul-2019 Analyzed: 25-Jul-2019 11:02						
Trichloroethene	50.5			ug/kg	50.0		101	80-120	0.71	30	
Surrogate: Toluene-d8	53.3			ug/kg	*50.0*		*107*	*77-120*			

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Seattle WA, 98103-8636	Project Manager:	Joseph Sawdey	30-Jul-2019 13:50

Volatile Organic Compounds - Quality Control

Batch BHG0646 - EPA 5035 (Methanol Extraction)

Instrument: NT5 Analyst: PB

QC Sample/Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Blank (BHG0646-BLK1)				Prepared: 25-Jul-2019 Analyzed: 25-Jul-2019 11:25							
Trichloroethene	ND	9.00	50.0	ug/kg							U
Surrogate: Toluene-d8	53.1			ug/kg	*50.0*		*106*	*80-120*			
LCS (BHG0646-BS1)				Prepared: 25-Jul-2019 Analyzed: 25-Jul-2019 10:24							
Trichloroethene	2510			ug/kg	2500		100	77-120			
Surrogate: Toluene-d8	52.8			ug/kg	*50.0*		*106*	*80-120*			
LCS Dup (BHG0646-BSD1)				Prepared: 25-Jul-2019 Analyzed: 25-Jul-2019 11:02							
Trichloroethene	2530			ug/kg	2500		101	77-120	0.71	30	
Surrogate: Toluene-d8	53.3			ug/kg	*50.0*		*107*	*80-120*			

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Seattle WA, 98103-8636	Project Manager: Joseph Sawdey	30-Jul-2019 13:50

Volatile Organic Compounds - SIM - Quality Control

Batch BHG0680 - EPA 5030 (Purge and Trap)

Instrument: NT7 Analyst: PB

QC Sample/Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Blank (BHG0680-BLK1)					Prepared: 29-Jul-2019 Analyzed: 29-Jul-2019 13:23						
Vinyl chloride	ND	5.01	20.0	ng/L							U
Surrogate: 1,2-Dichloroethane-d4	5800			ng/L	*5000*		*116*	*80-129*			
LCS (BHG0680-BS1)					Prepared: 29-Jul-2019 Analyzed: 29-Jul-2019 12:16						
Vinyl chloride	1910	5.01	20.0	ng/L	2000		95.3	76-120			
Surrogate: 1,2-Dichloroethane-d4	5230			ng/L	*5000*		*105*	*80-129*			
LCS Dup (BHG0680-BSD1)					Prepared: 29-Jul-2019 Analyzed: 29-Jul-2019 12:57						
Vinyl chloride	1840	5.01	20.0	ng/L	2000		92.2	76-120	3.36	30	
Surrogate: 1,2-Dichloroethane-d4	5230			ng/L	*5000*		*105*	*80-129*			

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Certified Analyses included in this Report

Analyte	Certifications
EPA 8260C in Solid	
Chloromethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Vinyl Chloride	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Bromomethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Chloroethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Trichlorofluoromethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Acrolein	WADOE,DoD-ELAP,NELAP,CALAP
1,1,2-Trichloro-1,2,2-Trifluoroethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Acetone	WADOE,DoD-ELAP,NELAP,CALAP
1,1-Dichloroethene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Bromoethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Iodomethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Methylene Chloride	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Acrylonitrile	WADOE,DoD-ELAP,NELAP,CALAP
Carbon Disulfide	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
trans-1,2-Dichloroethene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Vinyl Acetate	WADOE,DoD-ELAP,NELAP,CALAP
1,1-Dichloroethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
2-Butanone	WADOE,DoD-ELAP,NELAP,CALAP
2,2-Dichloropropane	WADOE,DoD-ELAP,NELAP,CALAP
cis-1,2-Dichloroethene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Chloroform	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Bromochloromethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
1,1,1-Trichloroethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
1,1-Dichloropropene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Carbon tetrachloride	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
1,2-Dichloroethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Benzene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Trichloroethene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
1,2-Dichloropropane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Bromodichloromethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Dibromomethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
2-Chloroethyl vinyl ether	WADOE,DoD-ELAP,NELAP
4-Methyl-2-Pentanone	WADOE,DoD-ELAP,NELAP,CALAP
cis-1,3-Dichloropropene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Toluene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC

trans-1,3-Dichloropropene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
2-Hexanone	WADOE,DoD-ELAP,NELAP,CALAP
1,1,2-Trichloroethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
1,3-Dichloropropane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Tetrachloroethene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Dibromochloromethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
1,2-Dibromoethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Chlorobenzene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Ethylbenzene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
1,1,1,2-Tetrachloroethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
m,p-Xylene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
o-Xylene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Xylenes, total	WADOE
Styrene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Bromoform	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
1,1,2,2-Tetrachloroethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
1,2,3-Trichloropropane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
trans-1,4-Dichloro 2-Butene	WADOE,DoD-ELAP,NELAP
n-Propylbenzene	WADOE,DoD-ELAP,NELAP,CALAP
Bromobenzene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Isopropyl Benzene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
2-Chlorotoluene	WADOE,DoD-ELAP,NELAP,CALAP
4-Chlorotoluene	WADOE,DoD-ELAP,NELAP,CALAP
t-Butylbenzene	WADOE,DoD-ELAP,NELAP,CALAP
1,3,5-Trimethylbenzene	WADOE,DoD-ELAP,NELAP,CALAP
1,2,4-Trimethylbenzene	WADOE,DoD-ELAP,NELAP,CALAP
s-Butylbenzene	WADOE,DoD-ELAP,NELAP,CALAP
4-Isopropyl Toluene	WADOE,DoD-ELAP,NELAP,CALAP
1,3-Dichlorobenzene	WADOE,DoD-ELAP,NELAP,CALAP
1,4-Dichlorobenzene	WADOE,DoD-ELAP,NELAP,CALAP
n-Butylbenzene	WADOE,DoD-ELAP,NELAP,CALAP
1,2-Dichlorobenzene	WADOE,DoD-ELAP,NELAP,CALAP
1,2-Dibromo-3-chloropropane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
1,2,4-Trichlorobenzene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Hexachloro-1,3-Butadiene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Naphthalene	WADOE,DoD-ELAP,NELAP,CALAP
1,2,3-Trichlorobenzene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Dichlorodifluoromethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Methyl tert-butyl Ether	WADOE,DoD-ELAP,NELAP,CALAP
n-Hexane	WADOE

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2-Pentanone	WADOE
Dibromofluoromethane	WADOE
4-Bromofluorobenzene	WADOE
Chloromethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Vinyl Chloride	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Bromomethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Chloroethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Trichlorofluoromethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Acrolein	WADOE,DoD-ELAP,NELAP,CALAP
1,1,2-Trichloro-1,2,2-Trifluoroethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Acetone	WADOE,DoD-ELAP,NELAP,CALAP
1,1-Dichloroethene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Bromoethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Iodomethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Methylene Chloride	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Acrylonitrile	WADOE,DoD-ELAP,NELAP,CALAP
Carbon Disulfide	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
trans-1,2-Dichloroethene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Vinyl Acetate	WADOE,DoD-ELAP,NELAP,CALAP
1,1-Dichloroethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
2-Butanone	WADOE,DoD-ELAP,NELAP,CALAP
2,2-Dichloropropane	WADOE,DoD-ELAP,NELAP,CALAP
cis-1,2-Dichloroethene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Chloroform	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Bromochloromethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
1,1,1-Trichloroethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
1,1-Dichloropropene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Carbon tetrachloride	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
1,2-Dichloroethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Benzene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Trichloroethene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
1,2-Dichloropropane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Bromodichloromethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Dibromomethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
2-Chloroethyl vinyl ether	DoD-ELAP
4-Methyl-2-Pentanone	WADOE,DoD-ELAP,NELAP,CALAP
cis-1,3-Dichloropropene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Toluene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
trans-1,3-Dichloropropene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
2-Hexanone	WADOE,DoD-ELAP,NELAP,CALAP

Shannon & Wilson, Inc	Project: 8801 E Marginal Way S	
400 N 34th St., Suite 100	Project Number: 103485	**Reported:**
Seattle WA, 98103-8636	Project Manager: Joseph Sawdey	30-Jul-2019 13:50

1,1,2-Trichloroethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
1,3-Dichloropropane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Tetrachloroethene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Dibromochloromethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
1,2-Dibromoethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Chlorobenzene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Ethylbenzene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
1,1,1,2-Tetrachloroethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
m,p-Xylene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
o-Xylene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Styrene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Bromoform	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
1,1,2,2-Tetrachloroethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
1,2,3-Trichloropropane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
trans-1,4-Dichloro 2-Butene	WADOE,DoD-ELAP
n-Propylbenzene	WADOE,DoD-ELAP,NELAP,CALAP
Bromobenzene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Isopropyl Benzene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
2-Chlorotoluene	WADOE,DoD-ELAP,NELAP,CALAP
4-Chlorotoluene	WADOE,DoD-ELAP,NELAP,CALAP
t-Butylbenzene	WADOE,DoD-ELAP,NELAP,CALAP
1,3,5-Trimethylbenzene	WADOE,DoD-ELAP,NELAP,CALAP
1,2,4-Trimethylbenzene	WADOE,DoD-ELAP,NELAP,CALAP
s-Butylbenzene	WADOE,DoD-ELAP,NELAP,CALAP
4-Isopropyl Toluene	WADOE,DoD-ELAP,NELAP,CALAP
1,3-Dichlorobenzene	WADOE,DoD-ELAP,NELAP,CALAP
1,4-Dichlorobenzene	WADOE,DoD-ELAP,NELAP,CALAP
n-Butylbenzene	WADOE,DoD-ELAP,NELAP,CALAP
1,2-Dichlorobenzene	WADOE,DoD-ELAP,NELAP,CALAP
1,2-Dibromo-3-Chloropropane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
1,2,4-Trichlorobenzene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Hexachloro-1,3-Butadiene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Naphthalene	WADOE,DoD-ELAP,NELAP,CALAP
1,2,3-Trichlorobenzene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Dichlorodifluoromethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Methyl tert-butyl Ether	WADOE,DoD-ELAP,NELAP,CALAP
n-Hexane	WADOE

EPA 8260C in Water

Chloromethane	DoD-ELAP,ADEC,NELAP,CALAP,WADOE

Shannon & Wilson, Inc	Project: 8801 E Marginal Way S	
400 N 34th St., Suite 100	Project Number: 103485	**Reported:**
Seattle WA, 98103-8636	Project Manager: Joseph Sawdey	30-Jul-2019 13:50

Vinyl Chloride	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
Bromomethane	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
Chloroethane	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
Trichlorofluoromethane	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
Acrolein	DoD-ELAP,NELAP,CALAP,WADOE
1,1,2-Trichloro-1,2,2-Trifluoroethane	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
Acetone	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
1,1-Dichloroethene	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
Bromoethane	DoD-ELAP,NELAP,CALAP,WADOE
Iodomethane	DoD-ELAP,NELAP,CALAP,WADOE
Methylene Chloride	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
Acrylonitrile	DoD-ELAP,NELAP,CALAP,WADOE
Carbon Disulfide	DoD-ELAP,NELAP,CALAP,WADOE
trans-1,2-Dichloroethene	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
Vinyl Acetate	DoD-ELAP,NELAP,CALAP,WADOE
1,1-Dichloroethane	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
2-Butanone	DoD-ELAP,NELAP,CALAP,WADOE
2,2-Dichloropropane	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
cis-1,2-Dichloroethene	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
Chloroform	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
Bromochloromethane	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
1,1,1-Trichloroethane	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
1,1-Dichloropropene	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
Carbon tetrachloride	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
1,2-Dichloroethane	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
Benzene	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
Trichloroethene	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
1,2-Dichloropropane	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
Bromodichloromethane	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
Dibromomethane	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
2-Chloroethyl vinyl ether	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
4-Methyl-2-Pentanone	DoD-ELAP,NELAP,CALAP,WADOE
cis-1,3-Dichloropropene	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
Toluene	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
trans-1,3-Dichloropropene	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
2-Hexanone	DoD-ELAP,NELAP,CALAP,WADOE
1,1,2-Trichloroethane	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
1,3-Dichloropropane	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
Tetrachloroethene	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
Dibromochloromethane	DoD-ELAP,ADEC,NELAP,CALAP,WADOE

1,2-Dibromoethane	DoD-ELAP,NELAP,CALAP,WADOE
Chlorobenzene	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
Ethylbenzene	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
1,1,1,2-Tetrachloroethane	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
m,p-Xylene	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
o-Xylene	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
Styrene	DoD-ELAP,NELAP,CALAP,WADOE
Bromoform	DoD-ELAP,NELAP,CALAP,WADOE
1,1,2,2-Tetrachloroethane	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
1,2,3-Trichloropropane	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
trans-1,4-Dichloro 2-Butene	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
n-Propylbenzene	DoD-ELAP,NELAP,CALAP,WADOE
Bromobenzene	DoD-ELAP,NELAP,CALAP,WADOE
Isopropyl Benzene	DoD-ELAP,NELAP,CALAP,WADOE
2-Chlorotoluene	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
4-Chlorotoluene	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
t-Butylbenzene	DoD-ELAP,NELAP,CALAP,WADOE
1,3,5-Trimethylbenzene	DoD-ELAP,NELAP,CALAP,WADOE
1,2,4-Trimethylbenzene	DoD-ELAP,NELAP,CALAP,WADOE
s-Butylbenzene	DoD-ELAP,NELAP,CALAP,WADOE
4-Isopropyl Toluene	DoD-ELAP,NELAP,CALAP,WADOE
1,3-Dichlorobenzene	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
1,4-Dichlorobenzene	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
n-Butylbenzene	DoD-ELAP,NELAP,CALAP,WADOE
1,2-Dichlorobenzene	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
1,2-Dibromo-3-chloropropane	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
1,2,4-Trichlorobenzene	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
Hexachloro-1,3-Butadiene	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
Naphthalene	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
1,2,3-Trichlorobenzene	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
Dichlorodifluoromethane	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
Methyl tert-butyl Ether	DoD-ELAP,ADEC,NELAP,CALAP,WADOE
n-Hexane	WADOE
2-Pentanone	WADOE

EPA 8260C-SIM in Water

Acrylonitrile	NELAP,CALAP,WADOE
Vinyl chloride	NELAP,CALAP,WADOE
1,1-Dichloroethene	NELAP,CALAP,WADOE
cis-1,2-Dichloroethene	NELAP,CALAP,WADOE

Shannon & Wilson, Inc	Project: 8801 E Marginal Way S	
400 N 34th St., Suite 100	Project Number: 103485	**Reported:**
Seattle WA, 98103-8636	Project Manager: Joseph Sawdey	30-Jul-2019 13:50

trans-1,2-Dichloroethene	NELAP,CALAP,WADOE
Trichloroethene	NELAP,CALAP,WADOE
Tetrachloroethene	NELAP,CALAP,WADOE
1,1,2,2-Tetrachloroethane	NELAP,CALAP,WADOE
1,2-Dichloroethane	NELAP,CALAP,WADOE
Benzene	NELAP,CALAP,WADOE

Code	Description	Number	Expires
ADEC	Alaska Dept of Environmental Conservation	17-015	01/31/2021
CALAP	California Department of Public Health CAELAP	2748	06/30/2019
DoD-ELAP	DoD-Environmental Laboratory Accreditation Program	66169	01/01/2021
NELAP	ORELAP - Oregon Laboratory Accreditation Program	WA100006-012	05/12/2020
WADOE	WA Dept of Ecology	C558	06/30/2019
WA-DW	Ecology - Drinking Water	C558	06/30/2019

Shannon & Wilson, Inc	Project: 8801 E Marginal Way S	
400 N 34th St., Suite 100	Project Number: 103485	**Reported:**
Seattle WA, 98103-8636	Project Manager: Joseph Sawdey	30-Jul-2019 13:50

Notes and Definitions

E	The analyte concentration exceeds the upper limit of the calibration range of the instrument established by the initial calibration (ICAL)
J	Estimated concentration value detected below the reporting limit.
Q	Indicates a detected analyte with an initial or continuing calibration that does not meet established acceptance criteria (<20% RSD, <20% drift or minimum RRF)
U	This analyte is not detected above the reporting limit (RL) or if noted, not detected above the limit of detection (LOD).
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference
[2C]	Indicates this result was quantified on the second column on a dual column analysis.

Analytical Resources, Incorporated
Analytical Chemists and Consultants

17 February 2020

Joseph Sawdey
Shannon & Wilson, Inc
400 N 34th St., Suite 100
Seattle, WA 98103-8636

RE: 8801 E Marginal Way S

Please find enclosed sample receipt documentation and analytical results for samples from the project referenced above.

Sample analyses were performed according to ARI's Quality Assurance Plan and any provided project specific Quality Assurance Plan. Each analytical section of this report has been approved and reviewed by an analytical peer, the appropriate Laboratory Supervisor or qualified substitute, and a technical reviewer.

Should you have any questions or problems, please feel free to contact us at your convenience.

Associated Work Order(s)	Associated SDG ID(s)
20B0027	N/A

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed in the enclose Narrative. ARI, an accredited laboratory, certifies that the report results for which ARI is accredited meets all the requirements of the accrediting body. A list of certified analyses, accreditations, and expiration dates is included in this report.

Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or his/her designee, as verified by the following signature.

Analytical Resources, Inc.

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

ACCREDITED IN ACCORDANCE WITH nelac
Cert# 100006

PJLA Testing
Accreditation # 66169

4611 S. 134th Place, Suite 100 • Tukwila, WA 98168 • Ph: (206) 695-6200 • Fax: (206) 695-6202

Chain of Custody Record & Laboratory Analysis Request

ARI Assigned Number: 20B0027	Turn-around Requested: Standard	Page: 1 of 1	
ARI Client Company: Shannon & Wilson	Phone: (206) 695-6907	Date: 2/4/2020	Ice Present? Yes
Client Contact: Joe Sawdey		No. of Coolers: 1	Cooler Temps: -6.9°C
Client Project Name: 8801 Remediation			
Client Project #: 103485	Samplers: J. Sawdey		

Analytical Resources, Incorporated
Analytical Chemists and Consultants
4611 South 134th Place, Suite 100
Tukwila, WA 98168
206-695-6200 206-695-6201 (fax)
www.arilabs.com

Sample ID	Date	Time	Matrix	No. Containers	HVOCs by EPA 8260C	TCLP HVOCs	Hold						Notes/Comments
B-6:6-9	9/2018	—	Soil	1	X	X							
B-6:11-14	↓	↓	↓	↓	X	X							
B-6:20-25.5							X						

Comments/Special Instructions: Soil Jars Frozen after sample collection.

	Relinquished by:	Received by:	Relinquished by:	Received by:
(Signature)	[signature]	[signature]		
Printed Name:	RYAN PETERSON	Jacob Walter		
Company:	Shannon & Wilson	ARI		
Date & Time:	2/4/2020 1100	02/04/2020 1100		

Limits of Liability: ARI will perform all requested services in accordance with appropriate methodology following ARI Standard Operating Procedures and the ARI Quality Assurance Program. This program meets standards for the industry. The total liability of ARI, its officers, agents, employees, or successors, arising out of or in connection with the requested services, shall not exceed the Invoiced amount for said services. The acceptance by the client of a proposal for services by ARI release ARI from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order or co-signed agreement between ARI and the Client.

Sample Retention Policy: All samples submitted to ARI will be appropriately discarded no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alternate retention schedules have been established by work-order or contract.

Shannon & Wilson, Inc	Project: 8801 E Marginal Way S	
400 N 34th St., Suite 100	Project Number: 103425	**Reported:**
Seattle WA, 98103-8636	Project Manager: Joseph Sawdey	17-Feb-2020 11:35

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
B-6: 6-9	20B0027-01	Solid	01-Sep-2018 00:00	04-Feb-2020 11:00
B-6: 11-14	20B0027-02	Solid	01-Sep-2018 00:00	04-Feb-2020 11:00

Shannon & Wilson, Inc	Project: 8801 E Marginal Way S	
400 N 34th St., Suite 100	Project Number: 103425	**Reported:**
Seattle WA, 98103-8636	Project Manager: Joseph Sawdey	17-Feb-2020 11:35

Work Order Case Narrative

Sample receipt

Samples as listed on the preceding page were received February 4, 2020 under ARI work order 20B0027. For details regarding sample receipt, please refer to the Cooler Receipt Form.

Volatiles - EPA Method SW8260C/1311 TCLP

The samples were received outside of the 14 day recommended holding time and have been flagged with "H" qualifiers.

Initial and continuing calibrations were within method requirements.

Internal standard areas were within limits.

The surrogate percent recoveries were within control limits.

The method blanks were clean at the reporting limits.

The LCS/LCSD percent recoveries and RPD were within control limits.

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Cooler Receipt Form

ARI Client: Shannon & Wilson

Project Name: 8801 Remediation

COC No(s): ______ NA

Delivered by: Fed-Ex UPS Courier Hand Delivered Other: ______

Assigned ARI Job No: 20B0027

Tracking No: ______ NA

Preliminary Examination Phase:

Were intact, properly signed and dated custody seals attached to the outside of the cooler?	YES	NO
Were custody papers included with the cooler?	YES	NO
Were custody papers properly filled out (ink, signed, etc.)	YES	NO

Temperature of Cooler(s) (°C) (recommended 2.0-6.0 °C for chemistry)

Time 1100 -6.9°C

If cooler temperature is out of compliance fill out form 00070F

Temp Gun ID#: D005606

Cooler Accepted by: JR Date: 02/04/2020 Time: 1100

Complete custody forms and attach all shipping documents

Log-In Phase:

Was a temperature blank included in the cooler?		YES	NO
What kind of packing material was used? ... Bubble Wrap Wet Ice Gel Packs Baggies Foam Block Paper Other: ______			
Was sufficient ice used (if appropriate)?	NA	YES	NO
How were bottles sealed in plastic bags?	Individually	Grouped	Not
Did all bottles arrive in good condition (unbroken)?		YES	NO
Were all bottle labels complete and legible?		YES	NO
Did the number of containers listed on COC match with the number of containers received?		YES	NO
Did all bottle labels and tags agree with custody papers?		~~YES~~ GS 2/4/2020	NO
Were all bottles used correct for the requested analyses?		YES	NO
Do any of the analyses (bottles) require preservation? (attach preservation sheet, excluding VOCs)	NA	YES	NO
Were all VOC vials free of air bubbles?	NA	YES	NO
Was sufficient amount of sample sent in each bottle?		YES	NO
Date VOC Trip Blank was made at ARI	NA	______	

Were the sample(s) split by ARI? NA YES Date/Time: ______ Equipment: ______ Split by: ______

Samples Logged by: G SW Date: 2/4/2020 Time: 1131 Labels checked by: GS

***** Notify Project Manager of discrepancies or concerns *****

Sample ID on Bottle	Sample ID on COC	Sample ID on Bottle	Sample ID on COC
	B-6; 6-9		
	B-6; 11-14		
	B-6; 20-23.5		

Additional Notes, Discrepancies, & Resolutions:

No labels on containers, some identifiers on lids, + IDs written on bags jars came in, Samples arrived Frozen.

By: G SW Date: 2/4/2020

0016F
01/17/2018

Cooler Receipt Form

Revision 014A

Shannon & Wilson, Inc	Project: 8801 E Marginal Way S	
400 N 34th St., Suite 100	Project Number: 103425	**Reported:**
Seattle WA, 98103-8636	Project Manager: Joseph Sawdey	17-Feb-2020 11:35

B-6: 6-9

20B0027-01 (Solid)

Volatile Organic Compounds

Method: EPA 8260C — Sampled: 09/01/2018 00:00

Instrument: NT5 Analyst: PB — Analyzed: 02/06/2020 19:07

Sample Preparation: Preparation Method: No Prep - Volatiles — Extract ID: 20B0027-01 A

Preparation Batch: BIB0124 — Sample Size: 5.1 g (wet) — Dry Weight:3.50 g

Prepared: 02/06/2020 — Final Volume: 5 g — % Solids: 68.72

Analyte	CAS Number	Dilution	Detection Limit	Reporting Limit	Result	Units	Notes
Vinyl Chloride	75-01-4	1	0.34	1.43	ND	ug/kg	H, U
1,1-Dichloroethene	75-35-4	1	0.48	1.43	ND	ug/kg	H, U
trans-1,2-Dichloroethene	156-60-5	1	0.38	1.43	ND	ug/kg	H, U
1,1-Dichloroethane	75-34-3	1	0.29	1.43	ND	ug/kg	H, U
cis-1,2-Dichloroethene	156-59-2	1	0.34	1.43	ND	ug/kg	H, U
Trichloroethene	79-01-6	1	0.30	1.43	ND	ug/kg	H, U
Tetrachloroethene	127-18-4	1	0.37	1.43	ND	ug/kg	H, U
Surrogate: Dibromofluoromethane				*80-120 %*	*110*	*%*	H
Surrogate: 1,2-Dichloroethane-d4				*80-149 %*	*109*	*%*	H
Surrogate: Toluene-d8				*77-120 %*	*98.9*	*%*	H
Surrogate: 4-Bromofluorobenzene				*80-120 %*	*99.5*	*%*	H
Surrogate: 1,2-Dichlorobenzene-d4				*80-120 %*	*101*	*%*	H

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Analytical Resources, Incorporated
Analytical Chemists and Consultants

Analytical Report

Shannon & Wilson, Inc	Project: 8801 E Marginal Way S	
400 N 34th St., Suite 100	Project Number: 103425	**Reported:**
Seattle WA, 98103-8636	Project Manager: Joseph Sawdey	17-Feb-2020 11:35

B-6: 6-9

20B0027-01 (Solid)

TCLP Volatile Organic Compounds

Method: EPA 8260C — Sampled: 09/01/2018 00:00

Instrument: NT2 Analyst: PKC — Analyzed: 02/14/2020 11:59

Sample Preparation: Preparation Method: EPA 5030 (Purge and Trap) — Extract ID: 20B0027-01 A 01

Preparation Batch: BIB0361 — Sample Size: 1 mL

Prepared: 02/14/2020 — Final Volume: 10 mL

Analyte	CAS Number	Dilution	Reporting Limit	Result	Units	Notes
Vinyl Chloride	75-01-4	1	2.00	ND	ug/L	H, U
1,1-Dichloroethene	75-35-4	1	2.00	ND	ug/L	H, U
2-Butanone	78-93-3	1	50.0	ND	ug/L	H, U
Chloroform	67-66-3	1	2.00	ND	ug/L	H, U
Carbon tetrachloride	56-23-5	1	2.00	ND	ug/L	H, U
1,2-Dichloroethane	107-06-2	1	2.00	ND	ug/L	H, U
Benzene	71-43-2	1	2.00	ND	ug/L	H, U
Trichloroethene	79-01-6	1	2.00	ND	ug/L	H, U
Tetrachloroethene	127-18-4	1	2.00	ND	ug/L	H, U
Chlorobenzene	108-90-7	1	2.00	ND	ug/L	H, U
1,4-Dichlorobenzene	106-46-7	1	2.00	ND	ug/L	H, U
Surrogate: 1,2-Dichloroethane-d4			*80-129 %*	*113*	*%*	H
Surrogate: Toluene-d8			*80-120 %*	*99.6*	*%*	H
Surrogate: 4-Bromofluorobenzene			*80-120 %*	*89.4*	*%*	H
Surrogate: 1,2-Dichlorobenzene-d4			*80-120 %*	*100*	*%*	H

Shannon & Wilson, Inc	Project: 8801 E Marginal Way S	
400 N 34th St., Suite 100	Project Number: 103425	**Reported:**
Seattle WA, 98103-8636	Project Manager: Joseph Sawdey	17-Feb-2020 11:35

B-6: 11-14

20B0027-02 (Solid)

Volatile Organic Compounds

Method: EPA 8260C — Sampled: 09/01/2018 00:00

Instrument: NT5 Analyst: PB — Analyzed: 02/06/2020 19:29

Sample Preparation:	Preparation Method: No Prep - Volatiles		Extract ID: 20B0027-02 A
	Preparation Batch: BIB0124	Sample Size: 5.22 g (wet)	Dry Weight:4.29 g
	Prepared: 02/06/2020	Final Volume: 5 g	% Solids: 82.26

Analyte	CAS Number	Dilution	Detection Limit	Reporting Limit	Result	Units	Notes
Vinyl Chloride	75-01-4	1	0.27	1.16	ND	ug/kg	H, U
1,1-Dichloroethene	75-35-4	1	0.39	1.16	ND	ug/kg	H, U
trans-1,2-Dichloroethene	156-60-5	1	0.31	1.16	ND	ug/kg	H, U
1,1-Dichloroethane	75-34-3	1	0.24	1.16	ND	ug/kg	H, U
cis-1,2-Dichloroethene	156-59-2	1	0.28	1.16	ND	ug/kg	H, U
Trichloroethene	79-01-6	1	0.25	1.16	ND	ug/kg	H, U
Tetrachloroethene	127-18-4	1	0.30	1.16	ND	ug/kg	H, U
Surrogate: Dibromofluoromethane				*80-120 %*	*108*	*%*	H
Surrogate: 1,2-Dichloroethane-d4				*80-149 %*	*110*	*%*	H
Surrogate: Toluene-d8				*77-120 %*	*98.7*	*%*	H
Surrogate: 4-Bromofluorobenzene				*80-120 %*	*99.4*	*%*	H
Surrogate: 1,2-Dichlorobenzene-d4				*80-120 %*	*102*	*%*	H

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Shannon & Wilson, Inc	Project: 8801 E Marginal Way S	
400 N 34th St., Suite 100	Project Number: 103425	**Reported:**
Seattle WA, 98103-8636	Project Manager: Joseph Sawdey	17-Feb-2020 11:35

B-6: 11-14

20B0027-02 (Solid)

TCLP Volatile Organic Compounds

Method: EPA 8260C — Sampled: 09/01/2018 00:00

Instrument: NT2 Analyst: PKC — Analyzed: 02/14/2020 12:22

Sample Preparation: Preparation Method: EPA 5030 (Purge and Trap) — Extract ID: 20B0027-02 A 01

Preparation Batch: BIB0361 — Sample Size: 1 mL

Prepared: 02/14/2020 — Final Volume: 10 mL

Analyte	CAS Number	Dilution	Reporting Limit	Result	Units	Notes
Vinyl Chloride	75-01-4	1	2.00	ND	ug/L	H, U
1,1-Dichloroethene	75-35-4	1	2.00	ND	ug/L	H, U
2-Butanone	78-93-3	1	50.0	ND	ug/L	H, U
Chloroform	67-66-3	1	2.00	ND	ug/L	H, U
Carbon tetrachloride	56-23-5	1	2.00	ND	ug/L	H, U
1,2-Dichloroethane	107-06-2	1	2.00	ND	ug/L	H, U
Benzene	71-43-2	1	2.00	ND	ug/L	H, U
Trichloroethene	79-01-6	1	2.00	ND	ug/L	H, U
Tetrachloroethene	127-18-4	1	2.00	ND	ug/L	H, U
Chlorobenzene	108-90-7	1	2.00	ND	ug/L	H, U
1,4-Dichlorobenzene	106-46-7	1	2.00	ND	ug/L	H, U
Surrogate: 1,2-Dichloroethane-d4			*80-129 %*	*114*	*%*	H
Surrogate: Toluene-d8			*80-120 %*	*97.6*	*%*	H
Surrogate: 4-Bromofluorobenzene			*80-120 %*	*93.1*	*%*	H
Surrogate: 1,2-Dichlorobenzene-d4			*80-120 %*	*99.2*	*%*	H

Shannon & Wilson, Inc	Project: 8801 E Marginal Way S	
400 N 34th St., Suite 100	Project Number: 103425	**Reported:**
Seattle WA, 98103-8636	Project Manager: Joseph Sawdey	17-Feb-2020 11:35

Volatile Organic Compounds - Quality Control

Batch BIB0124 - No Prep - Volatiles

Instrument: NT5 Analyst: PB

QC Sample/Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Blank (BIB0124-BLK1)					Prepared: 06-Feb-2020 Analyzed: 06-Feb-2020 13:09						
Vinyl Chloride	ND	0.24	1.00	ug/kg							U
1,1-Dichloroethene	ND	0.34	1.00	ug/kg							U
trans-1,2-Dichloroethene	ND	0.27	1.00	ug/kg							U
1,1-Dichloroethane	ND	0.20	1.00	ug/kg							U
cis-1,2-Dichloroethene	ND	0.24	1.00	ug/kg							U
Trichloroethene	ND	0.21	1.00	ug/kg							U
Tetrachloroethene	ND	0.26	1.00	ug/kg							U
Surrogate: Dibromofluoromethane	50.4			ug/kg	*50.0*		*101*	*80-120*			
Surrogate: 1,2-Dichloroethane-d4	47.5			ug/kg	*50.0*		*94.9*	*80-149*			
Surrogate: Toluene-d8	48.0			ug/kg	*50.0*		*96.0*	*77-120*			
Surrogate: 4-Bromofluorobenzene	49.2			ug/kg	*50.0*		*98.3*	*80-120*			
Surrogate: 1,2-Dichlorobenzene-d4	50.7			ug/kg	*50.0*		*101*	*80-120*			
LCS (BIB0124-BS1)					Prepared: 06-Feb-2020 Analyzed: 06-Feb-2020 12:08						
Vinyl Chloride	53.0			ug/kg	50.0		106	74-135			
1,1-Dichloroethene	49.7			ug/kg	50.0		99.5	77-134			
trans-1,2-Dichloroethene	50.5			ug/kg	50.0		101	79-130			
1,1-Dichloroethane	51.8			ug/kg	50.0		104	80-126			
cis-1,2-Dichloroethene	51.5			ug/kg	50.0		103	80-125			
Trichloroethene	50.8			ug/kg	50.0		102	80-120			
Tetrachloroethene	50.4			ug/kg	50.0		101	74-124			
Surrogate: Dibromofluoromethane	51.0			ug/kg	*50.0*		*102*	*80-120*			
Surrogate: 1,2-Dichloroethane-d4	49.5			ug/kg	*50.0*		*99.1*	*80-149*			
Surrogate: Toluene-d8	49.0			ug/kg	*50.0*		*97.9*	*77-120*			
Surrogate: 4-Bromofluorobenzene	49.3			ug/kg	*50.0*		*98.6*	*80-120*			
Surrogate: 1,2-Dichlorobenzene-d4	50.8			ug/kg	*50.0*		*102*	*80-120*			
LCS Dup (BIB0124-BSD1)					Prepared: 06-Feb-2020 Analyzed: 06-Feb-2020 12:48						
Vinyl Chloride	53.8			ug/kg	50.0		108	74-135	1.44	30	
1,1-Dichloroethene	51.6			ug/kg	50.0		103	77-134	3.60	30	
trans-1,2-Dichloroethene	51.1			ug/kg	50.0		102	79-130	1.20	30	
1,1-Dichloroethane	50.1			ug/kg	50.0		100	80-126	3.37	30	
cis-1,2-Dichloroethene	50.2			ug/kg	50.0		100	80-125	2.55	30	
Trichloroethene	51.5			ug/kg	50.0		103	80-120	1.48	30	
Tetrachloroethene	53.6			ug/kg	50.0		107	74-124	6.07	30	

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Shannon & Wilson, Inc	Project: 8801 E Marginal Way S	
400 N 34th St., Suite 100	Project Number: 103425	**Reported:**
Seattle WA, 98103-8636	Project Manager: Joseph Sawdey	17-Feb-2020 11:35

Volatile Organic Compounds - Quality Control

Batch BIB0124 - No Prep - Volatiles

Instrument: NT5 Analyst: PB

QC Sample/Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
LCS Dup (BIB0124-BSD1)					Prepared: 06-Feb-2020 Analyzed: 06-Feb-2020 12:48						
Surrogate: Dibromofluoromethane	49.8			ug/kg	*50.0*		*99.5*	*80-120*			
Surrogate: 1,2-Dichloroethane-d4	48.1			ug/kg	*50.0*		*96.2*	*80-149*			
Surrogate: Toluene-d8	48.8			ug/kg	*50.0*		*97.7*	*77-120*			
Surrogate: 4-Bromofluorobenzene	48.7			ug/kg	*50.0*		*97.4*	*80-120*			
Surrogate: 1,2-Dichlorobenzene-d4	50.5			ug/kg	*50.0*		*101*	*80-120*			

Shannon & Wilson, Inc	Project: 8801 E Marginal Way S	
400 N 34th St., Suite 100	Project Number: 103425	Reported:
Seattle WA, 98103-8636	Project Manager: Joseph Sawdey	17-Feb-2020 11:35

TCLP Volatile Organic Compounds - Quality Control

Batch BIB0361 - EPA 5030 (Purge and Trap)

Instrument: NT2 Analyst: PKC

QC Sample/Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Blank (BIB0361-BLK1)				Prepared: 14-Feb-2020 Analyzed: 14-Feb-2020 11:36						
Vinyl Chloride	ND	0.200	ug/L							U
1,1-Dichloroethene	ND	0.200	ug/L							U
2-Butanone	ND	5.00	ug/L							U
Chloroform	ND	0.200	ug/L							U
Carbon tetrachloride	ND	0.200	ug/L							U
1,2-Dichloroethane	ND	0.200	ug/L							U
Benzene	ND	0.200	ug/L							U
Trichloroethene	ND	0.200	ug/L							U
Tetrachloroethene	ND	0.200	ug/L							U
Chlorobenzene	ND	0.200	ug/L							U
1,4-Dichlorobenzene	ND	0.200	ug/L							U
Surrogate: 1,2-Dichloroethane-d4	5.59		ug/L	*5.00*		*112*	*80-129*			
Surrogate: Toluene-d8	4.94		ug/L	*5.00*		*98.8*	*80-120*			
Surrogate: 4-Bromofluorobenzene	4.51		ug/L	*5.00*		*90.2*	*80-120*			
Surrogate: 1,2-Dichlorobenzene-d4	5.01		ug/L	*5.00*		*100*	*80-120*			
LCS (BIB0361-BS1)				Prepared: 14-Feb-2020 Analyzed: 14-Feb-2020 10:35						
Vinyl Chloride	10.8	0.200	ug/L	10.0		108	70-130			
1,1-Dichloroethene	11.3	0.200	ug/L	10.0		113	76-123			
2-Butanone	52.7	5.00	ug/L	50.0		105	67-134			
Chloroform	10.5	0.200	ug/L	10.0		105	77-123			
Carbon tetrachloride	9.41	0.200	ug/L	10.0		94.1	69-139			
1,2-Dichloroethane	10.6	0.200	ug/L	10.0		106	71-125			
Benzene	10.1	0.200	ug/L	10.0		101	80-120			
Trichloroethene	10.0	0.200	ug/L	10.0		100	80-120			
Tetrachloroethene	10.2	0.200	ug/L	10.0		102	80-120			
Chlorobenzene	10.4	0.200	ug/L	10.0		104	80-120			
1,4-Dichlorobenzene	10.4	0.200	ug/L	10.0		104	77-120			
Surrogate: 1,2-Dichloroethane-d4	5.45		ug/L	*5.00*		*109*	*80-129*			
Surrogate: Toluene-d8	5.00		ug/L	*5.00*		*100*	*80-120*			
Surrogate: 4-Bromofluorobenzene	4.81		ug/L	*5.00*		*96.2*	*80-120*			
Surrogate: 1,2-Dichlorobenzene-d4	5.02		ug/L	*5.00*		*100*	*80-120*			
LCS Dup (BIB0361-BSD1)				Prepared: 14-Feb-2020 Analyzed: 14-Feb-2020 10:55						
Vinyl Chloride	10.5	0.200	ug/L	10.0		105	70-130	2.60	30	

Shannon & Wilson, Inc	Project: 8801 E Marginal Way S	
400 N 34th St., Suite 100	Project Number: 103425	**Reported:**
Seattle WA, 98103-8636	Project Manager: Joseph Sawdey	17-Feb-2020 11:35

TCLP Volatile Organic Compounds - Quality Control

Batch BIB0361 - EPA 5030 (Purge and Trap)

Instrument: NT2 Analyst: PKC

QC Sample/Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
LCS Dup (BIB0361-BSD1)				Prepared: 14-Feb-2020	Analyzed: 14-Feb-2020 10:55					
1,1-Dichloroethene	11.1	0.200	ug/L	10.0		111	76-123	1.67	30	
2-Butanone	52.8	5.00	ug/L	50.0		106	67-134	0.16	30	
Chloroform	10.4	0.200	ug/L	10.0		104	77-123	0.38	30	
Carbon tetrachloride	9.67	0.200	ug/L	10.0		96.7	69-139	2.64	30	
1,2-Dichloroethane	10.6	0.200	ug/L	10.0		106	71-125	0.01	30	
Benzene	10.0	0.200	ug/L	10.0		100	80-120	0.67	30	
Trichloroethene	9.99	0.200	ug/L	10.0		99.9	80-120	0.04	30	
Tetrachloroethene	9.73	0.200	ug/L	10.0		97.3	80-120	5.13	30	
Chlorobenzene	10.1	0.200	ug/L	10.0		101	80-120	3.25	30	
1,4-Dichlorobenzene	9.63	0.200	ug/L	10.0		96.3	77-120	7.48	30	
Surrogate: 1,2-Dichloroethane-d4	5.47		ug/L	*5.00*		*109*	*80-129*			
Surrogate: Toluene-d8	5.03		ug/L	*5.00*		*101*	*80-120*			
Surrogate: 4-Bromofluorobenzene	4.73		ug/L	*5.00*		*94.5*	*80-120*			
Surrogate: 1,2-Dichlorobenzene-d4	4.94		ug/L	*5.00*		*98.7*	*80-120*			
Matrix Spike (BIB0361-MS1)		**Source: 20B0027-01**		Prepared: 14-Feb-2020	Analyzed: 14-Feb-2020 18:48					
Vinyl Chloride	96.3	2.00	ug/L	100	ND	96.3	70-130			
1,1-Dichloroethene	99.2	2.00	ug/L	100	ND	99.2	76-123			
2-Butanone	449	50.0	ug/L	500	ND	89.7	67-134			
Chloroform	92.6	2.00	ug/L	100	ND	92.6	77-123			
Carbon tetrachloride	81.8	2.00	ug/L	100	ND	81.8	69-129			
1,2-Dichloroethane	92.3	2.00	ug/L	100	ND	92.3	71-125			
Benzene	88.1	2.00	ug/L	100	ND	88.1	80-120			
Trichloroethene	88.5	2.00	ug/L	100	ND	88.5	80-120			
Tetrachloroethene	88.6	2.00	ug/L	100	ND	88.6	80-120			
Chlorobenzene	90.5	2.00	ug/L	100	ND	90.5	80-120			
1,4-Dichlorobenzene	93.1	2.00	ug/L	100	ND	93.1	77-120			
Surrogate: 1,2-Dichloroethane-d4	5.63		ug/L	*5.00*	*5.63*	*113*	*80-129*			
Surrogate: Toluene-d8	4.95		ug/L	*5.00*	*4.98*	*99.0*	*80-120*			
Surrogate: 4-Bromofluorobenzene	4.72		ug/L	*5.00*	*4.47*	*94.4*	*80-120*			
Surrogate: 1,2-Dichlorobenzene-d4	5.05		ug/L	*5.00*	*5.01*	*101*	*80-120*			

Recovery limits for target analytes in MS/MSD QC samples are advisory only.

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Analytical Report

Shannon & Wilson, Inc 400 N 34th St., Suite 100 Seattle WA, 98103-8636	Project: 8801 E Marginal Way S Project Number: 103425 Project Manager: Joseph Sawdey	Reported: 17-Feb-2020 11:35

Certified Analyses included in this Report

Analyte	Certifications
EPA 8260C in Solid	
Chloromethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Vinyl Chloride	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Bromomethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Chloroethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Trichlorofluoromethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Acrolein	WADOE,DoD-ELAP,NELAP,CALAP
1,1,2-Trichloro-1,2,2-Trifluoroethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Acetone	WADOE,DoD-ELAP,NELAP,CALAP
1,1-Dichloroethene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Bromoethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Iodomethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Methylene Chloride	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Acrylonitrile	WADOE,DoD-ELAP,NELAP,CALAP
Carbon Disulfide	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
trans-1,2-Dichloroethene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Vinyl Acetate	WADOE,DoD-ELAP,NELAP,CALAP
1,1-Dichloroethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
2-Butanone	WADOE,DoD-ELAP,NELAP,CALAP
2,2-Dichloropropane	WADOE,DoD-ELAP,NELAP,CALAP
cis-1,2-Dichloroethene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Chloroform	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Bromochloromethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
1,1,1-Trichloroethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
1,1-Dichloropropene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Carbon tetrachloride	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
1,2-Dichloroethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Benzene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Trichloroethene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
1,2-Dichloropropane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Bromodichloromethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Dibromomethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
2-Chloroethyl vinyl ether	WADOE,DoD-ELAP,NELAP
4-Methyl-2-Pentanone	WADOE,DoD-ELAP,NELAP,CALAP
cis-1,3-Dichloropropene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Toluene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC

trans-1,3-Dichloropropene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
2-Hexanone	WADOE,DoD-ELAP,NELAP,CALAP
1,1,2-Trichloroethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
1,3-Dichloropropane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Tetrachloroethene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Dibromochloromethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
1,2-Dibromoethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Chlorobenzene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Ethylbenzene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
1,1,1,2-Tetrachloroethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
m,p-Xylene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
o-Xylene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Xylenes, total	WADOE
Styrene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Bromoform	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
1,1,2,2-Tetrachloroethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
1,2,3-Trichloropropane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
trans-1,4-Dichloro 2-Butene	WADOE,DoD-ELAP,NELAP
n-Propylbenzene	WADOE,DoD-ELAP,NELAP,CALAP
Bromobenzene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Isopropyl Benzene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
2-Chlorotoluene	WADOE,DoD-ELAP,NELAP,CALAP
4-Chlorotoluene	WADOE,DoD-ELAP,NELAP,CALAP
t-Butylbenzene	WADOE,DoD-ELAP,NELAP,CALAP
1,3,5-Trimethylbenzene	WADOE,DoD-ELAP,NELAP,CALAP
1,2,4-Trimethylbenzene	WADOE,DoD-ELAP,NELAP,CALAP
s-Butylbenzene	WADOE,DoD-ELAP,NELAP,CALAP
4-Isopropyl Toluene	WADOE,DoD-ELAP,NELAP,CALAP
1,3-Dichlorobenzene	WADOE,DoD-ELAP,NELAP,CALAP
1,4-Dichlorobenzene	WADOE,DoD-ELAP,NELAP,CALAP
n-Butylbenzene	WADOE,DoD-ELAP,NELAP,CALAP
1,2-Dichlorobenzene	WADOE,DoD-ELAP,NELAP,CALAP
1,2-Dibromo-3-chloropropane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
1,2,4-Trichlorobenzene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Hexachloro-1,3-Butadiene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Naphthalene	WADOE,DoD-ELAP,NELAP,CALAP
1,2,3-Trichlorobenzene	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Dichlorodifluoromethane	WADOE,DoD-ELAP,NELAP,CALAP,ADEC
Methyl tert-butyl Ether	WADOE,DoD-ELAP,NELAP,CALAP
n-Hexane	WADOE

2-Pentanone	WADOE
Dibromofluoromethane	WADOE
4-Bromofluorobenzene	WADOE

EPA 8260C in Water

Chloromethane	DoD-ELAP,NELAP,CALAP,WADOE
Vinyl Chloride	DoD-ELAP,NELAP,CALAP,WADOE
Bromomethane	DoD-ELAP,NELAP,CALAP,WADOE
Chloroethane	DoD-ELAP,NELAP,CALAP,WADOE
Trichlorofluoromethane	DoD-ELAP,NELAP,CALAP,WADOE
Acrolein	DoD-ELAP,NELAP,CALAP,WADOE
1,1,2-Trichloro-1,2,2-Trifluoroethane	DoD-ELAP,NELAP,CALAP,WADOE
Acetone	DoD-ELAP,NELAP,CALAP,WADOE
1,1-Dichloroethene	DoD-ELAP,NELAP,CALAP,WADOE
Bromoethane	DoD-ELAP,NELAP,CALAP,WADOE
Iodomethane	DoD-ELAP,NELAP,CALAP,WADOE
Methylene Chloride	DoD-ELAP,NELAP,CALAP,WADOE
Acrylonitrile	DoD-ELAP,NELAP,CALAP,WADOE
Carbon Disulfide	DoD-ELAP,NELAP,CALAP,WADOE
trans-1,2-Dichloroethene	DoD-ELAP,NELAP,CALAP,WADOE
Vinyl Acetate	DoD-ELAP,NELAP,CALAP,WADOE
1,1-Dichloroethane	DoD-ELAP,NELAP,CALAP,WADOE
2-Butanone	DoD-ELAP,NELAP,CALAP,WADOE
2,2-Dichloropropane	DoD-ELAP,NELAP,CALAP,WADOE
cis-1,2-Dichloroethene	DoD-ELAP,NELAP,CALAP,WADOE
Chloroform	DoD-ELAP,NELAP,CALAP,WADOE
Bromochloromethane	DoD-ELAP,NELAP,CALAP,WADOE
1,1,1-Trichloroethane	DoD-ELAP,NELAP,CALAP,WADOE
1,1-Dichloropropene	DoD-ELAP,NELAP,CALAP,WADOE
Carbon tetrachloride	DoD-ELAP,NELAP,CALAP,WADOE
1,2-Dichloroethane	DoD-ELAP,NELAP,CALAP,WADOE
Benzene	DoD-ELAP,NELAP,CALAP,WADOE
Trichloroethene	DoD-ELAP,NELAP,CALAP,WADOE
1,2-Dichloropropane	DoD-ELAP,NELAP,CALAP,WADOE
Bromodichloromethane	DoD-ELAP,NELAP,CALAP,WADOE
Dibromomethane	DoD-ELAP,NELAP,CALAP,WADOE
2-Chloroethyl vinyl ether	DoD-ELAP,NELAP,CALAP,WADOE
4-Methyl-2-Pentanone	DoD-ELAP,NELAP,CALAP,WADOE
cis-1,3-Dichloropropene	DoD-ELAP,NELAP,CALAP,WADOE
Toluene	DoD-ELAP,NELAP,CALAP,WADOE

Shannon & Wilson, Inc	Project: 8801 E Marginal Way S	
400 N 34th St., Suite 100	Project Number: 103425	**Reported:**
Seattle WA, 98103-8636	Project Manager: Joseph Sawdey	17-Feb-2020 11:35

trans-1,3-Dichloropropene	DoD-ELAP,NELAP,CALAP,WADOE
2-Hexanone	DoD-ELAP,NELAP,CALAP,WADOE
1,1,2-Trichloroethane	DoD-ELAP,NELAP,CALAP,WADOE
1,3-Dichloropropane	DoD-ELAP,NELAP,CALAP,WADOE
Tetrachloroethene	DoD-ELAP,NELAP,CALAP,WADOE
Dibromochloromethane	DoD-ELAP,NELAP,CALAP,WADOE
1,2-Dibromoethane	DoD-ELAP,NELAP,CALAP,WADOE
Chlorobenzene	DoD-ELAP,NELAP,CALAP,WADOE
Ethylbenzene	DoD-ELAP,NELAP,CALAP,WADOE
1,1,1,2-Tetrachloroethane	DoD-ELAP,NELAP,CALAP,WADOE
m,p-Xylene	DoD-ELAP,NELAP,CALAP,WADOE
o-Xylene	DoD-ELAP,NELAP,CALAP,WADOE
Xylenes, total	DoD-ELAP,NELAP,CALAP,WADOE
Styrene	DoD-ELAP,NELAP,CALAP,WADOE
Bromoform	DoD-ELAP,NELAP,CALAP,WADOE
1,1,2,2-Tetrachloroethane	DoD-ELAP,NELAP,CALAP,WADOE
1,2,3-Trichloropropane	DoD-ELAP,NELAP,CALAP,WADOE
trans-1,4-Dichloro 2-Butene	DoD-ELAP,NELAP,CALAP,WADOE
n-Propylbenzene	DoD-ELAP,NELAP,CALAP,WADOE
Bromobenzene	DoD-ELAP,NELAP,CALAP,WADOE
Isopropyl Benzene	DoD-ELAP,NELAP,CALAP,WADOE
2-Chlorotoluene	DoD-ELAP,NELAP,CALAP,WADOE
4-Chlorotoluene	DoD-ELAP,NELAP,CALAP,WADOE
t-Butylbenzene	DoD-ELAP,NELAP,CALAP,WADOE
1,3,5-Trimethylbenzene	DoD-ELAP,NELAP,CALAP,WADOE
1,2,4-Trimethylbenzene	DoD-ELAP,NELAP,CALAP,WADOE
s-Butylbenzene	DoD-ELAP,NELAP,CALAP,WADOE
4-Isopropyl Toluene	DoD-ELAP,NELAP,CALAP,WADOE
1,3-Dichlorobenzene	DoD-ELAP,NELAP,CALAP,WADOE
1,4-Dichlorobenzene	DoD-ELAP,NELAP,CALAP,WADOE
n-Butylbenzene	DoD-ELAP,NELAP,CALAP,WADOE
1,2-Dichlorobenzene	DoD-ELAP,NELAP,CALAP,WADOE
1,2-Dibromo-3-chloropropane	DoD-ELAP,NELAP,CALAP,WADOE
1,2,4-Trichlorobenzene	DoD-ELAP,NELAP,CALAP,WADOE
Hexachloro-1,3-Butadiene	DoD-ELAP,NELAP,CALAP,WADOE
Naphthalene	DoD-ELAP,NELAP,CALAP,WADOE
1,2,3-Trichlorobenzene	DoD-ELAP,NELAP,CALAP,WADOE
Dichlorodifluoromethane	DoD-ELAP,NELAP,CALAP,WADOE
Methyl tert-butyl Ether	DoD-ELAP,NELAP,CALAP,WADOE
n-Hexane	DoD-ELAP,NELAP,CALAP,WADOE

Shannon & Wilson, Inc	Project: 8801 E Marginal Way S	
400 N 34th St., Suite 100	Project Number: 103425	**Reported:**
Seattle WA, 98103-8636	Project Manager: Joseph Sawdey	17-Feb-2020 11:35

2-Pentanone DoD-ELAP,NELAP,CALAP,WADOE

Code	Description	Number	Expires
ADEC	Alaska Dept of Environmental Conservation	17-015	01/31/2021
CALAP	California Department of Public Health CAELAP	2748	06/30/2019
DoD-ELAP	DoD-Environmental Laboratory Accreditation Program	66169	01/01/2021
NELAP	ORELAP - Oregon Laboratory Accreditation Program	WA100006-012	05/12/2020
WADOE	WA Dept of Ecology	C558	06/30/2019
WA-DW	Ecology - Drinking Water	C558	06/30/2019

4611 S. 134th Place, Suite 100 • Tukwila, WA 98168 • Ph: (206) 695-6200 • Fax: (206) 695-6202

Shannon & Wilson, Inc	Project: 8801 E Marginal Way S	
400 N 34th St., Suite 100	Project Number: 103425	**Reported:**
Seattle WA, 98103-8636	Project Manager: Joseph Sawdey	17-Feb-2020 11:35

Notes and Definitions

*	Flagged value is not within established control limits.
E	The analyte concentration exceeds the upper limit of the calibration range of the instrument established by the initial calibration (ICAL)
H	Hold time violation - Hold time was exceeded.
J	Estimated concentration value detected below the reporting limit.
Q	Indicates a detected analyte with an initial or continuing calibration that does not meet established acceptance criteria (<20% RSD, <20% drift or minimum RRF)
U	This analyte is not detected above the reporting limit (RL) or if noted, not detected above the limit of detection (LOD).
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference
[2C]	Indicates this result was quantified on the second column on a dual column analysis.

3600 Fremont Ave. N.
Seattle, WA 98103
T: (206) 352-3790
F: (206) 352-7178
info@fremontanalytical.com

Shannon & Wilson
Meg Strong
400 N. 34th Street, Suite 100
Seattle, WA 98103

RE: 8801
Work Order Number: 2103041

March 17, 2021

Attention Meg Strong:

Fremont Analytical, Inc. received 3 sample(s) on 3/2/2021 for the analyses presented in the following report.

Mercury by EPA Method 7471
Metals (EPA 200.8) with TCLP Extraction (EPA 1311)
Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)
Polychlorinated Biphenyls (PCB) by EPA 8082
Sample Moisture (Percent Moisture)
Total Metals by EPA Method 6020B
Volatile Organic Compounds by EPA Method 8260D

This report consists of the following:

- Case Narrative
- Analytical Results
- Applicable Quality Control Summary Reports
- Chain of Custody

All analyses were performed consistent with the Quality Assurance program of Fremont Analytical, Inc. Please contact the laboratory if you should have any questions about the results.

Thank you for using Fremont Analytical.

Sincerely,

Brianna Barnes
Project Manager

DoD-ELAP Accreditation #79636 by PJLA, ISO/IEC 17025:2017 and QSM 5.3 for Environmental Testing
ORELAP Certification: WA 100009 (NELAP Recognized) for Environmental Testing
Washington State Department of Ecology Accredited for Environmental Testing, Lab ID C910

Date: *03/17/2021*

CLIENT:	Shannon & Wilson
Project:	8801
Work Order:	2103041

Work Order Sample Summary

Lab Sample ID	Client Sample ID	Date/Time Collected	Date/Time Received
2103041-001	A7A8-WA	03/02/2021 3:28 PM	03/02/2021 5:14 PM
2103041-002	A4-WA	03/02/2021 3:38 PM	03/02/2021 5:14 PM
2103041-003	A5-WA	03/02/2021 3:48 AM	03/02/2021 5:14 PM

Note: If no "Time Collected" is supplied, a default of 12:00AM is assigned

Case Narrative

WO#: **2103041**

Date: **3/17/2021**

CLIENT: Shannon & Wilson

Project: 8801

I. SAMPLE RECEIPT:
Samples receipt information is recorded on the attached Sample Receipt Checklist.

II. GENERAL REPORTING COMMENTS:
Results are reported on a wet weight basis unless dry-weight correction is denoted in the units field on the analytical report ("mg/kg-dry" or "ug/kg-dry").

Matrix Spike (MS) and MS Duplicate (MSD) samples are tested from an analytical batch of "like" matrix to check for possible matrix effect. The MS and MSD will provide site specific matrix data only for those samples which are spiked by the laboratory. The sample chosen for spike purposes may or may not have been a sample submitted in this sample delivery group. The validity of the analytical procedures for which data is reported in this analytical report is determined by the Laboratory Control Sample (LCS) and the Method Blank (MB). The LCS and the MB are processed with the samples and the MS/MSD to ensure method criteria are achieved throughout the entire analytical process.

III. ANALYSES AND EXCEPTIONS:
Exceptions associated with this report will be footnoted in the analytical results page(s) or the quality control summary page(s) and/or noted below.

3/17/21, Revision 1: Includes analysis of TCLP lead requested by the client.

Qualifiers:

* - Flagged value is not within established control limits
B - Analyte detected in the associated Method Blank
D - Dilution was required
E - Value above quantitation range
H - Holding times for preparation or analysis exceeded
I - Analyte with an internal standard that does not meet established acceptance criteria
J - Analyte detected below Reporting Limit
N - Tentatively Identified Compound (TIC)
Q - Analyte with an initial or continuing calibration that does not meet established acceptance criteria
S - Spike recovery outside accepted recovery limits
ND - Not detected at the Reporting Limit
R - High relative percent difference observed

Acronyms:

%Rec - Percent Recovery
CCB - Continued Calibration Blank
CCV - Continued Calibration Verification
DF - Dilution Factor
DUP - Sample Duplicate
HEM - Hexane Extractable Material
ICV - Initial Calibration Verification
LCS/LCSD - Laboratory Control Sample / Laboratory Control Sample Duplicate
MCL - Maximum Contaminant Level
MB or MBLANK - Method Blank
MDL - Method Detection Limit
MS/MSD - Matrix Spike / Matrix Spike Duplicate
PDS - Post Digestion Spike
Ref Val - Reference Value
REP - Sample Replicate
RL - Reporting Limit
RPD - Relative Percent Difference
SD - Serial Dilution
SGT - Silica Gel Treatment
SPK - Spike
Surr - Surrogate

Analytical Report

Work Order: **2103041**
Date Reported: **3/17/2021**

Client: Shannon & Wilson
Collection Date: 3/2/2021 3:28:00 PM
Project: 8801
Lab ID: 2103041-001
Matrix: Soil
Client Sample ID: A7A8-WA

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Polychlorinated Biphenyls (PCB) by EPA 8082				Batch ID: 31554		Analyst: SB
Aroclor 1016	ND	0.0100		mg/Kg-dry	1	3/4/2021 10:44:56 PM
Aroclor 1221	ND	0.0100		mg/Kg-dry	1	3/4/2021 10:44:56 PM
Aroclor 1232	ND	0.0100		mg/Kg-dry	1	3/4/2021 10:44:56 PM
Aroclor 1242	ND	0.0100		mg/Kg-dry	1	3/4/2021 10:44:56 PM
Aroclor 1248	ND	0.0100		mg/Kg-dry	1	3/4/2021 10:44:56 PM
Aroclor 1254	ND	0.0100		mg/Kg-dry	1	3/4/2021 10:44:56 PM
Aroclor 1260	ND	0.0100		mg/Kg-dry	1	3/4/2021 10:44:56 PM
Aroclor 1262	ND	0.0100		mg/Kg-dry	1	3/4/2021 10:44:56 PM
Aroclor 1268	ND	0.0100		mg/Kg-dry	1	3/4/2021 10:44:56 PM
Total PCBs	ND	0.0100		mg/Kg-dry	1	3/4/2021 10:44:56 PM
Surr: Decachlorobiphenyl	81.0	9.23 - 163		%Rec	1	3/4/2021 10:44:56 PM
Surr: Tetrachloro-m-xylene	86.3	12 - 153		%Rec	1	3/4/2021 10:44:56 PM
Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)				Batch ID: 31566		Analyst: SB
Naphthalene	37.3	20.2		µg/Kg-dry	1	3/5/2021 8:04:53 PM
2-Methylnaphthalene	64.5	20.2		µg/Kg-dry	1	3/5/2021 8:04:53 PM
1-Methylnaphthalene	55.9	20.2		µg/Kg-dry	1	3/5/2021 8:04:53 PM
Acenaphthylene	28.9	20.2		µg/Kg-dry	1	3/5/2021 8:04:53 PM
Acenaphthene	24.0	20.2		µg/Kg-dry	1	3/5/2021 8:04:53 PM
Fluorene	36.6	20.2		µg/Kg-dry	1	3/5/2021 8:04:53 PM
Phenanthrene	233	40.4		µg/Kg-dry	1	3/5/2021 8:04:53 PM
Anthracene	ND	40.4		µg/Kg-dry	1	3/5/2021 8:04:53 PM
Fluoranthene	320	40.4		µg/Kg-dry	1	3/5/2021 8:04:53 PM
Pyrene	319	40.4		µg/Kg-dry	1	3/5/2021 8:04:53 PM
Benz(a)anthracene	119	20.2		µg/Kg-dry	1	3/5/2021 8:04:53 PM
Chrysene	103	40.4		µg/Kg-dry	1	3/5/2021 8:04:53 PM
Benzo(b)fluoranthene	84.1	20.2		µg/Kg-dry	1	3/5/2021 8:04:53 PM
Benzo(k)fluoranthene	107	20.2		µg/Kg-dry	1	3/5/2021 8:04:53 PM
Benzo(a)pyrene	152	20.2		µg/Kg-dry	1	3/5/2021 8:04:53 PM
Indeno(1,2,3-cd)pyrene	68.1	40.4		µg/Kg-dry	1	3/5/2021 8:04:53 PM
Dibenz(a,h)anthracene	ND	40.4		µg/Kg-dry	1	3/5/2021 8:04:53 PM
Benzo(g,h,i)perylene	71.6	20.2		µg/Kg-dry	1	3/5/2021 8:04:53 PM
Surr: 2-Fluorobiphenyl	69.6	19 - 135		%Rec	1	3/5/2021 8:04:53 PM
Surr: Terphenyl-d14 (surr)	78.2	42.9 - 156		%Rec	1	3/5/2021 8:04:53 PM
Volatile Organic Compounds by EPA Method 8260D				Batch ID: 31569		Analyst: CR
Dichlorodifluoromethane (CFC-12)	ND	0.0279		mg/Kg-dry	1	3/5/2021 1:52:07 PM

Analytical Report

Work Order: **2103041**
Date Reported: **3/17/2021**

Client: Shannon & Wilson **Collection Date:** 3/2/2021 3:28:00 PM
Project: 8801
Lab ID: 2103041-001 **Matrix:** Soil
Client Sample ID: A7A8-WA

Volatile Organic Compounds by EPA Method 8260D Batch ID: 31569 Analyst: CR

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Chloromethane	ND	0.0698		mg/Kg-dry	1	3/5/2021 1:52:07 PM
Vinyl chloride	ND	0.0279		mg/Kg-dry	1	3/5/2021 1:52:07 PM
Bromomethane	ND	0.0698		mg/Kg-dry	1	3/5/2021 1:52:07 PM
Trichlorofluoromethane (CFC-11)	ND	0.0279		mg/Kg-dry	1	3/5/2021 1:52:07 PM
Chloroethane	ND	0.0698		mg/Kg-dry	1	3/5/2021 1:52:07 PM
1,1-Dichloroethene	ND	0.0279		mg/Kg-dry	1	3/5/2021 1:52:07 PM
Methylene chloride	ND	0.0279		mg/Kg-dry	1	3/5/2021 1:52:07 PM
trans-1,2-Dichloroethene	ND	0.0279		mg/Kg-dry	1	3/5/2021 1:52:07 PM
Methyl tert-butyl ether (MTBE)	ND	0.0279		mg/Kg-dry	1	3/5/2021 1:52:07 PM
1,1-Dichloroethane	ND	0.0279		mg/Kg-dry	1	3/5/2021 1:52:07 PM
cis-1,2-Dichloroethene	ND	0.0279		mg/Kg-dry	1	3/5/2021 1:52:07 PM
Chloroform	ND	0.0279		mg/Kg-dry	1	3/5/2021 1:52:07 PM
1,1,1-Trichloroethane (TCA)	ND	0.0279		mg/Kg-dry	1	3/5/2021 1:52:07 PM
1,1-Dichloropropene	ND	0.0279		mg/Kg-dry	1	3/5/2021 1:52:07 PM
Carbon tetrachloride	ND	0.0279		mg/Kg-dry	1	3/5/2021 1:52:07 PM
1,2-Dichloroethane (EDC)	ND	0.0279		mg/Kg-dry	1	3/5/2021 1:52:07 PM
Benzene	ND	0.0279		mg/Kg-dry	1	3/5/2021 1:52:07 PM
Trichloroethene (TCE)	ND	0.0279		mg/Kg-dry	1	3/5/2021 1:52:07 PM
1,2-Dichloropropane	ND	0.0279		mg/Kg-dry	1	3/5/2021 1:52:07 PM
Bromodichloromethane	ND	0.0279		mg/Kg-dry	1	3/5/2021 1:52:07 PM
Dibromomethane	ND	0.0279		mg/Kg-dry	1	3/5/2021 1:52:07 PM
cis-1,3-Dichloropropene	ND	0.0279		mg/Kg-dry	1	3/5/2021 1:52:07 PM
Toluene	0.0569	0.0279		mg/Kg-dry	1	3/5/2021 1:52:07 PM
trans-1,3-Dichloropropylene	ND	0.0279		mg/Kg-dry	1	3/5/2021 1:52:07 PM
1,1,2-Trichloroethane	ND	0.0279		mg/Kg-dry	1	3/5/2021 1:52:07 PM
1,3-Dichloropropane	ND	0.0349		mg/Kg-dry	1	3/5/2021 1:52:07 PM
Tetrachloroethene (PCE)	ND	0.0279		mg/Kg-dry	1	3/5/2021 1:52:07 PM
Dibromochloromethane	ND	0.0279		mg/Kg-dry	1	3/5/2021 1:52:07 PM
1,2-Dibromoethane (EDB)	ND	0.00698		mg/Kg-dry	1	3/5/2021 1:52:07 PM
Chlorobenzene	ND	0.0279		mg/Kg-dry	1	3/5/2021 1:52:07 PM
1,1,1,2-Tetrachloroethane	ND	0.0279		mg/Kg-dry	1	3/5/2021 1:52:07 PM
Ethylbenzene	0.356	0.0349		mg/Kg-dry	1	3/5/2021 1:52:07 PM
m,p-Xylene	2.33	0.0698		mg/Kg-dry	1	3/5/2021 1:52:07 PM
o-Xylene	0.180	0.0349		mg/Kg-dry	1	3/5/2021 1:52:07 PM
Styrene	ND	0.0279		mg/Kg-dry	1	3/5/2021 1:52:07 PM
Isopropylbenzene	0.327	0.0279		mg/Kg-dry	1	3/5/2021 1:52:07 PM
Bromoform	ND	0.0698		mg/Kg-dry	1	3/5/2021 1:52:07 PM
1,1,2,2-Tetrachloroethane	ND	0.0279		mg/Kg-dry	1	3/5/2021 1:52:07 PM
n-Propylbenzene	1.05	0.0279		mg/Kg-dry	1	3/5/2021 1:52:07 PM

Client: Shannon & Wilson
Collection Date: 3/2/2021 3:28:00 PM
Project: 8801
Lab ID: 2103041-001
Matrix: Soil
Client Sample ID: A7A8-WA

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Volatile Organic Compounds by EPA Method 8260D				Batch ID: 31569		Analyst: CR
Bromobenzene	ND	0.0279		mg/Kg-dry	1	3/5/2021 1:52:07 PM
1,3,5-Trimethylbenzene	4.20	0.558	D	mg/Kg-dry	20	3/8/2021 10:29:40 AM
2-Chlorotoluene	ND	0.0349		mg/Kg-dry	1	3/5/2021 1:52:07 PM
4-Chlorotoluene	ND	0.0279		mg/Kg-dry	1	3/5/2021 1:52:07 PM
tert-Butylbenzene	ND	0.0279		mg/Kg-dry	1	3/5/2021 1:52:07 PM
1,2,3-Trichloropropane	ND	0.0349		mg/Kg-dry	1	3/5/2021 1:52:07 PM
1,2,4-Trichlorobenzene	ND	0.0279		mg/Kg-dry	1	3/5/2021 1:52:07 PM
sec-Butylbenzene	0.346	0.0349		mg/Kg-dry	1	3/5/2021 1:52:07 PM
4-Isopropyltoluene	0.558	0.0349		mg/Kg-dry	1	3/5/2021 1:52:07 PM
1,3-Dichlorobenzene	ND	0.0279		mg/Kg-dry	1	3/5/2021 1:52:07 PM
1,4-Dichlorobenzene	ND	0.0279		mg/Kg-dry	1	3/5/2021 1:52:07 PM
n-Butylbenzene	ND	0.0279		mg/Kg-dry	1	3/5/2021 1:52:07 PM
1,2-Dichlorobenzene	ND	0.0279		mg/Kg-dry	1	3/5/2021 1:52:07 PM
1,2-Dibromo-3-chloropropane	ND	0.698		mg/Kg-dry	1	3/5/2021 1:52:07 PM
1,2,4-Trimethylbenzene	10.1	0.558	D	mg/Kg-dry	20	3/8/2021 10:29:40 AM
Hexachloro-1,3-butadiene	ND	0.0349		mg/Kg-dry	1	3/5/2021 1:52:07 PM
Naphthalene	0.130	0.0698		mg/Kg-dry	1	3/5/2021 1:52:07 PM
1,2,3-Trichlorobenzene	ND	0.0279		mg/Kg-dry	1	3/5/2021 1:52:07 PM
Surr: Dibromofluoromethane	100	82.3 - 112		%Rec	1	3/5/2021 1:52:07 PM
Surr: Toluene-d8	95.4	90.7 - 109		%Rec	1	3/5/2021 1:52:07 PM
Surr: 1-Bromo-4-fluorobenzene	96.4	88.4 - 109		%Rec	1	3/5/2021 1:52:07 PM
Mercury by EPA Method 7471				Batch ID: 31550		Analyst: LB
Mercury	ND	0.262		mg/Kg-dry	1	3/4/2021 2:42:38 PM
Total Metals by EPA Method 6020B				Batch ID: 31552		Analyst: EH
Arsenic	2.96	0.110		mg/Kg-dry	1	3/9/2021 1:49:58 PM
Barium	35.8	0.550		mg/Kg-dry	1	3/6/2021 12:16:46 AM
Cadmium	0.270	0.183		mg/Kg-dry	1	3/6/2021 12:16:46 AM
Chromium	15.8	0.366		mg/Kg-dry	1	3/6/2021 12:16:46 AM
Copper	12.5	0.916		mg/Kg-dry	1	3/6/2021 12:16:46 AM
Lead	5.37	0.183		mg/Kg-dry	1	3/6/2021 12:16:46 AM
Nickel	7.81	0.458		mg/Kg-dry	1	3/6/2021 12:16:46 AM
Selenium	0.865	0.183		mg/Kg-dry	1	3/6/2021 12:16:46 AM
Silver	ND	0.137		mg/Kg-dry	1	3/6/2021 12:16:46 AM
Zinc	41.3	1.60		mg/Kg-dry	1	3/6/2021 12:16:46 AM

Analytical Report

Work Order: **2103041**
Date Reported: **3/17/2021**

Client: Shannon & Wilson
Project: 8801
Lab ID: 2103041-001
Client Sample ID: A7A8-WA

Collection Date: 3/2/2021 3:28:00 PM
Matrix: Soil

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Sample Moisture (Percent Moisture)				Batch ID: R65642		Analyst: mch
Percent Moisture	14.7			wt%	1	3/4/2021 1:47:55 PM

Analytical Report

Work Order: **2103041**
Date Reported: **3/17/2021**

Client: Shannon & Wilson
Collection Date: 3/2/2021 3:38:00 PM
Project: 8801
Lab ID: 2103041-002
Matrix: Soil
Client Sample ID: A4-WA

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Polychlorinated Biphenyls (PCB) by EPA 8082				Batch ID: 31554		Analyst: SB
Aroclor 1016	ND	0.0102		mg/Kg-dry	1	3/4/2021 10:54:38 PM
Aroclor 1221	ND	0.0102		mg/Kg-dry	1	3/4/2021 10:54:38 PM
Aroclor 1232	ND	0.0102		mg/Kg-dry	1	3/4/2021 10:54:38 PM
Aroclor 1242	ND	0.0102		mg/Kg-dry	1	3/4/2021 10:54:38 PM
Aroclor 1248	ND	0.0102		mg/Kg-dry	1	3/4/2021 10:54:38 PM
Aroclor 1254	0.0294	0.0102		mg/Kg-dry	1	3/4/2021 10:54:38 PM
Aroclor 1260	ND	0.0102		mg/Kg-dry	1	3/4/2021 10:54:38 PM
Aroclor 1262	ND	0.0102		mg/Kg-dry	1	3/4/2021 10:54:38 PM
Aroclor 1268	ND	0.0102		mg/Kg-dry	1	3/4/2021 10:54:38 PM
Total PCBs	0.0294	0.0102		mg/Kg-dry	1	3/4/2021 10:54:38 PM
Surr: Decachlorobiphenyl	83.8	9.23 - 163		%Rec	1	3/4/2021 10:54:38 PM
Surr: Tetrachloro-m-xylene	112	12 - 153		%Rec	1	3/4/2021 10:54:38 PM
Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)				Batch ID: 31566		Analyst: SB
Naphthalene	25.5	21.0		µg/Kg-dry	1	3/5/2021 8:26:06 PM
2-Methylnaphthalene	ND	21.0		µg/Kg-dry	1	3/5/2021 8:26:06 PM
1-Methylnaphthalene	ND	21.0		µg/Kg-dry	1	3/5/2021 8:26:06 PM
Acenaphthylene	ND	21.0		µg/Kg-dry	1	3/5/2021 8:26:06 PM
Acenaphthene	138	21.0		µg/Kg-dry	1	3/5/2021 8:26:06 PM
Fluorene	278	21.0		µg/Kg-dry	1	3/5/2021 8:26:06 PM
Phenanthrene	844	42.0		µg/Kg-dry	1	3/5/2021 8:26:06 PM
Anthracene	253	42.0		µg/Kg-dry	1	3/5/2021 8:26:06 PM
Fluoranthene	1,290	42.0		µg/Kg-dry	1	3/5/2021 8:26:06 PM
Pyrene	993	42.0		µg/Kg-dry	1	3/5/2021 8:26:06 PM
Benz(a)anthracene	470	21.0		µg/Kg-dry	1	3/5/2021 8:26:06 PM
Chrysene	362	42.0		µg/Kg-dry	1	3/5/2021 8:26:06 PM
Benzo(b)fluoranthene	231	21.0		µg/Kg-dry	1	3/5/2021 8:26:06 PM
Benzo(k)fluoranthene	250	21.0		µg/Kg-dry	1	3/5/2021 8:26:06 PM
Benzo(a)pyrene	326	21.0		µg/Kg-dry	1	3/5/2021 8:26:06 PM
Indeno(1,2,3-cd)pyrene	93.1	42.0		µg/Kg-dry	1	3/5/2021 8:26:06 PM
Dibenz(a,h)anthracene	47.2	42.0		µg/Kg-dry	1	3/5/2021 8:26:06 PM
Benzo(g,h,i)perylene	86.1	21.0		µg/Kg-dry	1	3/5/2021 8:26:06 PM
Surr: 2-Fluorobiphenyl	64.9	19 - 135		%Rec	1	3/5/2021 8:26:06 PM
Surr: Terphenyl-d14 (surr)	73.6	42.9 - 156		%Rec	1	3/5/2021 8:26:06 PM
Volatile Organic Compounds by EPA Method 8260D				Batch ID: 31569		Analyst: CR
Dichlorodifluoromethane (CFC-12)	ND	0.0211	Q	mg/Kg-dry	1	3/8/2021 9:59:19 AM

Fremont Analytical

Analytical Report

Work Order: **2103041**
Date Reported: **3/17/2021**

Client: Shannon & Wilson
Project: 8801
Lab ID: 2103041-002
Client Sample ID: A4-WA

Collection Date: 3/2/2021 3:38:00 PM
Matrix: Soil

Volatile Organic Compounds by EPA Method 8260D Batch ID: 31569 Analyst: CR

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Chloromethane	ND	0.0527		mg/Kg-dry	1	3/8/2021 9:59:19 AM
Vinyl chloride	ND	0.0211		mg/Kg-dry	1	3/8/2021 9:59:19 AM
Bromomethane	ND	0.0527		mg/Kg-dry	1	3/8/2021 9:59:19 AM
Trichlorofluoromethane (CFC-11)	ND	0.0211		mg/Kg-dry	1	3/8/2021 9:59:19 AM
Chloroethane	ND	0.0527		mg/Kg-dry	1	3/8/2021 9:59:19 AM
1,1-Dichloroethene	ND	0.0211		mg/Kg-dry	1	3/8/2021 9:59:19 AM
Methylene chloride	ND	0.0211		mg/Kg-dry	1	3/8/2021 9:59:19 AM
trans-1,2-Dichloroethene	ND	0.0211		mg/Kg-dry	1	3/8/2021 9:59:19 AM
Methyl tert-butyl ether (MTBE)	ND	0.0211		mg/Kg-dry	1	3/8/2021 9:59:19 AM
1,1-Dichloroethane	ND	0.0211		mg/Kg-dry	1	3/8/2021 9:59:19 AM
cis-1,2-Dichloroethene	ND	0.0211		mg/Kg-dry	1	3/8/2021 9:59:19 AM
Chloroform	ND	0.0211		mg/Kg-dry	1	3/8/2021 9:59:19 AM
1,1,1-Trichloroethane (TCA)	ND	0.0211		mg/Kg-dry	1	3/8/2021 9:59:19 AM
1,1-Dichloropropene	ND	0.0211		mg/Kg-dry	1	3/8/2021 9:59:19 AM
Carbon tetrachloride	ND	0.0211		mg/Kg-dry	1	3/8/2021 9:59:19 AM
1,2-Dichloroethane (EDC)	ND	0.0211		mg/Kg-dry	1	3/8/2021 9:59:19 AM
Benzene	ND	0.0211		mg/Kg-dry	1	3/8/2021 9:59:19 AM
Trichloroethene (TCE)	0.0235	0.0211		mg/Kg-dry	1	3/8/2021 9:59:19 AM
1,2-Dichloropropane	ND	0.0211		mg/Kg-dry	1	3/8/2021 9:59:19 AM
Bromodichloromethane	ND	0.0211		mg/Kg-dry	1	3/8/2021 9:59:19 AM
Dibromomethane	ND	0.0211		mg/Kg-dry	1	3/8/2021 9:59:19 AM
cis-1,3-Dichloropropene	ND	0.0211		mg/Kg-dry	1	3/8/2021 9:59:19 AM
Toluene	0.0758	0.0211		mg/Kg-dry	1	3/8/2021 9:59:19 AM
trans-1,3-Dichloropropylene	ND	0.0211		mg/Kg-dry	1	3/8/2021 9:59:19 AM
1,1,2-Trichloroethane	ND	0.0211		mg/Kg-dry	1	3/8/2021 9:59:19 AM
1,3-Dichloropropane	ND	0.0264		mg/Kg-dry	1	3/8/2021 9:59:19 AM
Tetrachloroethene (PCE)	ND	0.0211		mg/Kg-dry	1	3/8/2021 9:59:19 AM
Dibromochloromethane	ND	0.0211		mg/Kg-dry	1	3/8/2021 9:59:19 AM
1,2-Dibromoethane (EDB)	ND	0.00527		mg/Kg-dry	1	3/8/2021 9:59:19 AM
Chlorobenzene	ND	0.0211		mg/Kg-dry	1	3/8/2021 9:59:19 AM
1,1,1,2-Tetrachloroethane	ND	0.0211		mg/Kg-dry	1	3/8/2021 9:59:19 AM
Ethylbenzene	0.0565	0.0264		mg/Kg-dry	1	3/8/2021 9:59:19 AM
m,p-Xylene	0.387	0.0527		mg/Kg-dry	1	3/8/2021 9:59:19 AM
o-Xylene	0.0750	0.0264		mg/Kg-dry	1	3/8/2021 9:59:19 AM
Styrene	ND	0.0211		mg/Kg-dry	1	3/8/2021 9:59:19 AM
Isopropylbenzene	ND	0.0211		mg/Kg-dry	1	3/8/2021 9:59:19 AM
Bromoform	ND	0.0527		mg/Kg-dry	1	3/8/2021 9:59:19 AM
1,1,2,2-Tetrachloroethane	ND	0.0211		mg/Kg-dry	1	3/8/2021 9:59:19 AM
n-Propylbenzene	0.0264	0.0211		mg/Kg-dry	1	3/8/2021 9:59:19 AM

Client: Shannon & Wilson
Project: 8801
Lab ID: 2103041-002
Client Sample ID: A4-WA
Collection Date: 3/2/2021 3:38:00 PM
Matrix: Soil

Volatile Organic Compounds by EPA Method 8260D

Batch ID: 31569 Analyst: CR

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Bromobenzene	ND	0.0211		mg/Kg-dry	1	3/8/2021 9:59:19 AM
1,3,5-Trimethylbenzene	0.104	0.0211		mg/Kg-dry	1	3/8/2021 9:59:19 AM
2-Chlorotoluene	ND	0.0264		mg/Kg-dry	1	3/8/2021 9:59:19 AM
4-Chlorotoluene	ND	0.0211		mg/Kg-dry	1	3/8/2021 9:59:19 AM
tert-Butylbenzene	ND	0.0211		mg/Kg-dry	1	3/8/2021 9:59:19 AM
1,2,3-Trichloropropane	ND	0.0264		mg/Kg-dry	1	3/8/2021 9:59:19 AM
1,2,4-Trichlorobenzene	ND	0.0211		mg/Kg-dry	1	3/8/2021 9:59:19 AM
sec-Butylbenzene	ND	0.0264		mg/Kg-dry	1	3/8/2021 9:59:19 AM
4-Isopropyltoluene	ND	0.0264		mg/Kg-dry	1	3/8/2021 9:59:19 AM
1,3-Dichlorobenzene	ND	0.0211		mg/Kg-dry	1	3/8/2021 9:59:19 AM
1,4-Dichlorobenzene	ND	0.0211		mg/Kg-dry	1	3/8/2021 9:59:19 AM
n-Butylbenzene	ND	0.0211		mg/Kg-dry	1	3/8/2021 9:59:19 AM
1,2-Dichlorobenzene	ND	0.0211		mg/Kg-dry	1	3/8/2021 9:59:19 AM
1,2-Dibromo-3-chloropropane	ND	0.527		mg/Kg-dry	1	3/8/2021 9:59:19 AM
1,2,4-Trimethylbenzene	0.288	0.0211		mg/Kg-dry	1	3/8/2021 9:59:19 AM
Hexachloro-1,3-butadiene	ND	0.0264		mg/Kg-dry	1	3/8/2021 9:59:19 AM
Naphthalene	ND	0.0527		mg/Kg-dry	1	3/8/2021 9:59:19 AM
1,2,3-Trichlorobenzene	ND	0.0211		mg/Kg-dry	1	3/8/2021 9:59:19 AM
Surr: Dibromofluoromethane	98.6	82.3 - 112		%Rec	1	3/8/2021 9:59:19 AM
Surr: Toluene-d8	101	90.7 - 109		%Rec	1	3/8/2021 9:59:19 AM
Surr: 1-Bromo-4-fluorobenzene	99.6	88.4 - 109		%Rec	1	3/8/2021 9:59:19 AM

NOTES:
Q - Indicates an analyte with a continuing calibration that does not meet established acceptance criteria

Mercury by EPA Method 7471

Batch ID: 31550 Analyst: LB

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Mercury	0.436	0.278		mg/Kg-dry	1	3/4/2021 2:51:04 PM

Total Metals by EPA Method 6020B

Batch ID: 31552 Analyst: EH

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Arsenic	4.11	0.104		mg/Kg-dry	1	3/6/2021 12:22:19 AM
Barium	43.5	0.520		mg/Kg-dry	1	3/6/2021 12:22:19 AM
Cadmium	ND	0.173		mg/Kg-dry	1	3/6/2021 12:22:19 AM
Chromium	12.0	0.346		mg/Kg-dry	1	3/6/2021 12:22:19 AM
Copper	788	8.66	D	mg/Kg-dry	10	3/9/2021 1:55:32 PM
Lead	13.1	0.173		mg/Kg-dry	1	3/6/2021 12:22:19 AM
Nickel	11.0	0.433		mg/Kg-dry	1	3/6/2021 12:22:19 AM
Selenium	0.945	0.173		mg/Kg-dry	1	3/6/2021 12:22:19 AM
Silver	ND	0.130		mg/Kg-dry	1	3/6/2021 12:22:19 AM

Analytical Report

Work Order: **2103041**
Date Reported: **3/17/2021**

Client: Shannon & Wilson
Collection Date: 3/2/2021 3:38:00 PM
Project: 8801
Lab ID: 2103041-002
Matrix: Soil
Client Sample ID: **A4-WA**

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Metals by EPA Method 6020B				Batch ID: 31552		Analyst: EH
Zinc	46.0	1.52		mg/Kg-dry	1	3/6/2021 12:22:19 AM
Sample Moisture (Percent Moisture)				Batch ID: R65642		Analyst: mch
Percent Moisture	11.9			wt%	1	3/4/2021 1:47:55 PM

Analytical Report

Work Order: **2103041**
Date Reported: **3/17/2021**

Client: Shannon & Wilson
Collection Date: 3/2/2021 3:48:00 AM
Project: 8801
Lab ID: 2103041-003
Matrix: Soil
Client Sample ID: A5-WA

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Polychlorinated Biphenyls (PCB) by EPA 8082				Batch ID: 31567		Analyst: SB
Aroclor 1016	ND	0.0123		mg/Kg-dry	1	3/9/2021 9:11:27 AM
Aroclor 1221	ND	0.0123		mg/Kg-dry	1	3/9/2021 9:11:27 AM
Aroclor 1232	ND	0.0123		mg/Kg-dry	1	3/9/2021 9:11:27 AM
Aroclor 1242	ND	0.0123		mg/Kg-dry	1	3/9/2021 9:11:27 AM
Aroclor 1248	ND	0.0123		mg/Kg-dry	1	3/9/2021 9:11:27 AM
Aroclor 1254	0.122	0.0123		mg/Kg-dry	1	3/9/2021 9:11:27 AM
Aroclor 1260	ND	0.0123		mg/Kg-dry	1	3/9/2021 9:11:27 AM
Aroclor 1262	ND	0.0123		mg/Kg-dry	1	3/9/2021 9:11:27 AM
Aroclor 1268	ND	0.0123		mg/Kg-dry	1	3/9/2021 9:11:27 AM
Total PCBs	0.122	0.0123		mg/Kg-dry	1	3/9/2021 9:11:27 AM
Surr: Decachlorobiphenyl	90.8	9.23 - 163		%Rec	1	3/9/2021 9:11:27 AM
Surr: Tetrachloro-m-xylene	98.1	12 - 153		%Rec	1	3/9/2021 9:11:27 AM
Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)				Batch ID: 31566		Analyst: SB
Naphthalene	ND	21.3		µg/Kg-dry	1	3/5/2021 8:47:17 PM
2-Methylnaphthalene	25.3	21.3		µg/Kg-dry	1	3/5/2021 8:47:17 PM
1-Methylnaphthalene	33.4	21.3		µg/Kg-dry	1	3/5/2021 8:47:17 PM
Acenaphthylene	ND	21.3		µg/Kg-dry	1	3/5/2021 8:47:17 PM
Acenaphthene	91.3	21.3		µg/Kg-dry	1	3/5/2021 8:47:17 PM
Fluorene	66.8	21.3		µg/Kg-dry	1	3/5/2021 8:47:17 PM
Phenanthrene	351	42.7		µg/Kg-dry	1	3/5/2021 8:47:17 PM
Anthracene	129	42.7		µg/Kg-dry	1	3/5/2021 8:47:17 PM
Fluoranthene	381	42.7		µg/Kg-dry	1	3/5/2021 8:47:17 PM
Pyrene	512	42.7		µg/Kg-dry	1	3/5/2021 8:47:17 PM
Benz(a)anthracene	298	21.3		µg/Kg-dry	1	3/5/2021 8:47:17 PM
Chrysene	258	42.7		µg/Kg-dry	1	3/5/2021 8:47:17 PM
Benzo(b)fluoranthene	134	21.3		µg/Kg-dry	1	3/5/2021 8:47:17 PM
Benzo(k)fluoranthene	129	21.3		µg/Kg-dry	1	3/5/2021 8:47:17 PM
Benzo(a)pyrene	242	21.3		µg/Kg-dry	1	3/5/2021 8:47:17 PM
Indeno(1,2,3-cd)pyrene	66.6	42.7		µg/Kg-dry	1	3/5/2021 8:47:17 PM
Dibenz(a,h)anthracene	ND	42.7		µg/Kg-dry	1	3/5/2021 8:47:17 PM
Benzo(g,h,i)perylene	76.8	21.3		µg/Kg-dry	1	3/5/2021 8:47:17 PM
Surr: 2-Fluorobiphenyl	79.8	19 - 135		%Rec	1	3/5/2021 8:47:17 PM
Surr: Terphenyl-d14 (surr)	90.4	42.9 - 156		%Rec	1	3/5/2021 8:47:17 PM
Volatile Organic Compounds by EPA Method 8260D				Batch ID: 31569		Analyst: CR
Dichlorodifluoromethane (CFC-12)	ND	0.0243		mg/Kg-dry	1	3/5/2021 3:23:21 PM

Analytical Report

Work Order: **2103041**
Date Reported: **3/17/2021**

Client: Shannon & Wilson **Collection Date:** 3/2/2021 3:48:00 AM
Project: 8801
Lab ID: 2103041-003 **Matrix:** Soil
Client Sample ID: A5-WA

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Volatile Organic Compounds by EPA Method 8260D				Batch ID: 31569		Analyst: CR
Chloromethane	ND	0.0609		mg/Kg-dry	1	3/5/2021 3:23:21 PM
Vinyl chloride	ND	0.0243		mg/Kg-dry	1	3/5/2021 3:23:21 PM
Bromomethane	ND	0.0609		mg/Kg-dry	1	3/5/2021 3:23:21 PM
Trichlorofluoromethane (CFC-11)	ND	0.0243		mg/Kg-dry	1	3/5/2021 3:23:21 PM
Chloroethane	ND	0.0609		mg/Kg-dry	1	3/5/2021 3:23:21 PM
1,1-Dichloroethene	ND	0.0243		mg/Kg-dry	1	3/5/2021 3:23:21 PM
Methylene chloride	ND	0.0243		mg/Kg-dry	1	3/5/2021 3:23:21 PM
trans-1,2-Dichloroethene	ND	0.0243		mg/Kg-dry	1	3/5/2021 3:23:21 PM
Methyl tert-butyl ether (MTBE)	ND	0.0243		mg/Kg-dry	1	3/5/2021 3:23:21 PM
1,1-Dichloroethane	ND	0.0243		mg/Kg-dry	1	3/5/2021 3:23:21 PM
cis-1,2-Dichloroethene	0.0595	0.0243		mg/Kg-dry	1	3/5/2021 3:23:21 PM
Chloroform	ND	0.0243		mg/Kg-dry	1	3/5/2021 3:23:21 PM
1,1,1-Trichloroethane (TCA)	ND	0.0243		mg/Kg-dry	1	3/5/2021 3:23:21 PM
1,1-Dichloropropene	ND	0.0243		mg/Kg-dry	1	3/5/2021 3:23:21 PM
Carbon tetrachloride	ND	0.0243		mg/Kg-dry	1	3/5/2021 3:23:21 PM
1,2-Dichloroethane (EDC)	ND	0.0243		mg/Kg-dry	1	3/5/2021 3:23:21 PM
Benzene	ND	0.0243		mg/Kg-dry	1	3/5/2021 3:23:21 PM
Trichloroethene (TCE)	0.206	0.0243		mg/Kg-dry	1	3/5/2021 3:23:21 PM
1,2-Dichloropropane	0.0355	0.0243		mg/Kg-dry	1	3/5/2021 3:23:21 PM
Bromodichloromethane	ND	0.0243		mg/Kg-dry	1	3/5/2021 3:23:21 PM
Dibromomethane	ND	0.0243		mg/Kg-dry	1	3/5/2021 3:23:21 PM
cis-1,3-Dichloropropene	ND	0.0243		mg/Kg-dry	1	3/5/2021 3:23:21 PM
Toluene	0.0517	0.0243		mg/Kg-dry	1	3/5/2021 3:23:21 PM
trans-1,3-Dichloropropylene	ND	0.0243		mg/Kg-dry	1	3/5/2021 3:23:21 PM
1,1,2-Trichloroethane	ND	0.0243		mg/Kg-dry	1	3/5/2021 3:23:21 PM
1,3-Dichloropropane	ND	0.0304		mg/Kg-dry	1	3/5/2021 3:23:21 PM
Tetrachloroethene (PCE)	ND	0.0243		mg/Kg-dry	1	3/5/2021 3:23:21 PM
Dibromochloromethane	ND	0.0243		mg/Kg-dry	1	3/5/2021 3:23:21 PM
1,2-Dibromoethane (EDB)	ND	0.00609		mg/Kg-dry	1	3/5/2021 3:23:21 PM
Chlorobenzene	ND	0.0243		mg/Kg-dry	1	3/5/2021 3:23:21 PM
1,1,1,2-Tetrachloroethane	ND	0.0243		mg/Kg-dry	1	3/5/2021 3:23:21 PM
Ethylbenzene	ND	0.0304		mg/Kg-dry	1	3/5/2021 3:23:21 PM
m,p-Xylene	0.150	0.0609		mg/Kg-dry	1	3/5/2021 3:23:21 PM
o-Xylene	ND	0.0304		mg/Kg-dry	1	3/5/2021 3:23:21 PM
Styrene	ND	0.0243		mg/Kg-dry	1	3/5/2021 3:23:21 PM
Isopropylbenzene	ND	0.0243		mg/Kg-dry	1	3/5/2021 3:23:21 PM
Bromoform	ND	0.0609		mg/Kg-dry	1	3/5/2021 3:23:21 PM
1,1,2,2-Tetrachloroethane	ND	0.0243		mg/Kg-dry	1	3/5/2021 3:23:21 PM
n-Propylbenzene	ND	0.0243		mg/Kg-dry	1	3/5/2021 3:23:21 PM

Fremont Analytical

Analytical Report

Work Order: **2103041**
Date Reported: **3/17/2021**

Client: Shannon & Wilson
Project: 8801
Lab ID: 2103041-003
Client Sample ID: A5-WA

Collection Date: 3/2/2021 3:48:00 AM
Matrix: Soil

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Volatile Organic Compounds by EPA Method 8260D				Batch ID: 31569		Analyst: CR
Bromobenzene	ND	0.0243		mg/Kg-dry	1	3/5/2021 3:23:21 PM
1,3,5-Trimethylbenzene	0.0320	0.0243		mg/Kg-dry	1	3/5/2021 3:23:21 PM
2-Chlorotoluene	ND	0.0304		mg/Kg-dry	1	3/5/2021 3:23:21 PM
4-Chlorotoluene	ND	0.0243		mg/Kg-dry	1	3/5/2021 3:23:21 PM
tert-Butylbenzene	ND	0.0243		mg/Kg-dry	1	3/5/2021 3:23:21 PM
1,2,3-Trichloropropane	ND	0.0304		mg/Kg-dry	1	3/5/2021 3:23:21 PM
1,2,4-Trichlorobenzene	ND	0.0243		mg/Kg-dry	1	3/5/2021 3:23:21 PM
sec-Butylbenzene	ND	0.0304		mg/Kg-dry	1	3/5/2021 3:23:21 PM
4-Isopropyltoluene	ND	0.0304		mg/Kg-dry	1	3/5/2021 3:23:21 PM
1,3-Dichlorobenzene	ND	0.0243		mg/Kg-dry	1	3/5/2021 3:23:21 PM
1,4-Dichlorobenzene	ND	0.0243		mg/Kg-dry	1	3/5/2021 3:23:21 PM
n-Butylbenzene	ND	0.0243		mg/Kg-dry	1	3/5/2021 3:23:21 PM
1,2-Dichlorobenzene	ND	0.0243		mg/Kg-dry	1	3/5/2021 3:23:21 PM
1,2-Dibromo-3-chloropropane	ND	0.609		mg/Kg-dry	1	3/5/2021 3:23:21 PM
1,2,4-Trimethylbenzene	0.0960	0.0243		mg/Kg-dry	1	3/5/2021 3:23:21 PM
Hexachloro-1,3-butadiene	ND	0.0304		mg/Kg-dry	1	3/5/2021 3:23:21 PM
Naphthalene	ND	0.0609		mg/Kg-dry	1	3/5/2021 3:23:21 PM
1,2,3-Trichlorobenzene	ND	0.0243		mg/Kg-dry	1	3/5/2021 3:23:21 PM
Surr: Dibromofluoromethane	103	82.3 - 112		%Rec	1	3/5/2021 3:23:21 PM
Surr: Toluene-d8	86.3	90.7 - 109	S	%Rec	1	3/5/2021 3:23:21 PM
Surr: 1-Bromo-4-fluorobenzene	105	88.4 - 109		%Rec	1	3/5/2021 3:23:21 PM

NOTES:
S - Outlying surrogate recovery(ies) observed.

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Mercury by EPA Method 7471				Batch ID: 31550		Analyst: LB
Mercury	0.320	0.303		mg/Kg-dry	1	3/4/2021 2:55:19 PM
Total Metals by EPA Method 6020B				Batch ID: 31552		Analyst: EH
Arsenic	6.43	0.119		mg/Kg-dry	1	3/6/2021 12:27:53 AM
Barium	206	0.596		mg/Kg-dry	1	3/6/2021 12:27:53 AM
Cadmium	2.39	0.199		mg/Kg-dry	1	3/6/2021 12:27:53 AM
Chromium	33.6	0.397		mg/Kg-dry	1	3/6/2021 12:27:53 AM
Copper	210	0.993		mg/Kg-dry	1	3/6/2021 12:27:53 AM
Lead	428	1.99	D	mg/Kg-dry	10	3/9/2021 2:01:06 PM
Nickel	20.5	0.496		mg/Kg-dry	1	3/6/2021 12:27:53 AM
Selenium	1.29	0.199		mg/Kg-dry	1	3/6/2021 12:27:53 AM
Silver	0.652	0.149		mg/Kg-dry	1	3/6/2021 12:27:53 AM

Analytical Report

Work Order: **2103041**
Date Reported: **3/17/2021**

Client: Shannon & Wilson
Collection Date: 3/2/2021 3:48:00 AM
Project: 8801
Lab ID: 2103041-003
Matrix: Soil
Client Sample ID: A5-WA

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Metals by EPA Method 6020B				Batch ID: 31552		Analyst: EH
Zinc	327	17.4	D	mg/Kg-dry	10	3/9/2021 2:01:06 PM
Metals (EPA 200.8) with TCLP Extraction (EPA 1311)				Batch ID: 31676		Analyst: EH
Lead	1.23	0.200		mg/L	1	3/17/2021 2:17:21 PM
Sample Moisture (Percent Moisture)				Batch ID: R65642		Analyst: mch
Percent Moisture	20.7			wt%	1	3/4/2021 1:47:55 PM

Work Order: 2103041
CLIENT: Shannon & Wilson
Project: 8801

QC SUMMARY REPORT

Total Metals by EPA Method 6020B

Sample ID: **MB-31552**	SampType: **MBLK**				Units: **mg/Kg**		Prep Date: **3/4/2021**		RunNo: **65715**		
Client ID: **MBLKS**	Batch ID: **31552**						Analysis Date: **3/5/2021**		SeqNo: **1322040**		
Analyte	**Result**	**RL**	**SPK value**	**SPK Ref Val**	**%REC**	**LowLimit**	**HighLimit**	**RPD Ref Val**	**%RPD**	**RPDLimit**	**Qual**
Arsenic	ND	0.120									
Barium	ND	0.600									
Cadmium	ND	0.200									
Copper	ND	1.00									
Lead	ND	0.200									
Nickel	ND	0.500									
Selenium	ND	0.200									
Silver	ND	0.150									
Zinc	ND	1.75									

Sample ID: **LCS-31552**	SampType: **LCS**				Units: **mg/Kg**		Prep Date: **3/4/2021**		RunNo: **65715**		
Client ID: **LCSS**	Batch ID: **31552**						Analysis Date: **3/5/2021**		SeqNo: **1322041**		
Analyte	**Result**	**RL**	**SPK value**	**SPK Ref Val**	**%REC**	**LowLimit**	**HighLimit**	**RPD Ref Val**	**%RPD**	**RPDLimit**	**Qual**
Arsenic	43.7	0.120	50.00	0	87.5	80	120				
Barium	49.1	0.600	50.00	0	98.2	80	120				
Cadmium	2.49	0.200	2.500	0	99.7	80	120				
Copper	43.7	1.00	50.00	0	87.3	80	120				
Lead	25.6	0.200	25.00	0	102	80	120				
Nickel	43.3	0.500	50.00	0	86.6	80	120				
Selenium	4.80	0.200	5.000	0	96.0	80	120				
Silver	2.60	0.150	2.500	0	104	80	120				
Zinc	49.4	1.75	50.00	0	98.9	80	120				

Sample ID: **2103028-010AMS**	SampType: **MS**				Units: **mg/Kg-dry**		Prep Date: **3/4/2021**		RunNo: **65715**		
Client ID: **BATCH**	Batch ID: **31552**						Analysis Date: **3/5/2021**		SeqNo: **1322045**		
Analyte	**Result**	**RL**	**SPK value**	**SPK Ref Val**	**%REC**	**LowLimit**	**HighLimit**	**RPD Ref Val**	**%RPD**	**RPDLimit**	**Qual**
Arsenic	42.0	0.133	55.48	4.278	68.0	75	125				S

Fremont Analytical

Date: *3/17/2021*

Work Order: 2103041
CLIENT: Shannon & Wilson
Project: 8801

QC SUMMARY REPORT

Total Metals by EPA Method 6020B

Sample ID: **2103028-010AMS** SampType: **MS** Units: **mg/Kg-dry** Prep Date: **3/4/2021** RunNo: **65715**
Client ID: **BATCH** Batch ID: **31552** Analysis Date: **3/5/2021** SeqNo: **1322045**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Barium	79.0	0.666	55.48	46.97	57.8	75	125				S
Cadmium	2.15	0.222	2.774	0.06849	75.0	75	125				
Chromium	49.6	0.444	55.48	13.97	64.2	75	125				S
Copper	52.5	1.11	55.48	17.67	62.7	75	125				S
Lead	25.9	0.222	27.74	6.997	68.0	75	125				S
Nickel	47.0	0.555	55.48	9.944	66.8	75	125				S
Selenium	4.69	0.222	5.548	0.9977	66.6	75	125				S
Silver	2.11	0.166	2.774	0.08670	73.0	75	125				S
Zinc	71.3	1.94	55.48	36.70	62.4	75	125				S

NOTES:
S - Outlying spike recovery(ies) observed. A duplicate analysis was performed and recovered within range.

Sample ID: **2103028-010AMSD** SampType: **MSD** Units: **mg/Kg-dry** Prep Date: **3/4/2021** RunNo: **65715**
Client ID: **BATCH** Batch ID: **31552** Analysis Date: **3/5/2021** SeqNo: **1322046**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Arsenic	53.4	0.135	56.37	4.278	87.2	75	125	42.01	23.9	20	R
Barium	103	0.676	56.37	46.97	98.9	75	125	79.02	26.1	20	R
Cadmium	2.80	0.225	2.819	0.06849	96.9	75	125	2.149	26.3	20	R
Chromium	61.6	0.451	56.37	13.97	84.5	75	125	49.56	21.7	20	R
Copper	64.1	1.13	56.37	17.67	82.3	75	125	52.45	19.9	20	
Lead	33.1	0.225	28.19	6.997	92.7	75	125	25.86	24.6	20	R
Nickel	58.1	0.564	56.37	9.944	85.4	75	125	47.00	21.1	20	R
Selenium	6.07	0.225	5.637	0.9977	89.9	75	125	4.695	25.5	20	R
Silver	2.74	0.169	2.819	0.08670	94.1	75	125	2.113	25.8	20	R
Zinc	88.8	1.97	56.37	36.70	92.4	75	125	71.30	21.8	20	R

NOTES:
R - High RPD observed due to Matrix Spike recoveries. The method is in control as indicated by the LCS.

Fremont Analytical

Date: 3/17/2021

Work Order: 2103041
CLIENT: Shannon & Wilson
Project: 8801

QC SUMMARY REPORT

Total Metals by EPA Method 6020B

Sample ID: **2103028-010APDS** SampType: **PDS** Units: **mg/Kg-dry** Prep Date: **3/4/2021** RunNo: **65715**
Client ID: **BATCH** Batch ID: **31552** Analysis Date: **3/5/2021** SeqNo: **1322047**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Arsenic	71.6	0.169	70.5	4.28	95.5	75	125				
Barium	130	0.846	70.5	47.0	118	75	125				
Cadmium	3.62	0.282	3.52	0.0685	101	75	125				
Chromium	80.3	0.564	70.5	14.0	94.1	75	125				
Copper	83.8	1.41	70.5	17.7	93.8	75	125				
Lead	43.4	0.282	35.2	7.00	103	75	125				
Nickel	74.7	0.705	70.5	9.94	91.9	75	125				
Selenium	7.85	0.282	7.05	0.998	97.2	75	125				
Silver	3.62	0.211	3.52	0.0867	100	75	125				
Zinc	118	2.47	70.5	36.7	116	75	125				

Sample ID: **MB-31552** SampType: **MBLK** Units: **mg/Kg** Prep Date: **3/4/2021** RunNo: **65715**
Client ID: **MBLKS** Batch ID: **31552** Analysis Date: **3/9/2021** SeqNo: **1322582**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	ND	0.400									

Sample ID: **LCS-31552** SampType: **LCS** Units: **mg/Kg** Prep Date: **3/4/2021** RunNo: **65715**
Client ID: **LCSS** Batch ID: **31552** Analysis Date: **3/9/2021** SeqNo: **1322583**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	45.4	0.400	50.00	0	90.9	80	120				

Fremont Analytical

Date: *3/17/2021*

Work Order: 2103041
CLIENT: Shannon & Wilson
Project: 8801

QC SUMMARY REPORT

Mercury by EPA Method 7471

Sample ID: **MB-31550** SampType: **MBLK** Units: **mg/Kg** Prep Date: **3/3/2021** RunNo: **65645**
Client ID: **MBLKS** Batch ID: **31550** Analysis Date: **3/4/2021** SeqNo: **1320628**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	ND	0.250									

Sample ID: **LCS-31550** SampType: **LCS** Units: **mg/Kg** Prep Date: **3/3/2021** RunNo: **65645**
Client ID: **LCSS** Batch ID: **31550** Analysis Date: **3/4/2021** SeqNo: **1320629**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.519	0.250	0.5000	0	104	80	120				

Sample ID: **2103036-001ADUP** SampType: **DUP** Units: **mg/Kg-dry** Prep Date: **3/3/2021** RunNo: **65645**
Client ID: **BATCH** Batch ID: **31550** Analysis Date: **3/4/2021** SeqNo: **1320631**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	ND	0.285						0		20	

Sample ID: **2103036-001AMS** SampType: **MS** Units: **mg/Kg-dry** Prep Date: **3/3/2021** RunNo: **65645**
Client ID: **BATCH** Batch ID: **31550** Analysis Date: **3/4/2021** SeqNo: **1320632**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.628	0.290	0.5803	0.04549	100	70	130				

Sample ID: **2103036-001AMSD** SampType: **MSD** Units: **mg/Kg-dry** Prep Date: **3/3/2021** RunNo: **65645**
Client ID: **BATCH** Batch ID: **31550** Analysis Date: **3/4/2021** SeqNo: **1320633**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.593	0.270	0.5395	0.04549	102	70	130	0.6278	5.62	20	

Fremont Analytical

Date: *3/17/2021*

Work Order: 2103041
CLIENT: Shannon & Wilson
Project: 8801

QC SUMMARY REPORT

Metals (EPA 200.8) with TCLP Extraction (EPA 1311)

Sample ID: **MB-31676** SampType: **MBLK** Units: **mg/L** Prep Date: **3/17/2021** RunNo: **65942**
Client ID: **MBLKS** Batch ID: **31676** Analysis Date: **3/17/2021** SeqNo: **1326864**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	0.200									

Sample ID: **LCS-31676** SampType: **LCS** Units: **mg/L** Prep Date: **3/17/2021** RunNo: **65942**
Client ID: **LCSS** Batch ID: **31676** Analysis Date: **3/17/2021** SeqNo: **1326865**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	2.33	0.200	2.500	0	93.1	65	135				

Sample ID: **2103041-003ADUP** SampType: **DUP** Units: **mg/L** Prep Date: **3/17/2021** RunNo: **65942**
Client ID: **A5-WA** Batch ID: **31676** Analysis Date: **3/17/2021** SeqNo: **1326867**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	1.19	0.200						1.227	2.83	30	

Sample ID: **2103041-003AMS** SampType: **MS** Units: **mg/L** Prep Date: **3/17/2021** RunNo: **65942**
Client ID: **A5-WA** Batch ID: **31676** Analysis Date: **3/17/2021** SeqNo: **1326870**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	3.62	0.200	2.500	1.227	95.7	65	135				

Sample ID: **2103041-003AMSD** SampType: **MSD** Units: **mg/L** Prep Date: **3/17/2021** RunNo: **65942**
Client ID: **A5-WA** Batch ID: **31676** Analysis Date: **3/17/2021** SeqNo: **1326871**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	3.61	0.200	2.500	1.227	95.2	65	135	3.619	0.315	30	

Fremont Analytical

Date: *3/17/2021*

Work Order: 2103041
CLIENT: Shannon & Wilson
Project: 8801

QC SUMMARY REPORT

Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)

Sample ID: **MB-31566** SampType: **MBLK** Units: **µg/Kg** Prep Date: **3/5/2021** RunNo: **65688**
Client ID: **MBLKS** Batch ID: **31566** Analysis Date: **3/5/2021** SeqNo: **1321483**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Naphthalene	ND	20.0									
2-Methylnaphthalene	ND	20.0									
1-Methylnaphthalene	ND	20.0									
Acenaphthylene	ND	20.0									
Acenaphthene	ND	20.0									
Fluorene	ND	20.0									
Phenanthrene	ND	40.0									
Anthracene	ND	40.0									
Fluoranthene	ND	40.0									
Pyrene	ND	40.0									
Benz(a)anthracene	ND	20.0									
Chrysene	ND	40.0									
Benzo(b)fluoranthene	ND	20.0									
Benzo(k)fluoranthene	ND	20.0									
Benzo(a)pyrene	ND	20.0									
Indeno(1,2,3-cd)pyrene	ND	40.0									
Dibenz(a,h)anthracene	ND	40.0									
Benzo(g,h,i)perylene	ND	20.0									
Surr: 2-Fluorobiphenyl	767		1,000		76.7	19	135				
Surr: Terphenyl-d14 (surr)	827		1,000		82.7	42.9	156				

Sample ID: **LCS-31566** SampType: **LCS** Units: **µg/Kg** Prep Date: **3/5/2021** RunNo: **65688**
Client ID: **LCSS** Batch ID: **31566** Analysis Date: **3/5/2021** SeqNo: **1321484**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Naphthalene	1,660	20.0	2,000	0	82.9	62.7	127				
2-Methylnaphthalene	1,660	20.0	2,000	0	83.1	62.7	132				
1-Methylnaphthalene	1,660	20.0	2,000	0	83.2	61.4	131				
Acenaphthylene	1,640	20.0	2,000	0	81.8	62	132				
Acenaphthene	1,610	20.0	2,000	0	80.4	59.2	132				

Work Order: 2103041
CLIENT: Shannon & Wilson
Project: 8801

QC SUMMARY REPORT

Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)

Sample ID: **LCS-31566**	SampType: **LCS**	Units: **µg/Kg**	Prep Date: **3/5/2021**	RunNo: **65688**
Client ID: **LCSS**	Batch ID: **31566**		Analysis Date: **3/5/2021**	SeqNo: **1321484**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Fluorene	1,670	20.0	2,000	0	83.4	59.1	136				
Phenanthrene	1,630	40.0	2,000	0	81.6	54.1	139				
Anthracene	1,620	40.0	2,000	0	81.2	55.5	136				
Fluoranthene	1,660	40.0	2,000	0	83.2	52.8	149				
Pyrene	1,660	40.0	2,000	0	83.2	53.6	146				
Benz(a)anthracene	1,650	20.0	2,000	0	82.7	49.7	153				
Chrysene	1,630	40.0	2,000	0	81.3	52.6	147				
Benzo(b)fluoranthene	1,560	20.0	2,000	0	77.8	50.6	151				
Benzo(k)fluoranthene	1,860	20.0	2,000	0	92.8	47.1	155				
Benzo(a)pyrene	1,890	20.0	2,000	0	94.3	48.3	169				
Indeno(1,2,3-cd)pyrene	1,660	40.0	2,000	0	82.9	52.3	145				
Dibenz(a,h)anthracene	1,670	40.0	2,000	0	83.6	53	144				
Benzo(g,h,i)perylene	1,700	20.0	2,000	0	85.2	49.7	144				
Surr: 2-Fluorobiphenyl	820		1,000		82.0	19	135				
Surr: Terphenyl-d14 (surr)	863		1,000		86.3	42.9	156				

Sample ID: **2103034-001AMS**	SampType: **MS**	Units: **µg/Kg-dry**	Prep Date: **3/5/2021**	RunNo: **65688**
Client ID: **BATCH**	Batch ID: **31566**		Analysis Date: **3/5/2021**	SeqNo: **1321486**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Naphthalene	1,500	23.1	2,310	0	65.1	28.7	139				
2-Methylnaphthalene	1,560	23.1	2,310	0	67.4	43.5	130				
1-Methylnaphthalene	1,550	23.1	2,310	0	67.2	42.6	127				
Acenaphthylene	1,570	23.1	2,310	0	68.0	45.3	129				
Acenaphthene	1,510	23.1	2,310	0	65.2	45.1	123				
Fluorene	1,600	23.1	2,310	0	69.1	41.6	128				
Phenanthrene	1,530	46.2	2,310	31.97	64.9	24.2	142				
Anthracene	1,650	46.2	2,310	6.437	71.2	33.1	143				
Fluoranthene	1,810	46.2	2,310	80.87	74.9	35.5	147				
Pyrene	1,790	46.2	2,310	104.6	72.9	38.3	141				

Date: *3/17/2021*

Work Order: 2103041
CLIENT: Shannon & Wilson
Project: 8801

QC SUMMARY REPORT

Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)

Sample ID: **2103034-001AMS** SampType: **MS** Units: **µg/Kg-dry** Prep Date: **3/5/2021** RunNo: **65688**
Client ID: **BATCH** Batch ID: **31566** Analysis Date: **3/5/2021** SeqNo: **1321486**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benz(a)anthracene	1,790	23.1	2,310	37.62	75.9	42.5	145				
Chrysene	1,510	46.2	2,310	88.32	61.6	39.7	134				
Benzo(b)fluoranthene	1,840	23.1	2,310	63.43	76.9	29.9	152				
Benzo(k)fluoranthene	1,650	23.1	2,310	61.03	68.8	33.2	143.5				
Benzo(a)pyrene	1,990	23.1	2,310	53.30	84.0	38.2	156				
Indeno(1,2,3-cd)pyrene	1,310	46.2	2,310	33.55	55.1	41.4	128				
Dibenz(a,h)anthracene	1,340	46.2	2,310	0	57.8	40.4	129				
Benzo(g,h,i)perylene	1,180	23.1	2,310	63.74	48.5	34.2	131				
Surr: 2-Fluorobiphenyl	775		1,155		67.1	19	135				
Surr: Terphenyl-d14 (surr)	902		1,155		78.1	42.9	156				

Sample ID: **2103034-001AMSD** SampType: **MSD** Units: **µg/Kg-dry** Prep Date: **3/5/2021** RunNo: **65688**
Client ID: **BATCH** Batch ID: **31566** Analysis Date: **3/5/2021** SeqNo: **1321487**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Naphthalene	1,660	26.2	2,619	0	63.3	28.7	139	1,504	9.66	30	
2-Methylnaphthalene	1,710	26.2	2,619	0	65.5	43.5	130	1,557	9.63	30	
1-Methylnaphthalene	1,710	26.2	2,619	0	65.2	42.6	127	1,552	9.45	30	
Acenaphthylene	1,710	26.2	2,619	0	65.3	45.3	129	1,572	8.49	30	
Acenaphthene	1,640	26.2	2,619	0	62.5	45.1	123	1,505	8.29	30	
Fluorene	1,740	26.2	2,619	0	66.6	41.6	128	1,595	8.96	30	
Phenanthrene	1,620	52.4	2,619	31.97	60.8	24.2	142	1,531	5.86	30	
Anthracene	1,800	52.4	2,619	6.437	68.4	33.1	143	1,651	8.50	30	
Fluoranthene	1,940	52.4	2,619	80.87	71.1	35.5	147	1,811	7.04	30	
Pyrene	1,910	52.4	2,619	104.6	69.0	38.3	141	1,788	6.61	30	
Benz(a)anthracene	1,920	26.2	2,619	37.62	71.9	42.5	145	1,790	7.07	30	
Chrysene	1,670	52.4	2,619	88.32	60.3	39.7	134	1,511	9.80	30	
Benzo(b)fluoranthene	2,000	26.2	2,619	63.43	73.8	29.9	152	1,840	8.16	30	
Benzo(k)fluoranthene	1,710	26.2	2,619	61.03	62.9	33.2	143.5	1,650	3.44	30	
Benzo(a)pyrene	2,090	26.2	2,619	53.30	77.8	38.2	156	1,994	4.80	30	

Date: *3/17/2021*

Work Order: 2103041
CLIENT: Shannon & Wilson
Project: 8801

QC SUMMARY REPORT

Polyaromatic Hydrocarbons by EPA Method 8270 (SIM)

Sample ID: **2103034-001AMSD** SampType: **MSD** Units: **µg/Kg-dry** Prep Date: **3/5/2021** RunNo: **65688**
Client ID: **BATCH** Batch ID: **31566** Analysis Date: **3/5/2021** SeqNo: **1321487**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Indeno(1,2,3-cd)pyrene	1,290	52.4	2,619	33.55	47.8	41.4	128	1,306	1.56	30	
Dibenz(a,h)anthracene	1,320	52.4	2,619	0	50.6	40.4	129	1,336	0.889	30	
Benzo(g,h,i)perylene	1,130	26.2	2,619	63.74	40.6	34.2	131	1,184	4.98	30	
Surr: 2-Fluorobiphenyl	862		1,309		65.9	19	135		0		
Surr: Terphenyl-d14 (surr)	993		1,309		75.8	42.9	156		0		

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Date: 3/17/2021

Work Order: 2103041
CLIENT: Shannon & Wilson
Project: 8801

QC SUMMARY REPORT

Polychlorinated Biphenyls (PCB) by EPA 8082

Sample ID: **MB-31554**	SampType: **MBLK**			Units: **mg/Kg**		Prep Date: **3/4/2021**		RunNo: **65657**			
Client ID: **MBLKS**	Batch ID: **31554**					Analysis Date: **3/4/2021**		SeqNo: **1320856**			
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Aroclor 1016	ND	0.0100									
Aroclor 1221	ND	0.0100									
Aroclor 1232	ND	0.0100									
Aroclor 1242	ND	0.0100									
Aroclor 1248	ND	0.0100									
Aroclor 1254	ND	0.0100									
Aroclor 1260	ND	0.0100									
Aroclor 1262	ND	0.0100									
Aroclor 1268	ND	0.0100									
Total PCBs	ND	0.0100									
Surr: Decachlorobiphenyl	21.3		20.00		107	9.23	163				
Surr: Tetrachloro-m-xylene	19.1		20.00		95.3	12	153				

Sample ID: **LCS1-31554**	SampType: **LCS**			Units: **mg/Kg**		Prep Date: **3/4/2021**		RunNo: **65657**			
Client ID: **LCSS**	Batch ID: **31554**					Analysis Date: **3/4/2021**		SeqNo: **1320857**			
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Aroclor 1016	0.105	0.0500	0.1000	0	105	55.7	140				
Aroclor 1260	0.118	0.0500	0.1000	0	118	58.6	145				
Surr: Decachlorobiphenyl	19.9		20.00		99.7	9.23	163				
Surr: Tetrachloro-m-xylene	17.5		20.00		87.4	12	153				

Sample ID: **LCS2-31554**	SampType: **LCS**			Units: **mg/Kg**		Prep Date: **3/4/2021**		RunNo: **65657**			
Client ID: **LCSS**	Batch ID: **31554**					Analysis Date: **3/4/2021**		SeqNo: **1320858**			
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Aroclor 1254	0.0978	0.0500	0.1000	0	97.8	47.9	148				
Surr: Decachlorobiphenyl	21.6		20.00		108	9.23	163				
Surr: Tetrachloro-m-xylene	19.2		20.00		96.1	12	153				

Work Order: 2103041
CLIENT: Shannon & Wilson
Project: 8801

QC SUMMARY REPORT

Polychlorinated Biphenyls (PCB) by EPA 8082

Sample ID: **LCS2-31554**	SampType: **LCS**			Units: **mg/Kg**		Prep Date: **3/4/2021**		RunNo: **65657**			
Client ID: **LCSS**	Batch ID: **31554**					Analysis Date: **3/4/2021**		SeqNo: **1320858**			
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Sample ID: **2102417-002AMS**	SampType: **MS**			Units: **mg/Kg-dry**		Prep Date: **3/4/2021**		RunNo: **65657**			
Client ID: **BATCH**	Batch ID: **31554**					Analysis Date: **3/4/2021**		SeqNo: **1320860**			
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Aroclor 1016	0.149	0.0637	0.1274	0	117	22.9	177				
Aroclor 1260	0.168	0.0637	0.1274	0	132	30.1	157				
Surr: Decachlorobiphenyl	29.0		25.48		114	9.23	163				
Surr: Tetrachloro-m-xylene	22.5		25.48		88.3	12	153				

Sample ID: **2102417-002AMSD**	SampType: **MSD**			Units: **mg/Kg-dry**		Prep Date: **3/4/2021**		RunNo: **65657**			
Client ID: **BATCH**	Batch ID: **31554**					Analysis Date: **3/4/2021**		SeqNo: **1320861**			
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Aroclor 1016	0.132	0.0601	0.1203	0	110	22.9	177	0.1490	11.9	30	
Aroclor 1260	0.147	0.0601	0.1203	0	123	30.1	157	0.1677	12.9	30	
Surr: Decachlorobiphenyl	26.1		24.06		109	9.23	163		0		
Surr: Tetrachloro-m-xylene	17.4		24.06		72.1	12	153		0		

Sample ID: **MB-31567**	SampType: **MBLK**			Units: **mg/Kg**		Prep Date: **3/5/2021**		RunNo: **65730**			
Client ID: **MBLKS**	Batch ID: **31567**					Analysis Date: **3/9/2021**		SeqNo: **1322273**			
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Aroclor 1016	ND	0.0100									
Aroclor 1221	ND	0.0100									
Aroclor 1232	ND	0.0100									
Aroclor 1242	ND	0.0100									
Aroclor 1248	ND	0.0100									
Aroclor 1254	ND	0.0100									

Work Order: 2103041
CLIENT: Shannon & Wilson
Project: 8801

QC SUMMARY REPORT

Polychlorinated Biphenyls (PCB) by EPA 8082

Sample ID: **MB-31567** SampType: **MBLK** Units: **mg/Kg** Prep Date: **3/5/2021** RunNo: **65730**
Client ID: **MBLKS** Batch ID: **31567** Analysis Date: **3/9/2021** SeqNo: **1322273**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Aroclor 1260	ND	0.0100									
Aroclor 1262	ND	0.0100									
Aroclor 1268	ND	0.0100									
Total PCBs	ND	0.0100									
Surr: Decachlorobiphenyl	185		200.0		92.4	9.23	163				
Surr: Tetrachloro-m-xylene	216		200.0		108	12	153				

Sample ID: **LCS1-31567** SampType: **LCS** Units: **mg/Kg** Prep Date: **3/5/2021** RunNo: **65730**
Client ID: **LCSS** Batch ID: **31567** Analysis Date: **3/9/2021** SeqNo: **1322274**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Aroclor 1016	0.907	0.0500	1.000	0	90.7	55.7	140				
Aroclor 1260	0.959	0.0500	1.000	0	95.9	58.6	145				
Surr: Decachlorobiphenyl	190		200.0		95.1	9.23	163				
Surr: Tetrachloro-m-xylene	219		200.0		110	12	153				

Sample ID: **LCS2-31567** SampType: **LCS** Units: **mg/Kg** Prep Date: **3/5/2021** RunNo: **65730**
Client ID: **LCSS** Batch ID: **31567** Analysis Date: **3/9/2021** SeqNo: **1322275**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Aroclor 1254	0.950	0.0500	1.000	0	95.0	47.9	148				
Surr: Decachlorobiphenyl	201		200.0		100	9.23	163				
Surr: Tetrachloro-m-xylene	227		200.0		113	12	153				

Sample ID: **2103041-003AMS** SampType: **MS** Units: **mg/Kg-dry** Prep Date: **3/5/2021** RunNo: **65730**
Client ID: **A5-WA** Batch ID: **31567** Analysis Date: **3/9/2021** SeqNo: **1322277**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Aroclor 1016	0.940	0.0530	1.059	0	88.7	22.9	177				

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Date: *3/17/2021*

Work Order: 2103041
CLIENT: Shannon & Wilson
Project: 8801

QC SUMMARY REPORT

Polychlorinated Biphenyls (PCB) by EPA 8082

Sample ID: **2103041-003AMS** SampType: **MS** Units: **mg/Kg-dry** Prep Date: **3/5/2021** RunNo: **65730**
Client ID: **A5-WA** Batch ID: **31567** Analysis Date: **3/9/2021** SeqNo: **1322277**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Aroclor 1260	0.860	0.0530	1.059	0	81.2	30.1	157				
Surr: Decachlorobiphenyl	180		211.9		85.1	9.23	163				
Surr: Tetrachloro-m-xylene	197		211.9		92.8	12	153				

Sample ID: **2103041-003AMSD** SampType: **MSD** Units: **mg/Kg-dry** Prep Date: **3/5/2021** RunNo: **65730**
Client ID: **A5-WA** Batch ID: **31567** Analysis Date: **3/9/2021** SeqNo: **1322278**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Aroclor 1016	0.882	0.0539	1.078	0	81.8	22.9	177	0.9397	6.32	30	
Aroclor 1260	0.823	0.0539	1.078	0	76.3	30.1	157	0.8601	4.45	30	
Surr: Decachlorobiphenyl	173		215.7		80.0	9.23	163		0		
Surr: Tetrachloro-m-xylene	193		215.7		89.5	12	153		0		

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Date: *3/17/2021*

Work Order: 2103041
CLIENT: Shannon & Wilson
Project: 8801

QC SUMMARY REPORT

Volatile Organic Compounds by EPA Method 8260D

Sample ID: **LCS-31569** SampType: **LCS** Units: **µg/L** Prep Date: **3/5/2021** RunNo: **65699**
Client ID: **LCSS** Batch ID: **31569** Analysis Date: **3/5/2021** SeqNo: **1321707**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Dichlorodifluoromethane (CFC-12)	0.855	0.0200	1.000	0	85.5	13.3	197				
Chloromethane	0.927	0.0500	1.000	0	92.7	59.8	139				
Vinyl chloride	1.10	0.0200	1.000	0	110	63.6	138				
Bromomethane	0.889	0.0500	1.000	0	88.9	49.6	171				
Trichlorofluoromethane (CFC-11)	0.938	0.0200	1.000	0	93.8	73.2	134				
Chloroethane	0.805	0.0500	1.000	0	80.5	59.2	147				
1,1-Dichloroethene	0.912	0.0200	1.000	0	91.2	73.7	131				
Methylene chloride	0.914	0.0200	1.000	0	91.4	75.4	127				
trans-1,2-Dichloroethene	0.917	0.0200	1.000	0	91.7	77.9	125				
Methyl tert-butyl ether (MTBE)	1.03	0.0200	1.000	0	103	73.6	119				
1,1-Dichloroethane	0.896	0.0200	1.000	0	89.6	73.8	127				
cis-1,2-Dichloroethene	0.906	0.0200	1.000	0	90.6	82.1	118				
Chloroform	0.924	0.0200	1.000	0	92.4	81.5	118				
1,1,1-Trichloroethane (TCA)	0.916	0.0200	1.000	0	91.6	81.5	119				
1,1-Dichloropropene	1.05	0.0200	1.000	0	105	80.6	121				
Carbon tetrachloride	1.06	0.0200	1.000	0	106	79.3	122				
1,2-Dichloroethane (EDC)	1.13	0.0200	1.000	0	113	76.1	120				
Benzene	1.15	0.0200	1.000	0	115	81.7	119				
Trichloroethene (TCE)	1.20	0.0200	1.000	0	120	81.4	120				
1,2-Dichloropropane	1.05	0.0200	1.000	0	105	78.8	120				
Bromodichloromethane	1.07	0.0200	1.000	0	107	79.4	118				
Dibromomethane	1.11	0.0200	1.000	0	111	79.8	117				
cis-1,3-Dichloropropene	1.11	0.0200	1.000	0	111	81.4	118				
Toluene	1.02	0.0200	1.000	0	102	81.7	120				
trans-1,3-Dichloropropylene	0.956	0.0200	1.000	0	95.6	78.3	119				
1,1,2-Trichloroethane	1.02	0.0200	1.000	0	102	78.3	117				
1,3-Dichloropropane	1.02	0.0250	1.000	0	102	77.4	118				
Tetrachloroethene (PCE)	0.996	0.0200	1.000	0	99.6	79.9	123				
Dibromochloromethane	1.02	0.0200	1.000	0	102	77.9	117				
1,2-Dibromoethane (EDB)	1.05	0.00500	1.000	0	105	76.3	119				

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Date: *3/17/2021*

Work Order: 2103041
CLIENT: Shannon & Wilson
Project: 8801

QC SUMMARY REPORT

Volatile Organic Compounds by EPA Method 8260D

Sample ID: **LCS-31569**	SampType: **LCS**	Units: **µg/L**	Prep Date: **3/5/2021**	RunNo: **65699**
Client ID: **LCSS**	Batch ID: **31569**		Analysis Date: **3/5/2021**	SeqNo: **1321707**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chlorobenzene	0.978	0.0200	1.000	0	97.8	86.2	113				
1,1,1,2-Tetrachloroethane	1.02	0.0200	1.000	0	102	84.9	113				
Ethylbenzene	1.10	0.0250	1.000	0	110	83.7	122				
m,p-Xylene	2.15	0.0500	2.000	0	108	85.1	119				
o-Xylene	1.04	0.0250	1.000	0	104	85.2	116				
Styrene	0.977	0.0200	1.000	0	97.7	84.8	116				
Isopropylbenzene	0.972	0.0200	1.000	0	97.2	82.2	124				
Bromoform	1.13	0.0500	1.000	0	113	76.1	121				
1,1,2,2-Tetrachloroethane	0.950	0.0200	1.000	0	95.0	68.1	122				
n-Propylbenzene	1.04	0.0200	1.000	0	104	81.1	127				
Bromobenzene	0.993	0.0200	1.000	0	99.3	88.7	109				
1,3,5-Trimethylbenzene	0.965	0.0200	1.000	0	96.5	82.9	121				
2-Chlorotoluene	0.945	0.0250	1.000	0	94.5	82.8	121				
4-Chlorotoluene	0.962	0.0200	1.000	0	96.2	83.4	119				
tert-Butylbenzene	0.953	0.0200	1.000	0	95.3	82.3	121				
1,2,3-Trichloropropane	1.01	0.0250	1.000	0	101	72.4	119				
1,2,4-Trichlorobenzene	0.947	0.0200	1.000	0	94.7	73.6	123				
sec-Butylbenzene	0.986	0.0250	1.000	0	98.6	81.1	126				
4-Isopropyltoluene	0.974	0.0250	1.000	0	97.4	81.4	124				
1,3-Dichlorobenzene	0.989	0.0200	1.000	0	98.9	85.2	120				
1,4-Dichlorobenzene	0.975	0.0200	1.000	0	97.5	84.9	119				
n-Butylbenzene	0.945	0.0200	1.000	0	94.5	81.2	128				
1,2-Dichlorobenzene	1.00	0.0200	1.000	0	100	86.3	116				
1,2-Dibromo-3-chloropropane	1.10	0.500	1.000	0	110	60.7	132				
1,2,4-Trimethylbenzene	0.974	0.0200	1.000	0	97.4	83.8	120				
Hexachloro-1,3-butadiene	1.00	0.0250	1.000	0	100	78.1	129				
Naphthalene	1.01	0.0500	1.000	0	101	56.8	135				
1,2,3-Trichlorobenzene	0.975	0.0200	1.000	0	97.5	68.2	125				
Surr: Dibromofluoromethane	1.17		1.250		93.3	82.3	112				
Surr: Toluene-d8	1.17		1.250		93.4	90.7	109				

Work Order: 2103041
CLIENT: Shannon & Wilson
Project: 8801

QC SUMMARY REPORT

Volatile Organic Compounds by EPA Method 8260D

Sample ID: **LCS-31569** SampType: **LCS** Units: **µg/L** Prep Date: **3/5/2021** RunNo: **65699**
Client ID: **LCSS** Batch ID: **31569** Analysis Date: **3/5/2021** SeqNo: **1321707**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: 1-Bromo-4-fluorobenzene	1.26		1.250		100	88.4	109				

Sample ID: **MB-31569** SampType: **MBLK** Units: **mg/Kg** Prep Date: **3/5/2021** RunNo: **65699**
Client ID: **MBLKS** Batch ID: **31569** Analysis Date: **3/5/2021** SeqNo: **1321706**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Dichlorodifluoromethane (CFC-12)	ND	0.0200									
Chloromethane	ND	0.0500									
Vinyl chloride	ND	0.0200									
Bromomethane	ND	0.0500									
Trichlorofluoromethane (CFC-11)	ND	0.0200									
Chloroethane	ND	0.0500									
1,1-Dichloroethene	ND	0.0200									
Methylene chloride	ND	0.0200									
trans-1,2-Dichloroethene	ND	0.0200									
Methyl tert-butyl ether (MTBE)	ND	0.0200									
1,1-Dichloroethane	ND	0.0200									
cis-1,2-Dichloroethene	ND	0.0200									
Chloroform	ND	0.0200									
1,1,1-Trichloroethane (TCA)	ND	0.0200									
1,1-Dichloropropene	ND	0.0200									
Carbon tetrachloride	ND	0.0200									
1,2-Dichloroethane (EDC)	ND	0.0200									
Benzene	ND	0.00699									MDL
Trichloroethene (TCE)	ND	0.0200									
1,2-Dichloropropane	ND	0.0200									
Bromodichloromethane	ND	0.0200									
Dibromomethane	ND	0.0200									
cis-1,3-Dichloropropene	ND	0.0200									
Toluene	ND	0.0200									

Fremont Analytical

Date: *3/17/2021*

Work Order: 2103041
CLIENT: Shannon & Wilson
Project: 8801

QC SUMMARY REPORT

Volatile Organic Compounds by EPA Method 8260D

Sample ID: **MB-31569** SampType: **MBLK** Units: **mg/Kg** Prep Date: **3/5/2021** RunNo: **65699**
Client ID: **MBLKS** Batch ID: **31569** Analysis Date: **3/5/2021** SeqNo: **1321706**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
trans-1,3-Dichloropropylene	ND	0.0200									
1,1,2-Trichloroethane	ND	0.0200									
1,3-Dichloropropane	ND	0.0250									
Tetrachloroethene (PCE)	ND	0.0200									
Dibromochloromethane	ND	0.0200									
1,2-Dibromoethane (EDB)	ND	0.00500									
Chlorobenzene	ND	0.0200									
1,1,1,2-Tetrachloroethane	ND	0.0200									
Ethylbenzene	ND	0.0250									
m,p-Xylene	ND	0.0500									
o-Xylene	ND	0.0250									
Styrene	ND	0.0200									
Isopropylbenzene	ND	0.0200									
Bromoform	ND	0.0500									
1,1,2,2-Tetrachloroethane	ND	0.0200									
n-Propylbenzene	ND	0.0200									
Bromobenzene	ND	0.0200									
1,3,5-Trimethylbenzene	ND	0.0200									
2-Chlorotoluene	ND	0.0250									
4-Chlorotoluene	ND	0.0200									
tert-Butylbenzene	ND	0.0200									
1,2,3-Trichloropropane	ND	0.0250									
1,2,4-Trichlorobenzene	ND	0.0200									
sec-Butylbenzene	ND	0.0250									
4-Isopropyltoluene	ND	0.0250									
1,3-Dichlorobenzene	ND	0.0200									
1,4-Dichlorobenzene	ND	0.0200									
n-Butylbenzene	ND	0.0200									
1,2-Dichlorobenzene	ND	0.0200									
1,2-Dibromo-3-chloropropane	ND	0.500									

Fremont Analytical

Date: *3/17/2021*

Work Order: 2103041
CLIENT: Shannon & Wilson
Project: 8801

QC SUMMARY REPORT

Volatile Organic Compounds by EPA Method 8260D

Sample ID: **MB-31569** SampType: **MBLK** Units: **mg/Kg** Prep Date: **3/5/2021** RunNo: **65699**
Client ID: **MBLKS** Batch ID: **31569** Analysis Date: **3/5/2021** SeqNo: **1321706**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
1,2,4-Trimethylbenzene	ND	0.0200									
Hexachloro-1,3-butadiene	ND	0.0250									
Naphthalene	ND	0.0500									
1,2,3-Trichlorobenzene	ND	0.0200									
Surr: Dibromofluoromethane	1.22		1.250		97.6	82.3	112				
Surr: Toluene-d8	1.30		1.250		104	90.7	109				
Surr: 1-Bromo-4-fluorobenzene	1.18		1.250		94.6	88.4	109				

Sample ID: **2103041-001BDUP** SampType: **DUP** Units: **mg/Kg-dry** Prep Date: **3/5/2021** RunNo: **65699**
Client ID: **A7A8-WA** Batch ID: **31569** Analysis Date: **3/5/2021** SeqNo: **1321691**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Dichlorodifluoromethane (CFC-12)	ND	0.0279						0		30	
Chloromethane	ND	0.0698						0		30	
Vinyl chloride	ND	0.0279						0		30	
Bromomethane	ND	0.0698						0		30	
Trichlorofluoromethane (CFC-11)	ND	0.0279						0		30	
Chloroethane	ND	0.0698						0		30	
1,1-Dichloroethene	ND	0.0279						0		30	
Methylene chloride	ND	0.0279						0		30	
trans-1,2-Dichloroethene	ND	0.0279						0		30	
Methyl tert-butyl ether (MTBE)	ND	0.0279						0		30	
1,1-Dichloroethane	ND	0.0279						0		30	
cis-1,2-Dichloroethene	ND	0.0279						0		30	
Chloroform	ND	0.0279						0		30	
1,1,1-Trichloroethane (TCA)	ND	0.0279						0		30	
1,1-Dichloropropene	ND	0.0279						0		30	
Carbon tetrachloride	ND	0.0279						0		30	
1,2-Dichloroethane (EDC)	ND	0.0279						0		30	
Benzene	ND	0.0279						0		30	

Date: *3/17/2021*

Work Order: 2103041
CLIENT: Shannon & Wilson
Project: 8801

QC SUMMARY REPORT

Volatile Organic Compounds by EPA Method 8260D

Sample ID: **2103041-001BDUP** SampType: **DUP** Units: **mg/Kg-dry** Prep Date: **3/5/2021** RunNo: **65699**
Client ID: **A7A8-WA** Batch ID: **31569** Analysis Date: **3/5/2021** SeqNo: **1321691**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Trichloroethene (TCE)	ND	0.0279						0		30	
1,2-Dichloropropane	ND	0.0279						0		30	
Bromodichloromethane	ND	0.0279						0		30	
Dibromomethane	ND	0.0279						0		30	
cis-1,3-Dichloropropene	ND	0.0279						0		30	
Toluene	0.0557	0.0279						0	200	30	
trans-1,3-Dichloropropylene	ND	0.0279						0		30	
1,1,2-Trichloroethane	ND	0.0279						0		30	
1,3-Dichloropropane	ND	0.0349						0		30	
Tetrachloroethene (PCE)	ND	0.0279						0		30	
Dibromochloromethane	ND	0.0279						0		30	
1,2-Dibromoethane (EDB)	ND	0.00698						0		30	
Chlorobenzene	ND	0.0279						0		30	
1,1,1,2-Tetrachloroethane	ND	0.0279						0		30	
Ethylbenzene	0.370	0.0349						0.2883	24.9	30	
m,p-Xylene	2.36	0.0698						2.371	0.385	30	
o-Xylene	0.183	0.0349						0.1909	4.27	30	
Styrene	ND	0.0279						0		30	
Isopropylbenzene	0.336	0.0279						0.2654	23.4	30	
Bromoform	ND	0.0698						0		30	
1,1,2,2-Tetrachloroethane	ND	0.0279						0		30	
n-Propylbenzene	1.10	0.0279						0.9873	10.4	30	
Bromobenzene	ND	0.0279						0		30	
1,3,5-Trimethylbenzene	3.96	0.0279						4.199	5.78	30	
2-Chlorotoluene	ND	0.0349						0		30	
4-Chlorotoluene	ND	0.0279						0		30	
tert-Butylbenzene	ND	0.0279						0		30	
1,2,3-Trichloropropane	ND	0.0349						0		30	
1,2,4-Trichlorobenzene	ND	0.0279						0		30	
sec-Butylbenzene	0.365	0.0349						0	200	30	

Date: *3/17/2021*

Work Order: 2103041
CLIENT: Shannon & Wilson
Project: 8801

QC SUMMARY REPORT

Volatile Organic Compounds by EPA Method 8260D

Sample ID: **2103041-001BDUP** SampType: **DUP** Units: **mg/Kg-dry** Prep Date: **3/5/2021** RunNo: **65699**
Client ID: **A7A8-WA** Batch ID: **31569** Analysis Date: **3/5/2021** SeqNo: **1321691**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4-Isopropyltoluene	0.592	0.0349						0.5487	7.52	30	
1,3-Dichlorobenzene	ND	0.0279						0		30	
1,4-Dichlorobenzene	ND	0.0279						0		30	
n-Butylbenzene	0.705	0.0279						0.6230	12.4	30	
1,2-Dichlorobenzene	ND	0.0279						0		30	
1,2-Dibromo-3-chloropropane	ND	0.698						0		30	
1,2,4-Trimethylbenzene	5.59	0.0279						10.06	57.1	30	R
Hexachloro-1,3-butadiene	ND	0.0349						0		30	
Naphthalene	0.168	0.0698						0	200	30	
1,2,3-Trichlorobenzene	ND	0.0279						0		30	
Surr: Dibromofluoromethane	1.81		1.744		104	82.3	112		0		
Surr: Toluene-d8	1.59		1.744		91.2	90.7	109		0		
Surr: 1-Bromo-4-fluorobenzene	1.72		1.744		98.6	88.4	109		0		

NOTES:
R - High RPD observed. The method is in control as indicated by the LCS.

Sample ID: **2103041-002BMS** SampType: **MS** Units: **mg/Kg-dry** Prep Date: **3/5/2021** RunNo: **65699**
Client ID: **A4-WA** Batch ID: **31569** Analysis Date: **3/5/2021** SeqNo: **1321694**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Dichlorodifluoromethane (CFC-12)	0.683	0.0211	1.055	0	64.8	5.08	187				
Chloromethane	0.903	0.0527	1.055	0.01498	84.2	41.2	147				
Vinyl chloride	0.799	0.0211	1.055	0	75.7	49.9	147				
Bromomethane	0.882	0.0527	1.055	0	83.6	47.1	182				
Trichlorofluoromethane (CFC-11)	0.951	0.0211	1.055	0	90.2	51.7	151				
Chloroethane	0.760	0.0527	1.055	0	72.1	47.5	166				
1,1-Dichloroethene	0.922	0.0211	1.055	0	87.5	61.3	144				
Methylene chloride	0.808	0.0211	1.055	0	76.6	75.3	130				
trans-1,2-Dichloroethene	0.972	0.0211	1.055	0	92.2	73.5	130				
Methyl tert-butyl ether (MTBE)	1.14	0.0211	1.055	0	108	73	126				
1,1-Dichloroethane	0.973	0.0211	1.055	0	92.2	71.8	135				

Date: *3/17/2021*

Work Order: 2103041
CLIENT: Shannon & Wilson
Project: 8801

QC SUMMARY REPORT

Volatile Organic Compounds by EPA Method 8260D

Sample ID: **2103041-002BMS**	SampType: **MS**	Units: **mg/Kg-dry**	Prep Date: **3/5/2021**	RunNo: **65699**
Client ID: **A4-WA**	Batch ID: **31569**		Analysis Date: **3/5/2021**	SeqNo: **1321694**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
cis-1,2-Dichloroethene	1.15	0.0211	1.055	0	109	77.5	127				
Chloroform	1.11	0.0211	1.055	0	105	77.3	127				
1,1,1-Trichloroethane (TCA)	1.12	0.0211	1.055	0	106	71.3	131				
1,1-Dichloropropene	1.21	0.0211	1.055	0	114	69.8	134				
Carbon tetrachloride	1.18	0.0211	1.055	0	112	66.1	133				
1,2-Dichloroethane (EDC)	1.24	0.0211	1.055	0	117	73.5	128				
Benzene	1.19	0.0211	1.055	0	113	76.8	129				
Trichloroethene (TCE)	1.15	0.0211	1.055	0.02348	107	70.5	140				
1,2-Dichloropropane	1.00	0.0211	1.055	0	94.9	74.6	130				
Bromodichloromethane	0.972	0.0211	1.055	0	92.2	76.2	121				
Dibromomethane	1.05	0.0211	1.055	0	99.5	78	124				
cis-1,3-Dichloropropene	0.984	0.0211	1.055	0	93.3	76	120				
Toluene	1.09	0.0211	1.055	0.07583	96.2	77.8	127				
trans-1,3-Dichloropropylene	1.00	0.0211	1.055	0	95.1	73.5	121				
1,1,2-Trichloroethane	1.06	0.0211	1.055	0	100	77.7	123				
1,3-Dichloropropane	1.06	0.0264	1.055	0	100	77.4	123				
Tetrachloroethene (PCE)	1.08	0.0211	1.055	0	102	70.7	131				
Dibromochloromethane	1.02	0.0211	1.055	0	97.1	74.7	120				
1,2-Dibromoethane (EDB)	1.08	0.00527	1.055	0	103	76.1	124				
Chlorobenzene	1.04	0.0211	1.055	0	98.9	80.4	123				
1,1,1,2-Tetrachloroethane	1.05	0.0211	1.055	0	99.3	79.5	121				
Ethylbenzene	1.14	0.0264	1.055	0.05652	103	78.7	130				
m,p-Xylene	2.48	0.0527	2.109	0.3867	99.1	79.3	127				
o-Xylene	1.09	0.0264	1.055	0.07502	96.1	80.7	124				
Styrene	1.01	0.0211	1.055	0	95.6	81.9	122				
Isopropylbenzene	1.07	0.0211	1.055	0.01170	101	75.7	132				
Bromoform	1.14	0.0527	1.055	0	108	74.3	121				
1,1,2,2-Tetrachloroethane	0.938	0.0211	1.055	0	88.9	60.2	136				
n-Propylbenzene	1.10	0.0211	1.055	0.02644	102	76.4	134				
Bromobenzene	1.04	0.0211	1.055	0	98.8	80.3	122				

Fremont Analytical

Date: *3/17/2021*

Work Order: 2103041
CLIENT: Shannon & Wilson
Project: 8801

QC SUMMARY REPORT

Volatile Organic Compounds by EPA Method 8260D

Sample ID: **2103041-002BMS** SampType: **MS** Units: **mg/Kg-dry** Prep Date: **3/5/2021** RunNo: **65699**
Client ID: **A4-WA** Batch ID: **31569** Analysis Date: **3/5/2021** SeqNo: **1321694**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
1,3,5-Trimethylbenzene	1.12	0.0211	1.055	0.1042	96.5	79.5	127				
2-Chlorotoluene	1.02	0.0264	1.055	0	97.0	77.6	131				
4-Chlorotoluene	1.01	0.0211	1.055	0	95.9	80.2	126				
tert-Butylbenzene	1.02	0.0211	1.055	0	97.0	75.5	132				
1,2,3-Trichloropropane	1.08	0.0264	1.055	0	102	70.2	126				
1,2,4-Trichlorobenzene	1.24	0.0211	1.055	0	118	64.2	142				
sec-Butylbenzene	1.06	0.0264	1.055	0	100	75	133				
4-Isopropyltoluene	1.03	0.0264	1.055	0.008735	97.2	74.4	133				
1,3-Dichlorobenzene	1.06	0.0211	1.055	0	101	80.7	127				
1,4-Dichlorobenzene	1.05	0.0211	1.055	0	99.4	81.9	124				
n-Butylbenzene	1.03	0.0211	1.055	0	97.4	71.5	140				
1,2-Dichlorobenzene	1.08	0.0211	1.055	0	103	83.7	122				
1,2-Dibromo-3-chloropropane	1.49	0.527	1.055	0	141	64.9	130				S
1,2,4-Trimethylbenzene	1.34	0.0211	1.055	0.2877	99.6	79.3	127				
Hexachloro-1,3-butadiene	1.09	0.0264	1.055	0	103	59.2	149				
Naphthalene	1.61	0.0527	1.055	0.02762	150	44.6	171				
1,2,3-Trichlorobenzene	1.08	0.0211	1.055	0	103	52.6	156				
Surr: Dibromofluoromethane	1.36		1.318		103	82.3	112				
Surr: Toluene-d8	1.23		1.318		93.7	90.7	109				
Surr: 1-Bromo-4-fluorobenzene	1.29		1.318		97.6	88.4	109				

NOTES:
S - Outlying spike recovery observed (high bias).

Fremont Analytical

Sample Log-In Check List

Client Name:	**SW**	Work Order Number:	**2103041**
Logged by:	**Claire Anderson**	Date Received:	**3/2/2021 5:14:00 PM**

Chain of Custody

1.	Is Chain of Custody complete?	Yes ☑	No ☐	Not Present ☐
2.	How was the sample delivered?	Client		

Log In

3.	Coolers are present?	Yes ☑	No ☐	NA ☐
4.	Shipping container/cooler in good condition?	Yes ☑	No ☐	
5.	Custody Seals present on shipping container/cooler? (Refer to comments for Custody Seals not intact)	Yes ☐	No ☐	Not Present ☑
6.	Was an attempt made to cool the samples?	Yes ☑	No ☐	NA ☐
7.	Were all items received at a temperature of >2°C to 6°C *	Yes ☑	No ☐	NA ☐
8.	Sample(s) in proper container(s)?	Yes ☑	No ☐	
9.	Sufficient sample volume for indicated test(s)?	Yes ☑	No ☐	
10.	Are samples properly preserved?	Yes ☑	No ☐	
11.	Was preservative added to bottles?	Yes ☐	No ☑	NA ☐
12.	Is there headspace in the VOA vials?	Yes ☐	No ☐	NA ☑
13.	Did all samples containers arrive in good condition(unbroken)?	Yes ☑	No ☐	
14.	Does paperwork match bottle labels?	Yes ☑	No ☐	
15.	Are matrices correctly identified on Chain of Custody?	Yes ☑	No ☐	
16.	Is it clear what analyses were requested?	Yes ☑	No ☐	
17.	Were all holding times able to be met?	Yes ☑	No ☐	

Special Handling (if applicable)

18.	Was client notified of all discrepancies with this order?	Yes ☐	No ☑	NA ☐

Person Notified: ______ Date: ______

By Whom: ______ Via: ☐ eMail ☐ Phone ☐ Fax ☐ In Person

Regarding: ______

Client Instructions: ______

19. Additional remarks:

Item Information

Item #	Temp ºC
Sample 1	4.5

* Note: DoD/ELAP and TNI require items to be received at 4°C +/- 2°C

Fremont Analytical

3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790
Fax: 206-352-7178

Chain of Custody Record & Laboratory Services Agreement

Client: Shannon & Wilson, Inc.
Address: 400 N. 34th St, Suite 100
City, State, Zip: Seattle, WA 98103
Telephone: 206-632-8020
Fax: 206-695-6777

Date: 3/2/2021 Page: 1 of: 1
Project Name: 8801
Project No: 21-1-12567
Collected by: CTC
Location: ~~Seat~~ Tukwila, WA
Report To (PM): Meg Strong
PM Email: MJS@shanwil.com

Laboratory Project No (internal): 2103041
Special Remarks:
• Please refer to Email for required reporting limits

Sample Disposal: ☐ Return to client ☒ Disposal by lab (after 30 days)

Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	# of Cont.	VOCs (EPA 8260 / 624)	BTEX	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8)	Total (T) | Dissolved (D)	Anions (IC)***	EDB (8011)	Comments
1 47A8-WA	3/2	1528	S	4	X						X	X	X				
2 A4-WA	3/2	1538	S	4	X						X	X	X				
3 A5-WA	3/2	1548	S	4	X						X	X	X				
4																	
5																	
6																	
7																	
8																	
9																	
10																	

*Matrix: A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, S = Soil, SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

**Metals (Circle): MTCA-5 RCRA-8 Priority Pollutants TAL *Individual:* Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Ti Tl V Zn

***Anions (Circle): Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride Nitrate+Nitrite

Turn-around Time:
☒ Standard ☐ Next Day
☐ 3 Day ☐ Same Day
☐ 2 Day ____ (specify)

I represent that I am authorized to enter into this Agreement with Fremont Analytical on behalf of the Client named above, that I have verified Client's agreement to each of the terms on the front and backside of this Agreement.

Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x [signature]	Christian Canfield	3/2/2021 1600	x [signature]	Mary Childress	3/2/21 5:14pm
x			x		

Fremont Analytical

3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790
Fax: 206-352-7178

Chain of Custody Record & Laboratory Services Agreement

Client: Shannon & Wilson, Inc.
Address: 400 N. 34th St, Suite 100
City, State, Zip: Seattle, WA 98103
Telephone: 206-632-8020
Fax: 206-695-6777

Date: 3/2/2021 Page: 1 of: 1
Project Name: 8801
Project No: 21-1-12567
Collected by: CTC
Location: Tukwila, WA
Report To (PM): Meg Strong
PM Email: MJS@shanwil.com

Laboratory Project No (internal): 2103041
Special Remarks:
• Please refer to Email for required reporting limits

Sample Disposal: ☐ Return to client ☒ Disposal by lab (after 30 days)

	Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	# of Cont.	VOCs (EPA 8260 / 624)	BTEX	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8)	Total (T) / Dissolved (D)	Anions (IC)***	EDB (8011)						Comments
1	47A8-WA	3/2	1528	S	4	X						X	X	X									
2	A4-WA	3/2	1538	S	4	X						X	X	X									
3	A5-WA	3/2	1548	S	4	X						X	X	X									+TCLP-Pb per M.S. 3/9/21@5:30pm -BB
4																							
5																							
6																							
7																							
8																							
9																							
10																							

*Matrix: A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, S = Soil, SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

**Metals (Circle): MTCA-5 RCRA-8 Priority Pollutants TAL *Individual:* Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Ti Tl V Zn

***Anions (Circle): Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride Nitrate+Nitrite

Turn-around Time:
☒ Standard ☐ Next Day
☐ 3 Day ☐ Same Day
☐ 2 Day ______ (specify)

I represent that I am authorized to enter into this Agreement with Fremont Analytical on behalf of the Client named above, that I have verified Client's agreement to each of the terms on the front and backside of this Agreement.

Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x [signature]	Christian Canfield	3/2/2021 1600	x [signature]	Mary Childress	3/2/21 5:14pm
x			x		

www.fremontanalytical.com

Rainier
ENVIRONMENTAL

Dangerous Waste Characterization

Sample ID: A4+A5 :C

Report date: May 24, 2021

Submitted to:

Shannon & Wilson, Inc
400 N 34th Street, Suite 100
Seattle, WA 98103

Rainier Environmental
5013 Pacific Hwy East
Suite 20
Tacoma, WA 98424

1.0 INTRODUCTION

A dangerous waste characterization using the test organism *Oncorhynchus mykiss* (rainbow trout) was conducted on one sample submitted by Shannon & Wilson to Rainier Environmental. Testing was conducted following the Washington State Department of Ecology Publication 80-12.

2.0 METHODS

The sample, identified as A4+A5 :C was received in the laboratory on May 17, 2021. Upon arrival at the laboratory the sample was inspected and contents verified against information provided on the chain-of-custody form. The sample was stored at 4°C in the dark until use. The test procedure is outlined in Table 1.

Table 1. Summary of Dangerous Waste Characterization Test Conditions

Parameter	Standard Fish Toxicity Test
Test number	2105-012
Sample ID	A4+A5 :C
Test initiation date; time	5/18/2021; 0935h
Test termination date; time	5/22/2021; 0935h
Endpoint	Mortality at 96-hours
Test chamber	7.5 L plastic tank
Test temperature	12 ± 1°C
Dilution water	Moderately hard synthetic water
Test solution volume	6 L
Test concentrations (mg/L)	100, 10, 0
Number of organisms/chamber	10
Number of replicates	3
Test organism	*Oncorhynchus mykiss* (rainbow trout)
Feeding	No feeding during test
Photoperiod	16 hours light/ 8 hours dark
Extraction	Rotary agitation (30 +/- 2 rpm) for 18 hours
Reference Toxicant	Copper sulfate
Deviations	None

The test organisms used in the test are outlined in Table 2. The samples were tested using fish received on April 20, 2021.

Table 2. Test organisms (*Oncorhynchus mykiss*)

Test organism age	53 days post swim-up (hatch date 2/28/2021)
Mean weight	0.40 g
Mean length	40 mm
Ratio of longest to shortest	1.2
Loading	0.66 g/L
Test organism source	Trout Lodge; Sumner, WA

3.0 RESULTS

A summary of results for the dangerous waste characterization conducted on sample A4+A5 :C is contained in Table 3. There was no mortality during the test. Based on these results, the sample does not designate as either a dangerous or extremely hazardous waste. Copies of the laboratory bench sheets, statistical summaries of reference toxicant tests, and chain-of-custody form are provided in Appendices A through C.

Table 3. Summary of Results

Sample ID	Concentration (mg/L)	Survival (# fish, N=30)	Percent Mortality	Dangerous Waste Designation
Control	0	30	0	NA
A4+A5 :C	10 100	30 30	0 0	None

4.0 QUALITY ASSURANCE

The most recently completed reference toxicant test was initiated May 3, 2021. The LC_{50} of 174 g/L copper fell within the acceptable range of mean ± two standard deviations of historical test results indicating that the test organisms were of an appropriate degree of sensitivity. The coefficient of variation (CV) for the last 20 tests was 22.9 percent, which is considered excellent by the Biomonitoring Science Advisory Board.

5.0 REFERENCES

WDOE. 2016. Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria. Washington State Department of Ecology. Water Quality Program. Publication number: WQ-R-95-80, Revised June 2016.

WDOE. 2020. Biological Testing Methods 80-12 for the Designation of Dangerous Waste. Washington State Department of Ecology. Hazardous Waste and Toxics Reduction Program. Publication number: 80-12, Revised September 2020.

Appendix A
Oncorhynchus mykiss Dangerous Waste Toxicity Test
Raw Bench Sheets

Dangerous Waste Toxicity Test

Client: Shannon & Wilson, Inc.
Sample ID: A4+A5 : C
Test #: 2105-012
Log In #: T21-131

Start Date & Time: 5/18/2021 0935
End Date & Time: 5/22/2021 0935
Test Organism: *Oncorhynchus mykiss*
Test Protocol: **Washington State Department of Ecology Publ. 80-12**

Rep	Conc.	Cont #	Number of Live Organisms					Dissolved Oxygen (mg/L)					pH (units)					Conductivity (umhos/cm)					Temperature (°C)					Percent Survival
			0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	
1	CON	12	10	10	10	10	10	8.5	8.2	7.9	7.7	7.5	7.84	7.67	7.42	7.37	7.18	260				271	12.0	12.1	12.3	11.9	12.4	
2		14	10	10	10	10	10	8.7	8.4	8.2	8.1	7.8	7.81	7.65	7.45	7.34	7.22	263				265						
3		23	10	10	10	10	10	8.4	8.0	7.6	7.5	7.3	7.86	7.61	7.40	7.32	7.21	261				264						
1	10 PPM	21	10	10	10	10	10	8.6	8.4	8.1	7.6	7.4	7.85	7.63	7.46	7.35	7.23	261				265	12.4	12.4	12.4	12.2	12.2	
2		6	10	10	10	10	10	8.7	8.3	8.0	7.9	7.5	7.89	7.62	7.44	7.37	7.21	261				266						
3		10	10	10	10	10	10	8.6	8.2	7.8	7.5	7.2	7.87	7.67	7.47	7.34	7.19	264				266						
1	100 PPM	15	10	10	10	10	10	8.9	8.5	8.3	8.1	7.7	7.96	7.64	7.49	7.35	7.21	263				265	12.3	12.2	12.4	11.7	12.1	
2		26	10	10	10	10	10	8.5	8.1	7.7	7.4	7.3	7.88	7.66	7.45	7.34	7.22	262				265						
3		3	10	10	10	10	10	8.6	8.4	8.1	7.7	7.5	7.90	7.63	7.48	7.35	7.20	260				267						
1																												
2																												
3																												
1																												
2																												
3																												
1																												
2																												
3																												
1																												
2																												
3																												
Technician Initials			AJ	AJ	AJ	Q	Q	AJ	AJ	AJ	Q	Q																

Sample	Alk. (init.)	Hard. (init.)	Alk. (fin.)	Hard. (fin.)	Chlorine
	(mg/L as CaCO3)				(mg/L Cl2)
Control	68	92	68	92	<0.03
100PPM	68	92	68	92	

Animal Source: Troutlodge
Date Received: 4/20/2021

Test Volume: 6.0L
Date of Hatch: 2/28/2021
Date of Swim up: 3/25/2021

Weights (g): .38 .37 .42 .40 .39 .44 .38 .38 .42 .40 μ = .40
Lengths(mm): 37 39 43 41 39 44 38 37 41 41 μ = 40
Length max/min: 44/37 1.2
Loading: 0.66 g/L

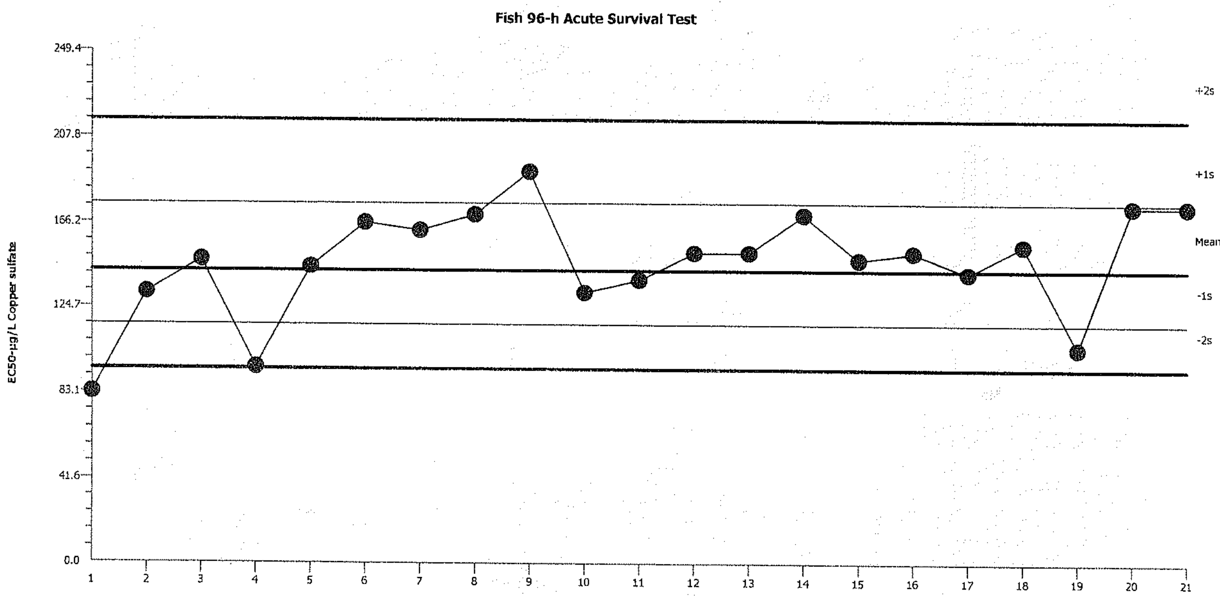
Rainier Environmental
Washington Laboratory
5013 Pacific HWY E Suite 20
Tacoma, WA 98424

Dilution Water Source: MHSW 038
QA Check Q

Appendix B
Reference Toxicant Test
Control Chart and Statistical Summary

Fish 96-h Acute Survival Test — **Rainier Environmental Laboratory**

Test Type:	Survival (96h)	**Organism:**	Oncorhynchus mykiss (Rainbow Tro	**Material:**	Copper sulfate
Protocol:	Not Applicable	**Endpoint:**	96h Survival Rate	**Source:**	Reference Toxicant-REF



Mean:	142.9	**Count:**	20	**-1s Warning Limit:**	116.2	**-2s Action Limit:**	94.56
Sigma:	NA	**CV:**	22.90%	**+1s Warning Limit:**	175.6	**+2s Action Limit:**	215.9

Quality Control Data

Point	Year	Month	Day	QC Data	Delta	Sigma	Warning	Action	Test ID	Analysis ID
1	2019	Jul	23	83.12	-59.76	-2.624	(-)	(-)	09-5504-5129	09-5466-8341
2		Aug	23	132	-10.93	-0.3855			06-2129-4986	03-1480-8200
3		Sep	20	148.1	5.231	0.1742			14-9775-6582	02-8526-9159
4		Oct	22	95.48	-47.4	-1.953	(-)		08-2604-9852	04-5996-4554
5		Nov	25	144.7	1.848	0.06225			19-0900-7567	17-7816-6246
6		Dec	26	166.2	23.37	0.7339			18-0718-4325	01-1522-2292
7	2020	Jan	27	162.5	19.57	0.622			15-7428-0290	09-7189-2054
8		Feb	28	170.1	27.25	0.8458			09-4267-7927	12-7910-1452
9		Apr	1	191	48.09	1.406	(+)		13-6543-5000	21-3363-8866
10		May	1	132	-10.93	-0.3855			05-3085-5611	09-0915-7454
11		Jun	4	138.2	-4.688	-0.1616			02-5099-4531	13-4027-8146
12		Jul	6	151.6	8.692	0.2861			15-0399-3719	05-1602-0366
13		Aug	11	151.6	8.692	0.2861			11-3397-1930	16-8568-1199
14		Sep	14	170.1	27.25	0.8458			14-7225-6269	12-3543-2567
15		Oct	16	148.1	5.231	0.1742			14-5810-5046	20-2713-3131
16		Nov	18	151.6	8.692	0.2861			10-5338-0034	08-0074-4976
17		Dec	23	141.4	-1.458	-0.04969			15-6478-5352	03-7190-5847
18	2021	Jan	25	155.1	12.24	0.3981			20-5317-8946	09-6722-9321
19		Feb	25	104.7	-38.15	-1.505	(-)		02-0723-8590	03-5049-2171
20		Mar	26	174.1	31.23	0.9578			20-1005-2762	02-2683-0690
21		May	3	174.1	31.23	0.9578			06-3924-6336	17-2626-4312

Analyst: ℧ QA: ℧

CETIS Summary Report

Report Date: 10 May-21 10:30 (p 1 of 1)
Test Code: RA050321OM | 06-3924-6336

Fish 96-h Acute Survival Test — **Rainier Environmental Laboratory**

Batch ID:	16-3837-5190	**Test Type:**	Survival (96h)	**Analyst:**	Eric Tollefson
Start Date:	03 May-21 09:45	**Protocol:**	Not Applicable	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	07 May-21 09:45	**Species:**	Oncorhynchus mykiss	**Brine:**	
Duration:	96h	**Source:**	Trout Lodge Fish Farm	**Age:**	71d

Sample ID:	15-3163-0371	**Code:**	RA050321OM	**Client:**	Internal Lab
Sample Date:	03 May-21	**Material:**	Copper sulfate	**Project:**	
Receive Date:	03 May-21	**Source:**	Reference Toxicant		
Sample Age:	10h	**Station:**	In House		

Comparison Summary

Analysis ID	Endpoint	NOEL	LOEL	TOEL	PMSD	TU	Method
07-1703-3784	96h Survival Rate	50	100	70.71	17.8%		Dunnett Multiple Comparison Test

Point Estimate Summary

Analysis ID	Endpoint	Level	µg/L	95% LCL	95% UCL	TU	Method
17-2626-4312	96h Survival Rate	LC50	174.1	148.1	204.7		Spearman-Kärber

96h Survival Rate Summary

C-µg/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	3	1	1	1	1	1	0	0	0.0%	0.0%
25		3	1	1	1	1	1	0	0	0.0%	0.0%
50		3	1	1	1	1	1	0	0	0.0%	0.0%
100		3	0.8	0.7627	0.8373	0.7	0.9	0.05774	0.1	12.5%	20.0%
200		3	0.5	0.4012	0.5988	0.3	0.8	0.1528	0.2646	52.92%	50.0%
400		3	0	0	0	0	0	0	0		100.0%

96h Survival Rate Detail

C-µg/L	Control Type	Rep 1	Rep 2	Rep 3
0	Dilution Water	1	1	1
25		1	1	1
50		1	1	1
100		0.7	0.9	0.8
200		0.8	0.3	0.4
400		0	0	0

96h Survival Rate Binomials

C-µg/L	Control Type	Rep 1	Rep 2	Rep 3
0	Dilution Water	10/10	10/10	10/10
25		10/10	10/10	10/10
50		10/10	10/10	10/10
100		7/10	9/10	8/10
200		8/10	3/10	4/10
400		0/10	0/10	0/10

Appendix C

Chain-of-Custody Form

Rainier ENVIRONMENTAL

Washington
5013 Pacific Highway East, Suite 20
Fife, WA 98424
Phone253.922.8898

Chain of Custody

Date 5/17/21 Page 1 of 1

Sample Collection By:

Report to:		**Invoice To:**	
Company	Shannon & Wilson, Inc	Company	Shannon & Wilson, Inc
Address	400 N. 34th St, Suite 100	Address	
City/State/Zip	Seattle, WA 98103	City/State/Zip	
Contact	Christian Canfield	Contact	
Phone	206-714-7637	Phone	
Email	ctc@shanwil.com	Email	AP-Seattle@shanwil.com

	SAMPLE ID	DATE	TIME	MATRIX	CONTAINER TYPE	NO. OF CONTAINERS	COMMENTS	ANALYSES REQUIRED: Fish Bioassay	Receipt Temperature (°C)
1	A4+A5:C	5/17	1100	S	HDPE	1	Composite	X	
2									
3									
4									
5									
6									
7									
8									
9									
10									

PROJECT INFORMATION		SAMPLE RECEIPT	
Client:	SWI	Total No. of Containers	1
PO No.:	21-1-12567	Received Good Condition?	Y
Shipped Via:	Client	Matches Test Schedule?	Y

SPECIAL INSTRUCTIONS/COMMENTS:

RELINQUISHED BY (CLIENT)
(Signature) [signature] (Time) 1218
(Printed Name) Christian Canfield (Date) 5/17/21
(Company) Shannon & Wilson, Inc.

RELINQUISHED BY (COURIER)
(Signature) (Time)
(Printed Name) (Date)
(Company)

RECEIVED BY (COURIER)
(Signature) (Time)
(Printed Name) (Date)
(Company)

RECEIVED BY (LABORATORY)
(Signature) Eric Tollefson (Time) 1218
(Printed Name) ERIC TOLLEFSON (Date) 5/17/21
(Log in #) T21-131

Non-Hazardous WAM Approval

Requested Management Facility: Columbia Ridge Landfill, Duwamish Reload Facility

Profile Number: 135321OR

Waste Acceptance Expiration Date: 05/27/2022

Common Name: LF02 - Petroleum Contaminated Soil

WM Regulatory Volume Limit: ☑ NA

APPROVAL DETAILS

Approval Decision: ☑ Approved ☐ Not Approved

Profile Renewal: ☐ Yes ☑ No

Management Method: Alternate Daily Cover (ADC)

Generator Name: PACCAR Inc

Profile Expiration Date: 05/27/2022

Periodic Testing Due Date: ☑ NA

Other Due Date: ☑ NA (Specify)

Management Facility Precautions, Special Handling Procedures or Limitation on approval:

Generator Conditions

- Shall not contain free liquids.
- Shipment must be scheduled into the disposal facility at least 24 hours in advance. Contact information will be provided by your TSR.
- Waste manifest or applicable shipping document must accompany load.
- The waste profile number must appear on the shipping papers.

YOU MAY NOT HAUL TO DUWAMISH W/OUT PRIOR SCHEDULING. Please contact Kim at 206-694-0600 to schedule your load with the landfill 24 hours in advance. A copy of the WAM Approval Form must be presented with each load to the landfill scale house attendant upon arrival.

No soil from the CERCLA clean-up may be shipped on this profile

Facility Conditions

- Approved via transfer station

WM Authorization Name: Leslie Fichera

Title: Waste Approval Manager

WM Authorization Signature: Leslie Fichera

Date: 05/27/2021

Agency Authorization (if Required):

Date:

WASTE MANAGEMENT

Non-Hazardous WAM Approval

Requested Management Facility: Columbia Ridge Landfill, Duwamish Reload Facility

Profile Number: 135321OR

Waste Acceptance Expiration Date: 06/08/2023

Common Name: LF02 - Petroleum Contaminated Soil

WM Regulatory Volume Limit: ☑ NA

APPROVAL DETAILS

Approval Decision: ☑ Approved ☐ Not Approved

Profile Renewal: ☑ Yes ☐ No

Management Method: Alternate Daily Cover (ADC)

Generator Name: PACCAR Inc

Profile Expiration Date: 06/08/2023

Periodic Testing Due Date: ☑ NA

Other Due Date: ☑ NA (Specify)

Management Facility Precautions, Special Handling Procedures or Limitation on approval

Generator Conditions

- Shall not contain free liquids.
- Shipment must be scheduled into the disposal facility at least 24 hours in advance. Contact information will be provided by your TSR.
- Waste manifest or applicable shipping document must accompany load.
- The waste profile number must appear on the shipping papers.

YOU MAY NOT HAUL TO DUWAMISH W/OUT PRIOR SCHEDULING. Please contact Kim at 206-694-0600 to schedule your load with the landfill 24 hours in advance. A copy of the WAM Approval Form must be presented with each load to the landfill scale house attendant upon arrival.

No soil from the CERCLA clean-up may be shipped on this profile
YOU MAY NOT HAUL TO DUWAMISH W/OUT PRIOR SCHEDULING. Please contact Kim Funk at 206-694-0600 to schedule your load with the landfill 24 hours in advance. A copy of the WAM Approval Form must be presented with each load to the landfill scale house attendant upon arrival.

Facility Conditions

- Approved via transfer station

No soil from the CERCLA clean-up may be shipped on this profile

WM Authorization Name: Donald Lavrinc

Title: Waste Approval Manager

WM Authorization Signature: Donald R. Lavrinc

Date: 06/08/2022

Agency Authorization (if Required):

Date:

APPENDIX C: DISPOSAL TRUCK TICKETS

Appendix C

Disposal Truck Tickets

CONTENTS

WASTE MANAGEMENT

8th Ave Reload
7400 8th Ave S
Seattle, WA, 98108

Ph: 206-694-0600

Reprint
Ticket# 80508

Customer Name PACCAR INC PACCAR INC
Ticket Date 01/30/2023
Payment Type Credit Account
Manual Ticket#
Route
Hauling Ticket#
Destination
PO# TBD/1353210R

Carrier SELF SELF
Vehicle# AEC
Container
Driver MARK HOVEY
Check#
Billing# 0000392
Grid

Volume

	Time	Scale	Operator	Inbound		
In	01/30/2023 09:48:08	Scale 1	kfunk2		Gross	31040 lb
Out	01/30/2023 10:00:00	Scale 1	kfunk2		Tare	17840 lb
					Net	13200 lb
					Tons	6.60

Comments AEC-KF

	Product	LD%	Qty	UOM	Rate	Tax	Amount	Origin
1	Daily Cover-PCS-Tons-Pet	100	6.60	Tons				KING
2	EVF-P-Standard Environme	100		%				KING
3	GOND TON-GONDOLA PER TON	100	6.60	Tons				KING

Total Tax
Total Ticket

Driver`s Signature

WASTE MANAGEMENT

8th Ave Reload
7400 8th Ave S
Seattle, WA, 98108

Ph: 206-694-0600

Reprint
Ticket# 80511

Customer Name	PACCAR INC PACCAR INC	Carrier	SELF SELF	
Ticket Date	01/30/2023	Vehicle#	AEC	Volume
Payment Type	Credit Account	Container		
Manual Ticket#		Driver	MARK HOVEY	
Route		Check#		
Hauling Ticket#		Billing#	0000392	
Destination		Grid		
PO#	TBD/1353210R			

	Time	Scale	Operator	Inbound		
In	01/30/2023 10:38:49	Scale 1	kfunk2		Gross	27080 lb
Out	01/30/2023 10:38:49		kfunk2		Tare	17840 lb
					Net	9240 lb
					Tons	4.62

Comments AEC-KF

	Product	LD%	Qty	UOM	Rate	Tax	Amount	Origin
1	Daily Cover-PCS-Tons-Pet	100	4.62	Tons				KING
2	EVF-P-Standard Environme	100		%				KING
3	GOND TON-GONDOLA PER TON	100	4.62	Tons				KING

Total Tax
Total Ticket

Driver`s Signature

WASTE MANAGEMENT

8th Ave Reload
7400 8th Ave S
Seattle, WA, 98108

Ph: 206-694-0600

Reprint
Ticket# 80516

Customer Name	PACCAR INC PACCAR INC	Carrier	SELF SELF		
Ticket Date	01/30/2023	Vehicle#	AEC	Volume	
Payment Type	Credit Account	Container			
Manual Ticket#		Driver	MARK HOVEY		
Route		Check#			
Hauling Ticket#		Billing#	0000392		
Destination		Grid			
PO#	TBD/1353210R				

	Time	Scale	Operator	Inbound		
In	01/30/2023 11:26:38	Scale 1	kfunk2		Gross	28640 lb
Out	01/30/2023 11:26:38		kfunk2		Tare	17840 lb
					Net	10800 lb
					Tons	5.40

Comments AEC-KF

	Product	LD%	Qty	UOM	Rate	Tax	Amount	Origin
1	Daily Cover-PCS-Tons-Pet	100	5.40	Tons				KING
2	EVF-P-Standard Environme	100		%				KING
3	GOND TON-GONDOLA PER TON	100	5.40	Tons				KING

Total Tax
Total Ticket

Driver`s Signature MH

WASTE MANAGEMENT

8th Ave Reload
7400 8th Ave S
Seattle, WA, 98108
Ph: 206-694-0600

Reprint
Ticket# 80522

Customer Name	PACCAR INC PACCAR INC	Carrier	SELF SELF
Ticket Date	01/30/2023	Vehicle#	AEC
Payment Type	Credit Account	Container	
Manual Ticket#		Driver	MARK HOVEY
Route		Check#	
Hauling Ticket#		Billing#	0000392
Destination		Grid	
PO#	TBD/1353210R		

Volume

	Time	Scale	Operator	Inbound		
In	01/30/2023 14:50:50	Scale 1	kfunk2		Gross	25080 lb
Out	01/30/2023 14:50:50		kfunk2		Tare	17840 lb
					Net	7240 lb
					Tons	3.62

Comments AEC-KF

	Product	LD%	Qty	UOM	Rate	Tax	Amount	Origin
1	Daily Cover-PCS-Tons-Pet	100	3.62	Tons				KING
2	EVF-P-Standard Environme	100		%				KING
3	GOND TON-GONDOLA PER TON	100	3.62	Tons				KING

Total Tax
Total Ticket

Driver`s Signature MH

8th Ave Reload
7400 8th Ave S
Seattle, WA, 98108

Ph: 206-694-0600

Reprint
Ticket# 81536

Customer Name	PACCAR INC PACCAR INC	Carrier	SELF SELF
Ticket Date	03/14/2023	Vehicle#	AEC
Payment Type	Credit Account	Container	
Manual Ticket#		Driver	MARK HOVEY
Route		Check#	
Hauling Ticket#		Billing#	0000392
Destination		Grid	
PO#	TBD/135321OR		

Volume

	Time	Scale	Operator	Inbound		
In	03/14/2023 12:35:29	Scale 1	kfunk2		Gross	20740 lb
Out	03/14/2023 12:49:14	Scale 1	kfunk2		Tare	19400 lb
					Net	1340 lb
					Tons	0.67

Comments AEC-KF

	Product	LD%	Qty	UOM	Rate	Tax	Amount	Origin
1	Daily Cover-PCS-Tons-Pet	100	0.67	Tons				KING
2	EVF-P-Standard Environme	100		%				KING
3	GOND TON-GONDOLA PER TON	100	0.67	Tons				KING

Total Tax
Total Ticket

Driver`s Signature MH

APPENDIX D: CULTURAL RESOURCES MONITORING REPORT

Appendix D

Cultural Resources Monitoring Report

CULTURAL RESOURCES REPORT COVER SHEET

Author: Nichole Padovano, James W. Brown, Aimee Steele, and Sarah M.H. Steinkraus

Title of Report: Final: 8801 East Marginal Way South AS/SVE System Extension and Modification Project Cultural Resources Monitoring Report

Date of Report: July 28, 2023

County(ies): King Section: 33 Township: 24N Range: 4E
Quad: South Park Acres: 24.3

PDF of report submitted (REQUIRED) ☒ Yes

Historic Property Inventory Forms to be Approved Online? ☐ Yes ☒ No

Archaeological Site(s)/Isolate(s) Found or Amended? ☐ Yes ☒ No

TCP(s) found? ☐ Yes ☒ No

Replace a draft? ☐ Yes ☒ No

Satisfy a DAHP Archaeological Excavation Permit requirement? ☐ Yes # ☒ No

Were Human Remains Found? ☐ Yes DAHP Case # ☒ No

Archaeological Site #:

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FINAL: 8801 EAST MARGINAL WAY SOUTH AS/SVE SYSTEM EXTENSION AND MODIFICATION PROJECT CULTURAL RESOURCES MONITORING REPORT

King County, Washington

July 28, 2023

Prepared for:

Shannon & Wilson, Inc.
400 N 34th Street, Suite 100
Seattle, WA 98103

Prepared by:

Stell
6100 219th St. SW Suite 480
Mountlake Terrace, WA 98043

By: Nichole Padovano, BA; James W. Brown, MS; Aimee L. Steele, MA; Sarah M.H. Steinkraus, MS

Stell Project No.: SHW004

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Acronyms and Abbreviations

Anderson	Anderson Map Company
APE	Area of Potential Effect
AS	Air Sparging
BLM GLO	United States, Bureau of Land Management, General Land Office
BP	Before Present
CenterPoint	CenterPoint 8801 Marginal LLC
DAHP	Washington Department of Archaeology and Historic Preservation
ft	Foot
HVOC	Halogenated volatile organic compound
Kroll	Kroll Map Company
LDW	Lower Duwamish Waterway
m	Meter
mi	Mile
msl	Mean Sea Level
NRHP	National Register of Historic Places
Project	8801 East Marginal Way South AS/SVE System Extension and Modification Project, Tukwila, King County, Washington, Cultural Resources Monitoring
SEPA	State Environmental Policy Act
Shannon &Wilson	Shannon & Wilson, Inc.
Stell	Stell Environmental Enterprises, Inc.
SVE	Soil Vapor Extraction
USDA	United States Department of Agriculture
USGS	United States Geological Survey
WA	Washington
WISAARD	Washington Information System for Architectural and Archaeological Records Data

EXECUTIVE SUMMARY

Stell Environmental Enterprises, Inc. was contracted by Shannon & Wilson, Inc. to conduct the cultural resources monitoring for the 8801 East Marginal Way South Air Sparging (AS)/Soil Vapor Extraction (SVE) System Extension and Modification Project, Tukwila, King County, Washington. The AS/SVE system extension and modification project (the Project) is one of the multiple interim remedial actions designed to address contaminated soil and groundwater at 8801 East Marginal Way South. The Project consisted of re-plumbing a portion of the existing AS/SVE system and installing an extension to the AS/SVE system. The extension consisted of 22 vertical AS wells, 3 horizontal SVE screens, and associated piping to connect the new AS wells and SVE screens to existing aboveground equipment. The Project Area of Potential Effect (APE) is on the right (eastern) bank of the Lower Duwamish Waterway, approximately 4 miles (mi) upstream from the mouth of the Duwamish River. The Project is located in King County Parcel No. 5422600060, King County, WA, owned by CenterPoint 8801 Marginal LLC, and is bordered by King County Parcels No. 0007400033, 5422600010, and 5729800010. A literature review of Washington Information System for Architectural and Archaeological Records Data and other cultural and environmental documents revealed that 30 cultural resource surveys, 9 archaeological resources, 2 cemeteries, 3 registered historic properties, and 2,051 historic properties had been previously recorded within 1 mi of the Project APE. No archaeological sites were identified as being within the Project APE. A Monitoring and Inadvertent Discovery Plan (**Appendix A**) was developed and followed for this Project (Breidenthal and Steinkraus 2020). These recommendations were based on DAHP recommendations for the Project (see Appendix A in Steinkraus and McWilliams 2018). **The DAHP Project Number is 2019-03-01609**. Archaeological monitoring for the Project was conducted during several mobilizations on January 24–27, 2023; March 2–3, 6–7, 9–11, 2023, totaling 11 days of monitoring over 3 months. Archaeological monitoring for other interim remedial actions is reported separately. **No significant cultural resources were discovered during archaeological monitoring.**

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1. INTRODUCTION

1.1 PROJECT INFORMATION

Stell Environmental Enterprises, Inc. (Stell) was contracted by Shannon & Wilson, Inc. (Shannon & Wilson) to conduct cultural resources monitoring for the 8801 East Marginal Way South Air Sparging (AS)/Soil Vapor Extraction (SVE) System Extension and Modification Project, Tukwila, King County, Washington (WA) (the Project) (**Figure 1-1**) as part of the series of remedial activities to address the contaminated soil and groundwater within the Project area. See **Appendix A** for the Monitoring and Inadvertent Discovery Plan.

1.2 PROJECT LOCATION

The Project Area of Potential Effect (APE) is located in Tukwila, King County, WA, on the right (eastern) bank of the Lower Duwamish Waterway (LDW), approximately 4 miles (mi) upstream from the mouth of the Duwamish River, in Section 33 of Township 24 North, Range 4 East, Willamette Meridian (**Figure 1-1**). The Project is located in King County Parcel No. 5422600060, King County, WA (**Figure 1-2**), owned by CenterPoint 8801 Marginal LLC (CenterPoint), and is bordered by King County Parcels No. 0007400033, 5422600010, and 5729800010, King County, WA. The total acreage of the Project APE is 24.3 acres along the east bank of the LDW. This report documents the cultural resources and archaeological monitoring of subsurface exploration within the Project APE (see **Appendix A**).

The 8801 East Marginal Way South property site consists of an upland portion (the 8801 property) and the adjoining sediments in the LDW. The upland portion of the Project APE is relatively flat, with a ground surface elevation of approximately 20 feet (ft) above mean sea level (msl). The upland portion of the Project APE is owned by CenterPoint, but is currently vacant after the lease to Insurance Auto Auctions, Inc. ended in 2019. Zoning by the City of Tukwila, WA, is a manufacturing industrial center/heavy industry.

1.3 PROJECT BACKGROUND

A halogenated volatile organic compound (HVOC) groundwater plume is present throughout much of the western portion of the Project APE. The existing AS/SVE system is designed to remove HVOCs in the groundwater plume. The AS system injects pressurized air into the groundwater. The air bubbles up through the water column removing volatile contaminants. The SVE screens are placed above the water table in unsaturated soil. The SVE system vacuums air and volatilized contaminants and discharges above the roof of the AS/SVE Building (also referred to as the Small Warehouse).

The existing AS/SVE system is on the western portion of the 8801 Property. Underground features include 33 vertical AS wells and 6 horizontal SVE screens. Aboveground equipment, including compressors, blowers, and control panels, is located in the AS/SVE Building near center of the western boundary of the 8801 property. The property owner (CenterPoint) is redeveloping the 8801 property to construct an approximately 414,000-square-foot warehouse and parking area for trailer storage. CenterPoint demolished much of the property during 2021, although the existing AS/SVE system was not demolished.

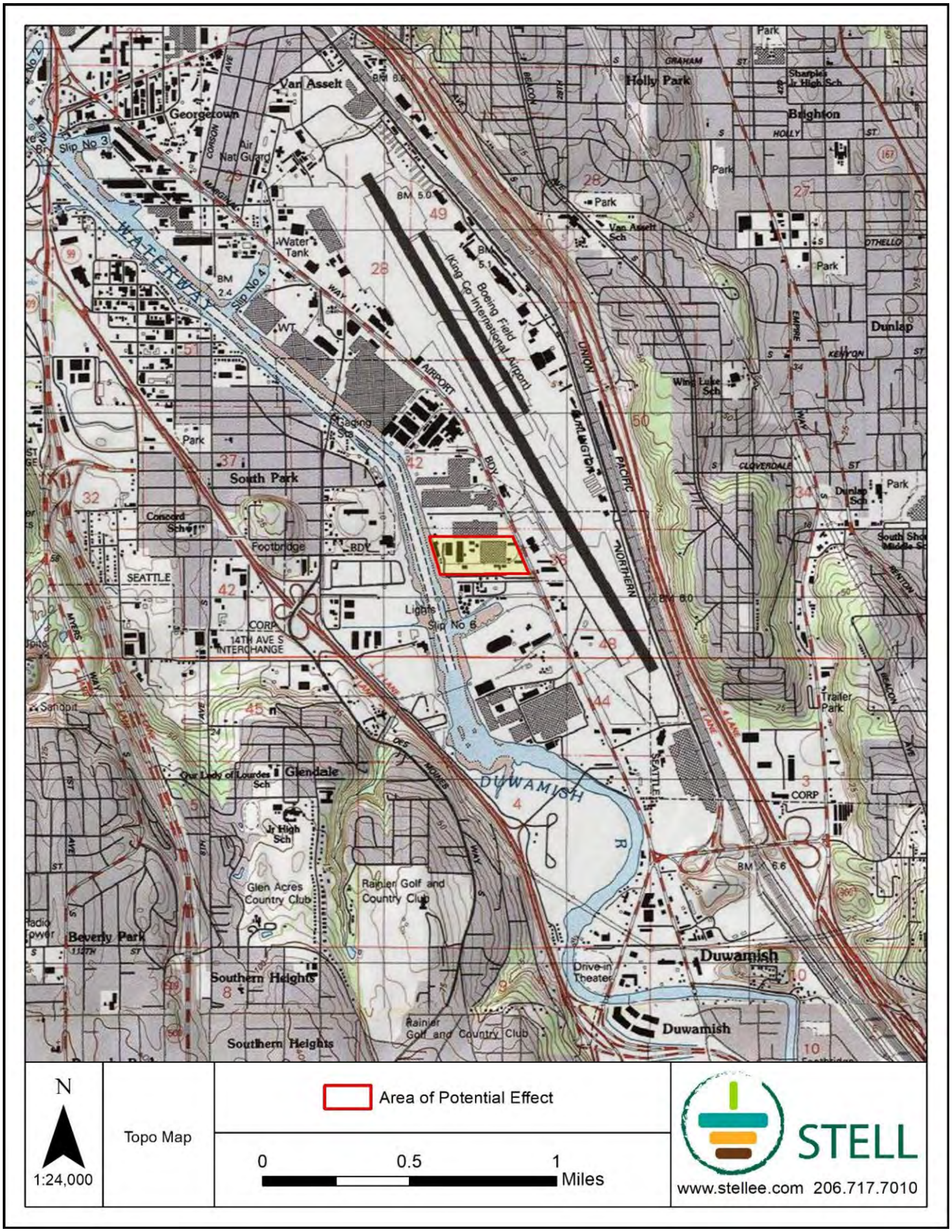

Figure 1-1. Topographic map of the Project APE

Figure 1-2. Aerial map of the Project APE

The scope of the Project related to Archaeological monitoring of subsurface work included:

- re-plumbing of a portion of the existing AS/SVE pipes that conflicted with CenterPoint's redevelopment work.
- installation of 22 new vertical AS wells
- installation of 3 new horizontal SVE screens
- installation of pipes in trenches to connect the new AS wells and SVE screens to the existing aboveground equipment.

The location of the subsurface work is shown in **Figure 1-3** and **Figure 1-4**.

1.4 REGULATORY ENVIRONMENT

This Project is subject to the State Environmental Policy Act (SEPA), which mirrors the National Environmental Policy Act. SEPA requires that all major actions sponsored, funded, permitted, or approved by Washington state and/or local agencies consider the impacts of the planned action on the environment and properties of historical, archaeological, scientific, or cultural importance (Washington Administrative Code 197-11-960), especially those that are or could be listed on the National Register of Historic Places (NRHP) or other historic registers, including the Washington Heritage Register or King County Landmarks.

The Washington Department of Archaeology and Historic Preservation (DAHP) is the lead agency for considering the effects of a proposed action on cultural resources and provides formal recommendations to local governments and other Washington State agencies for appropriate treatments or actions.

Historic properties that could be eligible for the NRHP include any artifacts, records, and remains that are related to such a district, site, building, structure, or object (16 United States Code 470[5]). The quality of significance in American history, architecture, archaeology, and culture is present in districts, sites, buildings, structures, and objects of state and local importance that possess integrity of location, design, setting, materials, workmanship, feeling, and association. They also:

- are associated with events that have made a contribution to the broad pattern of our history;
- are associated with the lives of people significant in our past;
- embody the distinct characteristics of a type, period, or method of construction, represent the work of a master, possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual distinction; or
- have yielded, or are likely to yield, information important for understanding prehistory or history (36 Code of Federal Regulations 60.4).

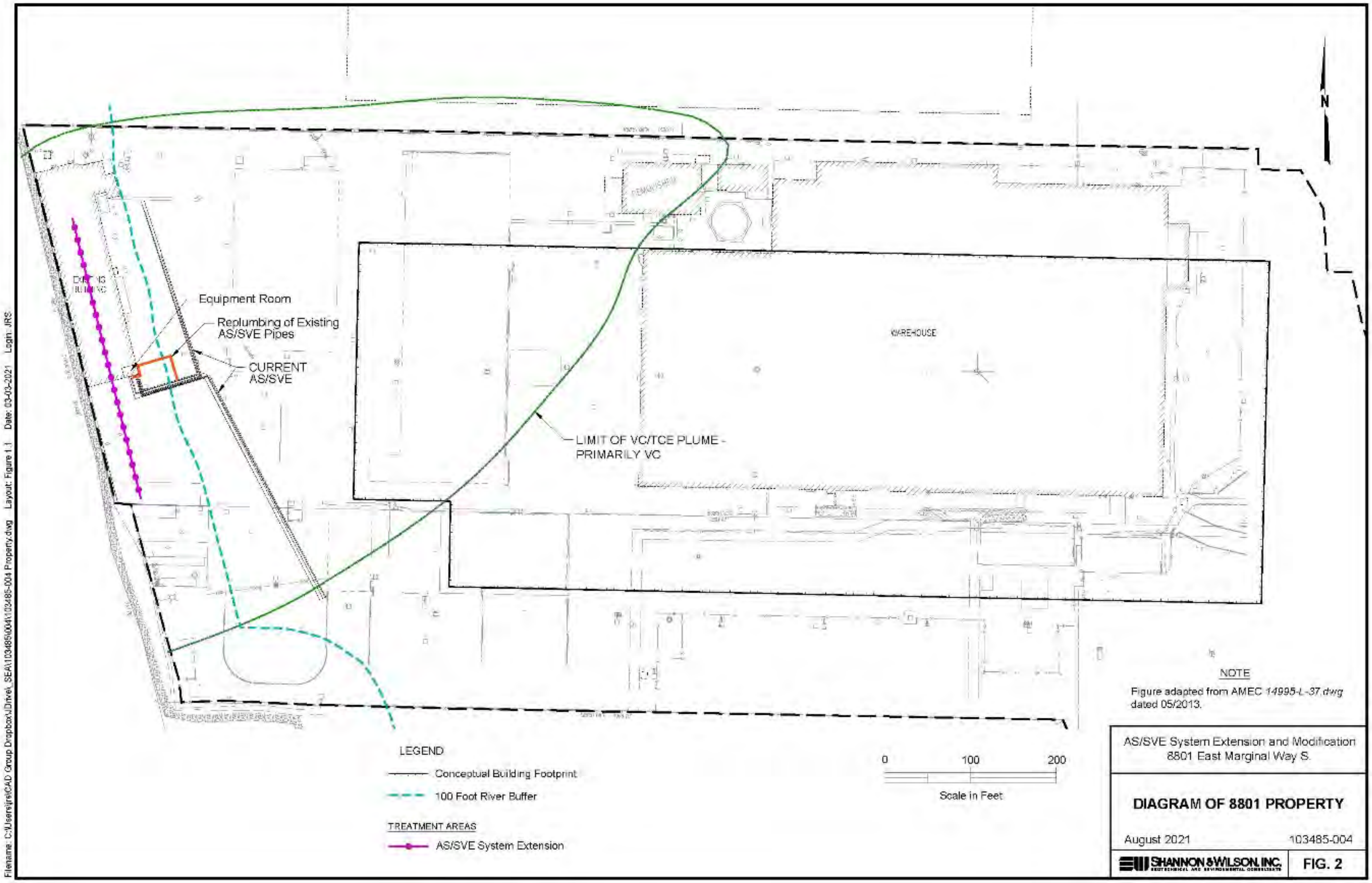

Figure 1-3. AS/SVE Extension and Modification Project diagram of 8801 property (Shannon & Wilson 2021)

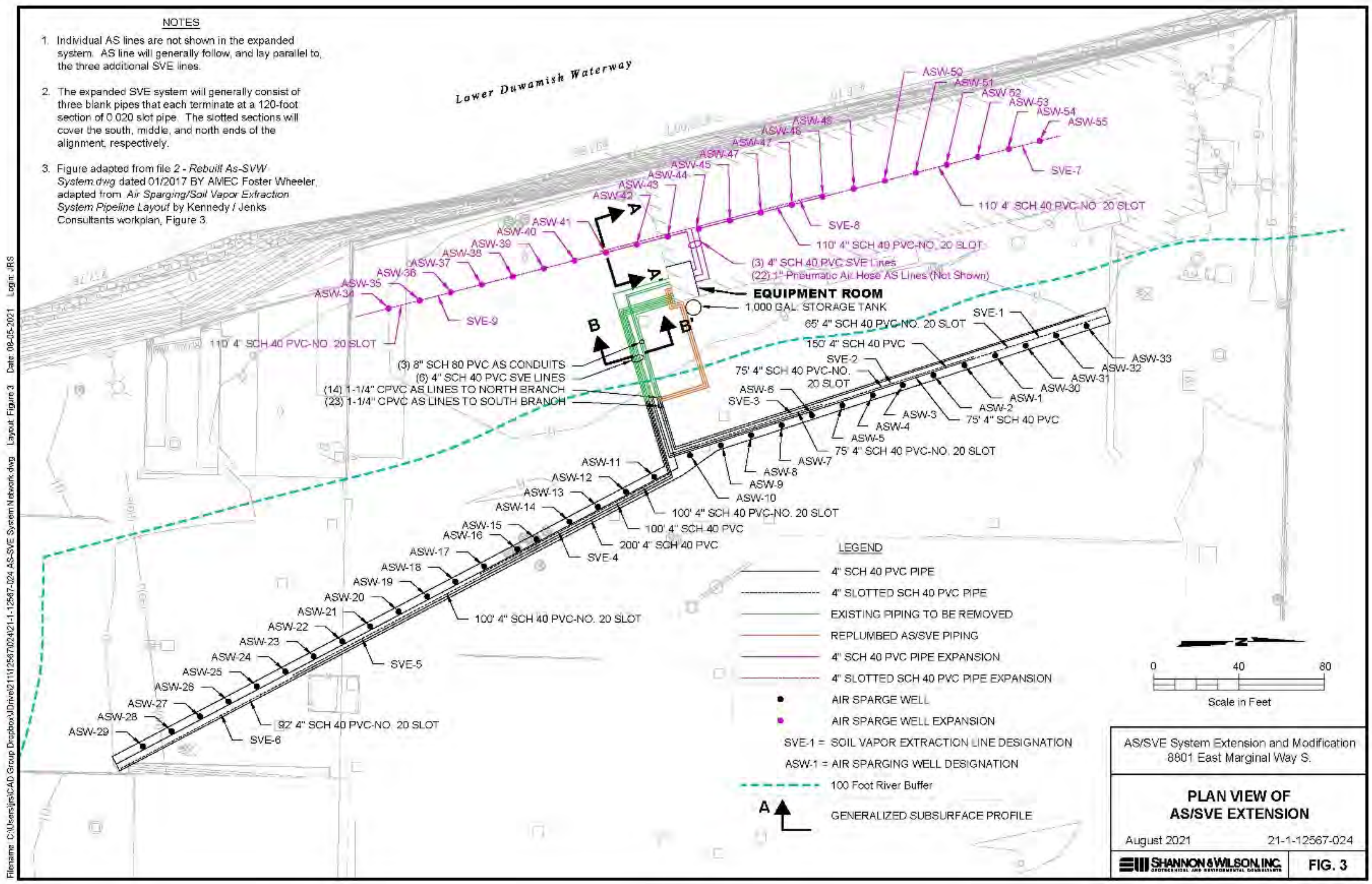

Figure 1-4. AS/SVE Extension and Modification Project plan view of AS/SVE extension (Shannon & Wilson 2021)

2. ENVIRONMENT AND CULTURAL SETTING

This section describes the environmental context of the Project APE. Elements of the environmental context include geology, soils, plants, and animal habitats. Knowledge of the geologic processes associated with the landforms in this area can help locate archaeological resources. Geographic features, such as shorelines, rivers, lakes, and terraces, often correlate with the archaeological record. Throughout prehistory these locations provided abundant plant resources and fish and often attracted terrestrial animals. As a result, sites tend to be found at locations along shorelines, within active floodplains, or along associated terraces. The depth of soils and potential for buried deposits can be derived from soil surveys and geomorphologic descriptions of the landscape. Understanding the extent of native plant and ecological habitats provides a context for interpreting archaeological sites and activity locations.

2.1 ENVIRONMENTAL CONTEXT

Environmental data for the Project APE were gathered from geologic and soil maps and reports of recent geological and geomorphological investigations describing subsurface conditions and the post-depositional processes that may have impacted the Project area's cultural deposits.

2.1.1 PHYSIOGRAPHIC PROVINCE

The Project is within the Puget Sound Area of the Western Hemlock (*Tsuga heterophylla*) Vegetation Zone within the Puget-Willamette Lowland physiographic province (Franklin and Dyrness 1988). The Western Hemlock Zone is the most extensive vegetation zone in Western Washington and Oregon (Franklin and Dyrness 1988). It extends from British Columbia through the Olympic Peninsula, Coast Ranges, Puget Trough, and both Cascade physiographic provinces in Western Washington (Franklin and Dyrness 1988). Major forest tree species in this zone are Douglas-fir (*Pseudotsuga menziesii*), western hemlock, and western red cedar (*Thuja plicata*). Less common conifers include grand fir (*Abies grandis*), Sitka spruce (*Picea sitchensis*), and western white pine (*Pinus monticola*). Western white pine and lodgepole pine (*Pinus contorta*) are common on glacial drift in the Puget Sound area. The Project APE presently contains standing structures, asphalt, manicured garden areas, and lawns.

2.1.2 GEOMORPHOLOGY

The Project APE is in the southern Puget Lowlands. The Puget Lowlands are a north-south-trending geological and physiographic province bordered by the Cascade Mountains on the east and the Olympic Mountains on the west (Franklin and Dyrness 1988; Troost and Stein 1995). It was shaped by at least four periods of extensive glaciation during the Pleistocene epoch (Easterbrook 2003; Lasmanis 1991). Glaciers depressed and deeply scoured the bedrock, and sediments were deposited and often reworked as the glaciers advanced and retreated. This can be seen in the area's overall rolling, low-relief topography that is deeply incised by large troughs/ravines. The area's elevation is generally within 500 ft above msl (Troost and Stein 1995). The scoured troughs left by the glaciers are currently occupied by the Puget Sound and freshwater lakes, such as Lake Washington and Lake Sammamish (Galster and Laprade 1991; Liesch et al. 1963; Yount et al. 1993).

A mantle of glacial drift and outwash deposits were left across much of the Puget Lowland at the end of the Fraser Glaciation (the last of the four glacial periods) (Booth et al. 2003; Easterbrook 2003). The Vashon Stade of the Fraser Glaciation began around 18,000 years Before Present (BP) with an advance of the Cordilleran Ice Sheet into the lowlands (Porter and Swanson 1998). The

Puget Lobe rapidly advanced into the Puget Lowland and reached its maximum extent near what is now the town of Centralia by about 15,000 BP. The glacier remained this way for approximately 1,000 years until the ice began to retreat. The retreating Puget Lobe reached Seattle by about 13,600 BP (Borden and Troost 2001; Porter and Swanson 1998). The Puget Lobe was thicker toward the north and thinned toward its terminus in the south.

The Project APE is located within the geologic unit Quaternary alluvium (Qal), indicating alluvium ranging from a few meters (m) to 30 m deep (United States Geological Survey [USGS] 2005). The Duwamish River is part of the greater Duwamish-Green River system, within a glacial trough formed by melting and incision beneath the Puget Lobe (Montgomery et al. 2003). This river system, along with other regional subglacial river systems, aggraded throughout the Holocene and developed long, meandering channels running through often far-reaching wetland environments (Montgomery and Wohl 2004).

The Duwamish-Green River delta reached its present position via repeated lahar events deriving from Mount Rainier, which helped shape and provide delta expansion material over the past 5,700 years (Dragovich et al. 1994). A lahar is sediment-laden debris and/or mudflow that originates from the flanks of a volcano (Smith and Lowe 1991). The largest of these events was the Osceola mudflow. Approximately 5,700 years ago, it flowed from the summit and northeastern flank of Mount Rainier down the White River drainage into the Green River and Puyallup River drainages, covering an area of 195 square miles (Dragovich et al. 1994). This lahar event and subsequent, smaller lahar events extended the Puyallup River and Duwamish River deltas into the marine embayments for these rivers and provided material for future delta advancement as the rivers downcut into the lahar material and deposited the sediment further downstream (Dragovich et al. 1994). In the 1800s, the Duwamish delta exhibited a complicated series of streams and channels extending across it (Collins and Sheikh 2005). Today, the sea level is approximately 5 ft higher than it was 5,700 years ago when the Duwamish deltas first began prograding into its current location, resulting in a slight increase in the elevation of the lower Duwamish floodplain (Steinkraus and Hodges 2018).

2.1.3 PALEOECOLOGY

Pollen samples collected through lake and wetland coring throughout the Puget Sound area suggest that paleoecology varied greatly over time (Tsukada 1982; Whitlock 1992). Lodgepole pine, bracken fern (*Pteridium aquilinum*), and red alder (*Alnus rubra*) were the first to populate the landscape after the glaciers receded, followed by Douglas-fir a few centuries later (Barnosky 1985).

At the beginning of the Holocene epoch (10,000 BP–present), the climate continued to warm, and grasslands, oak (*Quercus* sp.) woodlands, and hazel (*Corylus* sp.) woodlands established themselves on the landscape between 10,000 and 5000 BP. Douglas-fir became the dominant tree species in the area, precipitation became more seasonal, and summers saw increased levels of drought, which increased fire frequency and expanded prairies. Cedar (*Thuja* sp.) and hemlock (*Tsuga* sp.) populations increased between 7000 and 5000 BP as canopy forests dominated the landscape and weather conditions became cool and moist (Tsukada 1982; Whitlock 1992). Since then, the climate has remained fairly stable, with minimal fluctuation between warmer/drier and cooler/moister conditions (Leopold et al. 1982).

2.1.4 SOILS

As defined by the United States Department of Agriculture (USDA) soil survey, the soils within the Project APE are composed of Urban Land and Water. The Urban Land comprises all the soils surrounding the Project APE. No subsurface characteristics are defined for these soils (USDA Web Soil Survey 2021).

2.2 CULTURAL CONTEXT

This section describes the cultural context of the Project APE, which will inform the evaluation of findings from future field investigations performed as part of this Project. Elements of the cultural context include cultural chronologies developed for the precontact occupation through archaeological research, information derived from oral histories, and documented historic events and land use patterns. Reviewing archival archaeological, historical, and ethnographic documents provides insight toward developing hypotheses and a research design. The completion of this section included reviewing information from the DAHP; the Washington State Archives; the United States Department of the Interior, Bureau of Land Management General Land Office (BLM GLO) records; King County records; the University of Washington Libraries, and multiple historic imagery sources.

2.2.1 ARCHAEOLOGICAL CONTEXT

The first human occupation of Western Washington may date back about 14,000 BP, as evidenced at the Manis Mastodon site in Sequim, where a bone point and the spirally fractured bones of a mastodon suggest possible human hunting and butchering (Gustafson et al. 1979; Waters et al. 2011). Artifacts of the Clovis period, which began between 13,500 and 13,000 BP elsewhere in North America, have been found in isolated locales in southern and central Puget Sound. Still, no occupation sites of this period have been found in Washington. The Richey Roberts site, a cache of Clovis blades, is the sole in situ discovery of Clovis archaeology in Washington (Gramly 1991; Mehringer 1985). Several similar early sites that are coeval and possibly predate Clovis in the region are presented in recent literature (Huckleberry et al. 2003). While archaeologists have traditionally assumed that Clovis peoples focused heavily on big game for subsistence, there is increasing evidence that Clovis groups also relied on plants and smaller animals and had considerable dietary variability across North America (Cannon and Meltzer 2004).

As early as 9000 BP, as the climate stabilized, cultural complexes with distinct lithic technological assemblages emerged in the region (Carlson 1990; Fladmark 1979). These assemblages demonstrate a “foraging” economy based on generalized resource procurement for immediate consumption and high-residential group mobility (Ames 1981; Binford 1978). One of these distinct technologies is the Old Cordilleran Tradition (Butler 1961). In Western Washington, the Old Cordilleran Tradition manifestations are recognized by unifacial pebble and cobble tools and chopper-like cores (Butler 1961).

Other contemporary technologies include the Northwest Coast Microblade Tradition, identified by a diverse assemblage that includes microblade and microblade cores, leaf-shaped bifaces, and bifacial cores (Borden 1975; Fladmark 1979). The variety of technologies found in the archaeological record suggests the establishment of multiple well-defined cultural groups populating the Northwest Coast vicinity early in prehistory. The post-Clovis prehistory of Western Washington is commonly divided into three cultural periods—Early, Middle, and Late—defined by a series of technological characteristics found at archaeological sites.

2.2.1.1 Early Period

The Early period, which lasted from approximately 12,000 to 7000 BP, is classified archaeologically by the Old Cordilleran Tradition (Matson and Coupland 1995), with regional manifestations defined as the Olcott Complex in the Puget Sound and Western Cascade Range regions and the Cascade Phase east of the Cascade Range. Sites of this period in Western Washington typically occur on high marine and river terraces, sometimes at significant distances from modern watercourses. They comprise concentrations of cobble cores, flakes, large ovate knives, and broad-stemmed and leaf-shaped projectile points (Wessen 1990). It is thought that these peoples relied more on inland hunting than on fishing and shellfish procurement for subsistence. However, finds along the British Columbia coast indicate aquatic resources were sometimes important (Blukis Onat 1987).

2.2.1.2 Middle Period

The Middle period, lasting from 7000 to 4500 BP, incorporates a continuation of the Old Cordilleran Tradition and the emergence of a distinct Northwest Coastal culture; however, few sites in Washington can be attributed to this time interval (Blukis Onat et al. 2001; Morgan 1999). Toward the end of this period, as sea levels stabilized, the focus of subsistence activity seems to have changed from reliance on terrestrial to marine resources; most sites appear along the coasts or major river systems. It is thought that this adaptation may have occurred earlier in the Gulf of Georgia and Fraser Valley regions of Canada (Stein 2000).

Archaeological sites associated with this cultural period are found to be technologically more complex and more diverse. They often include tools and ornaments of bone and antler, along with flaked stone. In the Puget Sound and Western Washington, the Middle period is a transitional time represented archaeologically by a shift toward marine resource utilization (Morgan 1999).

2.2.1.3 Late Period

Human lifeways changed radically in the Late period (4500 to 250 BP), as people focused even more strongly on marine resources. During this period, the number and diversity of sites markedly increased (Matson and Coupland 1995). People maintained permanent villages on the coast and along the lower reaches of inland rivers. They used these as home bases and storage warehouses for fish, shellfish, game, and plant foods systematically amassed during the warm seasons (Matson and Coupland 1995). Cemeteries and petroglyph sites are often associated with significant places, such as villages and seasonal habitation areas; petroglyphs also occur occasionally in higher montane settings. Blazed cedars, stripped of bark for basketry or with planks removed from their living trunks, can still be found throughout the region. Seasonal habitation areas and task-specific locations have been documented in the lowlands and up into the subalpine zone of the mountains. Still, they usually remain close to larger, permanent sources of water. These places typically are concentrated along trade routes that linked communities living on both sides of the Cascade Mountains.

2.2.2 Ethnographic Background

Prior to the arrival of Europeans, the Northwest Coast was one of the world’s most densely populated nonagricultural areas. Between the mid-1700s and late 1800s, many outbreaks of infectious diseases, including smallpox and measles, decimated the population of the Northwest Coast (Boyd 1990). Despite the massive reduction of the local population, when the first Euroamerican settlers arrived at Alki Point in 1851, at least 17 Duwamish villages, including over 90 longhouses, were present along Elliott Bay and local river systems (Duwamish Tribe 2008).

The Duwamish people primarily utilized the Project APE, and neighboring groups, including members of what are now the Suquamish, Puyallup, and Yakima Tribes, traditionally utilized this region. The Duwamish Tribe is a Southern Coast Salish group who speak the southern dialect of the Lushootseed language (Suttles and Lane 1990). Duwamish, or *Dkh*^{w}*'Duw'Absh* in the Lushootseed language, means “the people of the inside.” The name refers to Elliott Bay, the Duwamish River, and other waterways that connect the people to the land. Upon the first European explorers’ arrival, the Duwamish people occupied at least 17 winter villages, living in over 90 longhouses throughout the Duwamish River basin and surrounding landscape (Speer 2004). Winter villages were the nexus of natural resources, political power, and ideological systems. These winter villages, including nearby seasonal habitation areas and spiritual places, were linked to the broader geographic community through kinship, trade, and diplomacy (Thrush 2007). Indigenous peoples in the area hunted deer, elk, and bear across the land, and ducks, geese, and other waterfowl from the estuarine environment. They fished for salmon, cod, and halibut; harvested clams; and gathered berries, camas, and other plants for food and medicine.

Although some of these places have undergone a complete transformation with the industrial development of the Duwamish River watershed in the twentieth century, these locations and resources remain important to the Duwamish people. They are significant in the understanding of Seattle’s development. The area surrounding the Lower Duwamish Superfund Project area still holds significance for the Duwamish people. The following place names are from Thomas T. Waterman’s ethnographic book *Puget Sound Geography* (2001) and are written using his linguistic characters (**Figure 2-1**). One such place is Lwalb, which means “abandoned” (Waterman 2001:120). Lwalb refers to an abandoned river channel on the southwestern side of the Duwamish. Another place name is T^{3} a’Lt^{3}aLusid or “where there is something overhead across the path” (Waterman 2001:120). This place was on the western side of the river, which is now filled in. hÛtesa’tci or “cut in two with reference to the hand” has a malevolent connotation with the Duwamish people (Waterman 2001:120–121). As Waterman retells the legend, an evil supernatural being’s mangled hand rose from the water. Waterman is unsure where exactly this spot is located along the Duwamish.

The closest Duwamish villages to the Project APE are Tuqwe'Ltid or “a large open space” (Waterman 2001:45, 121). There is some debate about where the village of Tuqwe'Ltid was located, but it is accepted it was near the South Park Bridge (Berger and Hartmann 2013:5; Blukis Onat et al. 2008:21). “A brace supporting a rafter,” or TEtc^{3}gwEs, is for an area where trees fell over a trail, possibly caused by a landslide, on the northern side of the Duwamish River (Waterman 2001:121). This place is now somewhere underneath the King County International Airport.

The area where the Duwamish River narrowed and made a sharp turn was called cka'lapsEb or “neck” (Waterman 2001:121). This area was once where the Duwamish people could collect lily bulbs (Waterman 2001:121). Hwa’pitcld means “where one throws something,” for this area was wide and flat near an old river channel (Waterman 2001:121). Qiyawa’lapsEd or “eel’s throat” is a place name for three knolls situated on the western side of the Duwamish River, which is in the South Park neighborhood (Waterman 2001:121). Xo’bxobti, or “canoe paddles,” is where the Duwamish people harvested ash trees to make paddles (Waterman 2001:121). This area is described as a flat in a bend of the river on the eastern side of the Duwamish River. The last placename is tsitskad’b, a small promontory that stuck out in the river (Waterman 2001:121). This could refer to Turn Basin Number 3.

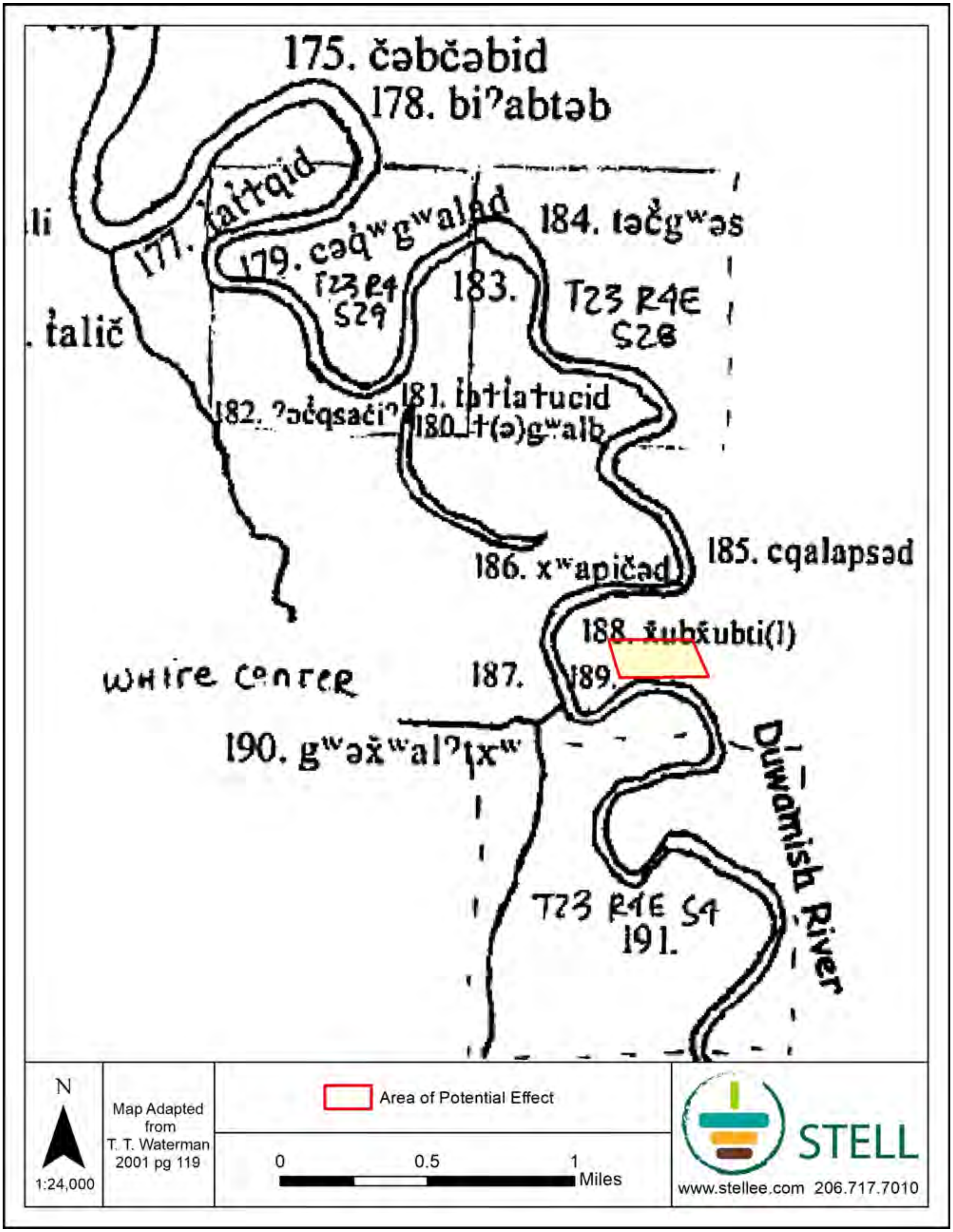

Figure 2-1. Place names map with Project APE (Waterman 2001)

Another Duwamish village sqoa'l-qo, or “meeting of rivers,” was approximately 3 mi upstream from the Project APE (Berger and Hartmann 2013:5; Waterman 2001:45). This village was near where the Black and White Rivers met. Waterman claimed there were additional villages near the Duwamish River, but the names were unknown to him (Berger and Hartmann 2013:5; Waterman 2001:45).

Once non-native settlers moved into this area, the Duwamish people were pushed out of their traditional lands, especially after the 1855 Treaty of Point Elliott. The Sackman and Dewatto Duwamish communities chose to stay within the area and formed new communities with other tribes in the area (Tollefson 1992:214–216). These communities were forced to live outside of the city of Seattle. They were able to retain some of their seasonal gathering, hunting, and fishing traditions that helped supplement their diet (Tollefson 1992:214–216).

2.2.3 HISTORIC BACKGROUND

Following non-native settlers’ arrival in the Pacific Northwest (by the mid-1850s), many Native village/habitation sites were subsequently homesteaded or platted as towns. This was especially true for locations near water, at river confluences, or along traditionally utilized travel corridors/trails, many of which were in use into the historical period, if not into modern times. Extensive logging and mining activity took place throughout the region from the mid-1800s to present. The construction and expansion of transportation corridors associated with railroads and roadways had a profound effect on the landscape in this area (Marino 1990).

2.2.3.1 History of King County

The first Euroamerican explorers to visit King County were Colonel Isaac Ebey and, later, John Holgate. European settlement of the area started in 1852, with lumber, hops, coal, and fish constituting the area’s first industries (Long 2006). King County was formed on December 22, 1852, by the Oregon Territorial Legislature, and 3 months later, in 1853, was included in the newly created Washington Territory. The county was originally named for William Rufus DeVane King, a senator from Alabama, who was elected as the United States vice president in 1853 and died shortly after the election. In 1986, the county was officially changed to honor Rev. Dr. Martin Luther King Jr. (Long 2006).

The first settlers of King County were a group of farmers led by Luther Collins who claimed land inland along the Duwamish River on September 14, 1851 (later called Georgetown). A week after the Collins party claimed their land, the initial vanguard of the Denny Party (the group credited with founding Seattle) arrived on Alki Point (near what is now West Seattle), with the remaining Denny Party arriving on November 13, 1851 (Long 2006).

Major industries in King County in the late 1800s were logging and coal mining. By the 1880s, sawmills and shingle mills were the main industries in many towns throughout the Puget Sound (Long 2006). Throughout this decade, hops were a major King County crop until hop lice/aphid infestations that started in 1889 prompted growers to turn to dairy farming, orchards, and other crops (Bagley 1929; Long 2006). Native Americans provided much of the labor for harvests in King County. A national economic depression in the 1890s exacerbated the hop lice crisis. Overall, King County recovered quickly because of the 1897 Klondike Gold Rush, during which Seattle and King County merchants provided supplies to those headed north to the goldfields (Long 2006).

2.2.3.2 History of the Project Area

Seattle's earliest non-native settlers first arrived in the Puget Sound via canoes floating down the Duwamish River from Nisqually. They were the Collins Party and settled along the Duwamish River in late September 1851, about 2 mi south of the mouth of the Duwamish River. Eventually, Luther Collins filed for a Donation Land Claim. Other parties of settlers were quick to join the Collins Party in acquiring lands around Elliott Bay. These included John Holgate, William Latimer, the Denny Party, and others (Lange 2000). The Duwamish River meandered in curves through the valley floor and eventually discharged into the southern end of Elliott Bay through a delta of intertidal marshlands (**Figure 2-1**).

Much of the surrounding land was submerged at high water and plus tides. Seattle was incorporated on December 2, 1869. By the 1890s, the population was well-established and maritime traffic was a common site on Elliott Bay. Steamboats could navigate the Duwamish River as far as Kent, but ocean-going vessels could not use the river. In 1895, Eugene Semple proposed a plan of public works that included digging a canal from Elliott Bay to Lake Washington, filling the tide flats west of Beacon Hill (**Figure 2-2**), and straightening the Duwamish River. The Washington State Legislature authorized the formation of diking and dredging districts in that same year. By 1901, Semple began construction, sluicing the soils of Beacon Hill and transporting soil from Seattle regrade projects for filling the tide flats south of downtown Seattle.

Figure 2-2. East Marginal Way, view to the southwest, dated February 24, 1916 (Seattle Municipal Archives 1916)

In 1909, City Engineer R. H. Thomson formed the Duwamish Waterway Commission to sell bonds for rechanneling the river. The straightening and dredging of the Duwamish River began on October 14, 1913 (Wilma 2001a), shown in **Figure 2-3** and **Figure 2-4**. The channel would allow larger ships to access the reclaimed land and alleviate flooding that frequently occurred throughout the valley.

Figure 2-3. Historic photograph of the Seattle tidelands looking southeast; taken from Centennial Mill in 1902 (University of Washington Libraries 1902)

Dredging began at the County Poor Farm in Georgetown, filling the meanders, except for a few recessed in the channel, to accommodate high water levels and turning ships. By 1920, the Duwamish Waterway had reached a depth of 50 ft for 4.5 mi (Wilma 2001a). All of the original meanders were filled except for one—a short section of the original course of the Duwamish delta channels, which is still present along the southwestern shore of Kellogg Island (Thrush 2007).

Dredge spoils were used to create Harbor Island, which was finished in 1909 by the Puget Sound Bridge and Dredging Company. At the time, Harbor Island was the largest artificial island in the world. Soil from the regrades of Beacon Hill, Denny Hill, Yesler Hill, Jackson Hill, and Dearborn Street were used to construct Harbor Island and fill the greater Duwamish delta tidelands (Stein and Goodman 2001; Wilma 2001a).

By 1920, the indigenous people, who traditionally utilized resources from the Duwamish River, could no longer safely gather food from that area (Thrush 2006:110). The channelization of the Duwamish River was complete and industrial factories were established along its banks. The 1949 USGS Seattle, South Quadrangle 7.5-minute series shows structures of all sizes up and down the Duwamish River.

2.2.3.3 Project Area Background

The Project APE is first seen in an 1862 GLO cadastral survey map (BLM GLO 1862) (**Figure 2-5**) and an 1863 GLO cadastral survey map (BLM GLO 1863) (**Figure 2-6**). Both maps show the APE prior to any channeling of the river, with the APE present east of the river course. The APE does not appear in 1862 to be in an area that was privately owned.

The following year in 1863, Francis McNatt owned the lands that included the present-day APE. Based on later maps, McNatt appears to own the property from 1863 through to at least 1907, although his name also appeared on a 1926 map. GLO and census searches returned no results for Francis McNatt, aside from a 1907 death certificate from Seattle.

Figure 2-4. Route of Duwamish Waterway with APE overlay, Commercial Waterway, Commercial Waterway District No. 1, received September 1, 1919 (King County Department of Transportation 1919)

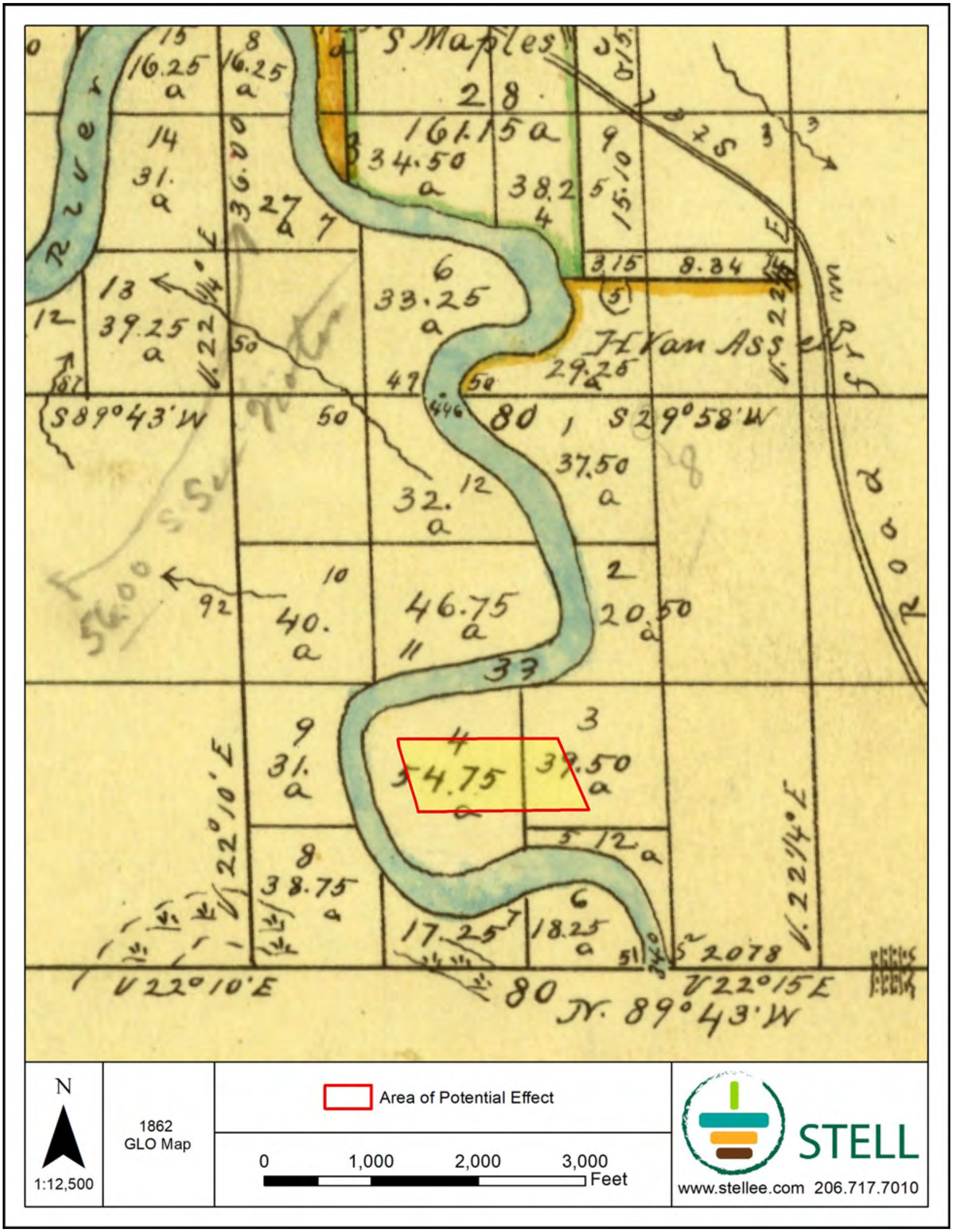

Figure 2-5. Cadastral survey from 1862 with APE overlay (BLM GLO 1862)

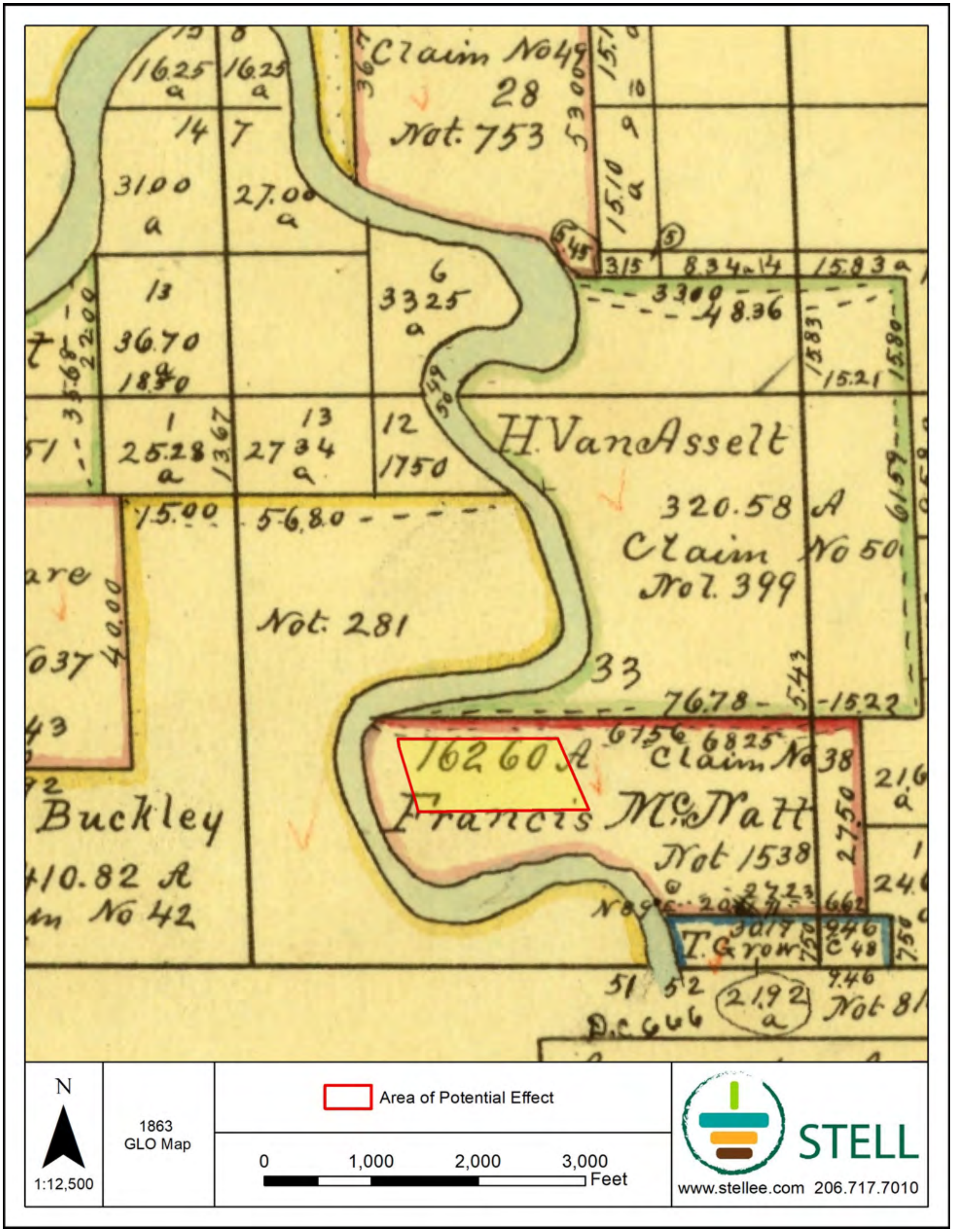

Figure 2-6. Cadastral survey with APE overlay; Francis McNatt's name is listed (BLM GLO 1863)

A 1907 Anderson Map Company (Anderson) map shows the Duwamish River still following a natural channel but with multiple landowners occupying the surrounding area (**Figure 2-7**). Francis McNalt owned the land that the APE is located within in 1907. Note that all other maps for the area reference a Francis McNatt, and Francis McNalt is likely a clerical error.

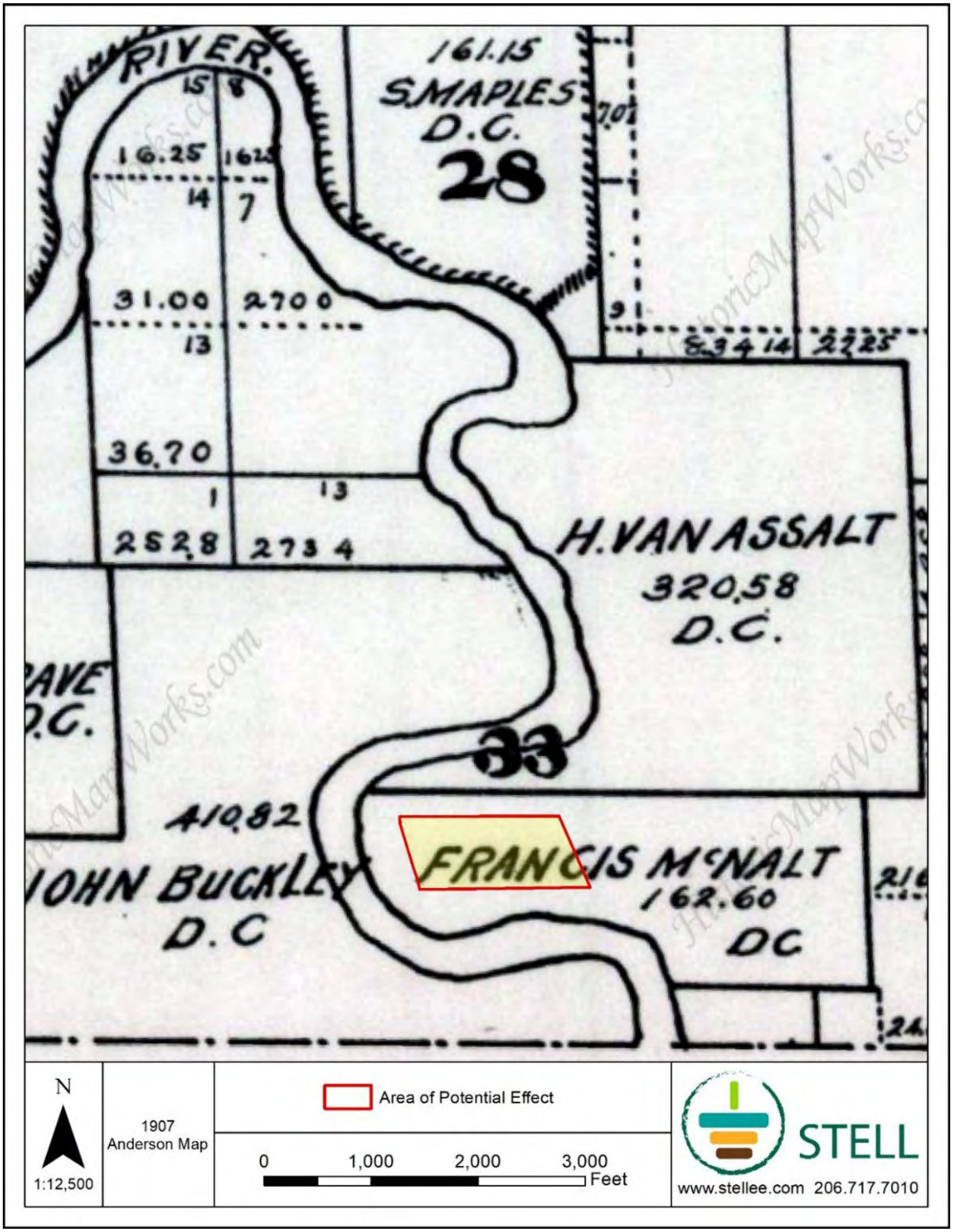

Figure 2-7. Map with APE overlay (Anderson 1907)

A 1912 Kroll Map Company (Kroll) map shows the Duwamish River remaining in its natural channel; however, the course appears to have shifted slightly west on the bend of the river where the APE is located (Kroll 1912) (**Figure 2-8**). Many of the landowners changed in this period. The large property Mr. McNalt owned had expanded and was named “The Meadows” with no owner listed.

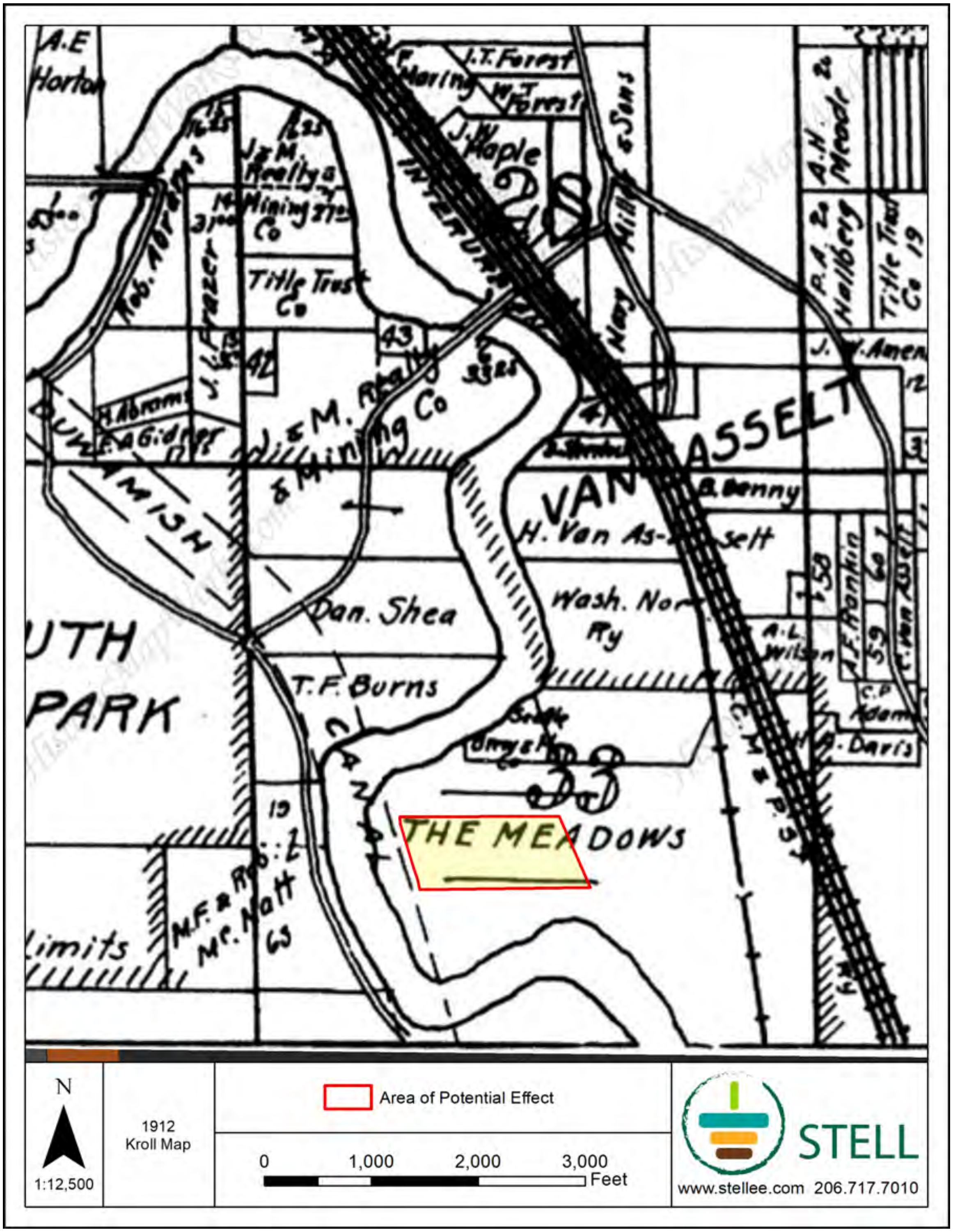

Figure 2-8. 1912 Map with APE overlay (Kroll 1912)

The King County Fair Association, under Aaron T. Van de Vanter's leadership, built The Meadows Race Track in 1902; the facility boasted grandstands that held 10,000 people, enough stalls for 1,000 horses, private quarters for jockeys, trainers, and stable hands, and an opulent clubhouse (see **Figure 2-9**). The nearby interurban line ran special trains on race days, and excited fans crowded into cattle cars when the passenger cars were full. Within a few years, the Seattle Automobile Club began organizing automobile races; the state-wide ban on gambling on horse races in 1909 increased the popularity of auto races over the following decade. The Meadows served other purposes over the twentieth century; it functioned as a military supply depot during World War I, and its barns housed livestock as racing diminished. Early airplane flights also utilized the track, and in 1928 the area near The Meadows became part of Boeing Field (Wilma 2001b).

Figure 2-9. The Meadows Race Track Clubhouse, circa 1909 (Wilma 2001b)

A 1926 Kroll map shows the Duwamish River as fully canaled and removed from its original channel north of the Project APE (**Figure 2-10**). The 1926 Kroll map does show the proposed path of the Duwamish Canal as it is labeled on the map. The Meadows tract was still listed, although several names also appeared: Francis McNatt, Jas. F. McElroy, Geo W. Dickerson, Minnie (illegible), and a final illegible name. The city limits of South Park were expanded from the 1912 map.

The 1936 Metsker map (**Figure 2-11**) shows a landscape similar to what is seen today around the APE, with the Duwamish River in its current orientation and many roads seen today. East of the APE, Boeing Field was present. Many of the large parcels that had been previously noted are no longer located on this map, with many smaller parcels having taken their place. The parcel where the Project APE is located appears to have been owned by the Fisher Body Corporation, which was an automobile coachbuilder founded in Detroit in 1908 (Jackson 2021). A small portion of the neighboring property, owned by Greer and others, was also part of the APE. No records to document the property owner could be located.

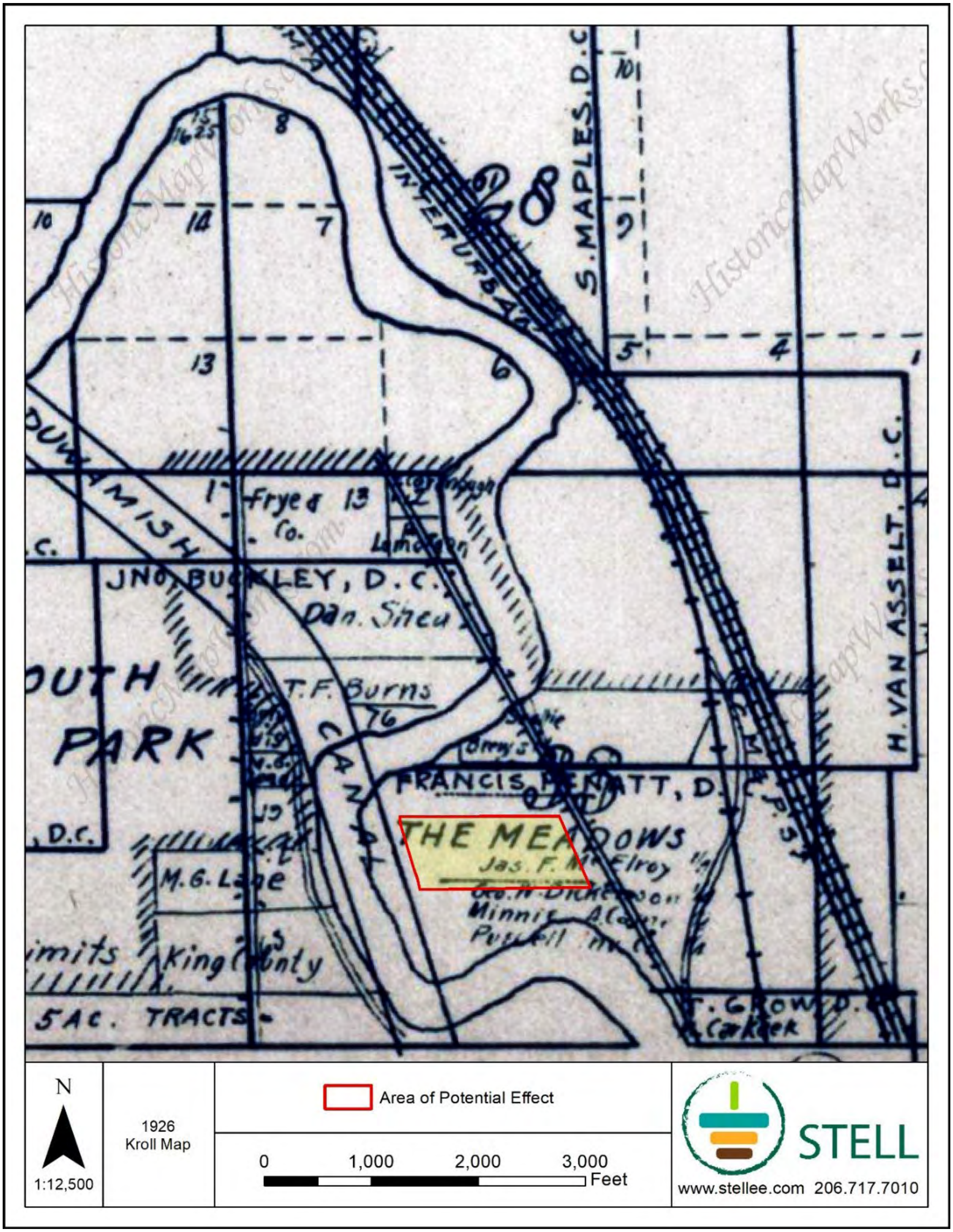

Figure 2-10. Map with APE overlay (Kroll 1926)

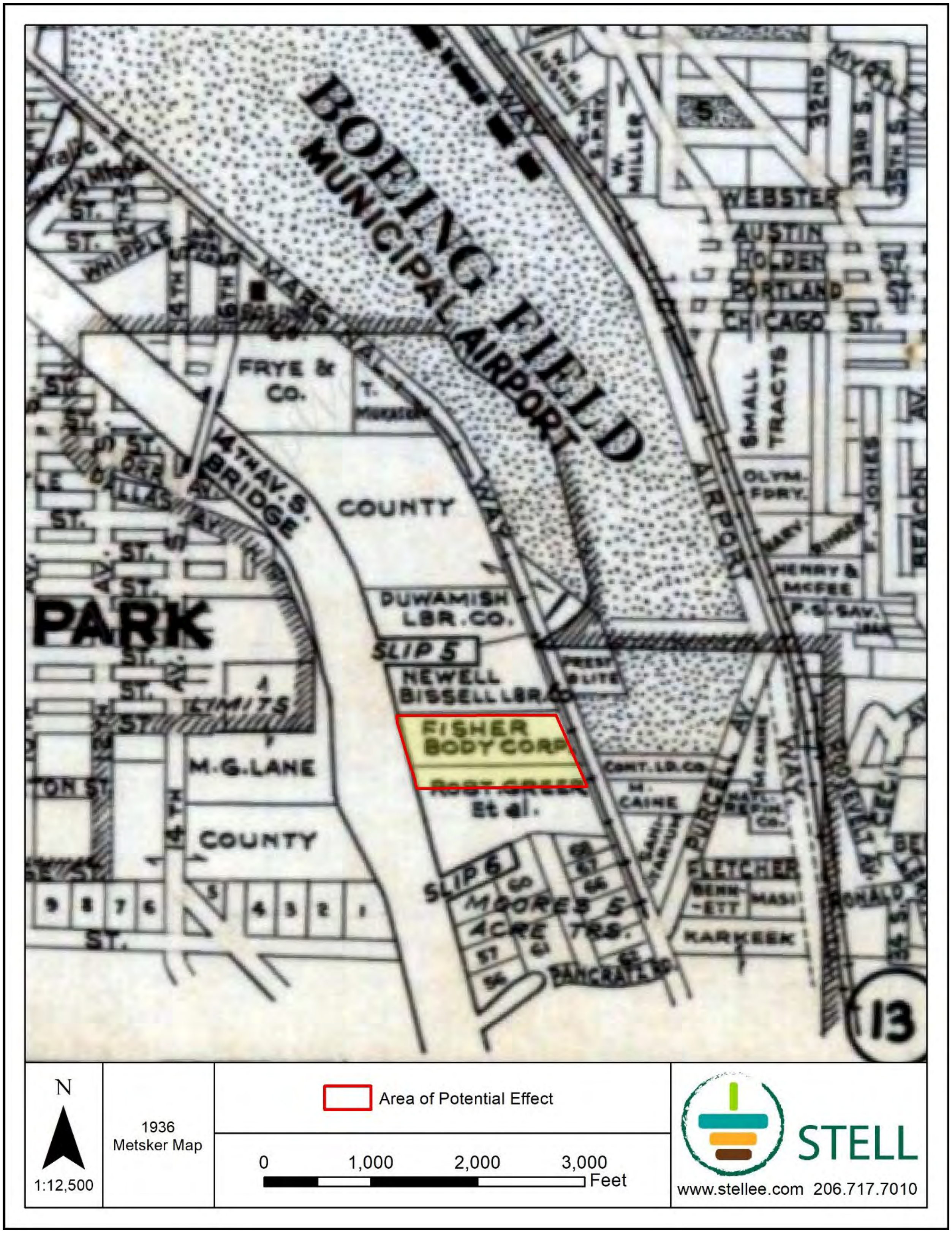

Figure 2-11. Map with APE Overlay (Metsker 1936)

The 1937 aerial imagery (**Figure 2-12**) shows the development of South Park west of the river. More open large tracts of land to the east of the river were noted in these images. To the east of the Duwamish River, East Marginal Way and railroad lines appear to be present in their modern layout. A portion of the Project APE appears to have been inundated by the river in 1937, with a large semi-circular area covered by water.

Figure 2-12. 1937 Aerial Imagery with APE overlay (King County Department of Transportation 1937)

3. RECORD SEARCH AND LITERATURE REVIEW

Stell conducted a literature review and record search for this Project by consulting the DAHP Washington Information System for Architectural and Archaeological Records Data (WISAARD), reviewing historical land records and maps, and online archives. According to the WISAARD predictive model, the Project area places the APE at a very high risk for locating cultural materials. This model is based primarily upon distance to water and soil types. No previous archaeological work has occurred within the APE. Within 1 mi of the APE, there are 30 cultural resource surveys, 9 archaeological resources, 2 cemeteries, 3 registered historic properties, and 2,051 structures. For additional information, see **Table 3-1**, **Table 3-2**, **Table 3-3**, and **Table 3-4**.

Table 3-1. Previous Cultural Resources Investigations Within 1 Mi of the APE

Author(s)	Date	NADB#	Title	Findings Relevant to the Current Project
Cooper, Jason	09/05/2013	1683973	Archaeological Monitoring Program Synopsis Construction Season 1: Duwamish Sediment Other Area and Southwest Bank Corrective Measure and Habitat Project	One historic object (45KI1142) was recorded.
Historical Research Associates, Inc	08/01/2004	1344408	South Park Bridge Project Cultural and Historical Resources Technical Report and Appendices	23 historic resources were identified; 3 NRHP eligible.
Lockwood, Chris	04/17/2014(a)	1691098	Archaeological Monitoring of South Park Hydrogeological Investigations, GSI Project – West Michigan and 8th Avenue, King County, Washington	Archaeological site 45KI1183 was identified.
Blukis Onat, Astrida R. (and others)	06/01/2008	1351645	Cultural Resources Survey for the South Park Bridge Project	Three prehistoric archaeological sites were identified.
Schultze, Carol (and others)	03/31/2015	1686020	Archaeological Monitoring Report for the South Park Bridge Replacement Project	Archaeological site #45KI815 was identified; Site not located within APE.
Roedel, Kurt W.	06/06/2001	1339904	Letter to Ronda Smith Regarding Archaeological Resources Monitoring for the South Park Bridge Project	No cultural resources were identified.
Gilpin, Jennifer	10/05/2006	1348322	Archaeological Monitoring at 9229 E. Marginal Way, Tukwila	No significant cultural resources were identified.
Berger, Margaret, and Glenn Hartmann	04/08/2013	1691049	Cultural Resources Assessment of the Duwamish Substation North Property	No cultural resources were identified.

Author(s)	Date	NADB#	Title	Findings Relevant to the Current Project
Boersema, Jana, and Anthony Cagle	08/03/2017	1689679	Cultural Resources Assessment for the Seattle City Light Technical Training Center, King County, Washington	No precontact or significant cultural material was discovered in the APE. The only cultural material found during this survey was scattered debris within the fill deposit that was not directly datable.
Marcotte, Jaqueline, and Paula Johnson	03/18/2015	1686226	West Duwamish Trail Extension Project, Seattle, Results of Archaeological Monitoring	No significant archaeological resources were identified.
Lockwood, Chris, and Bryan Hoyt	03/21/2014(b)	1691097	Archaeological Monitoring of Geotechnical Boring and Monitoring Well Installation, West Michigan and 8th Avenue, King County, Washington	No cultural resources were identified.
Boyle, Susan	09/24/2012	1682897	Historical Documentation King County International Airport/Boeing Field Seattle	Eight significant or potentially significant historic structures identified: Administration building, North Annex building, Civil Aeronautics Building, B29 Revetment Hangar/Hangar No. 5, Hangar No. 3, Air Traffic Control Tower, West Coast Airlines Hangar, Three Small Plane Hangars.
Stropes, Tracy	10/10/2019	1695191	A Cultural Resources Assessment for the 8801 East Marginal Way Project, City of Tukwila, King County, Washington	No archaeological resources identified. Four historic properties identified: warehouse building, office facility, water tower, groundwater treatment facility.
Foutch, Amy	07/01/2009	1353867	Cultural Resources Study for the SR 99 Intelligent Transportation System Improvements Project	No archaeological deposits identified. One historic resource identified: North 46th Street/SR 99 Overcrossing.
Cole, Stephen C.	05/14/2001	1339898	Heritage Resources Investigation of the South Park Cell # 41982 Tower	Cultural resources (house) were noted but not recorded.
Kopperl, Robert	02/15/2017	1694843	Archaeological Resources Assessment for the 8430 Dallas Ave Warehouse Project, King County, Washington	No cultural resources were identified.
Colon, Justin	05/05/2021	1696035	Cultural Resources Assessment for the South 106th Street Drainage Improvements Project	No cultural resources were identified.
Baldwin, Garth	05/06/2015	1686481	Cultural Resources Assessment for the Boeing Access Road Bridge Rehabilitation Project, Tukwila	No cultural resources were identified.

Author(s)	Date	NADB#	Title	Findings Relevant to the Current Project
Anchor QEA, LLC	09/01/2022	1697123	King County International Airport Runway 14L-32R Rehabilitation and Reconstruction Cultural Resources Survey Report	No cultural resources were identified.
Jones, Jessica	06/03/2022	1696843	Archaeological Monitoring at 14th Avenue S and Dallas Avenue S for a Proposed Signal Pole Installation	No cultural resources were identified.
Hoyt, Bryan	12/01/2021	1696132	South Park Plaza Project, Seattle, King County, Washington – Cultural Resources Assessment	No cultural resources were identified.
Berger, Margaret	07/24/2017	1692749	Cultural Resources Assessment for the Prologis Emerald Gateway Project, King County, Washington	No cultural resources were identified.
Schultze, Carol (and others)	02/27/2014	1684580	45KI815 Archaeological Data Recovery, South Park Bridge Replacement Project	Archaeological site #45KI815 was identified; Site not located within APE.
Silverman, Shari Maria (and others)	03/01/2009	1353028	Cultural Resources Reconnaissance for Norfolk Water Quality Treatment Site and Puget Creek Natural Area City of Seattle	No significant cultural resources were identified.
Robbins, Jeffery R.	10/13/1995	1339749	Cultural Resource Monitoring Alki Transfer/CSO Project Allentown Trunk	Cultural material from known site 45KI431 was recorded but not collected.
Durkin, Brian (and others)	11/07/2022	1697234	Cultural Resources Inventory for The Georgetown to South Park Trail Project in The City of Seattle, King County, Washington	No cultural resources were identified.
Earley, Amber	05/15/2012	1682084	Letter to Clay Antieau RE: Results of Archaeological Monitoring for the Norwalk MLK Water Quality Treatment Site Project, Seattle	No significant cultural resources were identified.
Juell, Kenneth E.	07/15/2004	1343453	Letter to Clay Antieau RE: Results of Archaeological Monitoring for the Norwalk MLK Water Quality Treatment Site Project, Seattle	No cultural resources or historic properties were identified.
Courtois, Shirley	11/01/1999(a)	1339836	Central Link Rail Transit Project Historic and Prehistoric Archaeological Sites Historic Resources Native American Traditional Cultural Properties Paleontological Sites	78 potentially significant historic properties were identified.
Courtois, Shirley	11/01/1999(b)	1339816	Sound Transit Central Link Light Rail EIS Historic and Archaeological Resources Technical Report	78 potentially significant historic properties were identified.

Note:

NADB = National Archaeological Database

No. = Number

Table 3-2. Previously Recorded Archaeological Resources Within 1 Mi of the APE

Site Trinomial	Description	Determination of Eligibility
KI01351	Hotel Butler Historic Debris Concentration	Not Eligible
KI01352	King County International Airport Debris	Not Eligible
KI01149	Hamm Creek Pilings, Pilings, 500 x 2.5M, CA. 1920-1940	Potentially Eligible
KI00817	Site Three, Pre-Contact Burned and Calcined Fragmentary Bone Found Below Blackened Coarse Sand, 10 X 30M	Not Determined
KI00816	LWALB Old Channel Two, Pre-Contact Shell Midden, Hearth, Charcoal, FMR, Mammal, Bird, Fish Bone, 20 X 50M.	Not Determined
KI00815	LWALB Old Channel One, Pre-Contact Shell Midden, Charcoal, FMR, Mammal, Bird, Fish Bone, 50 X 90M	Eligible
KI00538	Columbia and Puget Sound Railroad, 16.60 Miles, Historic Railroad Grade, 1874-Present	Not Eligible
KI01183	Historic Isolate, CA. 1900-1950	Not Determined
KI01142	Wooden Wagon Wheel Isolate, Historic Object, CA. 1890's to 1920's	Not Determined

Table 3-3. Previously Recorded Cemeteries Within 1 Mi of the APE

Site Trinomial	Description	Distance from APE	Comments
45KI01526	Rose Street	0.7 mi west-northwest of APE	Human remains found in 1925. The remains found at a depth of 18 inches in sandy clay soil.
45KI00910	Maple Grave/Memorial	0.67 mi north of APE	A monument and urn of the ashes of John and Samuel, son, Maple. Located on Perimeter Road, Seattle.

Table 3-4. Historic Register Listed Properties Within 1 Mi of the APE

Site Trinomial	Listing Number	Property Name/Other Name(s)	Register	Address
KI01440	SG100004460	Eng. Jimmie & Betty, House	NRHP, Washington Heritage Register	8310 Beacon Ave. S, Seattle, WA 98118
KI00139	71000872	Building No. 105, Boeing Airplane Company; Building 105; Red Barn	NRHP, Washington Heritage Register	Purcell Avenue, Tukwila, WA
KI00259	82004228	14th Avenue South Bridge – Seattle	NRHP, Washington Heritage Register	Spans Duwamish River, Seattle, WA

4. RESEARCH DESIGN

4.1 ARCHAEOLOGICAL EXPECTATIONS

The DAHP Predictive Model places the Project APE as very high risk for locating cultural materials. This model is based primarily upon distance to water and soil types. No previous archaeological work has occurred within the Project APE. Within 1 mi of the APE, there are 30 cultural resource surveys, 9 archaeological resources, 2 cemeteries, 3 registered historic properties, and 2,051 structures. Given the amount of human activity within the area historically, expected archaeological deposits that were likely to be encountered included debris of historic-era buildings and railroads. Furthermore, due to the APE's location within the long-inhabited Duwamish Waterway by Native populations, there was the possibility of encountering precontact cultural resources during archaeological monitoring. For additional information, see **Table 3-1**, **Table 3-2**, **Table 3-3**, and **Table 3-4**.

4.2 OBJECTIVE

The Project required subsurface exploration that utilized sonic drill rig core barrel extractions and three separate trench excavations. Stell provided on-site archaeological monitoring to comply with state and local regulations.

4.3 FIELD METHODS

The first excavation of the Project took place on November 10 and 11, 2021, to disconnect existing subsurface AS/SVE piping. The excavation work on November 10 and 11, 2021, was not monitored for archaeological artifacts because the excavation was limited to exposing pipes buried in 2005, and the subsurface material consisted of imported fill from 2005. The disconnection was required because future work by CenterPoint would damage the AS/SVE pipes. The AS/SVE pipes were replaced during the second excavation of the Project, which was conducted January 24–27, 2023. The excavated trench was approximately 350 ft long, 3 ft wide, and 3 ft deep, running north to south through the AS/SVE Building. Located roughly 5 m east of the LDW, the trench sat directly adjacent to where the 22 AS wells were installed on March 2–3 and 6–7, 2023.

A sonic drill was used to conduct the core barrel extractions to install the AS wells. Twenty-two borings were plotted 15 ft apart, running north to south, through the AS/SVE Building, where each boring would serve as the foundation for a single-screened well that would be inserted before the next boring was to be drilled. Each well was drilled until there was a transition from Poorly Graded Sand to Silty Sand, approximately 30 ft below ground surface.

Following the installation of the 22 AS wells, the third and final trench was excavated on March 9–11, 2023, to reconnect existing AS/SVE system from below the south side of the AS/SVE Building to their severed counterparts approximately 30 ft east-southeast. The west end trench, on the south side of the AS/SVE Building, was shallower at about 4 ft deep, while the east end trench was excavated to be about 6 ft deep.

4.3.1 MONITORING

Stell Archaeologists Nichole Padovano, BA, and James Brown, MS, conducted on-site archaeological monitoring that observed the sonic-drill rig-core barrel extractions and small-scale soil trenching as needed based on the monitoring plan (**Appendix A**). James Brown was the lead archaeologist on this project and meets the Secretary of the Interior's, and thus Washington State's, criteria for a Professional Archaeologist. Mr. Brown has extensive experience in conducting archaeological surveys, assessments, and monitoring in the Puget Sound region.

The archaeological monitor documented the stratigraphic matrix of sediment as it was removed, making note of any exposed cultural materials. The monitor closely looked for any organic or shell midden deposits, signs of soil oxidation, lithic or bone artifacts, or animal or human bones. If any cultural materials were identified, the archaeologist would direct the contractor to temporarily cease work in the immediate vicinity while the monitor collected information to determine the significance of the findings. Daily notes and photographs were taken and compiled for documentation in an archaeological monitoring report. Weekly progress reports were provided, summarizing the findings for each day monitored. For additional information, see **Appendix B.**

Monitoring took place January 24–27, 2023, and March 2–3, 6–7, and 9–11, 2023.

All other monitoring activities were conducted following the monitoring plan developed by Stell (Breidenthal and Steinkraus 2020). Other tasks separate from the Project were recorded in a separate and appropriate report. See **Appendix A** for a full copy of the Monitoring and Inadvertent Discovery Plan and **Appendix B** for all Monitoring Logs.

5. RESULTS

Archaeological monitoring for the Project was conducted during several mobilizations on January 24–27, 2023, March 2–3, 6–7, and 9–11, 2023 totaling 11 days of monitoring over 3 months. Monitoring was conducted by Stell Archaeologists Nichole Padovano, BA, and James W. Brown, MS, as needed based on the monitoring plan (**Appendix A**). Soil was observed and described during each ground-disturbing process. Soil was not collected or sampled during this Project. See **Table 5-1** and **Appendix B** for additional details.

Table 5-1. Monitoring Table

Date	Monitor	Cultural Materials (Y/N)	Cultural Materials Description	Work Undertaken
1/24/2023	Nichole Padovano	N	N/A	Small-scale trench excavation
1/25/2023	Nichole Padovano	N	N/A	Small-scale trench excavation
1/26/2023	Nichole Padovano	N	N/A	Small-scale trench excavation
1/27/2023	Nichole Padovano	N	N/A	Small-scale trench excavation
3/02/2023	Nichole Padovano	N	N/A	Sonic drill core barrel extraction
3/03/2023	Nichole Padovano	N	N/A	Sonic drill core barrel extraction
3/06/2023	Nichole Padovano	N	N/A	Sonic drill core barrel extraction
3/07/2023	Nichole Padovano	N	N/A	Sonic drill core barrel extraction
3/09/2023	Nichole Padovano	N	N/A	Trench excavation
3/10/2023	Nichole Padovano	N	N/A	Trench excavation
3/11/2023	Nichole Padovano	N	N/A	Trench excavation

Note:
N/A = Not applicable
Y/N = Yes/No

Several modern and non-diagnostic materials were identified during both excavations and core processing (**Table 5-1**). These materials included red brick and terracotta fragments, segments of rusty metal pipes and asbestos pipes, and glass shards that were either amber, green, or decolorized. Due to the non-diagnostic nature of these materials, they could not be identified to a specific time period and are therefore not considered to be significant cultural resources.

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6. INTERPRETATIONS AND CONCLUSIONS

Shannon and Wilson contracted Stell to conduct cultural resource monitoring for the Project as part of a series of remedial tasks to address contaminated soil and water within the Project area. The Project APE is located in King County, WA, in the city of Tukwila, covering 24.3 acres.

Several modern and non-diagnostic materials were identified during both excavations and core processing. These materials included red brick and terracotta fragments, segments of rusty metal pipes and asbestos pipes, and glass shards that were either amber, green, or colorless. Due to the non-diagnostic nature of these materials, these materials cannot be assigned to a specific time period and are therefore not considered to be significant cultural resources.

The findings of this report concur with prior cultural resources investigations within the vicinity that identified large fill deposits and supposed that any intact precontact or early historic-era cultural resources will likely be deeply buried. In the next 10–20 years, many of the cultural resources around the Project APE will be considered archaeological in nature, most of which would be associated with early industry along the riverway—particularly the development of the Boeing Company.

Archaeological monitoring for the Project was conducted during several mobilizations on January 24–27, 2023, March 2–3, 6–7, and 9–11, 2023 totaling 11 days of monitoring over 3 months. Archaeological monitoring for other interim remedial actions is reported separately. **This report is a summary of monitoring activities. No significant cultural resources were discovered during monitoring.**

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APPENDIX A

Monitoring and Inadvertent Discovery Plan

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CULTURAL RESOURCES REPORT COVER SHEET

Author: Matthew Breidenthal and Sarah M.H. Steinkraus

Title of Report: Cultural Resources Monitoring and Inadvertent Discovery Plan for 8801 East Marginal Way South, Tukwila, Washington

Date of Report: January 12, 2020

County(ies): King Section: 33 Township: 24 Range: 4E

Quad: South Park Acres: 25

PDF of report submitted (REQUIRED) ☒ Yes

Historic Property Inventory Forms to be Approved Online? ☐ Yes ☒ No

Archaeological Site(s)/Isolate(s) Found or Amended? ☐ Yes ☒ No

TCP(s) found? ☐ Yes ☒ No

Replace a draft? ☐ Yes ☒ No

Satisfy a DAHP Archaeological Excavation Permit requirement? ☐ Yes # ☒ No

Were Human Remains Found? ☐ Yes DAHP Case # ☒ No

Archaeological Site #:

______
______
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______

8801 East Marginal Way South Remediation Project
Cultural Resources Monitoring
and Inadvertent Discovery Plan
Tukwila, Washington

January 12, 2020

Prepared for:

Shannon & Wilson, Inc.
400 N 34th Street, Suite 100
Seattle, WA 98103

DAHP Project #2019-03-01609.

Prepared by:

Stell
6100 219th St. SW Suite 480
Mountlake Terrace, WA 98043

By and Matthew Breidenthal, MS and Sarah M.H. Steinkraus, MS, RPA

Stell Project Number: SHW004

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Acronyms and Abbreviations

AS	Air Sparge
Centerpoint	Centerpoint 8801 Marginal LLC
CFR	Code of Federal Regulations
DAHP	Washington State Department of Archaeology and Historic Places
IAAI	Insurance Auto Auctions, Inc.
IDP	Inadvertent Discovery Plan
LDW	Lower Duwamish Waterway
MIDP	Monitoring and Inadvertent Discovery Plan
MOA	Memorandum of Agreement
msl	mean sea level
NHPA	National Environmental Policy Act
NRHP	National Register of Historic Places
Project	8801 East Marginal Way South Remediation Project, Tukwila, Washington project
RCW	Revised Code of Washington
SEPA	State Environmental Policy Act
Shannon & Wilson	Shannon & Wilson, Inc.
Stell	Stell Environmental Enterprises, Inc.
SVE	Soil Vapor Extraction
U.S.C.	United States Code
WA	Washington
WAC	Washington Administrative Code

1 INTRODUCTION

1.1 PROJECT INFORMATION

Stell Environmental Enterprises, Inc. (Stell) was contracted by Shannon & Wilson, Inc. (Shannon & Wilson) to create a cultural resources monitoring and inadvertent discovery plan for the 8801 East Marginal Way South Remediation Project, Tukwila, Washington (WA) project (Project) (**Figure 1-1**). See Appendix A for the Inadvertent Discovery Plan (IDP). Contaminated soils have been identified in a few locations within the Project area. Shannon & Wilson is proposing to undertake remediation of contaminated soil and water throughout the Project area. Seven discrete excavations are proposed to remove contaminated soil (as shown in **Figure 1-2**).

Areas with elevated concentrations of contaminants will be excavated, and the soil will be disposed of off-site. Groundwater is also contaminated with halogenated volatile organic compounds across much of the western portion of the Project area. Remedial activities to address the groundwater contamination consist of the injection of various chemicals into the subsurface and the installation of an additional line air sparge (AS)/ soil vapor extraction (SVE) system west of the existing line along the western boundary of much of the width of the Project area. In the northwestern corner of the Project area, air knifing (a method of using compressed air or water to remove soil) will be used to remove soil adjacent to the pile wall, and grout will be injected into the holes. The purpose of the grout is to prevent injected chemicals from entering the river. The chemical injections will be via borings drilled for that purpose. The AS/SVE will be trenched into place.

The western edge of the Project area has a sheet pile wall bulkhead built in approximately 1929 that extends along the approximate northern two-thirds of the western edge of the Project area to a depth of approximately 30 feet below ground surface. The sheet pile wall bends into the upland area of the Project area and extends approximately 100 feet to the east along the former southern property line. In the southwest corner of the Project area, a riprap embankment or berm was built in approximately 1969 along the southern one-third of the western property boundary and to the east on the southwestern corner of the Project area. After the berm was constructed, approximately 13.5 feet of fill was placed on the east side of the embankment, bringing the ground surface to roughly its present grade.

The Project area is within an area designated as very highly likely to yield cultural materials by the Washington State Department of Archaeology and Historic Places (DAHP) predictive model. A total of 30 cultural resources surveys, 9 archaeology sites (including precontact, historic-era, and multicomponent sites), 2 cemeteries, 3 historic properties listed on a historic register, and 2,051 Historic Property Inventory forms have been conducted/recorded and reported to DAHP within 1 mile of the Project area. Two ethnographic place names were recorded within or in the immediate vicinity of the Project area. The area was originally homesteaded in the 1860s and has been in continuous use since that time.

1.2 PROJECT AREA

The Project area is located on the right (eastern) bank of the Lower Duwamish Waterway (LDW), approximately 4 miles upstream from the mouth of the Duwamish River, in Section 33 of Township 24 North, Range 4 East, Willamette Meridian. The upland portion of the Project area occupies 24.30 acres at 8801 East Marginal Way South (King County Parcel No. 5422600060), in the City of Tukwila, WA (see **Figure 1-1**, **Figure 1-2**, **Figure 1-3**).

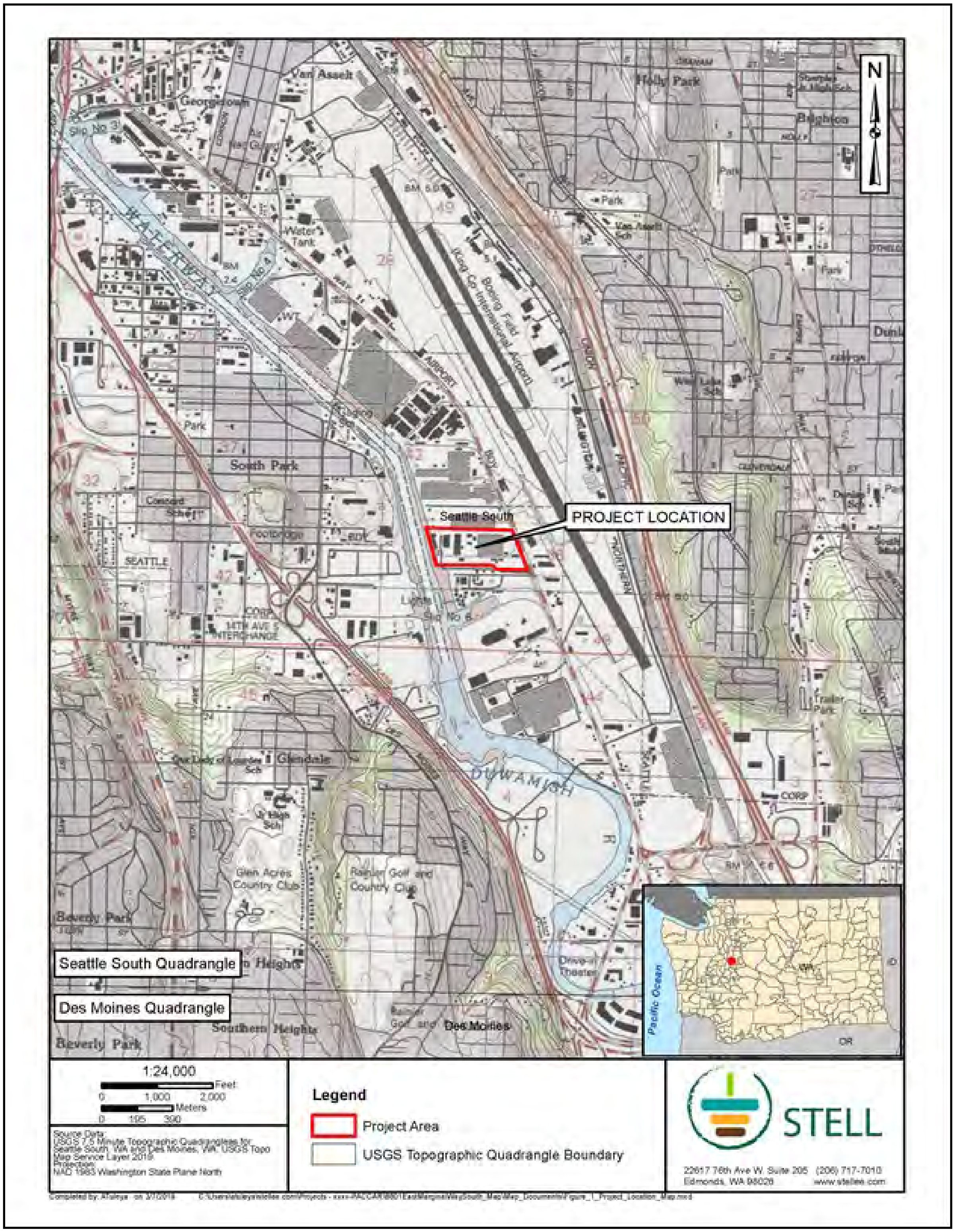

Figure 1-1. Project area location map projected on the United States Geological Survey (2019) topographic quadrangle.

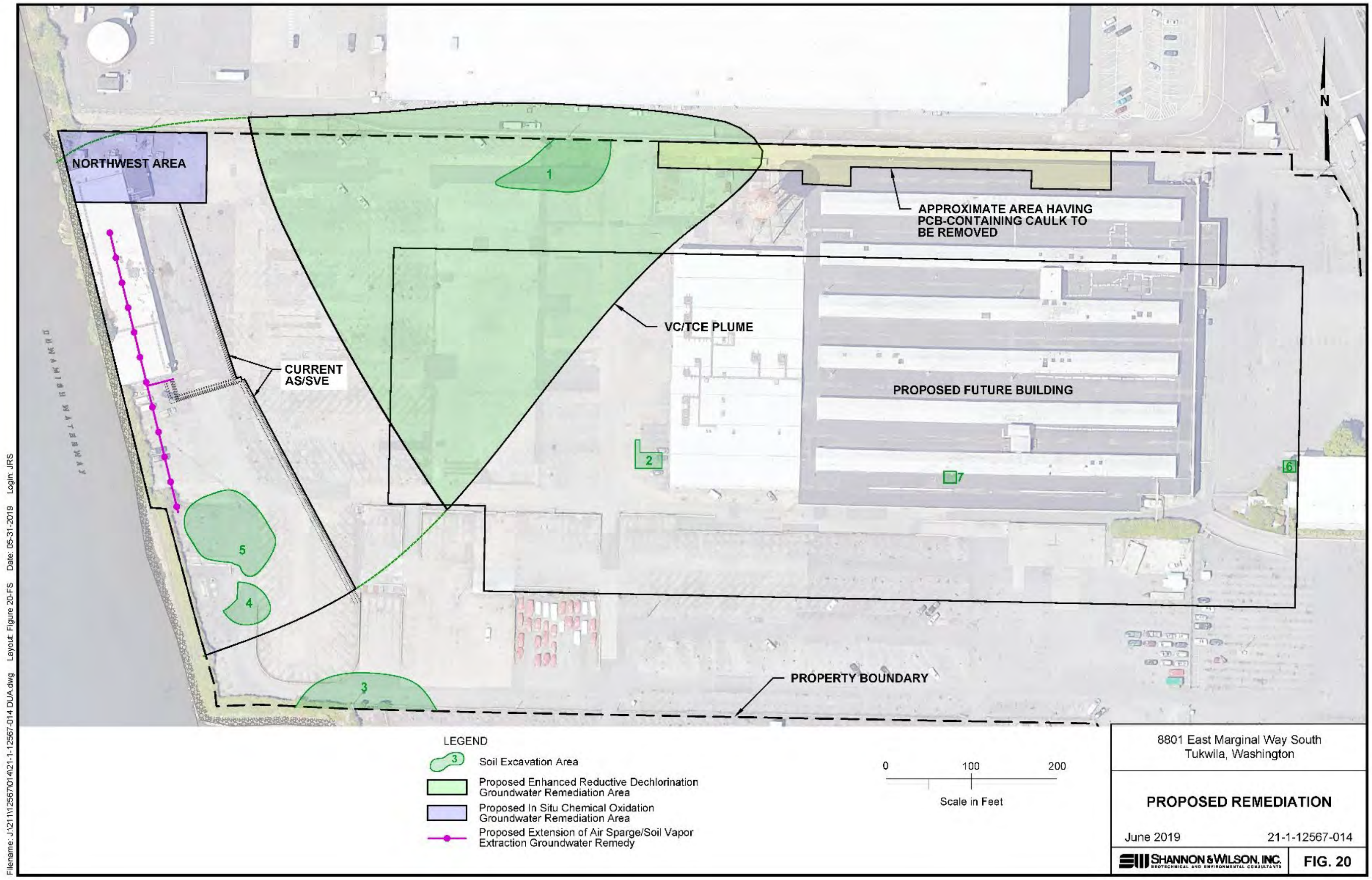

Figure 1-2. Draft Project plan map from Shannon & Wilson

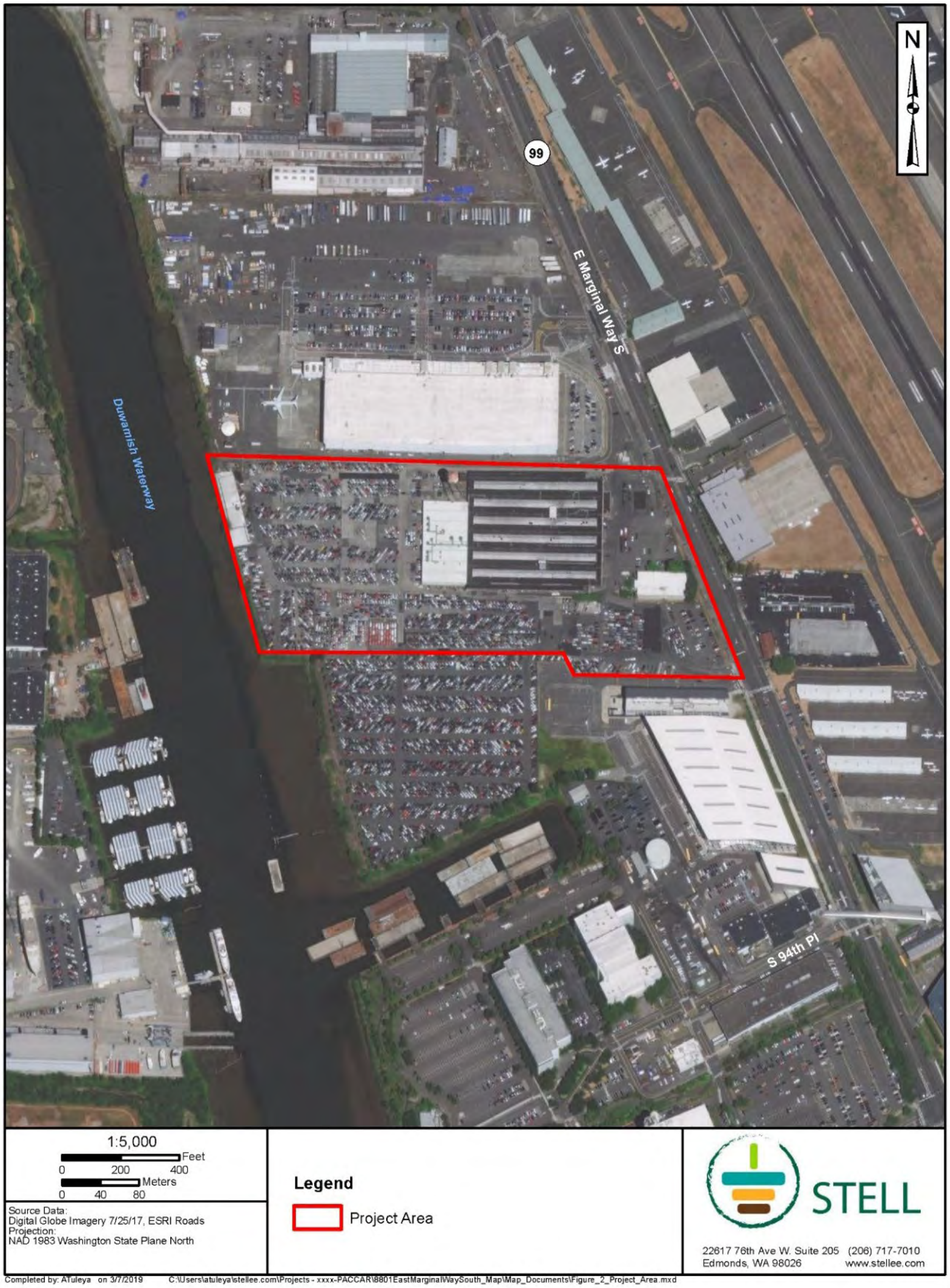

Figure 1-3. Project area location map projected on an aerial photograph (2017)

The upland portion of the Project area is relatively flat, with a ground surface elevation of approximately 20 feet above mean sea level (msl). The upland portion of the Project area is owned by Centerpoint 8801 Marginal LLC (Centerpoint). The Project area has been leased to Insurance Auto Auctions, Inc. (IAAI) since 2004, although the property is currently vacant. Zoning by the City of Tukwila is a manufacturing industrial center/heavy industry.

1.3 PROJECT BACKGROUND

A cultural resources review of the Project (which did not include fieldwork) was conducted in August 2018 by Stell (Steinkraus and McWilliams 2018) and updated in February 2023. The report recommended that the City of Tukwila consult with local affected Tribes regarding future project work and that a Monitoring and Inadvertent Discovery Plan (MIDP, this document) be created. These recommendations were based on DAHP recommendations for the Project (see Appendix A in Steinkraus and McWilliams [2018]). The DAHP Project Number is 2019-03-01609. This number should be attached to all cultural resources documentation and DAHP communications associated with this Project.

Stell's cultural resources review (Steinkraus and McWilliams 2018) found that previously recorded archaeological sites in the area consist of precontact isolates and several shell middens, as well as historic features and refuse concentrations. In terms of archaeological expectations, it is possible that these types of materials may also be located within the project area. This area is along the meander belt of the LDR, which was a major travel corridor until the Puget Sound region was logged and roads were constructed in the late 1800s and early 1900s. The placement of the Project area on a notable bend in the river (prior to channelization efforts in the early 1900s) increases the likelihood that humans stopped in this area, increasing the odds that cultural materials are present (**Figure 1-4**).

This area was also an early farm from 1866 until the land was industrialized in the 1930s. Evidence of agricultural activities, such as pieces of farming equipment, horse or other domesticated animal skeletal materials, and domestic materials dating from the late 1800s and early 1900s may also be present subsurface. There may also be evidence of early logging activities, as the farmland needed to be cleared to create agricultural fields (Steinkraus and McWilliams 2018).

Soils in the area are slightly to moderately acidic and poorly drained. Soils with low acid levels are generally better for preserving any cultural materials present, and the anaerobic conditions created in slow-draining soils also increase preservation. Acidic soils can degrade artifacts until they are no longer recognizable or, in extreme cases, until they degrade completely. This means that the subsurface preservation of cultural materials would be quite high in this location (Steinkraus and McWilliams 2018).

A study of the built environment was also conducted for the property in 2019 (Stropes et al. 2019) for a separate project (DAHP Project #2019-10-08110). This review documented four historic properties that include Property #720344, 720349, 720352, and 720356. The review recommended that none of these properties were eligible for the National Register of Historic Places (NRHP) or the Washington Heritage Register. All four properties will be demolished for Project #2019-10-08110.

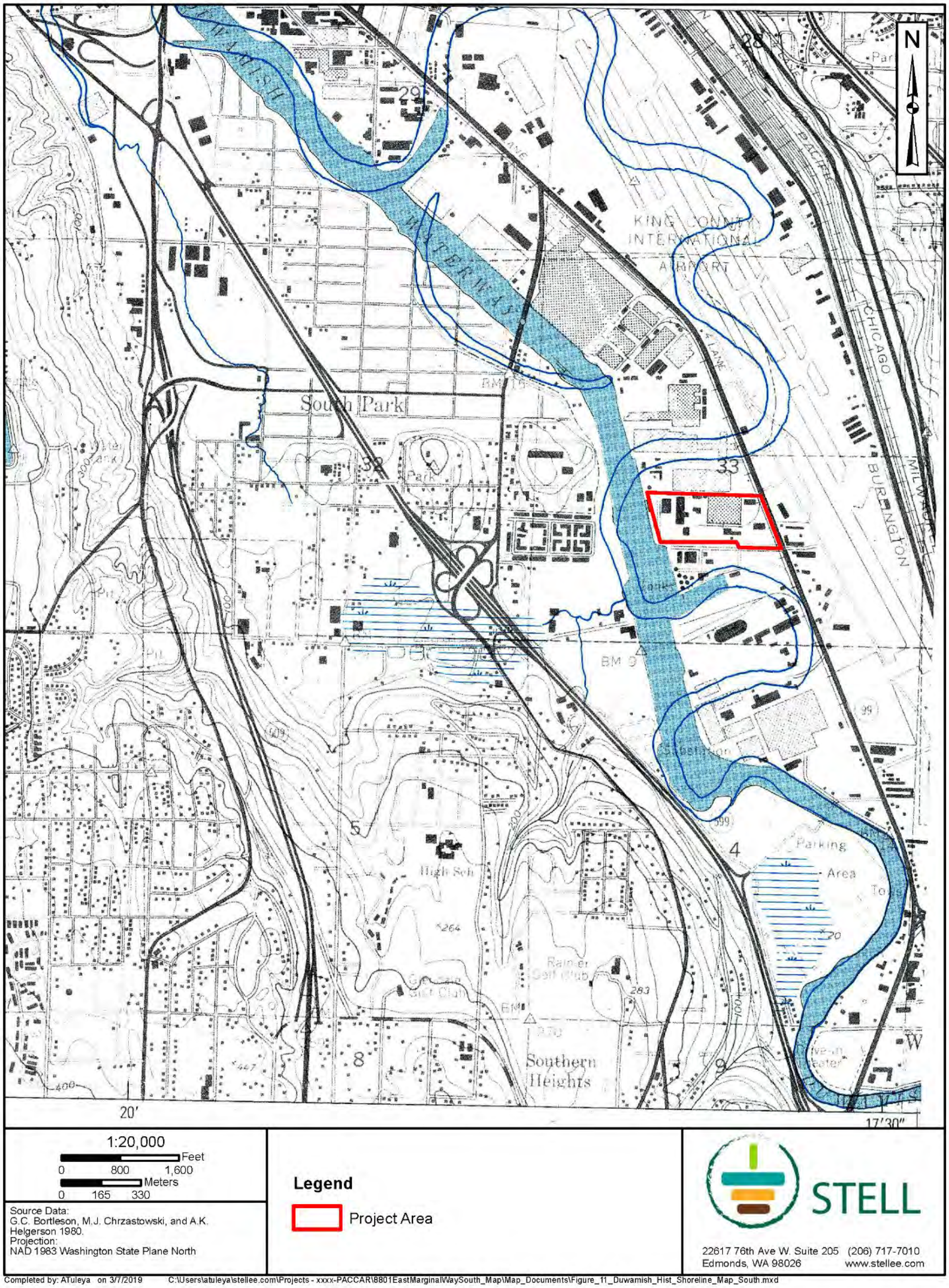

Figure 1-4. Duwamish River historical channel map.

1.4 REGULATORY ENVIRONMENT

This Project is subject to the State Environmental Policy Act (SEPA), which mirrors the National Environmental Policy Act (NHPA). SEPA requires that all major actions sponsored, funded, permitted, or approved by Washington State and/or local agencies consider the impacts of the planned action on the environment and properties of historical, archaeological, scientific, or cultural importance (Washington Administrative Code [WAC] 197-11-960). Especially those that are or could be listed on the NRHP or other historic registers, including the Washington Heritage Register or King County Landmarks. DAHP is the lead agency for considering the effects of a proposed action on cultural resources. It provides formal recommendations to local governments and other Washington State agencies for appropriate treatments or actions.

Historic properties that could be eligible for the NRHP include any artifacts, records, and remains that are related to such a district, site, building, structure, or object (16 United States Code [U.S.C.] 470[5]). The quality of significance in American history, architecture, archaeology, and culture is present in districts, sites, buildings, structures, and objects of state and local importance that possess integrity of location, design, setting, materials, workmanship, feeling, and association. They also:

a) Are associated with events that have made a contribution to the broad pattern of our history;
b) Are associated with the lives of people significant in our past;
c) Embody the distinct characteristics of a type, period, or method of construction, represent the work of a master, possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual distinction; or
d) Have yielded, or are likely to yield, information important for understanding prehistory or history (36 Code of Federal Regulations [CFR] 60.4).

2 ARCHAEOLOGICAL MONITORING PLAN

To satisfy DAHP requirements, Stell will provide on-site monitoring, daily logs during monitoring activities, and a technical report at the close of monitoring for the 8801 East Marginal Way South Project. James Brown, MS, will be the lead archaeologist on this Project. Mr. Brown meets the Secretary of the Interior's, and thus Washington State's, criteria for a Professional Archaeologist. Mr. Brown has extensive experience conducting archaeological surveys, assessments, and monitoring in the Puget Sound region.

2.1 ON-SITE MONITORING

The archaeological monitor will watch any ground-disturbing activities within the Project area. The monitor will closely look for any organic or shell midden deposits, signs of soil oxidation, lithic or bone artifacts, or animal or human bones. No previously recorded cultural resources are located within the Project area. If artifacts or other potential archaeological deposits are observed, the archaeological monitor will direct the contractor to temporarily cease work in the immediate vicinity while the monitor conducts a close inspection.

The archaeological monitor may, from time to time, request a temporary halt to work activities in order to document archaeological materials or for a closer inspection of the trench sidewall. Such documentation usually takes a few minutes (entailing photographs and written descriptions) but may take longer. The archaeologist will give an estimate of the amount of time needed to document materials to the equipment operator and/or foreman and will update them on any changes to the estimate.

If potentially significant archaeological deposits are discovered during construction while the archaeological monitor is on site, the monitor will direct the contractor to cordon off the area within 30 feet of the discovery and initiate the find reporting and evaluation processes described in the IDP (Appendix A). If evidence of cultural resources is found in exposed surfaces within the Project area, it will be further investigated to establish whether it is eligible for listing in the NRHP.

If human remains are encountered, the King County Sherriff and Medical Examiner will be immediately notified (Appendix A). If the remains are determined not to be associated with a criminal investigation, the DAHP will be immediately contacted, as well as any affected Tribes, if applicable (Appendix A).

2.1.1 MONITORING LOG

The archaeological monitor will complete a monitoring log for each monitoring session to document time in the field, the day's progress and findings, any difficulties encountered, and actions proposed or taken to alleviate them.

2.1.2 MONITORING REPORT

Following the conclusion of archaeological monitoring activities, Stell will prepare a report describing the conduct and findings of this work effort. The report will include a discussion of the Project, the methods used in monitoring, and observations about site geology, environmental history, and any cultural resources that were observed. Photographs, sketches, or maps may be included, as needed. The report will be submitted to Shannon & Wilson in complete draft form prior to it being sent to the DAHP and affected Tribes for review.

2.1.3 HEALTH AND SAFETY

The archaeological monitor will be working under an approved health and safety plan provided by the client's contractor. That individual will at all times be in compliance with the health and safety plan of the contractor. Staff will be briefed on that plan and will at all times comply with it. Field staff will have all necessary training and certification prior to commencing monitoring activities.

3 REFERENCES

Steinkraus, S.M.H., and T.A. McWilliams
2018 *Cultural Resources Review for 8801 East Marginal Way South, Tukwila, Washington*. Stell Environmental Enterprises, Inc., Edmonds, WA. Submitted to Shannon & Wilson, Inc., Seattle, WA.

Stropes, Tracy A., J. R. K Stropes, and Brian F. Smith
2019 Cultural Resources Assessment for the 8801 East Marginal Way Project, City of Tukwila, King County, Washington. Brian F. Smith & Associates, Poway, California. Submitted to CenterPoint Properties Trust, Oak Brook, Illinois.

Appendix A: Inadvertent Discovery Plan

INADVERTENT DISCOVERY PLAN FOR THE 8801 EAST MARGINAL WAY SOUTH REMEDIATION PROJECT, CITY OF TUKWILA, KING COUNTY, WASHINGTON

INTRODUCTION

Shannon & Wilson, Inc. (Shannon & Wilson) plans to undertake remediation of contaminated soil and water throughout the Project area in Tukwila, Washington (WA). Seven discrete excavations are proposed to remove contaminated soil. Areas with elevated concentrations of contaminants will be excavated, and the soil will be disposed of off-site. The following Inadvertent Discovery Plan (IDP) outlines procedures to follow, in accordance with federal laws, if archaeological materials or human remains are discovered.

State laws are in place which protect archaeological resources. The Archaeological Sites and Resources law (Revised Code of Washington [RCW] Chapter 27.53) outlines the protection of archaeological resources. Shannon & Wilson will act in accordance with State laws in dealing with the treatment of cultural resources and the consultation of concerned parties. Potentially concerned parties include the Duwamish Tribe, Suquamish Tribe, Snoqualmie Tribe, Tulalip Tribes, Muckleshoot Tribe, Stillaguamish Tribe, and the Washington State Department of Archaeology & Historic Preservation (DAHP), and the City of Tukwila.

A cultural resources review from Stell (Steinkraus and McWilliams 2018), discusses the cultural resources nearest to the Project Area and an assessment of the likelihood that cultural materials may be located within the Project area. It recommends the creation of a Monitoring and Inadvertent Discovery Plan (MIDP, the document this is attached to) and that an archaeological monitor observe all soils removed from the Project area.

A study of the built environment was also conducted for the property in 2019 (Stropes et al. 2019) for a separate project (DAHP Project #2019-10-08110). This review documented four historic properties, including Properties #720344, 720349, 720352, and 720356. The review recommended that none of these properties were eligible for the National Register of Historic Places (NRHP) or the Washington Heritage Register. All four properties will be demolished for Project #2019-10-08110.

The DAHP Project Number for this Project is 2019-03-01609. This number should be attached to all cultural resources documentation and DAHP communications associated with this project.

The monitoring archaeologist will have the ability to halt construction if they observe or identify any cultural materials and will have adequate time to assess, record, and potentially analyze any resources that might be uncovered. DAHP will be notified of all discoveries that occur during the course of the Project. The results of this monitoring effort will be documented at the completion of the Project.

This document serves as the plan for dealing with any discoveries of human skeletal remains, artifacts, sites, or other cultural resources potentially eligible for listing in the NRHP. This plan is intended to provide guidance to Shannon & Wilson so they can:

1. Comply with applicable local and State laws and regulations, particularly Title 27 RCW Chapter 27.44 Indian Graves and Records, Chapter 27.53 Archaeological Sites and Resources, and Title 68 Chapter 60.050 Protection of historic graves,
2. Describe to regulatory and review agencies the procedures that Shannon & Wilson, Inc. will follow to prepare for and deal with inadvertent discoveries, and
3. Provide direction and guidance to project personnel on the proper procedures to be followed should an inadvertent discovery occur.

RECOGNIZING CULTURAL MATERIALS

A cultural resource discovery could be from the precontact or historic eras. Examples include the following.

- Accumulation of shell, burned rocks, or other food-related materials.
- Bones or small pieces of bone
- Area(s) of charcoal or very dark stained soil with artifacts
- Stone tools or waste flakes (i.e., an arrowhead or stone chips).
- Clusters of tin cans, bottles, and logging or agricultural equipment that appears to be older than 50 years.
- Buried railroad tracks, decking, or other industrial materials
- Historic structures, portions of historic structures, or associated utilities aged 40 years or older. These do not include structures already documented and determined not eligible for the NRHP by DAHP.

When in doubt, assume the material is a cultural resource.

ON-SITE RESPONSIBILITIES

STEP 1: STOP WORK. If any Shannon & Wilson employee, contractor, or subcontractor believes that they have uncovered a cultural resource at any point during the Project, all work adjacent to the discovery must stop. The discovery location should be secured at all times.

STEP 2: NOTIFY MONITOR. If there is an archaeological monitor for the Project, notify that person. If there a monitoring plan is in place, the monitor will follow its provisions. If there is no archaeological monitor in place, the Project Manager should be notified, at which time they should contact a professional archaeologist to examine the find and determine if it is a cultural resource or not and provide significance recommendations.

STEP 3: NOTIFY AND CONSULT WITH DAHP. Immediately contact DAHP to assist in the significance evaluation of all inadvertent discoveries of cultural resources. Any discovery deemed eligible for listing in the NRHP will be assessed and treated per the provisions set forth in this document (Appendix A to the Project MIDP). If the state agency representatives determine that the discovery is an eligible cultural resource, they and the affected Tribes will consult to determine the appropriate treatment to be presented and agreed upon in a Memorandum of Agreement (MOA) or other appropriate documentation.

Mitigation measures will be developed in consultation with the City of Tukwila, DAHP, and the affected Tribes (where appropriate), including avoidance through redesign, conducting data recovery, and/or relocating materials or remains. Agreed-upon treatment measures performed by Shannon & Wilson, Inc. may include protecting in place or data recovery such as mapping, photography, limited probing, sample collection, or other measures. This information is covered by the Public Records Act (RCW 42.17.250), and specific components of the records are exempt from disclosure (RCW 42.17.310(1)(k)) to avoid the looting or depredation of such sites.

PROTOCOL FOR TREATMENT OF HUMAN REMAINS

As per RCW 68.50.645, in the event that human remains or material evidence of burial sites are encountered within the Project area, whether during planned maintenance and construction activities, authorized archaeological excavations, or as a result of natural processes, the following protocol will be strictly followed.

1. If human skeletal remains are located within the Project area, all activity that may cause further disturbance to the remains will cease within at least 30 feet.
2. The area of the find will be secured and protected from further disturbance.
3. The finding of human skeletal remains will be reported to the King County Medical Examiner and local law enforcement in the most expeditious manner possible. The remains will not be touched, moved, or further disturbed.
4. The county medical examiner will assume jurisdiction over the human skeletal remains and make a determination of whether those remains are forensic or non-forensic. If the county medical examiner determines the remains are non-forensic, they will report that finding to the DAHP, who will take jurisdiction over the remains.
5. The DAHP will notify any appropriate cemeteries and all affected tribes of the find.
6. The State Physical Anthropologist will make a determination of whether the remains are Indian or Non-Indian and report that finding to any appropriate cemeteries and the affected tribes.
7. The DAHP will then handle all consultation with the affected parties as to the future preservation, excavation, and disposition of the remains.

Failure to follow this human-remains protocol is a misdemeanor in Washington State.

PROTOCOL FOR RESPONSE TO VANDALISM

Vandalism consists of disturbance to historic properties, including unauthorized digging into archaeological sites or collecting artifacts. The probability for vandalism within the project is low; however, if at any time, employees or contractors encounter unauthorized visitors who appear to be digging or collecting materials from the ground surface or are in possession of excavation equipment, or if a Shannon & Wilson representative encounters evidence of recent unauthorized excavations or abandoned digging equipment (such as screens or shovels), the following protocol will be implemented.

1. If a possible vandal or looter is present, the Shannon & Wilson representative will note information about the person, their equipment, and their vehicle and immediately relay the information to the work supervisor, who will confirm the information and notify the King County Sheriff's Office.
2. If the Shannon & Wilson representative notes abandoned excavations or digging equipment, they will notify within 24 hours the cultural resources coordinator, who will notify the King County Sheriff's Office and the DAHP. The cultural resources coordinator will visit the site as soon as possible to assess any damage.
3. If a Native American site has been vandalized, the cultural resources coordinator will notify representatives of the affected Tribes and the DAHP about this assessment and will invite them to attend the site inspection.

4. The assessment of impact will be described in a formal letter report from Shannon & Wilson, Inc. to the City of Tukwila, affected Tribes, and DAHP, if applicable.
5. In consultation with the City of Tukwila, affected tribes, and DAHP, Shannon & Wilson will identify what actions, if any, should be taken to mitigate damage to an affected site and/or prevent further damage.
6. Any act of vandalism or looting that involves human remains will also trigger the protocol for the treatment of human remains outlined above.
7. All acts of vandalism or looting will be referred to the King County Sheriff for investigation and possible prosecution.

PROTOCOL FOR EMERGENCY RESPONSE

Several events can occur within the Project that require a rapid response to safeguard facilities, provide for the protection of wildlife habitat, protect public and private property, and prevent serious injury or loss of human life. These include but are not limited to, wildfire, wind and electrical storms, mass wasting events (erosion), flood, earthquake, and dam or other Project facility failure. The emergency response protocol is designed to be implemented after such events have occurred.

1. The supervisor of response will notify the cultural resources coordinator of the location and nature of the emergency activities.
2. The cultural resources coordinator will check relevant databases for historic properties in the vicinity of the emergency.
3. If historic properties are in the area of the emergency or the response (for example, both the area of the wildfire and the location of the construction of a fire line), then the cultural resources coordinator will be responsible for conducting a professional review by a qualified person of the condition of those properties.
4. The cultural resources coordinator will use existing documentation as a comparison to a field visit to determine if historic properties and/or cultural resources have been destroyed, damaged, or endangered by the emergency event or the response. If any of these conditions exist, then the cultural resources coordinator will document them in the field with mapping, photographs, and, in the case of imminent loss, collection of artifacts. The cultural resources coordinator will prepare a report documenting the nature and location of the emergency event, the nature of the response, the impact on the historic properties and/or cultural resources, and any proposals to prevent further damage to the properties and mitigate for the loss. This report will be submitted to the City of Tukwila, affected tribes, and DAHP within 4 months of the event for review and comment. After a 30-day comment period, the comments of all of the consulting parties will be incorporated into a final report, and copies will be sent to all of the participating parties.
5. If no alteration to the condition of the properties has occurred, a letter to that effect noting the date(s) of the field visit(s) will be placed on file in lieu of the formal report.

AGENCY CONTACTS

Shannon & Wilson, Inc.
Primary Contact: Ryan Peterson
Mobile: 509-319-1135

Cultural Resources Specialist, Stell
Primary Contact: James Brown, Senior Archaeologist/Principal Investigator
Mobile: 425-931-1405

Washington Dept. of Ecology
Primary Contact: Tom Buroker, Northwest Regional Director
Office: 206-594-0003

King County Medical Examiner
Contact Number: 206-731-3232

King County Sheriff
Contact Number: 206-296-3311 or 911

City of Tukwila Police Department
Business Contact Number: 206-433-1808

City of Tukwila
Office: 6200 Southcenter Blvd. Tukwila, WA
Contact Number: 206-433-1800

Department of Archaeology & Historic Preservation Office
Primary Contact: Stephanie Jolivette, Local Government Archaeologist
Office: 360-586-3088

Secondary Contact: Dr. Guy Tasa, State Physical Anthropologist
Office: 360-586-3534

Tribal Contacts:

Duwamish Tribe
Primary Contact: Cecile Hansen, Chairwoman
Office: 206-431-1582

Suquamish Tribe
Primary Contact: Dennis Lewarch, Tribal Historic Preservation Officer
Office: 360-394-8529

Snoqualmie Nation
Primary Contact: Steve Mullen-Moses, Director of Archaeology and Historic Preservation
Office: 425-495-6097

Tulalip Tribes
Primary Contact: Richard Young, Cultural Resources Director
Office: 360-716-2652

Muckleshoot Indian Tribe
Primary Contact: Laura Murphy, Archaeologist
Office: 253-876-327

Stillaguamish Tribe
Primary Contact: Kerry Lyste, Tribal Historic Preservation Officer
Office: 360-652-7362 ext. 226

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APPENDIX B

Monitoring Logs

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Monitor: Nichole Padovano

Date: January 24-27, 2023

Provenience:
Location: 8801 East Marginal Way South, Tukwila, WA 98108

Excavation Summary:
Visibility: Good
NHRP Eligible: No

Summary (including daily excavation goals/achievements of crew, soil observations, cultural material observed and context, and additional comments):

January 24th, 2023

Nichole Padovano monitored the soil vapor extraction (SVE) of the northern trench of planned excavation located along the NW corner of 8801 E Marginal Way South, Tukwila WA. Trench was 160 ft in length, 2 ft in width, and 1 ft in depth, with the southern end terminating at the northside AS/SVE Building wall (see figure 3). On the northern side of the trench, sediment removed was a loose gray/brown silty sand with some small gravels. On the southern side, sediment removed was a loose mix of pale brown and orange-gray silty loam with many nodules and some compact orange-gray clay clumps. Where the trench connected with the building, sediment became very gravely with many angular/sub-Angular cobbles >= 20 cm. Cultural material extracted from trench was an old brick fragment, 6 in x 9 in.

January 25th, 2023

Nichole Padovano monitored the SVE of the southern trench of planned excavation located along the NW corner of 8801 E Marginal Way South, Tukwila WA. Trench was 100 ft in length, 2 ft in width, and 1 ft in depth, with the northern end terminating at the southside building wall (see figure 6). Trench was approximately ¾ completed when monitor arrived on site. On the southern side, sediment removed was an oily-black/brown compacted silty clay with many clay clumps and < 20% gravels. On the northern side, sediment removed was brown/orange-gray loose silty sand with some clay clumps. Cultural material extracted from trench included both colorless and amber glass shards, many terracotta fragments, 3 rusty metal pipe segments, and 1 old brick fragment. No source for terracotta fragments was discovered, but shards existed on the southern end of trench, both on the surface and subsurface. The largest metal pipe to be excavated (20 in x 5 in; piping was hollow but filled with compressed soil) was located from the south end of trench while the other two pipes (19 in x 1 in; 6 in x 1 in) were excavated from in the middle of the trench.

January 26th, 2023

Nichole Padovano monitored the SVE of the AS/SVE Building trench that connected the northern and southern trenches together. Trench blueprint was 50 ft in length, 4 ft in width, and 2 ft in depth, but restraints cutting concrete flooring stalled excavation process, and approximately 30 ft in length was excavated this day (see Figures 8 & 9. The northern end of this trench was connected to the southern end of the northern trench, while the southern end of this trench was terminated ~10 feet north of AS/SVE Building wall (See Figure 7). Additionally, a 13 ft long, 4 ft wide, 2 ft deep branch extending east was excavated 24 ft south from the northern point of this (see Figure 12). Soil excavated immediately below concrete was a very wet, poorly sorted, dark grayish brown silty loamy sand that was very congealed. Sediment was gravely, with many angular and sub-angular gravels and small cobbles. The second sediment layer contained dry, loose, very fine silty sand in varying colors of gray, brown, and grayish brown. This sediment was also gravely with 40% medium sub-angular cobbles. Cultural materials extracted included fragments of red brick, asbestos pipes, and colorless glass.

January 27th, 2023

Nichole Padovano monitored the completion of the SVE trench along the NW corner of 8801 E Marginal Way South, Tukwila WA. The southern point of the AS/SVE Building trench was connected to the northern point of the southern trench, completing this project component (see Figure 10). Sediment excavated was a fine, poorly sorted, brown silty sand that was loose and dry and contained 50% sub-angular/sub-rounded gravels and medium cobbles. Cultural materials extracted included asbestos fragments and many red bricks fragments ranging from small shard to whole brick.

Photo Log:

Figure 1: Overview of AS/SVE Building that separates the southern and northern trenches, facing West. Trenches are approximately10 feet east of Duwamish River

Figure 2: Overview of northern trench at start of excavation, facing South

Figure 3: Overview of northern trench at end of excavation, facing South

Figure 4: Overview of southern trench before excavation, facing Southwest

Figure 5: Overview of southern trench during excavation when monitor arrived on site, facing North

Figure 6: Overview of southern trench at end of excavation, facing North

Figure 7: Overview of AS/SVE Building trench at start of excavation, facing North

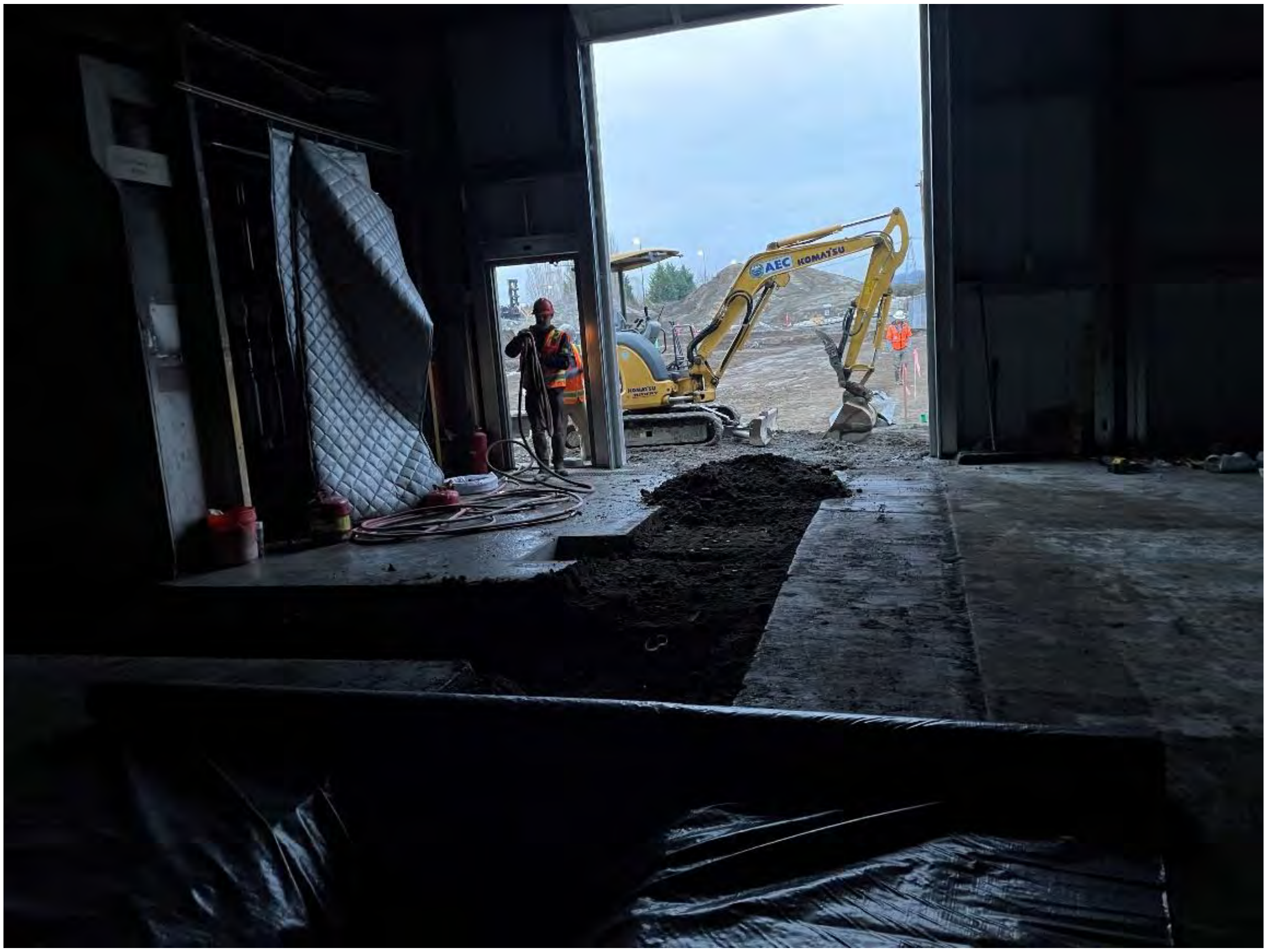

Figure 8: Inside overview of SVE Building trench at end of workday, 01/26/23, facing South

Figure 9: Outside overview of SVE Building trench at end of workday, 01/26/2023, facing North

Figure 10: Overview of AS/SVE Building trench connecting to southern trench, facing North

Figure 11: Overview of AS/SVE Building trench at completion of excavation, facing South

Figure 12: Overview of AS/SVE Building trench branch at completion of excavation, facing East

Monitor: Nichole Padovano

Date: March 2-11, 2023

Provenience:
Location: 8801 East Marginal Way South, Tukwila, WA 98108

Excavation Summary:
Visibility: Good
NHRP Eligible: No

Summary (including daily excavation goals/achievements of crew, soil observations, cultural material observed and context, and additional comments):

Along the west end of the APE boundary, air sparging wells (wells) were drilled approximately 30 feet below ground surface (bgs) where the contaminated ground water source lies as part of the Soil Vapor Extraction (SVE) plan to draw out contaminated soils and vapors. 22 borings were plotted 15 ft apart, running north to south, through the AS/SVE building, where each boring would serve as the foundation for a single screened well that would be inserted before the next boring was to be drilled. After the 22 wells were inserted into the ground, the crew would excavate a trench to reconnect the existing AS/SVE lines from below the south side of the AS/SVE Building to their severed counterparts ~30 ft ESE. Wells were drilled March 2-3, 2023 and March 6-7, 2023, while the trench was excavated March 9-11, 2023.

The crew started at the northern most boring, ASW-55, working south to boring ASW-34. Soil extractions were originally planned at 10 ft intervals until 20 ft bgs, and then 5 ft intervals until about 30 ft bgs, or further, soil depending. However, the use of high-water pressure to drill the well pushed loose sand out of the bit's way, and the soil could not be as easily collected. Extractions were thus limited to the two ends of sonic drilling: 0-10 ft bgs and 30-35 ft bgs. The soil that was extracted was dumped into the back of a trailer with the other extracted soils and was not collected. No significant cultural resources were identified at this time.

March 2nd, 2023

The ground disturbing activity of the day was 4" core barrel extractions by a sonic drill rig of the NW section of the APE. 1 of the 22 pre-plotted borings was extracted (ASW-55). Nichole Padovano arrived on site at 13:00, a brief safety meeting was conducted to go over the sonic drill. Drilling began at 13:47, and ended at 14:50. Archaeologist left site at 16:00. No cultural resources were identified.

March 3rd, 2023

The ground disturbing activity of the day was 4" core barrel extractions by a sonic drill rig on the NW section of the APE. 6 of the 22 pre-plotted borings were extracted (ASW-54 – ASW-49). Soil extractions were conducted between 0-10 ft bgs and 30-35 ft bgs. Nichole Padovano arrived on site at 08:00; drilling began at 9:12 and ended for the day at 15:51. Archaeologist left site at 16:00. No cultural resources were identified.

March 6th, 2023

The ground disturbing activity of the day was 4” core barrel extractions by a sonic drill rig on the NW and SW sections of the APE. 6 of the 22 pre-plotted borings were extracted (ASW-48 – ASW-46; ASW-41 – ASW-39). The section north of the AS/SVE Building was completed with ASW-46 and the section south of the AS/SVE building began at ASW-41. Soil extractions were conducted between 0-10 ft bgs and 30-35 ft bgs. Nichole Padovano arrived on site at 08:00; drilling began at 08:45 and ended for the day at 16:03. Archaeologist left site at 16:15. No cultural resources were identified.

March 7th, 2023

The ground disturbing activity of the day was 4” core barrel extractions by a sonic drill rig on the SW section of the APE and in the AS/AVE Building. 9 of the 22 pre-plotted borings were extracted (ASW-38 – ASW-34; ASW-45 – ASW-42), finishing the drilling portion of this task. Two drills were operated simultaneously in order to finish drilling by the end of the day. The larger drill operated outside the AS/SVE Building on the southwestern portion of the APE, while the smaller of the two drills operated inside the AS/SVE Building. The smaller drill was missing the correct liners to extract soil, so borings ASW-45 – ASW-42 did not have soil analyzed. Archaeologist was present, however, to observe the drilling process, despite the soil not being collected. Nichole Padovano arrived on site at 08:45; drilling began at 08:45 and ended at 13:51. Archaeologist left site at 14:00. No cultural resources were identified.

March 8th, 2023

Archaeologist was not needed on site for this day.

March 9th, 2023

The ground disturbing activity of the day was trenching to reconnect existing AS/SVE lines from below the south side of the AS/SVE Building to their severed counterparts ~30 ft ESE. Both ends of trench were excavated, completely exposing each set of the preexisting AS/SVE lines. The west end trench, on the south side of the AS/SVE Building, was more shallow at about ~4-5 ft deep, while the east end trench was excavated to be about 6 ft deep. Soil observed included:

- Yellowish Brown Sand, Loose, Dry, Fine, Poorly Sorted; 20% Medium-Fine Gravels
- 80% Medium-Fine Sub-Rounded Gravels; 10% Angular Cobbles; Some Brown Silty Sand
- Reddish/Orangish Brown Sandy Silt, Very Fine; Many Sub-Angular Cobbles
- Dark Brown Silty Sand, Poorly Sorted, Loose, Dry, Many Angular Cobbles

Nichole Padovano arrived on site at 07:45; excavation began at 8:00 and ended for the day at 14:45. Archaeologist left site at 15:00. Cultural materials extracted included fragments of brick, metal, and old PCP pipe.

March 10th, 2023

The ground disturbing activity of the day was trenching to reconnect existing AS/SVE lines from below the south side of the AS/SVE Building to their severed counterparts ~30 ft ESE. A set of pipes unaffiliated with this project were uncovered along the NW side of the trench, which caused the crew to use a laser to measure the pipes depths. Additionally, a 10ft x 10 ft x 1 ft slab of concrete that extended over the unaffiliated pipe paused excavation until crew could get a saw to cut through the slab. Soil observed was a mix of dark brown silty sand and reddish/orangish brown sandy silt. Many angular cobbles existed throughout. Nichole Padovano arrived on site at 07:00; excavation began at 07:45 and ended for the day at 15:52. Archaeologist left site at 16:00. Cultural materials extracted included fragments of brick, PCP pipe, and modern trash.

March 11th, 2023

The ground disturbing activity of the day was trenching to reconnect existing AS/SVE lines from below the south side of the AS/SVE Building to their severed counterparts ~30 ft ESE. Both ends of the trench were connected, and the trench was completed. Soil observed was a mix of dark brown silty sand and reddish/orangish brown sandy silt. Many angular cobbles existed throughout. Nichole Padovano arrived on site at 07:00; excavation began at 7:07 and ended at 09:50. Archaeologist left site at 10:20. Cultural materials extracted included fragments of brick, PCP pipe, and modern trash.

Monitor Table

ASW-55 Sonic Drilling Description Log

Depth of SPT	Cultural Materials	Soil Description	Photo Log
0-10 ft bgs	Negative	Brown Silty Sand, Loose, Dry on top; Brown-Gray Wet, Cemented Sandy Loam with depth	Figure 2
10-20 ft bgs	Negative	Gray Clayey Loam, Wet, Very Cemented, Very Fine, Very Well Sorted on top. With depth, Black, Angular Sand, Fine-Medium, Poorly Sorted, Wet	Figure 3
20-25 ft bgs	Negative	Black, Angular Sand, Fine-Medium, Very Poorly Sorted. Gray Sandy Loam, Very Wet, Very Cemented, Poorly Sorted	Figure 4
25-30 ft bgs	Negative	Black Angular Sand, Fine-Medium, Very Poorly Sorted Sand, Very Wet	Figure 5
30-35 ft bgs	Negative	Black Angular Sand, Fine-Medium, Very Poorly Sorted Sand, Very Wet. Very Dark Gray Silty Sand, Finer, More Well Sorted, Wet, Very Cemented	Figure 6
35-40 ft bgs	Negative	Very Dark Gray/Black Silty Sand, Poorly Sorted, Slightly Cemented, Very Wet, Some Fine Gravels. Terminated at 40 ft bgs.	Figure 7

Note:
Located at northern most end of boring line, at north end in northwestern portion. Drilling began at 13:12 and ended at 14:50.

ASW-54 Sonic Drilling Description Log

Depth of SPT	Cultural Materials	Soil Description	Photo Log
0-30 ft bgs	Negative	Brown Silty Sand, Some Nodules, Slightly Cemented but Fairly Loose. Gray Clay, Very Fine, Very Well Sorted, Very Cemented, Wet. Gray-Brown Sandy Loam, Wet, Poorly Sorted. Black Angular Sand, Very Poorly Sorted, Very Wet, Some Medium Gravels. Started looking wet around 10 ft bgs	Figure 9
30-35 ft bgs	Negative	Black Angular Sand, Very Poorly Sorted, Very Wet, Some Silty Loamy Sand in mix. Terminated at 35 ft bgs.	Figure 10

Note:
Located 15 ft S of ASW-55. Drilling began at 9:12 and ended at 9:35.

ASW-53 Sonic Drilling Description Log

Depth of SPT	Cultural Materials	Soil Description	Photo Log
0-10 ft bgs	Negative	Grayish, Orangish Brown San, Dry(ish), Loose, Very Poorly Sorted, Fine, Angular. Gray Clay, Very Fine, Very Well Sorted, Very Cemented, Wet	Figure 13
30-35 ft bgs	Negative	Black Angular Sand, Very Poorly Sorted, Wet, Some Silty Loamy Sand in Mix. Terminated at 35 ft bgs.	Figure 14

Note:
Located 15 ft S of ASW-54. Drilling started at 10:18 and ended at 10:48.

ASW-52 Sonic Drilling Description Log

Depth of SPT	Cultural Materials	Soil Description	Photo Log
0-10 ft bgs	Negative	Black Angular Sand, Very Poorly Sorted, Wet, No Silt, Some Sub-Rounded Fine-Medium Gravels	Figure 17
30-35 ft bgs	Negative	Black Angular Sand, Very Poorly Sorted, Wet, Some Silty Loamy Sand in Mix. Terminated at 35 ft bgs.	Figure 18

Note:
Located 15 ft S of ASW-53. Drilling started at 11:26 and ended at 11:50.

ASW-51 Sonic Drilling Description Log

Depth of SPT	Cultural Materials	Soil Description	Photo Log
0-10 ft bgs	Negative	Brown Silty Sand, Dry, Loose, Poorly Sorted, Many Nodules. Dark Gray Silty Clay, Very Fine, Very Well Sorted, Very Cemented, Wet, Some Sub-Angular Gravels	Figure 21
30-35 ft bgs	Negative	Black Angular Sand, Poorly Sorted, Wet, Some Silty Loamy Sand in Mix. Terminated at 35 ft bgs.	Figure 22

Note:
Located 15 ft S of ASW-52. Drilling started at 13:33 and ended at 13:50.

ASW-50 Sonic Drilling Description Log

Depth of SPT	Cultural Materials	Soil Description	Photo Log
0-10 ft bgs	Negative	Orangish Brown Silty Sand, Dry, Loose, Poorly Sorted, Some Nodules. Gray Silty Clay, Very Fine, Very Well Sorted, Very Cemented, Wet	Figure 25

Depth of SPT	Cultural Materials	Soil Description	Photo Log
30-35 ft bgs	Negative	Black Angular Sand, Poorly Sorted, Wet. Very Dark Gray Sandy Loam, Slightly Cemented, Very Wet. Terminated at 35 ft bgs.	Figure 26

Note:
Located 15 ft S of ASW-51. Drilling started at 14:25 and ended at 14:48.

ASW-49 Sonic Drilling Description Log

Depth of SPT	Cultural Materials	Soil Description	Photo Log
0-10 ft bgs	Negative	Brown Silty Sand, Wet, Loose, Poorly Sorted, Many Nodules. Gray Silty Clay, Very Fine, Very Well Sorted, Very Cemented, Wet	Figure 29
30-35 ft bgs	Negative	Black Angular Sand, Poorly Sorted, Wet, Loose, Some Presence of Fine Silts. Terminated at 35 ft bgs.	Figure 30

Note:
Located 15 ft S of ASW-50. Drilling started at 15:13 and ended at 15:51.

ASW-48 Sonic Drilling Description Log

Depth of SPT	Cultural Materials	Soil Description	Photo Log
0-10 ft bgs	Negative	Brown Silty Sand, Dry, Loose, Poorly Sorted, Many Nodules. Gray Silty Clay, Very Fine, Very Well Sorted, Very Cemented, Wet	Figure 33
30-35 ft bgs	Negative	Black Angular Sand, Poorly Sorted, Wet, Loose. Dark Gray, Very Fine Sandy Silt, Cemented, Wet, Some Fine Gravels. Terminated at 35 ft bgs.	Figure 34

Note:
Located 15 ft S of ASW-49. Started drilling at 08:45 and ended at 09:10. Use of a straight bit with no auger mixed soils, explaining the contrasting gray soil mix at 30-35 ft bgs.

ASW-47 Sonic Drilling Description Log

Depth of SPT	Cultural Materials	Soil Description	Photo Log
0-10 ft bgs	Negative	Orangish Brown Silty Sand, Very Fine, Well Sorted, Slightly Cemented (More Cemented than Loose), Slightly Wet, Some Fine Gravels. Light Gray Silty Clay, Very Cemented, Wet, Well Sorted, Many Fine-Medium Sub-Rounded Gravels	Figure 37

Depth of SPT	Cultural Materials	Soil Description	Photo Log
30-35 ft bgs	Negative	N/A - Soil slid out of the bit used (straight, no auger). Bit was replaced with an auger, but soil slid out of this too. Terminated at 35 ft bgs.	N/A

Note:
Located 15 ft S of ASW-48. Drilling started at 9:53 and ended at 10:37.

ASW-46 Sonic Drilling Description Log

Depth of SPT	Cultural Materials	Soil Description	Photo Log
0-10 ft bgs	Negative	Orangish Brown Silty Sand, Poorly Sorted, Loose, Dry. Light Gray Silty Clay, Slightly Wet, Compact, Poorly Sorted, Many Fine-Medium Sun-Rounded Gravels.	Figure 40
30-35 ft bgs	Negative	Black Silty Sand, Fine, Very Poorly Sorted, Very Wet, Slightly Compact (Still Fairly Loose). Terminated at 35 ft bgs.	Figure 41

Note:
Located 15 ft S of ASW-47, last boring in northwestern section, ~1 ft N of AS/SVE Building. Drilling started at 11:20 and ended at 11:43.

ASW-41 Sonic Drilling Description Log

Depth of SPT	Cultural Materials	Soil Description	Photo Log
0-10 ft bgs	Negative	Orangish Brown Silty Sand, Poorly Sorted, Loose, Dry. Light Gray Silty Clay, Slightly Wet, Compact, Poorly Sorted, Many Fine-Medium Sub-Rounded Gravels. Dark Gray Silty Sand, Very Dry, Very Loose, Very Poorly Sorted, Many Fine Angular/Sub-Angular Gravels.	Figure 45
30-35 ft bgs	Negative	Dark Brownish Gray, Very Silty Sand, Fine, Very Poorly Sorted, Very Wet, Slightly Compact, Some Fine Gravels. Terminated at 35 ft bgs.	Figure 46

Note:
First boring to be drilled in southwestern section, ~18 ft S from AS/SVE Building. Drilling started at 13:33 and ended at 13:56.

ASW-40 Sonic Drilling Description Log

Depth of SPT	Cultural Materials	Soil Description	Photo Log
0-10 ft bgs	Negative	Mostly Light Gray Silty Clay, Slightly Wet, Compact, Poorly Sorted, Many Fine-Medium Sub-Rounded Gravels. Dark Gray Silty Sand, Very Dry, Very Loose, Very Poorly Sorted, Many Fine Angular/Sub-Angular Gravels. Trace Orangish Brown Silty Sand, Poorly Sorted, Loose, Dry.	Figure 49
30-35 ft bgs	Negative	N/A - Wooden pieces found around 30-35 ft bgs mulched soil so that it slid out of auger bit and could not be collected. Terminates at 35 ft bgs.	N/A

Note:
Located 15 ft S of ASW-41. Drilling started at 14:30 and ended at 15:02.

ASW-39 Sonic Drilling Description Log

Depth of SPT	Cultural Materials	Soil Description	Photo Log
0-10 ft bgs	Negative	Dark Gray Silty Clay, Compact, Wet and Light Gray Silty Clay, Loose, Dry; Both Very Poorly Sorted, with Many Fine Sub-Rounded/Sub-Angular Gravels.	Figure 52
30-35 ft bgs	Negative	Black Sand, Angular, Loose, Wet, Very Poorly Sorted. Terminated at 35 ft bgs.	Figure 53

Note:
Located 15 ft S of ASW-40. Drilling started at 15:40 and ended at 16:03.

ASW-38 Sonic Drilling Description Log

Depth of SPT	Cultural Materials	Soil Description	Photo Log
0-10 ft bgs	Negative	Orangish Brown Silty Sand, Slightly Wet but Mostly Dry, Loose, Poorly Sorted	Figure 56
30-35 ft bgs	Negative	Black Sand, Angular, Wet, Lose, Very Poorly Sorted. Very Dark Gray, Very Fine Sandy Silt, Very Wet, Cemented. Terminated at 35 ft bgs.	Figure 57

Note:
Located 15 ft S of ASW-39. Drilling started at 08:58 and ended at 09:24.

ASW-37 Sonic Drilling Description Log

Depth of SPT	Cultural Materials	Soil Description	Photo Log
0-10 ft bgs	Negative	Brown Silty Sand, Dry, Loose, Many Nodules. Dark Gray Clay, Dry, Cemented.	Figure 62
30-35 ft bgs	Negative	Black Silty Sand, Very Angular, Very Poorly Sorted, Wet, Slightly Compact (Still Fairly Loose). Terminated at 35 ft bgs.	Figure 65

Note:
Located 15 ft S of ASW-38. Drilling started at 10:10 and ended at 10:27.

ASW-36 Sonic Drilling Description Log

Depth of SPT	Cultural Materials	Soil Description	Photo Log
0-10 ft bgs	Negative	Brown Silty Sand, Very Fine, Wet, Cemented, Many Fine-Medium Sub-Angular Gravels. Gray Clay, Poorly Sorted, Slightly Wet, Very Cemented	Figure 67
30-35 ft bgs	Negative	Very Dark Gray/Black Silty Sand, Both Part Very Cemented, And More Loose/Less Cemented, Poorly Sorted, Very Wet. Terminated at 35 ft bgs.	Figure 69

Note:
Located 15 ft S of ASW-37. Drilling started at 11:00 and ended at 11:24.

ASW-35 Sonic Drilling Description Log

Depth of SPT	Cultural Materials	Soil Description	Photo Log
0-10 ft bgs	Negative	Dark Brown, Very Fine Silty Sand, Dry, Slightly Cemented, Many Nodules. Dark Gray Clay, Very Dry, Very Cemented, Poorly Sorted, Many Fine-Medium Sub-Rounded/Sub-Angular Gravels	Figure 74
30-35 ft bgs	Negative	Black Silty Sand with Trace Fine Angular Sand, Very Poorly Sorted, Very Wet, Slightly Compact (Still Fairly Loose). Terminated at 35 ft bgs.	Figure 75

Note:
Located 15 ft S of ASW-36. Drilling started at 12:12 and ended at 12:34.

ASW-34 Sonic Drilling Description Log

Depth of SPT	Cultural Materials	Soil Description	Photo Log
0-10 ft bgs	Negative	Dark Gray Clay, Mostly Very Dry, Some Slightly Wet, Very Cemented, Very Poorly Sorted, Many Fine-Medium Angular/Sub-Angular/Sub-Rounded Gravels	Figure 80

Depth of SPT	Cultural Materials	Soil Description	Photo Log
30-35 ft bgs	Negative	Very Dark Gray/Black Silty Sand with Trace Fine Angular Sand, Both Part Very Cemented, And More Loose/Less Cemented, Poorly Sorted, Very Wet. Terminated at 35 ft bgs.	Figure 82

Note:
Southern most boring in boring line, located 15 ft S of ASW-34. Drilling started at 13:34 and ended at 13:55.

ASW-45 Sonic Drilling Description Log

Depth of SPT	Cultural Materials	Soil Description	Photo Log
0-35 ft bgs	Negative	N/A - Soil Not Collected Due to Drill Missing Correct Liners. Terminated at 35 ft bgs.	N/A

Note:
Northern most boring inside AS/SVE Building; first boring to be drilled in building. Drilling started at 09:55 and ended at 10:15.

ASW-44 Sonic Drilling Description Log

Depth of SPT	Cultural Materials	Soil Description	Photo Log
0-35 ft bgs	Negative	N/A - Soil Not Collected Due to Drill Missing Correct Liners. Terminated at 35 ft bgs.	N/A

Note:
Middle boring inside AS/SVE Building, located 15 ft S of ASW-45. Drilling started at 11:04 and ended at 11:25.

ASW-43 Sonic Drilling Description Log

Depth of SPT	Cultural Materials	Soil Description	Photo Log
0-35 ft bgs	Negative	N/A - Soil Not Collected Due to Drill Missing Correct Liners. Terminated at 35 ft bgs.	N/A

Note:
Southern most boring inside AS/SVE Building, located 15 ft S of ASW-44. Drilling Started 12:14 and ended at 12:36.

ASW-42 Sonic Drilling Description Log

Depth of SPT	Cultural Materials	Soil Description	Photo Log
0-35 ft bgs	Negative	N/A - Soil Not Collected Due to Drill Missing Correct Liners. Terminated at 35 ft bgs.	N/A

Note:
Located 15 ft S of ASW-43 and 15 ft N of ASW-41, northern most boring on the S side of the AS/SVE Building, approximately 3 ft S of building wall. Drilling started at 13:30 and ended at 13:51.

Photo Log

Figure 1: ASW-55 Overview at Start of Drilling

Figure 2: ASW-55 Soil Extraction 0-10 ft bgs

Figure 3: ASW-55 Soil Extraction 10-20 ft bgs

Figure 4: ASW-55 Soil Extraction 20-25 ft bgs

Figure 5: ASW-55 Soil Extraction 25-30 ft bgs

Figure 6: ASW-55 Soil Extraction 30-35 ft bgs

Figure 7: ASW-55 Soil Extraction 35-40 ft bgs

Figure 8: ASW-54 Overview at Start of Drilling

Figure 9: ASW-54 Soil Extraction 0-30 ft bgs

Figure 10: ASW-54 Soil Extraction 30-35 ft bgs

Figure 11: ASW-54 Overview at End of Drilling

Figure 12: ASW-53 Overview at Start of Drilling

Figure 13: ASW-53 Soil Extraction 0-10 ft bgs

Figure 14: ASW-53 Soil Extraction 30-35 ft bgs

Figure 15: ASW-53 Overview at End of Drilling

Figure 16: ASW-52 Overview at Start of Drilling

Figure 17: ASW-52 Soil Extraction 0-10 ft bgs

Figure 18: ASW-52 Soil Extraction 30-35 ft bgs

Figure 19: ASW-52 Overview at End of Drilling

Figure 20: ASW-51 Overview at Start of Drilling

Figure 21: ASW-51 Soil Extraction 0-10 ft bgs

Figure 22: ASW-51 Soil Extraction 30-35 ft bgs

Figure 23: ASW-51 Overview at End of Drilling

Figure 24: ASW-50 Overview at Start of Drilling

Figure 25: ASW-50 Soil Extraction 0-10 ft bgs

Figure 26: ASW-50 Soil Extraction 30-35 ft bgs

Figure 27: ASW-50 Overview at End of Drilling

Figure 28: ASW-49 Overview at Start of Drilling

Figure 29: ASW-49 Soil Extraction 0-10 ft bgs

Figure 30: ASW-49 Soil Extraction 30-35 ft bgs

Figure 31: ASW-49 Overview at End of Drilling

Figure 32: ASW-48 Overview at Start of Drilling

Figure 33: ASW-48 Soil Extraction 0-10 ft bgs

Figure 34: ASW-48 Soil Extraction 30-35 ft bgs

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Figure 36: ASW-47 Overview at Start of Drilling

Figure 37: ASW-47 Soil Extraction 0-10 ft bgs

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Figure 48: ASW-40 Overview at Start of Drilling

Figure 49: ASW-40 Soil Extraction 0-10 ft bgs

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Figure 52: ASW-39 Soil Extraction 0-10 ft bgs

Figure 53: ASW-39 Soil Extraction 30-35 ft bgs

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Figure 55: ASW-38 Overview at Start of Drilling

Figure 56: ASW-38 Soil Extraction 0-10 ft bgs

Figure 57: ASW-38 Soil Extraction 30-35 ft bgs

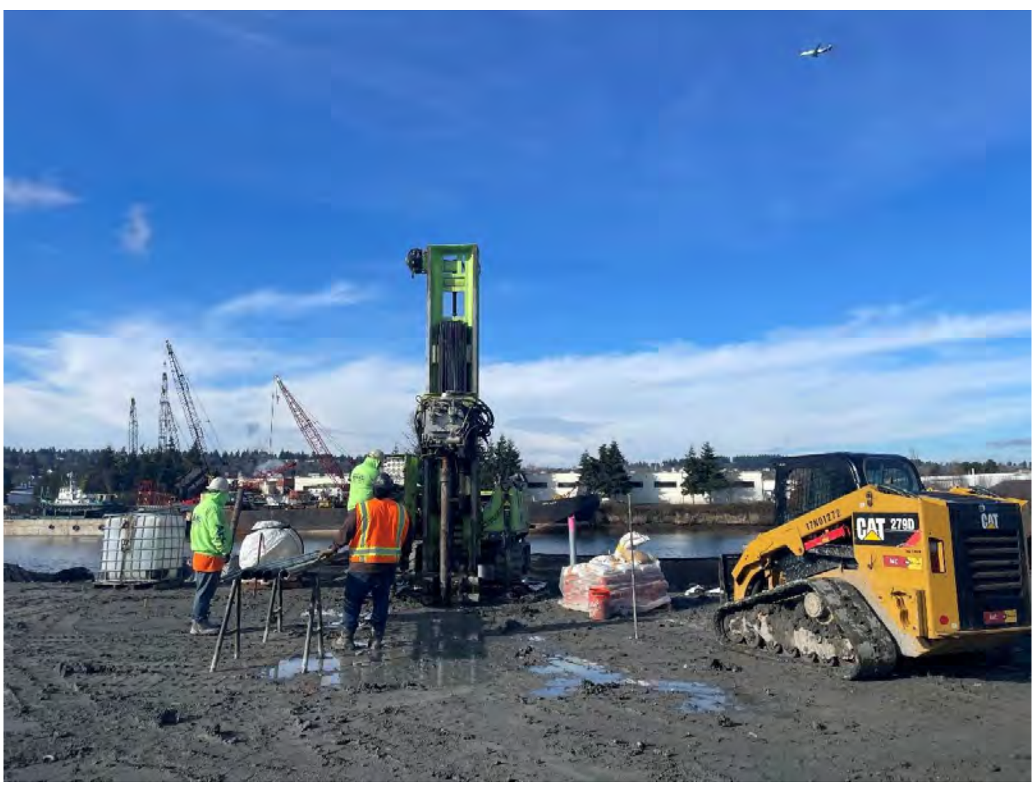

Figure 58: ASW-38 Overview at End of Drilling

Figure 59: Overview of AS/SVE Building Before Drilling

Figure 60: ASW-45 Overview at Start of Drilling

Figure 61: ASW-37 Overview at Start of Drilling

Figure 62: ASW-37 Soil Extraction 0-10 ft bgs

Figure 63: ASW-45 Overview at End of Drilling

Figure 64: ASW-37 Overview at End of Drilling

Figure 65: ASW-37 Soil Extraction 30-35 ft bgs

Figure 66: ASW-36 Overview at Start of Drilling

Figure 67: ASW-36 Soil Extraction 0-10 ft bgs

Figure 68: ASW-44 Overview at Start of Drilling

Figure 69: ASW-36 Soil Extraction 30-35 ft bgs

Figure 70: ASW-36 Overview at End of Drilling

Figure 71: ASW-44 Overview at End of Drilling

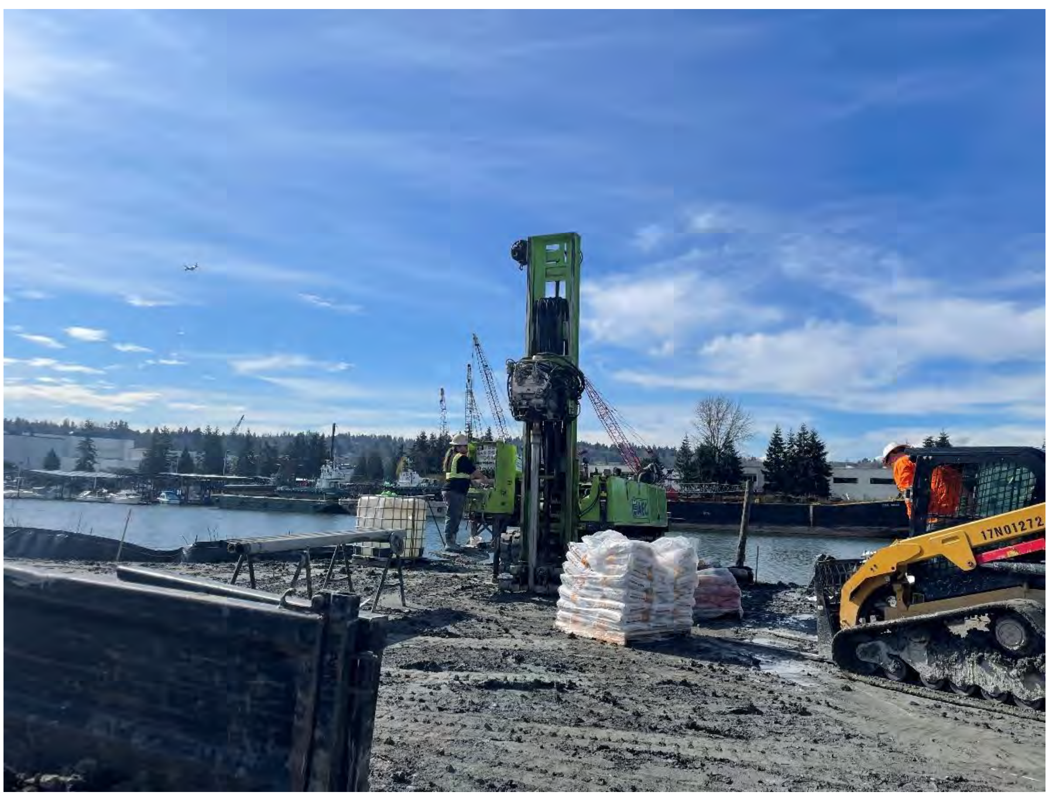

Figure 72: ASW-35 Overview at Start of Drilling

Figure 73: ASW-43 Overview at Start of Drilling

Figure 74: ASW-35 Soil Extraction 0-10 ft bgs

Figure 75: ASW-35 Soil Extraction 30-35 ft bgs

Figure 76: ASW-35 Overview at End of Drilling

Figure 77: ASW-43 Overview at End of Drilling

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Figure 79: ASW-34 Overview at Start of Drilling

Figure 80: ASW-34 Soil Extraction 0-10 ft bgs

Figure 81: ASW-42 Overview at End of Drilling

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Figure 108: E and W Trenches Merge

Figure 109: Completion of Trench Excavation Overview

Figure 110: Completion of Trench Excavation Overview

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APPENDIX E: BORING LOGS

Appendix E

Boring Logs

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Shannon & Wilson uses a soil identification system modified from the Unified Soil Classification System (USCS). Elements of the USCS and other definitions are provided on this and the following page. Soil descriptions are based on visual-manual procedures (ASTM D2488) and laboratory testing procedures (ASTM D2487), if performed.

Structure[1]	
Interbedded	Alternating layers of varying material or color with layers at least 1/4-inch-thick; singular: bed.
Laminated	Alternating layers of varying material or color with layers less than 1/4-inch-thick; singular: lamination.
Fissured	Breaks along definite planes or fractures with little resistance.
Slickensided	Fracture planes appear polished or glossy; sometimes striated.
Blocky	Cohesive soil that can be broken down into small angular lumps that resist further breakdown.
Lensed	Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay.
Homogeneous	Same color and appearance throughout.

Angularity and Shape[1]	
Angular	Sharp edges and unpolished planar surfaces.
Subangular	Similar to angular, but with rounded edges.
Subrounded	Nearly planar sides with well-rounded edges.
Rounded	Smoothly curved sides with no edges.
Flat	Width/thickness ratio > 3.
Elongated	Length/width ratio > 3.

Standard Penetration Test (SPT)[3]	
Hammer	140 pounds with a 30-inch free fall. Rope on 6- to 10-inch-diameter cathead 2-1/4 rope turns, > 100 rpm. If automatic hammers are used, blow counts shown on boring logs should be adjusted to account for efficiency of hammer.
Sampler	10 to 30 inches long Shoe I.D. = 1.375 inches Barrel I.D. = 1.5 inches Barrel O.D. = 2 inches
N-Value	Sum blow counts for second and third 6-inch increments. Refusal: 50 blows for 6 inches or less or 10 blows for 0 inch.

Moisture Content	
Dry	Absence of moisture, dusty, dry to the touch.
Moist	Damp but no visible water.
Wet	Visible free water, from below water table.

Gradation	
Poorly Graded	Narrow range of grain sizes present or, within the range of grain sizes present, one or more sizes are missing (Gap Graded). Meets criteria in ASTM D2487, if tested.
Well-Graded	Full range and even distribution of grain sizes present. Meets criteria in ASTM D2487, if tested.

Cementation[1]	
Weak	Crumbles/breaks with handling or slight finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

Plasticity[2]		
Nonplastic	Cannot roll a 1/8-in. thread at any water content.	PI < 4
Low	A thread can barely be rolled and a lump cannot be formed when drier than the plastic limit.	4 < PI < 10
Medium	A thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. A lump crumbles when drier than the plastic limit.	10 < PI < 20
High	It takes considerable time rolling and kneading to reach the plastic limit. A thread can be rerolled several times after reaching the plastic limit. A lump can be formed without crumbling when drier than the plastic limit.	PI > 21

Additional Terms	
Mottled	Irregular patches of different colors.
Bioturbated	Soil disturbance or mixing by plants or animals.
Diamict	Nonsorted sediment; sand and gravel in silt and/or clay matrix.
Cuttings	Material brought to surface by drilling.
Slough	Material that caved from sides of borehole.
Sheared	Disturbed texture, mix of strengths.

Notes:

[1]Reprinted, with permission, from ASTM D2488 - 09a Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), copyright ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428. A copy of the complete standard may be obtained from ASTM International, www.astm.org.

[2]Adapted, with permission, from ASTM D2488 - 09a Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), copyright ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428. A copy of the complete standard may be obtained from ASTM International, www.astm.org.

[3]Penetration resistances (N-values) shown on boring logs are as recorded in the field and have not been corrected for hammer efficiency, overburden, or other factors.

SOIL DESCRIPTION AND LOG KEY

AS/SVE System Extension and Modification
Final Compliance Monitoring Report
8801 East Marginal Way S.

Unified Soil Classification System (USCS)
Modified From USACE Tech Memo 3-357, ASTM D2487, and ASTM D2488

Major Divisions			Symbol	Typical Identifications
Coarse-Grained Soils *(more than 50% retained on No. 200 sieve)*	Gravels *(more than 50% of coarse fraction retained on No. 4 sieve)*	Gravel *(less than 5% fines)*	GW	Well-graded Gravel; Well-graded Gravel with Sand
			GP	Poorly Graded Gravel; Poorly Graded Gravel with Sand
		Silty or Clayey Gravel *(more than 12% fines)*	GM	Silty Gravel; Silty Gravel with Sand
			GC	Clayey Gravel; Clayey Gravel with Sand
	Sands *(50% or more of coarse fraction passes the No. 4 sieve)*	Sand *(less than 5% fines)*	SW	Well-graded Sand; Well-graded Sand with Gravel
			SP	Poorly Graded Sand; Poorly Graded Sand with Gravel
		Silty or Clayey Sand *(more than 12% fines)*	SM	Silty Sand; Silty Sand with Gravel
			SC	Clayey Sand; Clayey Sand with Gravel
Fine-Grained Soils *(50% or more passes the No. 200 sieve)*	Silts and Clays *(liquid limit less than 50)*	Inorganic	ML	Silt; Silt with Sand or Gravel; Sandy or Gravelly Silt
			CL	Lean Clay; Lean Clay with Sand or Gravel; Sandy or Gravelly Lean Clay
		Organic	OL	Organic Silt or Clay; Organic Silt or Clay with Sand or Gravel; Sandy or Gravelly Organic Silt or Clay
	Silts and Clays *(liquid limit 50 or more)*	Inorganic	MH	Elastic Silt; Elastic Silt with Sand or Gravel; Sandy or Gravelly Elastic Silt
			CH	Fat Clay; Fat Clay with Sand or Gravel; Sandy or Gravelly Fat Clay
		Organic	OH	Organic Silt or Clay; Organic Silt or Clay with Sand or Gravel; Sandy or Gravelly Organic Silt or Clay
Highly Organic Soils	Primarily organic matter, dark in color, and organic odor		PT	Peat or other highly organic soils (see ASTM D4427)

Acronyms and Abbreviations

ATD	At Time of Drilling	MgO	Magnesium Oxide	psi	Pounds per Square Inch
Diam.	Diameter	mm	Millimeter	PVC	Polyvinyl Chloride
Elev.	Elevation	MnO	Manganese Oxide	rpm	Rotations per Minute
ft	Feet	NA	Not Applicable or Not Available	SPT	Standard Penetration Test
FeO	Iron Oxide	NP	Nonplastic	USCS	Unified Soil Classification System
gal	Gallons	O.D.	Outside Diameter	q_u	Unconfined Compressive Strength
Horiz.	Horizontal	OW	Observation Well	VWP	Vibrating Wire Piezometer
HSA	Hollow-Stem Auger	pcf	Pounds per Cubic Foot	Vert.	Vertical
I.D.	Inside Diameter	PID	Photoionization Detector	WOH	Weight of Hammer
in	Inches	PMT	Pressuremeter Test	WOR	Weight of Rods
lbs	Pounds	ppm	Parts per Million	Wt	Weight

Well and Backfill Symbols

- Bentonite Cement Grout
- Bentonite Grout
- Bentonite Chips
- Silica Sand
- Perforated or Screened Casing
- Surface Cement Seal
- Asphalt or Cap
- Slough
- Inclinometer or Non-perforated Casing
- Instrumentation Riser or Electrical Lead
- Vibrating Wire Piezometer with Designation

Relative Density
Cohesionless Soils

N, SPT, Blows/ft	Relative Density
< 4	Very loose
4 - 10	Loose
10 - 30	Medium dense
30 - 50	Dense
> 50	Very dense

Relative Consistency
Cohesive Soils

N, SPT, Blows/ft	Relative Consistency
< 2	Very soft
2 - 4	Soft
4 - 8	Medium stiff
8 - 15	Stiff
15 - 30	Very stiff
> 30	Hard

Percentages[1, 2]

Trace	< 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

Notes:

Dual symbols *(symbols separated by a hyphen, i.e., SP-SM, Sand with Silt)* are used for soils with between 5% and 12% fines or when the liquid limit and plasticity index values plot in the CL-ML area of the plasticity chart. Graphics shown on the logs for these soil types are a combination of the two graphic symbols (e.g., SP and SM).

Borderline symbols *(symbols separated by a slash, i.e., CL/ML, Lean Clay to Silt; SP-SM/SM, Sand with Silt to Silty Sand)* indicate that the soil properties are close to the defining boundary between two groups.

No. 4 size = 4.75 mm = 0.187 in.; No. 200 size = 0.075 mm = 0.003 in.

Total Depth:	36 ft.	Northing:	193,824 ft.	Drilling Method:	Sonic Core	Hole Diam.:	5 in.
Top Elevation:	12.4 ft.	Easting:	1,276,449 ft.	Drilling Company:	AEC	Rod Diam.:	3 in.
Vert. Datum:	NGVD 1929	Station:	N/A	Drill Rig Equipment:	Terra Sonic 150cc	Hammer Type:	
Horiz. Datum:	State WA-N	Offset:	N/A	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Soil Description	Depth, ft.	Samples
Brown, *Silty Sand (SM)*; moist; trace fine gravel; mostly fine to coarse sand; some silt; some organics (roots, twigs, wood chips, bark). (Fill)	1.0	
Gray *Silt with Sand and Gravel (ML)*; moist; trace cobbles. (Fill)	5.0	R-1
Gray, *Poorly Graded Gravel (GP)*; moist; angular, coarse gravel up to 1.5 inches (crushed rock). (Fill) - Black geotextile at 5 feet.	6.0	
No recovery. Driller reports loose soil sliding out the bottom of the core barrel.	11.0	
Dark gray to black, *Poorly Graded Sand (SP)*; wet; fine to medium sand.		R-2

Ground Water: During Drilling ⊻ (approx. 11 ft.)

Depth, ft.: 5, 10, 15, 20, 25

◇ % Fines (<0.075mm)
● % Water Content

0 20 40 60

CONTINUED NEXT SHEET

LEGEND

- * Sample Not Recovered
- Soil Core (as in Sonic Core Borings)
- Well Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout
- ⊻ Ground Water Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

AS/SVE System Extension and Modification
Final Compliance Monitoring Report
8801 East Marginal Way S.

LOG OF BORING ASW-34

September 2023 108056-04

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. E-1
Sheet 1 of 2

Total Depth:	*36 ft.*	Northing:	*193,824 ft.*	Drilling Method:	*Sonic Core*	Hole Diam.:	*5 in.*
Top Elevation:	*12.4 ft.*	Easting:	*1,276,449 ft.*	Drilling Company:	*AEC*	Rod Diam.:	*3 in.*
Vert. Datum:	*NGVD 1929*	Station:	*N/A*	Drill Rig Equipment:	*Terra Sonic 150cc*	Hammer Type:	
Horiz. Datum:	*State WA-N*	Offset:	*N/A*	Other Comments:			

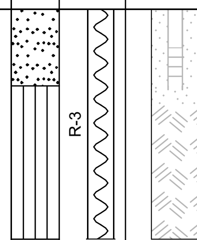
SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Depth, ft. | Symbol | Samples | Ground Water | Depth, ft.

◇ % Fines (<0.075mm)
● % Water Content

0 20 40 60



Soil Description	Depth, ft.
Dark gray to black *Silt (ML)*; wet.	32.0
	36.0

R-3

Depth, ft.: 35, 40, 45, 50, 55

BOTTOM OF BORING
COMPLETED 3/7/2023

Well Construction Details:
Flush-mount 24"-diameter green HDPE lid.
1" Sch. 80 PVC casing and screen.
0.020" slot screen at 31 to 32 feet depth.
Ecology well tag BNM-775.

0 20 40 60

LEGEND

- * Sample Not Recovered
- Soil Core (as in Sonic Core Borings)
- Well Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout
- Ground Water Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

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LOG OF BORING ASW-34

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SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. E-1
Sheet 2 of 2

Log: MEH Rev: JXS Typ: LKN

MASTER_LOG_E 103485-008.GPJ SHAN_WIL.GDT 9/25/23

VERSION 1
FINAL

Total Depth:	36 ft.	Northing:	193,839 ft.	Drilling Method:	Sonic Core	Hole Diam.:	5 in.
Top Elevation:	12.4 ft.	Easting:	1,276,446 ft.	Drilling Company:	AEC	Rod Diam.:	3 in.
Vert. Datum:	NGVD 1929	Station:	N/A	Drill Rig Equipment:	Terra Sonic 150cc	Hammer Type:	
Horiz. Datum:	State WA-N	Offset:	N/A	Other Comments:			

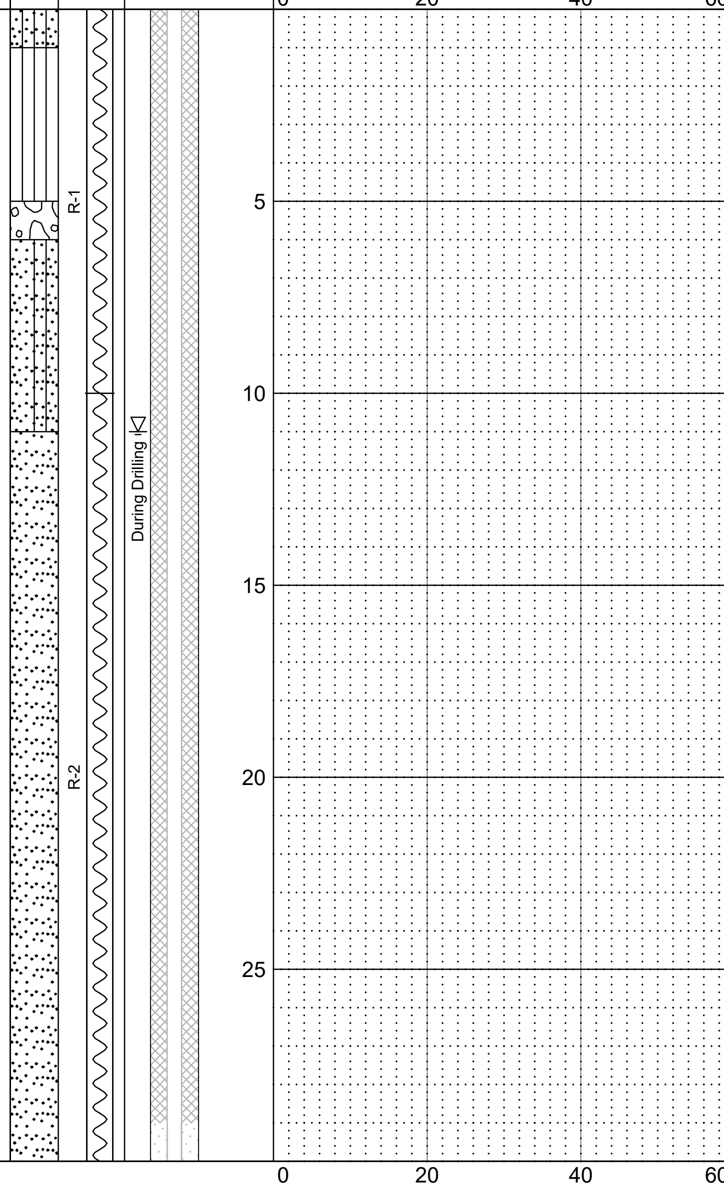
SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Soil Description	Depth, ft.
Brown, *Silty Sand (SM)*; moist; trace fine gravel; mostly fine to coarse sand; some silt; some organics (roots, twigs, wood chips, bark). (Fill)	1.0
Gray *Silt with Sand and Gravel (ML)*; moist. (Fill)	5.0
Gray, *Poorly Graded Gravel (GP)*; moist; angular, coarse gravel up to 1.5 inches (crushed rock). (Fill) - Black geotextile at 5 feet. - Geosynthetic clay liner at 6 feet.	6.0
Brown, *Poorly Graded Sand with Silt and Gravel (SP-SM)*; moist; fine sand; trace gravel.	11.0
Dark gray, *Poorly Graded Sand (SP)*; wet; fine to coarse sand.	

Symbol | Samples | Ground Water | Depth, ft.

◇ % Fines (<0.075mm)
● % Water Content



CONTINUED NEXT SHEET

LEGEND

- * Sample Not Recovered
- Soil Core (as in Sonic Core Borings)
- Well Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout
- Ground Water Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

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LOG OF BORING ASW-35

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SHANNON & WILSON, INC.
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FIG. E-2
Sheet 1 of 2

VERSION 1
FINAL

Total Depth:	*36 ft.*	Northing:	*193,839 ft.*	Drilling Method:	*Sonic Core*	Hole Diam.:	*5 in.*
Top Elevation:	*12.4 ft.*	Easting:	*1,276,446 ft.*	Drilling Company:	*AEC*	Rod Diam.:	*3 in.*
Vert. Datum:	*NGVD 1929*	Station:	*N/A*	Drill Rig Equipment:	*Terra Sonic 150cc*	Hammer Type:	
Horiz. Datum:	*State WA-N*	Offset:	*N/A*	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

SOIL DESCRIPTION	Depth, ft.	Samples
Dark gray *Silt (ML)*; wet.	32.0	R-3
BOTTOM OF BORING COMPLETED 3/7/2023	36.0	

Depth, ft.: 35, 40, 45, 50, 55

◇ % Fines (<0.075mm)
● % Water Content

0 20 40 60

Well Construction Details:
Flush-mount 24"-diameter green HDPE lid.
1" Sch. 80 PVC casing and screen.
0.020" slot screen at 31 to 32 feet depth.
Ecology well tag BNM-776.

LEGEND

- * Sample Not Recovered
- Soil Core (as in Sonic Core Borings)
- Well Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout
- Ground Water Level ATD

NOTES
1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

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LOG OF BORING ASW-35

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SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

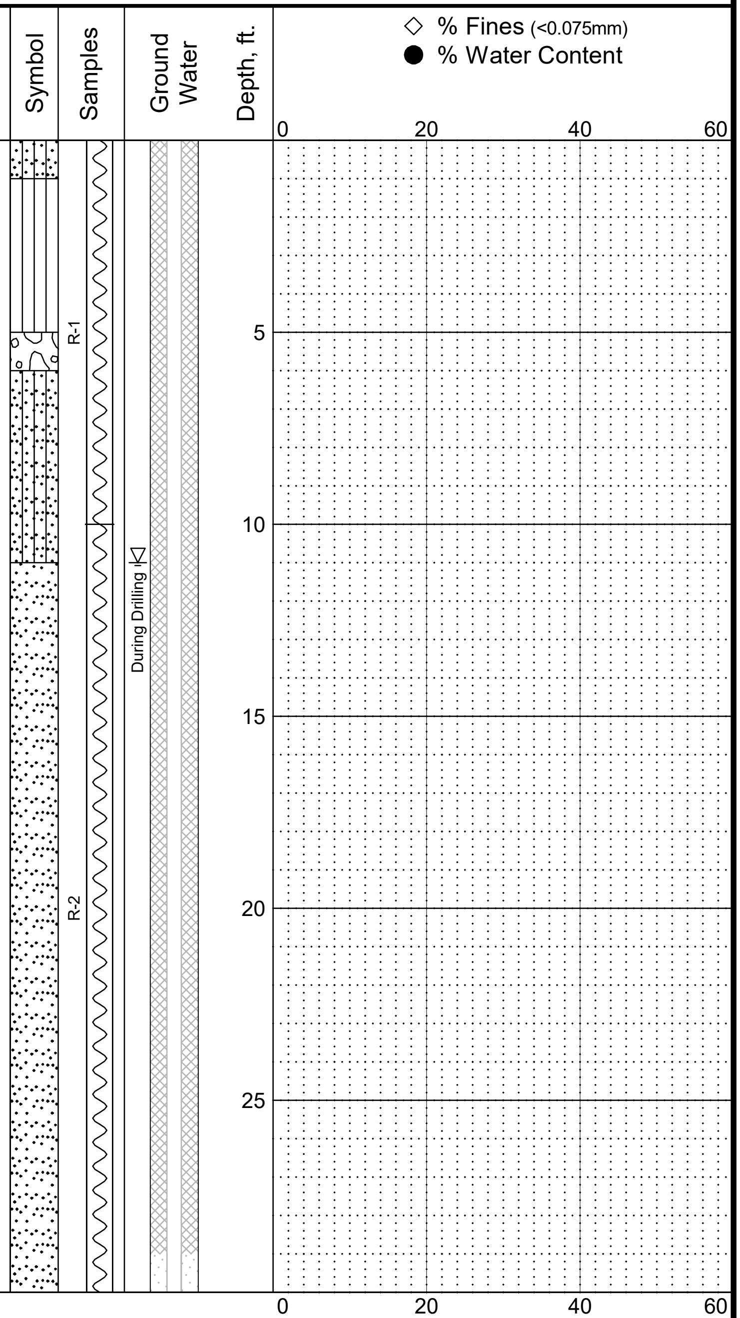
FIG. E-2
Sheet 2 of 2

Total Depth:	36 ft.	Northing:	193,853 ft.	Drilling Method:	Sonic Core	Hole Diam.:	5 in.
Top Elevation:	12.5 ft.	Easting:	1,276,442 ft.	Drilling Company:	AEC	Rod Diam.:	3 in.
Vert. Datum:	NGVD 1929	Station:	N/A	Drill Rig Equipment:	Terra Sonic 150cc	Hammer Type:	
Horiz. Datum:	State WA-N	Offset:	N/A	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Soil Description	Depth, ft.
Brown, *Silty Sand (SM)*; moist; trace fine gravel; mostly fine to coarse sand; some silt; some organics (roots, twigs, wood chips, bark). (Fill)	1.0
Gray *Silt with Sand and Gravel (ML)*; moist. (Fill)	5.0
Gray, *Poorly Graded Gravel (GP)*; moist; angular, coarse gravel up to 1.5 inches (crushed rock). (Fill) - Black geotextile at 5 feet. - Geosynthetic clay liner at 6 feet.	6.0
Brown, *Silty Sand (SM)*; moist; trace gravel.	11.0
Dark gray/trace brown, *Poorly Graded Sand (SP)*; wet; fine to medium sand.	



CONTINUED NEXT SHEET

LEGEND

- * Sample Not Recovered
- Soil Core (as in Sonic Core Borings)
- Well Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout
- Ground Water Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

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LOG OF BORING ASW-36

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SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. E-3
Sheet 1 of 2

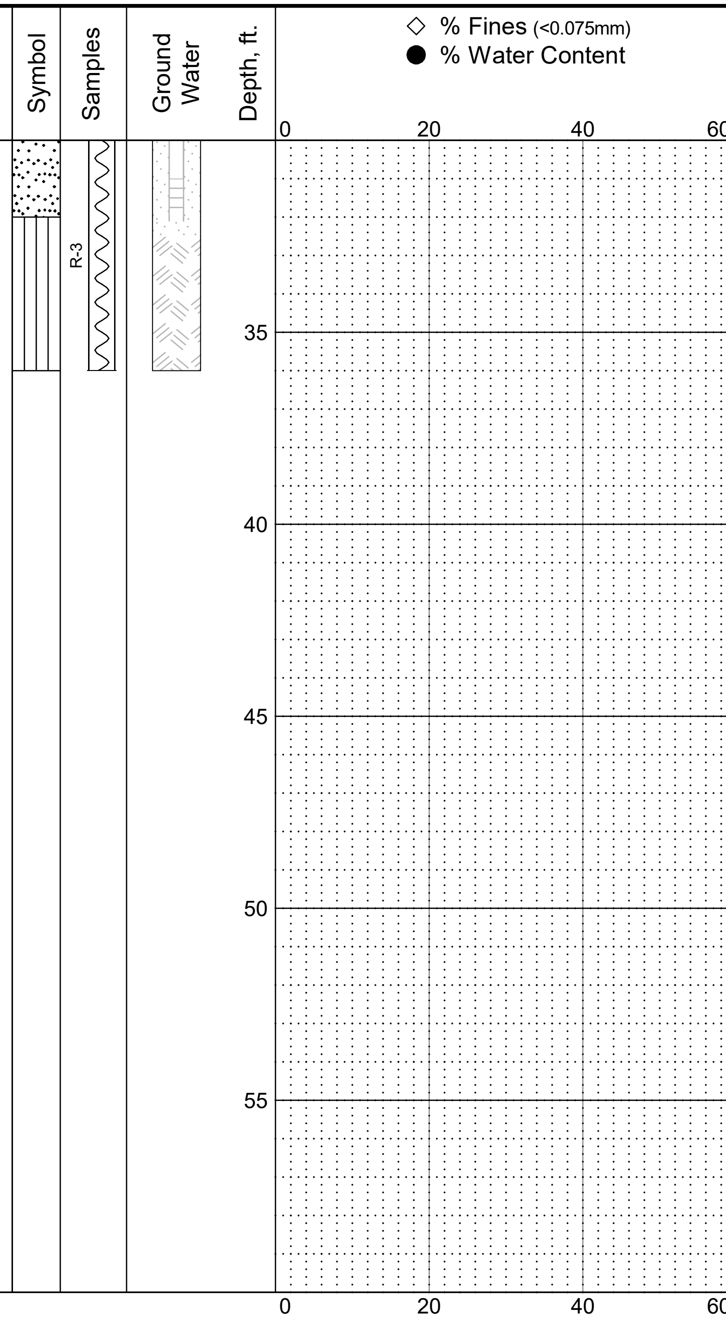
VERSION 1
FINAL

Total Depth:	*36 ft.*	Northing:	*193,853 ft.*	Drilling Method:	*Sonic Core*	Hole Diam.:	*5 in.*
Top Elevation:	*12.5 ft.*	Easting:	*1,276,442 ft.*	Drilling Company:	*AEC*	Rod Diam.:	*3 in.*
Vert. Datum:	*NGVD 1929*	Station:	*N/A*	Drill Rig Equipment:	*Terra Sonic 150cc*	Hammer Type:	
Horiz. Datum:	*State WA-N*	Offset:	*N/A*	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Soil Description	Depth, ft.
Dark gray *Silt (ML)*; wet.	32.0
BOTTOM OF BORING COMPLETED 3/7/2023	36.0



Well Construction Details:
Flush-mount 24"-diameter green HDPE lid.
1" Sch. 80 PVC casing and screen.
0.020" slot screen at 31 to 32 feet depth.
Ecology well tag BNM-777.

LEGEND

- * Sample Not Recovered
- Soil Core (as in Sonic Core Borings)
- Well Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout
- Ground Water Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

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FIG. E-3
Sheet 2 of 2

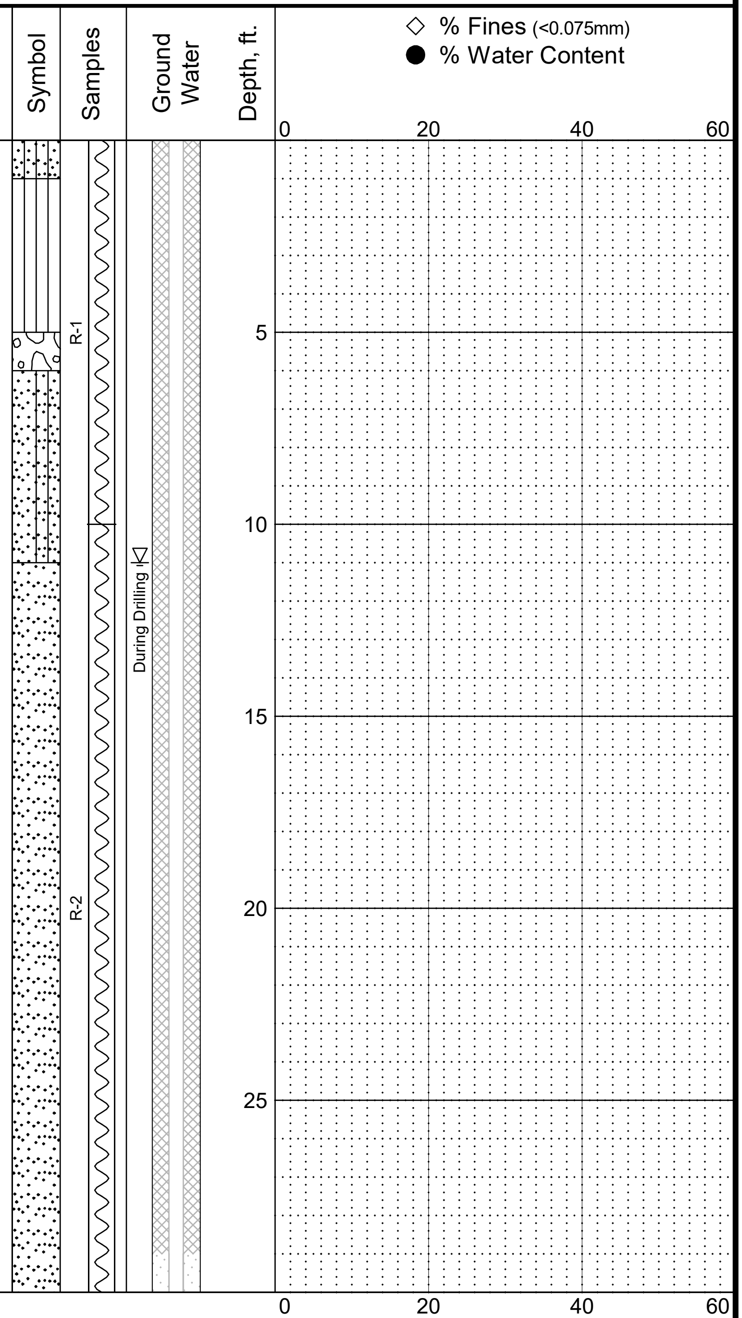
VERSION 1
FINAL

Total Depth:	36 ft.	Northing:	193,868 ft.	Drilling Method:	Sonic Core	Hole Diam.:	5 in.
Top Elevation:	12.4 ft.	Easting:	1,276,439 ft.	Drilling Company:	AEC	Rod Diam.:	3 in.
Vert. Datum:	NGVD 1929	Station:	N/A	Drill Rig Equipment:	Terra Sonic 150cc	Hammer Type:	
Horiz. Datum:	State WA-N	Offset:	N/A	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Soil Description	Depth, ft.
Brown, *Silty Sand (SM)*; moist; trace fine gravel; mostly fine to coarse sand; some silt; some organics (roots, twigs, wood chips, bark). (Fill)	1.0
Gray *Silt with Sand and Gravel (ML)*; moist. (Fill)	5.0
Gray, *Poorly Graded Gravel (GP)*; moist; angular, coarse gravel up to 1.5 inches (crushed rock). (Fill) - Black geotextile at 5 feet.	6.0
Brown, *Poorly Graded Sand with Silt (SP-SM)*; moist; trace gravel; fine sand and gravel.	11.0
Dark gray-black, *Poorly Graded Sand (SP)*; wet; fine to medium sand.	



CONTINUED NEXT SHEET

LEGEND

- * Sample Not Recovered
- Soil Core (as in Sonic Core Borings)
- Well Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout
- Ground Water Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

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SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. E-4
Sheet 1 of 2

VERSION 1
FINAL

Total Depth:	*36 ft.*	Northing:	*193,868 ft.*	Drilling Method:	*Sonic Core*	Hole Diam.:	*5 in.*
Top Elevation:	*12.4 ft.*	Easting:	*1,276,439 ft.*	Drilling Company:	*AEC*	Rod Diam.:	*3 in.*
Vert. Datum:	*NGVD 1929*	Station:	*N/A*	Drill Rig Equipment:	*Terra Sonic 150cc*	Hammer Type:	
Horiz. Datum:	*State WA-N*	Offset:	*N/A*	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Soil Description	Depth, ft.	Symbol	Samples	Ground Water	Depth, ft.
Dark gray-black *Silt (ML)*; wet; trace of sand.	32.0		R-3		35
BOTTOM OF BORING COMPLETED 3/7/2023	36.0				
					40
					45
					50
					55

Well Construction Details:
Flush-mount 24"-diameter green HDPE lid.
1" Sch. 80 PVC casing and screen.
0.020" slot screen at 31 to 32 feet depth.
Ecology well tag BNM-778.

◇ % Fines (<0.075mm)
● % Water Content

0 20 40 60

LEGEND

* Sample Not Recovered
Soil Core (as in Sonic Core Borings)
Well Screen and Sand Filter
Bentonite-Cement Grout
Bentonite Chips/Pellets
Bentonite Grout
Ground Water Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

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SHANNON & WILSON, INC.
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FIG. E-4
Sheet 2 of 2

Total Depth:	36 ft.	Northing:	193,882 ft.	Drilling Method:	Sonic Core	Hole Diam.:	5 in.
Top Elevation:	12.4 ft.	Easting:	1,276,435 ft.	Drilling Company:	AEC	Rod Diam.:	3 in.
Vert. Datum:	NGVD 1929	Station:	N/A	Drill Rig Equipment:	Terra Sonic 150cc	Hammer Type:	
Horiz. Datum:	State WA-N	Offset:	N/A	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Depth, ft. | Symbol | Samples | Ground Water | Depth, ft.

◇ % Fines (<0.075mm)
● % Water Content

Soil Description	Depth, ft.
Brown, *Silty Sand (SM)*; moist; trace fine gravel; mostly fine to coarse sand; some silt; some organics (roots, twigs, wood chips, bark). (Fill)	1.0
Gray *Silt with Sand and Gravel (ML)*; moist. (Fill)	5.0
Gray, *Poorly Graded Gravel (GP)*; moist; angular, coarse gravel up to 1.5 inches (crushed rock). (Fill) - Black geotextile at 5 feet. - Geosynthetic clay liner at 6 feet.	6.0
Brown, *Poorly Graded Sand with Silt (SP-SM)*; moist; trace gravel.	11.0
Dark gray, *Poorly Graded Sand (SP)*; wet; fine to medium sand.	

R-1

R-2

During Drilling

0 20 40 60

5 10 15 20 25

CONTINUED NEXT SHEET

LEGEND

- * Sample Not Recovered
- Soil Core (as in Sonic Core Borings)
- Well Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout
- Ground Water Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

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FIG. E-5
Sheet 1 of 2

Total Depth:	*36 ft.*	Northing:	*193,882 ft.*	Drilling Method:	*Sonic Core*	Hole Diam.:	*5 in.*
Top Elevation:	*12.4 ft.*	Easting:	*1,276,435 ft.*	Drilling Company:	*AEC*	Rod Diam.:	*3 in.*
Vert. Datum:	*NGVD 1929*	Station:	*N/A*	Drill Rig Equipment:	*Terra Sonic 150cc*	Hammer Type:	
Horiz. Datum:	*State WA-N*	Offset:	*N/A*	Other Comments:			

SOIL DESCRIPTION *Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.*	Depth, ft.	Symbol	Samples	Ground Water	Depth, ft.	◇ % Fines (<0.075mm) ● % Water Content 0 20 40 60
Dark gray *Silt (ML)*; wet.	32.0		R-3		35	
BOTTOM OF BORING COMPLETED 3/7/2023	36.0				40	
					45	
					50	
					55	

Well Construction Details:
Flush-mount 24"-diameter green HDPE lid.
1" Sch. 80 PVC casing and screen.
0.020" slot screen at 31 to 32 feet depth.
Ecology well tag BNM-779.

0 20 40 60

LEGEND

- * Sample Not Recovered
- Soil Core (as in Sonic Core Borings)
- Well Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout
- Ground Water Level ATD

NOTES
1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

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Geotechnical and Environmental Consultants

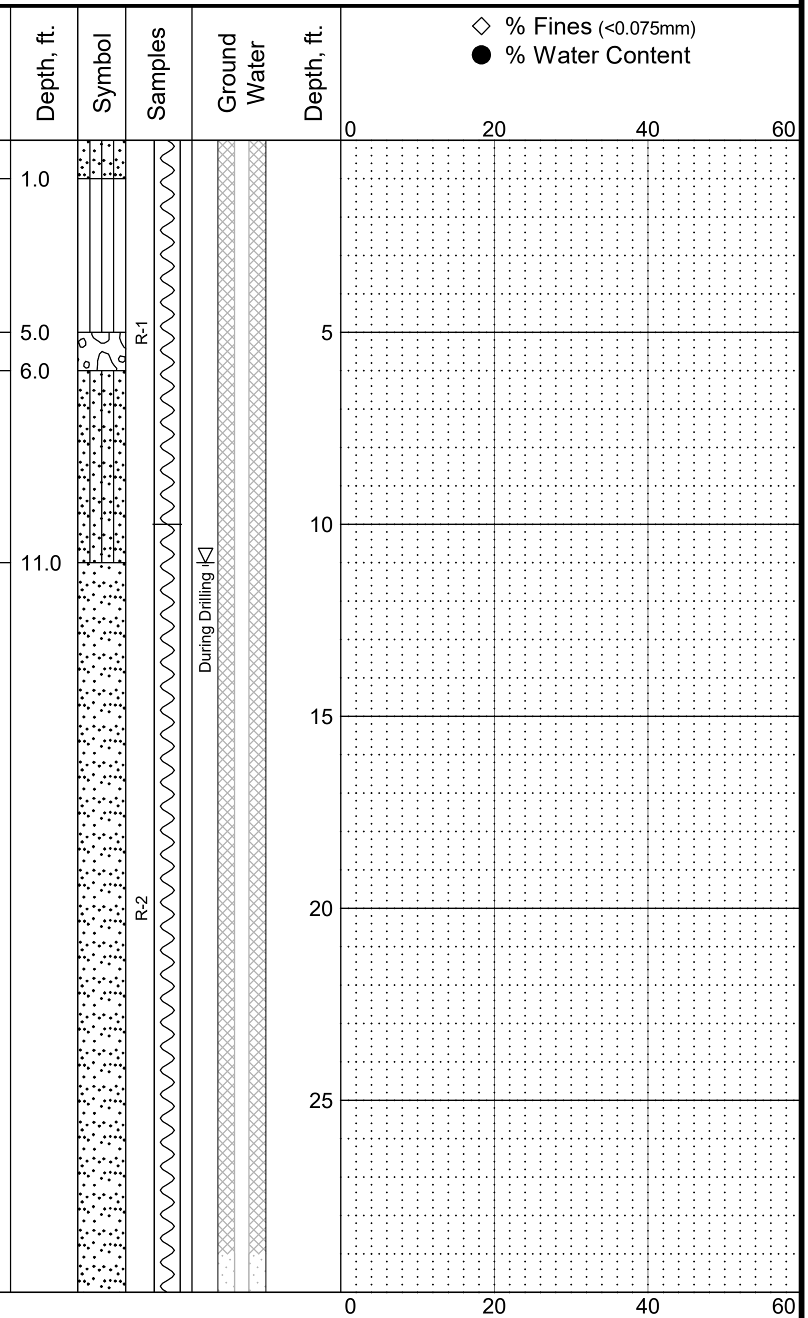
FIG. E-5
Sheet 2 of 2

Total Depth:	36 ft.	Northing:	193,896 ft.	Drilling Method:	Sonic Core	Hole Diam.:	5 in.
Top Elevation:	12.4 ft.	Easting:	1,276,431 ft.	Drilling Company:	AEC	Rod Diam.:	3 in.
Vert. Datum:	NGVD 1929	Station:	N/A	Drill Rig Equipment:	Terra Sonic 150cc	Hammer Type:	
Horiz. Datum:	State WA-N	Offset:	N/A	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Soil Description	Depth, ft.
Brown, *Silty Sand (SM)*; moist; trace fine gravel; mostly fine to coarse sand; some silt; some organics (roots, twigs, wood chips, bark). (Fill)	1.0
Gray *Silt with Sand and Gravel (ML)*; moist. (Fill)	5.0
Gray, *Poorly Graded Gravel (GP)*; moist; angular, coarse gravel up to 1.5 inches (crushed rock). (Fill) - Black geotextile at 5 feet. - Geosynthetic clay liner at 6 feet.	6.0
Brown, *Silty Sand (SM)*; moist; fine sand.	11.0
Dark gray, *Poorly Graded Sand (SP)*; wet; fine to coarse sand.	



CONTINUED NEXT SHEET

LEGEND

- * Sample Not Recovered
- Soil Core (as in Sonic Core Borings)
- Well Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout
- Ground Water Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

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LOG OF BORING ASW-39

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FIG. E-6
Sheet 1 of 2

VERSION 1
FINAL

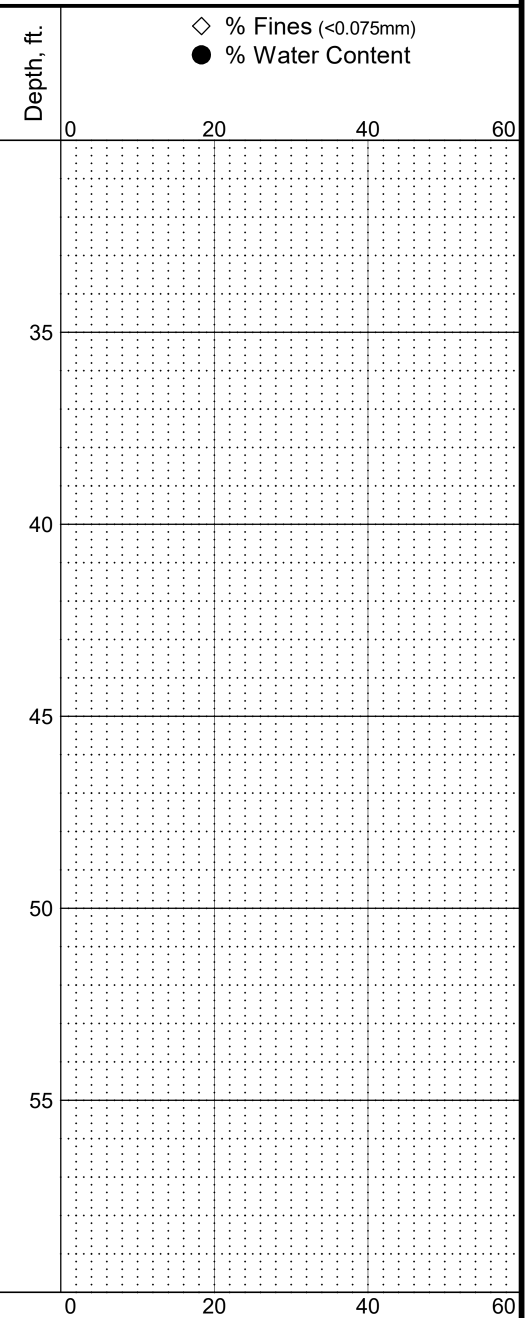
Total Depth:	36 ft.	Northing:	193,896 ft.	Drilling Method:	Sonic Core	Hole Diam.:	5 in.
Top Elevation:	12.4 ft.	Easting:	1,276,431 ft.	Drilling Company:	AEC	Rod Diam.:	3 in.
Vert. Datum:	NGVD 1929	Station:	N/A	Drill Rig Equipment:	Terra Sonic 150cc	Hammer Type:	
Horiz. Datum:	State WA-N	Offset:	N/A	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Soil Description	Depth, ft.	Symbol	Samples	Ground Water
Dark gray *Silty Sand (SM)*; wet; fine sand.	32.0		R-3	
BOTTOM OF BORING COMPLETED 3/6/2023	36.0			

Well Construction Details:
Flush-mount 24"-diameter green HDPE lid.
1" Sch. 80 PVC casing and screen.
0.020" slot screen at 31 to 32 feet depth.
Ecology well tag BNM-780.



LEGEND

- * Sample Not Recovered
- Soil Core (as in Sonic Core Borings)
- Well Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout
- Ground Water Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

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Geotechnical and Environmental Consultants

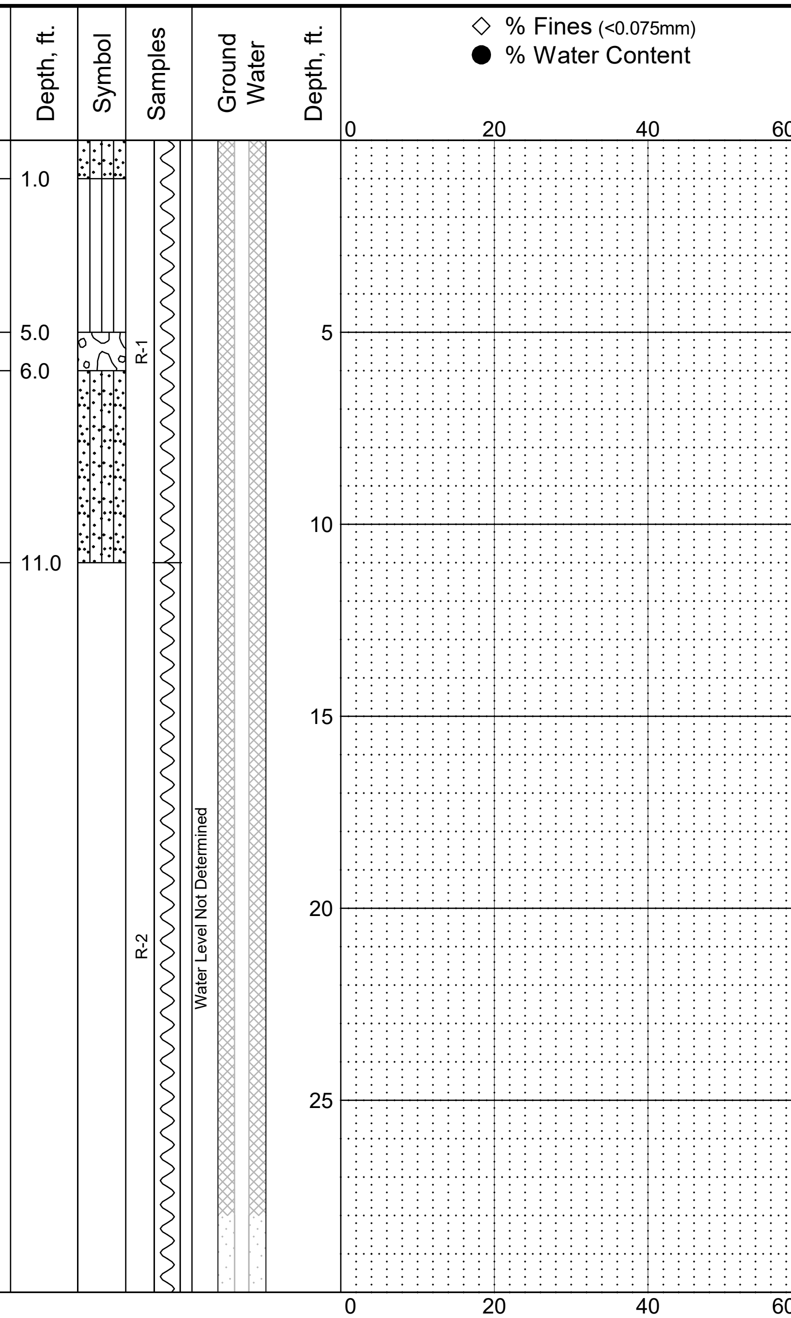
FIG. E-6
Sheet 2 of 2

Total Depth:	*36 ft.*	Northing:	*193,911 ft.*	Drilling Method:	*Sonic Core*	Hole Diam.:	*5 in.*
Top Elevation:	*12.3 ft.*	Easting:	*1,276,427 ft.*	Drilling Company:	*AEC*	Rod Diam.:	*3 in.*
Vert. Datum:	*NGVD 1929*	Station:	*N/A*	Drill Rig Equipment:	*Terra Sonic 150cc*	Hammer Type:	
Horiz. Datum:	*State WA-N*	Offset:	*N/A*	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Soil Description	Depth, ft.
Brown, *Silty Sand (SM)*; moist; trace fine gravel; mostly fine to coarse sand; some silt; some organics (roots, twigs, wood chips, bark). (Fill)	1.0
Gray *Silt with Sand and Gravel (ML)*; moist. (Fill)	5.0
Gray, *Poorly Graded Gravel (GP)*; moist; angular, coarse gravel up to 1.5 inches (crushed rock). (Fill) - Black geotextile at 5 feet. - Geosynthetic clay liner at 6 feet.	6.0
Brown, *Silty Sand (SM)*; moist; fine sand.	11.0
No recovery. Driller reports loose soil sliding out the bottom of the core barrel.	



CONTINUED NEXT SHEET

LEGEND

- * Sample Not Recovered
- Soil Core (as in Sonic Core Borings)
- Well Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

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Geotechnical and Environmental Consultants

FIG. E-7
Sheet 1 of 2

VERSION 1
FINAL

Total Depth:	*36 ft.*	Northing:	*193,911 ft.*	Drilling Method:	*Sonic Core*	Hole Diam.:	*5 in.*
Top Elevation:	*12.3 ft.*	Easting:	*1,276,427 ft.*	Drilling Company:	*AEC*	Rod Diam.:	*3 in.*
Vert. Datum:	*NGVD 1929*	Station:	*N/A*	Drill Rig Equipment:	*Terra Sonic 150cc*	Hammer Type:	
Horiz. Datum:	*State WA-N*	Offset:	*N/A*	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Depth, ft. | Symbol | Samples | Ground Water | Depth, ft.

◇ % Fines (<0.075mm)
● % Water Content

0 20 40 60

R-3

35

36.0

BOTTOM OF BORING
COMPLETED 3/6/2023

Well Construction Details:
Flush-mount 24"-diameter green HDPE lid.
1" Sch. 80 PVC casing and screen.
0.020" slot screen at 31 to 32 feet depth.
Ecology well tag BNM-781.

40

45

50

55

0 20 40 60

Log: RBP Rev: JXS Typ: LKN

LEGEND

- * Sample Not Recovered
- Soil Core (as in Sonic Core Borings)
- Well Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

AS/SVE System Extension and Modification
Final Compliance Monitoring Report
8801 East Marginal Way S.

LOG OF BORING ASW-40

September 2023 108056-04

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. E-7
Sheet 2 of 2

MASTER_LOG_E 103485-008.GPJ SHAN_WIL.GDT 9/25/23

VERSION 1
FINAL

Total Depth:	36 ft.	Northing:	193,925 ft.	Drilling Method:	Sonic Core	Hole Diam.:	5 in.
Top Elevation:	10.5 ft.	Easting:	1,276,424 ft.	Drilling Company:	AEC	Rod Diam.:	3 in.
Vert. Datum:	NGVD 1929	Station:	N/A	Drill Rig Equipment:	Terra Sonic 150cc	Hammer Type:	
Horiz. Datum:	State WA-N	Offset:	N/A	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Soil Description	Depth, ft.	Samples
Brown, *Silty Sand (SM)*; moist; trace fine gravel; mostly fine to coarse sand; some silt; some organics (roots, twigs, wood chips, bark). (Fill)	1.0	
Gray *Silt with Sand and Gravel (ML)*; moist. (Fill)	3.0	
Gray, *Poorly Graded Gravel (GP)*; moist; angular, coarse gravel up to 1.5 inches (crushed rock). (Fill) - Black geotextile at 3 feet. - Geosynthetic clay liner at 4 feet.	4.0	R-1
Brown, *Silty Sand (SM)*; moist; fine sand.	11.0	
Dark gray, *Poorly Graded Sand (SP)*; wet; fine to coarse sand.		R-2

Ground Water: During Drilling ▽ (approx. 11 ft)

Depth, ft.: 5, 10, 15, 20, 25

◇ % Fines (<0.075mm)
● % Water Content

0 20 40 60

CONTINUED NEXT SHEET

LEGEND

- * Sample Not Recovered
- Soil Core (as in Sonic Core Borings)
- Well Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout
- ▽ Ground Water Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

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LOG OF BORING ASW-41

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Geotechnical and Environmental Consultants

FIG. E-8
Sheet 1 of 2

VERSION 1
FINAL

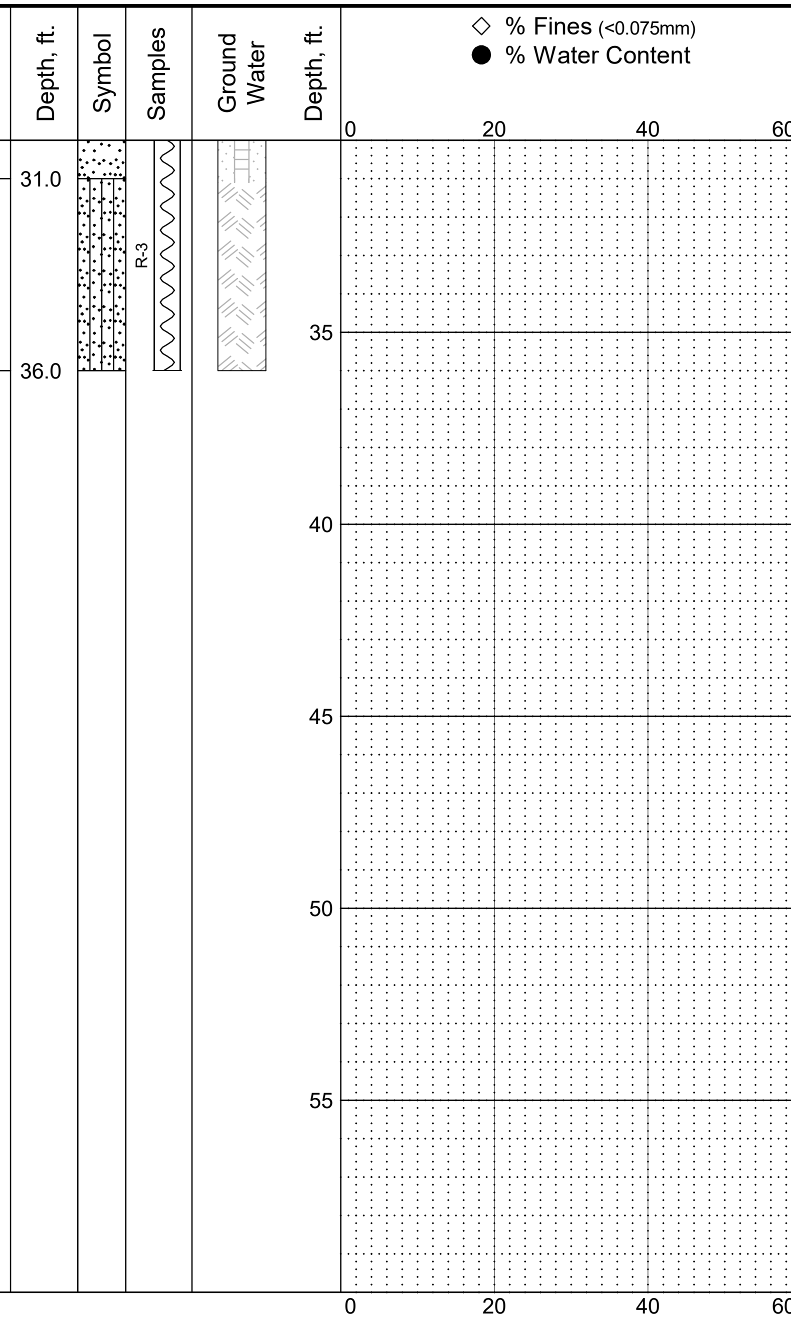
Total Depth:	36 ft.	Northing:	193,925 ft.	Drilling Method:	Sonic Core	Hole Diam.:	5 in.
Top Elevation:	10.5 ft.	Easting:	1,276,424 ft.	Drilling Company:	AEC	Rod Diam.:	3 in.
Vert. Datum:	NGVD 1929	Station:	N/A	Drill Rig Equipment:	Terra Sonic 150cc	Hammer Type:	
Horiz. Datum:	State WA-N	Offset:	N/A	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Depth, ft.	Soil Description
31.0	Dark gray, *Silty Sand (SM)*; wet; fine to coarse sand.
36.0	BOTTOM OF BORING COMPLETED 3/6/2023

Well Construction Details:
Flush-mount 24"-diameter green HDPE lid.
1" Sch. 80 PVC casing and screen.
0.020" slot screen at 30 to 31 feet depth.
Ecology well tag BNM-782.



LEGEND

- * Sample Not Recovered
- Soil Core (as in Sonic Core Borings)
- Well Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout
- Ground Water Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

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LOG OF BORING ASW-41

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FIG. E-8
Sheet 2 of 2

VERSION 1
FINAL

MASTER_LOG_E 103485-008.GPJ SHAN_WIL.GDT 9/25/23 Log: RBP Rev: JXS Typ: LKN

LOG OF GEOPROBE

Date Started 3/7/23	Location 8801 E Marginal Way S, Tukwila, WA 98108	Ground Elevation: Approx. 9.3 feet
Date Completed 3/7/23		Typical Run Length 5 feet
Total Depth (ft) 29.1	Drilling Company: AEC	Hole Diameter: 3.75 inches

Soil Description

Refer to the report text for a proper understanding of the subsurface materials and probing methods. The stratification lines indicated below represent the approximate boundaries between soil types. Actual boundaries may be different if soil shifted inside sample tubes during extraction.

Depth (ft)	Probe Run	Soil Description	Depth, ft.	Symbol	PID, ppm	Ground Water	Sample Number, Description, and Results	Depth (ft)
	R-1	Asphalt pavement.	0.5					
		Brown, *Silty Sand with Gravel (SM)*; moist.	0.5					
		No recovery.						
5	R-2							5
10	R-3							10
15	R-4							15
20	R-5					Water Level Not Determined		20
25	R-6							25
		BOTTOM OF GEOPROBE	29.1					

CONTINUED NEXT PAGE

NOTES

1. In some cases where recovery was low in the upper part of the run, the soil sample may have slid down in the tube prior to removal from the ground.
2. Groundwater level, if indicated above, was estimated during probing and should be considered approximate.
3. Refer to KEY for definitions and explanation of symbols.
4. CT = corrosion test sample; TR = thermal resistivity sample; EN = environmental sample; GE = geotechnical sample; AR = archeological sample.

LEGEND

- 2" Plastic Tube - No Soil Recovery
- 2" Plastic Tube with Soil Recovery
- 3 *Run No.*
- Piezometer Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout

AS/SVE System Extension and Modification
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LOG OF GEOPROBE ASW-42

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FIG. E-9
Sheet 1 of 2

LOG OF GEOPROBE

Date Started 3/7/23	Location 8801 E Marginal Way S, Tukwila, WA 98108	Ground Elevation: Approx. 9.3 feet
Date Completed 3/7/23		Typical Run Length 5 feet
Total Depth (ft) 29.1	Drilling Company: AEC	Hole Diameter: 3.75 inches

Depth (ft)	Probe Run	Soil Description *Refer to the report text for a proper understanding of the subsurface materials and probing methods. The stratification lines indicated below represent the approximate boundaries between soil types. Actual boundaries may be different if soil shifted inside sample tubes during extraction.*	Depth, ft.	Symbol	PID, ppm	Ground Water	Sample Number, Description, and Results	Depth (ft)
		COMPLETED 3/7/2023						
		Well Construction Details: Wellhead placed in a 30"x24" concrete vault with metal traffic-rated lid. 1-inch Sch. 80 PVC casing and screen. 0.020" slot screen at 28 to 29 feet depth. Ecology well tag BNM-783.						
35								35
40								40
45								45
50								50
55								55

NOTES

1. In some cases where recovery was low in the upper part of the run, the soil sample may have slid down in the tube prior to removal from the ground.
2. Groundwater level, if indicated above, was estimated during probing and should be considered approximate.
3. Refer to KEY for definitions and explanation of symbols.
4. CT = corrosion test sample; TR = thermal resistivity sample; EN = environmental sample; GE = geotechnical sample; AR = archeological sample.

LEGEND

- 2" Plastic Tube - No Soil Recovery
- 2" Plastic Tube with Soil Recovery
- *Run No.* (3)
- Piezometer Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout

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LOG OF GEOPROBE ASW-42

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FIG. E-9

GEOPROBE_WELL 103485-008.GPJ 21-20447.GPJ 9/25/23 Log: RBP Rev: JXS Typ: LKN

VERSION 1
FINAL

LOG OF GEOPROBE

Date Started 3/7/23	Location 8801 E Marginal Way S, Tukwila, WA 98108	Ground Elevation: Approx. 9.3 feet
Date Completed 3/7/23		Typical Run Length 5 feet
Total Depth (ft) 29.1	Drilling Company: AEC	Hole Diameter: 3.75 inches

Depth (ft)	Probe Run	Soil Description	Depth, ft.	Symbol	PID, ppm	Ground Water	Sample Number, Description, and Results	Depth (ft)
	R-1	Concrete floor slab.	0.5			Water Level Not Determined		
		Brown, *Silty Sand with Gravel (SM)*; dry.	0.5					
		No recovery.						
5	R-2							5
10	R-3							10
15	R-4							15
20	R-5							20
25	R-6							25
		BOTTOM OF GEOPROBE	29.1					

Soil Description: *Refer to the report text for a proper understanding of the subsurface materials and probing methods. The stratification lines indicated below represent the approximate boundaries between soil types. Actual boundaries may be different if soil shifted inside sample tubes during extraction.*

CONTINUED NEXT PAGE

NOTES

1. In some cases where recovery was low in the upper part of the run, the soil sample may have slid down in the tube prior to removal from the ground.
2. Groundwater level, if indicated above, was estimated during probing and should be considered approximate.
3. Refer to KEY for definitions and explanation of symbols.
4. CT = corrosion test sample; TR = thermal resistivity sample; EN = environmental sample; GE = geotechnical sample; AR = archeological sample.

LEGEND

- 2" Plastic Tube - No Soil Recovery
- 2" Plastic Tube with Soil Recovery
- 3 *Run No.*
- Piezometer Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout

AS/SVE System Extension and Modification
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LOG OF GEOPROBE ASW-43

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FIG. E-10
Sheet 1 of 2

VERSION 1
FINAL

LOG OF GEOPROBE

Date Started 3/7/23	Location 8801 E Marginal Way S, Tukwila, WA 98108	Ground Elevation: Approx. 9.3 feet
Date Completed 3/7/23		Typical Run Length 5 feet
Total Depth (ft) 29.1	Drilling Company: AEC	Hole Diameter: 3.75 inches

Depth (ft)	Probe Run	Soil Description *Refer to the report text for a proper understanding of the subsurface materials and probing methods. The stratification lines indicated below represent the approximate boundaries between soil types. Actual boundaries may be different if soil shifted inside sample tubes during extraction.*	Depth, ft.	Symbol	PID, ppm	Ground Water	Sample Number, Description, and Results	Depth (ft)
		COMPLETED 3/7/2023 Well Construction Details: Wellhead placed in a 30"x24" concrete vault with metal traffic-rated lid. 1-inch Sch. 80 PVC casing and screen. 0.020" slot screen at 28 to 29 feet depth. Ecology well tag BNM-784.						
35								35
40								40
45								45
50								50
55								55

NOTES

1. In some cases where recovery was low in the upper part of the run, the soil sample may have slid down in the tube prior to removal from the ground.
2. Groundwater level, if indicated above, was estimated during probing and should be considered approximate.
3. Refer to KEY for definitions and explanation of symbols.
4. CT = corrosion test sample; TR = thermal resistivity sample; EN = environmental sample; GE = geotechnical sample; AR = archeological sample.

LEGEND

- 2" Plastic Tube - No Soil Recovery
- 2" Plastic Tube with Soil Recovery
- *Run No.* (3)
- Piezometer Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout

AS/SVE System Extension and Modification
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LOG OF GEOPROBE ASW-43

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Geotechnical and Environmental Consultants

FIG. E-10
Sheet 2 of 2

LOG OF GEOPROBE

Date Started 3/7/23	Location 8801 E Marginal Way S, Tukwila, WA 98108	Ground Elevation: Approx. 9.3 feet
Date Completed 3/7/23		Typical Run Length 5 feet
Total Depth (ft) 29.1	Drilling Company: AEC	Hole Diameter: 3.75 inches

Depth (ft)	Probe Run	Soil Description	Depth, ft.	Symbol	PID, ppm	Ground Water	Sample Number, Description, and Results	Depth (ft)
		Refer to the report text for a proper understanding of the subsurface materials and probing methods. The stratification lines indicated below represent the approximate boundaries between soil types. Actual boundaries may be different if soil shifted inside sample tubes during extraction.						
	R-1	Concrete floor slab.	0.5					
		Brown, *Silty Sand with Gravel (SM)*; dry.	0.5					
		No recovery.						
5	R-2							5
10	R-3							10
15	R-4							15
20	R-5					Water Level Not Determined		20
25	R-6							25
		BOTTOM OF GEOPROBE	29.1					

CONTINUED NEXT PAGE

NOTES

1. In some cases where recovery was low in the upper part of the run, the soil sample may have slid down in the tube prior to removal from the ground.
2. Groundwater level, if indicated above, was estimated during probing and should be considered approximate.
3. Refer to KEY for definitions and explanation of symbols.
4. CT = corrosion test sample; TR = thermal resistivity sample; EN = environmental sample; GE = geotechnical sample; AR = archeological sample.

LEGEND

- 2" Plastic Tube - No Soil Recovery
- 2" Plastic Tube with Soil Recovery
- 3 *Run No.*
- Piezometer Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout

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LOG OF GEOPROBE ASW-44

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FIG. E-11
Sheet 1 of 2

LOG OF GEOPROBE

Date Started *3/7/23*	**Location** *8801 E Marginal Way S, Tukwila, WA 98108*	**Ground Elevation:** *Approx. 9.3 feet*
Date Completed *3/7/23*		**Typical Run Length** *5 feet*
Total Depth (ft) *29.1*	**Drilling Company:** *AEC*	**Hole Diameter:** *3.75 inches*

Depth (ft)	Probe Run	**Soil Description** *Refer to the report text for a proper understanding of the subsurface materials and probing methods. The stratification lines indicated below represent the approximate boundaries between soil types. Actual boundaries may be different if soil shifted inside sample tubes during extraction.*	Depth, ft.	Symbol	PID, ppm	Ground Water	Sample Number, Description, and Results	Depth (ft)
		COMPLETED 3/7/2023 Well Construction Details: Wellhead placed in a 30"x24" concrete vault with metal traffic-rated lid. 1-inch Sch. 80 PVC casing and screen. 0.020" slot screen at 28 to 29 feet depth. Ecology well tag BNM-785.						
35								35
40								40
45								45
50								50
55								55

NOTES

1. In some cases where recovery was low in the upper part of the run, the soil sample may have slid down in the tube prior to removal from the ground.
2. Groundwater level, if indicated above, was estimated during probing and should be considered approximate.
3. Refer to KEY for definitions and explanation of symbols.
4. CT = corrosion test sample; TR = thermal resistivity sample; EN = environmental sample; GE = geotechnical sample; AR = archeological sample.

LEGEND

- 2" Plastic Tube - No Soil Recovery
- 2" Plastic Tube with Soil Recovery
- *Run No.*
- Piezometer Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout

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LOG OF GEOPROBE ASW-44

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FIG. E-11
Sheet 2 of 2

LOG OF GEOPROBE

Date Started	*3/7/23*	**Location**	*8801 E Marginal Way S, Tukwila, WA 98108*	**Ground Elevation:**	*Approx. 9.2 feet*
Date Completed	*3/7/23*			**Typical Run Length**	*5 feet*
Total Depth (ft)	*29.1*	**Drilling Company:**	*AEC*	**Hole Diameter:**	*3.75 inches*

Depth (ft)	Probe Run	**Soil Description** *Refer to the report text for a proper understanding of the subsurface materials and probing methods. The stratification lines indicated below represent the approximate boundaries between soil types. Actual boundaries may be different if soil shifted inside sample tubes during extraction.*	Depth, ft.	Symbol	PID, ppm	Ground Water	Sample Number, Description, and Results	Depth (ft)
	R-1	Concrete floor slab.	0.5					
		Brown, *Silty Sand with Gravel (SM)*; dry.	0.5					
		No recovery.						
5	R-2							5
10	R-3							10
15	R-4							15
20	R-5					Water Level Not Determined		20
25	R-6							25
		BOTTOM OF GEOPROBE	29.1					

CONTINUED NEXT PAGE

NOTES

1. In some cases where recovery was low in the upper part of the run, the soil sample may have slid down in the tube prior to removal from the ground.
2. Groundwater level, if indicated above, was estimated during probing and should be considered approximate.
3. Refer to KEY for definitions and explanation of symbols.
4. CT = corrosion test sample; TR = thermal resistivity sample; EN = environmental sample; GE = geotechnical sample; AR = archeological sample.

LEGEND

- 2" Plastic Tube - No Soil Recovery
- 2" Plastic Tube with Soil Recovery
- 3 — *Run No.*
- Piezometer Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout

AS/SVE System Extension and Modification
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LOG OF GEOPROBE ASW-45

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FIG. E-12
Sheet 1 of 2

LOG OF GEOPROBE

Date Started *3/7/23*	**Location** *8801 E Marginal Way S, Tukwila, WA 98108*	**Ground Elevation:** *Approx. 9.2 feet*
Date Completed *3/7/23*		**Typical Run Length** *5 feet*
Total Depth (ft) *29.1*	**Drilling Company:** *AEC*	**Hole Diameter:** *3.75 inches*

Depth (ft)	Probe Run	**Soil Description** *Refer to the report text for a proper understanding of the subsurface materials and probing methods. The stratification lines indicated below represent the approximate boundaries between soil types. Actual boundaries may be different if soil shifted inside sample tubes during extraction.*	Depth, ft.	Symbol	PID, ppm	Ground Water	Sample Number, Description, and Results	Depth (ft)
		COMPLETED 3/7/2023 Well Construction Details: Wellhead placed in a 30"x24" concrete vault with metal traffic-rated lid. 1-inch Sch. 80 PVC casing and screen. 0.020" slot screen at 28 to 29 feet depth. Ecology well tag BNM-786.						
35								35
40								40
45								45
50								50
55								55

NOTES

1. In some cases where recovery was low in the upper part of the run, the soil sample may have slid down in the tube prior to removal from the ground.
2. Groundwater level, if indicated above, was estimated during probing and should be considered approximate.
3. Refer to KEY for definitions and explanation of symbols.
4. CT = corrosion test sample; TR = thermal resistivity sample; EN = environmental sample; GE = geotechnical sample; AR = archeological sample.

LEGEND

- 2" Plastic Tube - No Soil Recovery
- 2" Plastic Tube with Soil Recovery
- *Run No.* (3)
- Piezometer Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout

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LOG OF GEOPROBE ASW-45

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FIG. E-12
Sheet 2 of 2

Total Depth:	36 ft.	Northing:	194,000 ft.	Drilling Method:	Sonic Core	Hole Diam.:	5 in.
Top Elevation:	10.2 ft.	Easting:	1,276,406 ft.	Drilling Company:	AEC	Rod Diam.:	3 in.
Vert. Datum:	NGVD 1929	Station:	N/A	Drill Rig Equipment:	Terra Sonic 150cc	Hammer Type:	
Horiz. Datum:	State WA-N	Offset:	N/A	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

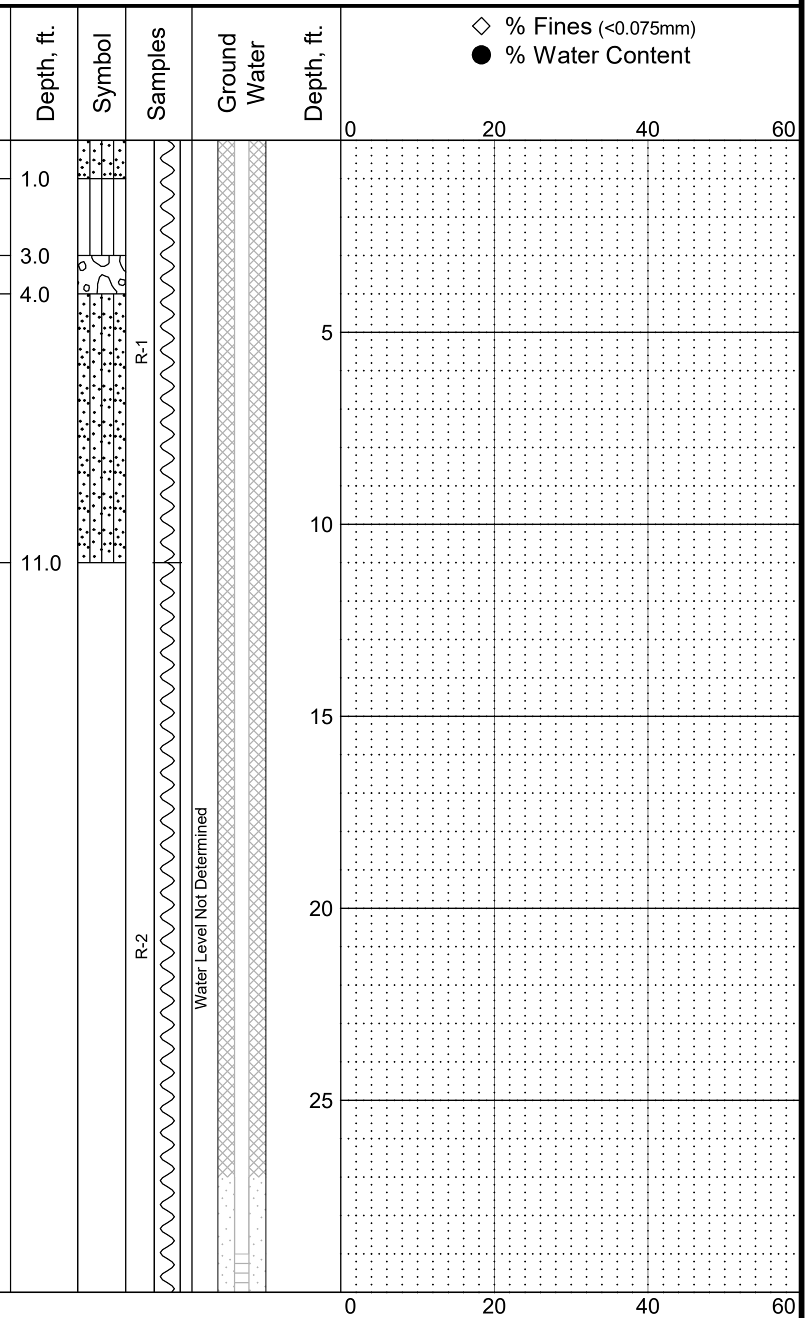
Brown, *Silty Sand (SM)*; moist; trace fine gravel; mostly fine to coarse sand; some silt; some organics (roots, twigs, wood chips, bark).
(Fill)

Gray *Silt with Sand and Gravel (ML)*; moist.
(Fill)

Gray, *Poorly Graded Gravel (GP)*; moist; angular, coarse gravel up to 1.5 inches (crushed rock).
(Fill)
- Black geotextile at 3 feet.
- Geosynthetic clay liner at 4 feet.

Brown, *Silty Sand (SM)*; moist; fine sand.

No recovery. Driller reports loose soil sliding out the bottom of the core barrel.



CONTINUED NEXT SHEET

LEGEND

- * Sample Not Recovered
- Soil Core (as in Sonic Core Borings)
- Well Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout

NOTES
1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

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LOG OF BORING ASW-46

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FIG. E-13
Sheet 1 of 2

MASTER_LOG_E 103485-008.GPJ SHAN_WIL.GDT 9/25/23 Log: RBP Rev: JXS Typ: LKN

VERSION 1
FINAL

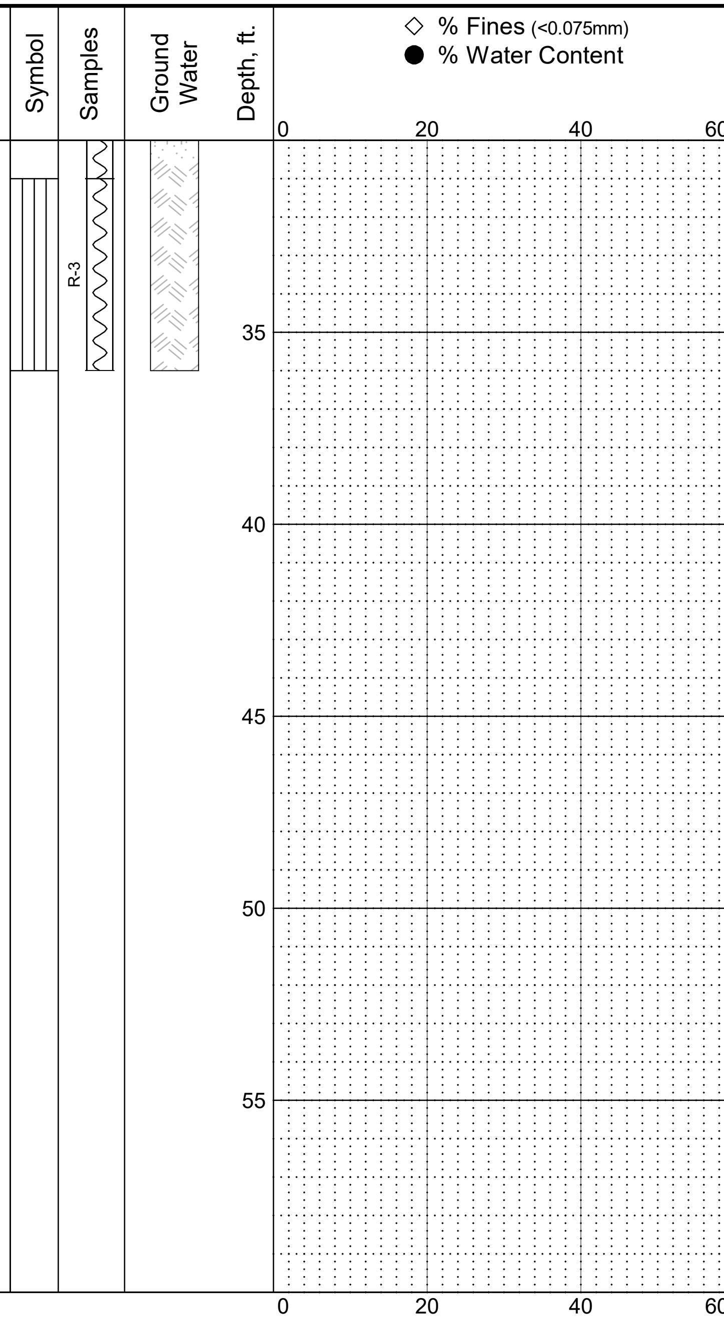
Total Depth:	*36 ft.*	Northing:	*194,000 ft.*	Drilling Method:	*Sonic Core*	Hole Diam.:	*5 in.*
Top Elevation:	*10.2 ft.*	Easting:	*1,276,406 ft.*	Drilling Company:	*AEC*	Rod Diam.:	*3 in.*
Vert. Datum:	*NGVD 1929*	Station:	*N/A*	Drill Rig Equipment:	*Terra Sonic 150cc*	Hammer Type:	
Horiz. Datum:	*State WA-N*	Offset:	*N/A*	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Soil Description	Depth, ft.
Dark gray, *Sandy Silt (ML)*; wet; fine sand.	31.0
BOTTOM OF BORING COMPLETED 3/6/2023	36.0

Well Construction Details:
Flush-mount 24"-diameter green HDPE lid.
1" Sch. 80 PVC casing and screen.
0.020" slot screen at 29 to 30 feet depth.
Ecology well tag BNM-787.



LEGEND

* Sample Not Recovered
Soil Core (as in Sonic Core Borings)
Well Screen and Sand Filter
Bentonite-Cement Grout
Bentonite Chips/Pellets
Bentonite Grout

NOTES
1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

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September 2023 108056-04

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. E-13
Sheet 2 of 2

VERSION 1
FINAL

Log: RBP Rev: JXS Typ: LKN

MASTER_LOG_E 103485-008.GPJ SHAN_WIL.GDT 9/25/23

Total Depth:	*36 ft.*	Northing:	*194,013 ft.*	Drilling Method:	*Sonic Core*	Hole Diam.:	*5 in.*
Top Elevation:	*12.2 ft.*	Easting:	*1,276,401 ft.*	Drilling Company:	*AEC*	Rod Diam.:	*3 in.*
Vert. Datum:	*NGVD 1929*	Station:	*N/A*	Drill Rig Equipment:	*Terra Sonic 150cc*	Hammer Type:	
Horiz. Datum:	*State WA-N*	Offset:	*N/A*	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Soil Description	Depth, ft.	Samples
Brown, *Silty Sand (SM)*; moist; trace fine gravel; mostly fine to coarse sand; some silt; some organics (roots, twigs, wood chips, bark). (Fill)	1.0	
Gray *Silt with Sand and Gravel (ML)*; moist. (Fill)	5.0	R-1
Gray, *Poorly Graded Gravel (GP)*; moist; angular, coarse gravel up to 1.5 inches (crushed rock). (Fill) - Black geotextile at 5 feet. - Geosynthetic clay liner at 6 feet.	6.0	
Brown, *Silty Sand (SM)*; moist; fine sand.	11.0	
No recovery. Driller reports loose soil sliding out the bottom of the core barrel.		R-2

Ground Water: Water Level Not Determined

Depth, ft.: 5, 10, 15, 20, 25

◇ % Fines (<0.075mm)
● % Water Content

0 20 40 60

CONTINUED NEXT SHEET

LEGEND

- * Sample Not Recovered
- Soil Core (as in Sonic Core Borings)
- Well Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

AS/SVE System Extension and Modification
Final Compliance Monitoring Report
8801 East Marginal Way S.

LOG OF BORING ASW-47

September 2023 108056-04

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. E-14
Sheet 1 of 2

MASTER_LOG_E 103485-008.GPJ SHAN_WIL.GDT 9/25/23 Log: RBP Rev: JXS Typ: LKN

VERSION 1
FINAL

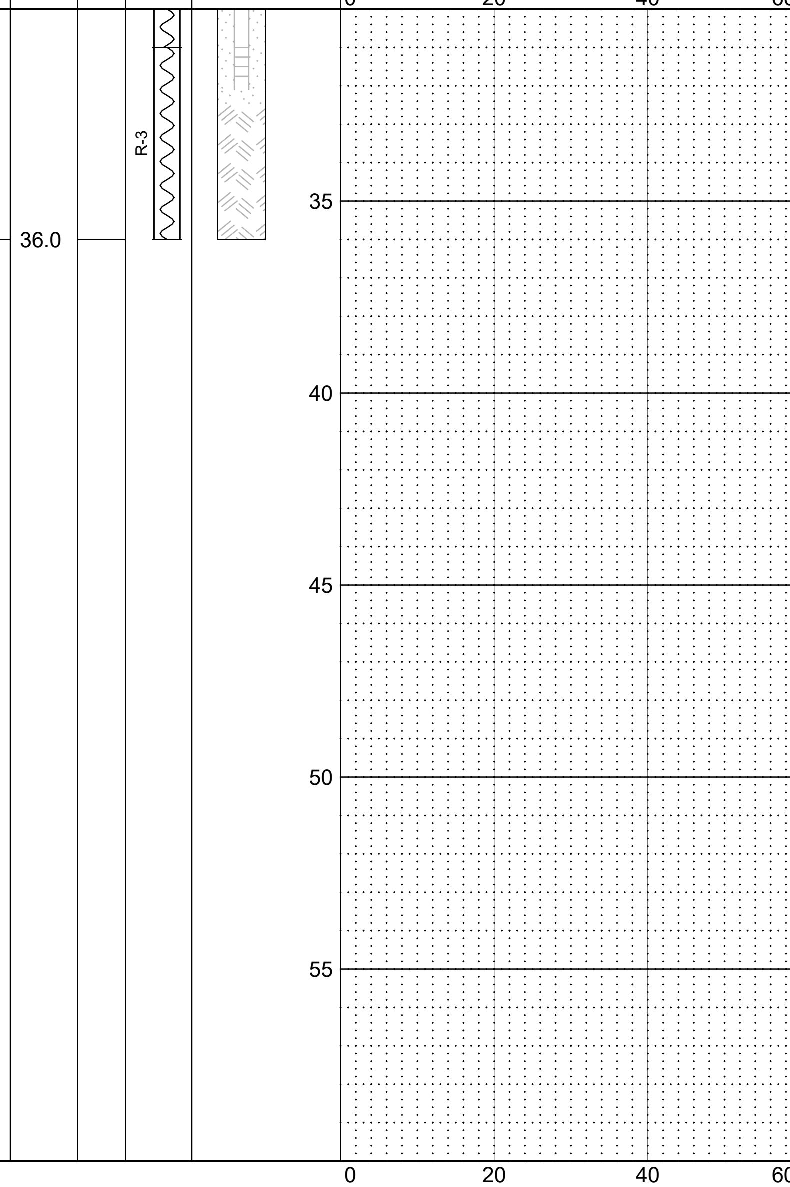
Total Depth:	36 ft.	Northing:	194,013 ft.	Drilling Method:	Sonic Core	Hole Diam.:	5 in.
Top Elevation:	12.2 ft.	Easting:	1,276,401 ft.	Drilling Company:	AEC	Rod Diam.:	3 in.
Vert. Datum:	NGVD 1929	Station:	N/A	Drill Rig Equipment:	Terra Sonic 150cc	Hammer Type:	
Horiz. Datum:	State WA-N	Offset:	N/A	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Depth, ft. | Symbol | Samples | Ground Water | Depth, ft.

◇ % Fines (<0.075mm)
● % Water Content



36.0

BOTTOM OF BORING
COMPLETED 3/6/2023

Well Construction Details:
Flush-mount 24"-diameter green HDPE lid.
1" Sch. 80 PVC casing and screen.
0.020" slot screen at 31 to 32 feet depth.
Ecology well tag BNM-788.

LEGEND

- * Sample Not Recovered
- Soil Core (as in Sonic Core Borings)
- Well Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

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LOG OF BORING ASW-47

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SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

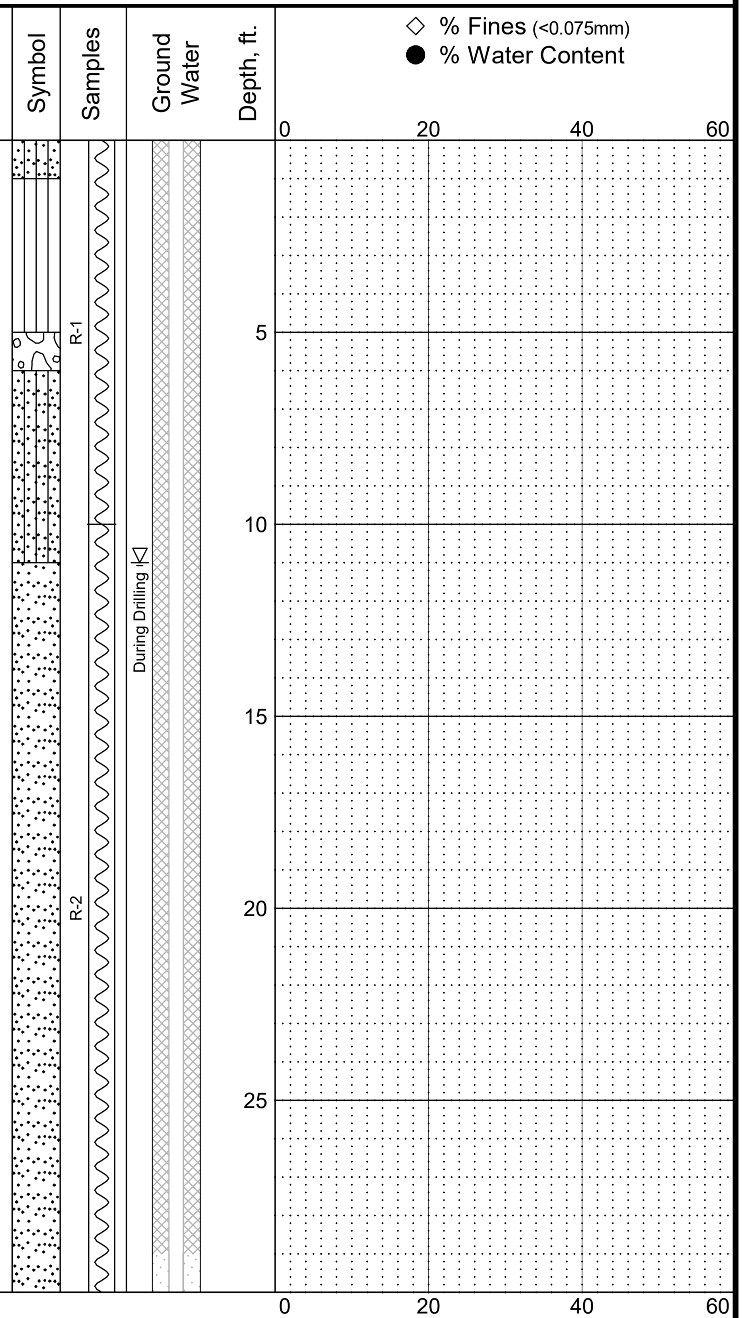
FIG. E-14
Sheet 2 of 2

Total Depth:	36 ft.	Northing:	194,027 ft.	Drilling Method:	Sonic Core	Hole Diam.:	5 in.
Top Elevation:	12.3 ft.	Easting:	1,276,398 ft.	Drilling Company:	AEC	Rod Diam.:	3 in.
Vert. Datum:	NGVD 1929	Station:	N/A	Drill Rig Equipment:	Terra Sonic 150cc	Hammer Type:	
Horiz. Datum:	State WA-N	Offset:	N/A	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Soil Description	Depth, ft.
Brown, *Silty Sand (SM)*; moist; trace fine gravel; mostly fine to coarse sand; some silt; some organics (roots, twigs, wood chips, bark). (Fill)	1.0
Gray *Silt with Sand and Gravel (ML)*; moist. (Fill)	5.0
Gray, *Poorly Graded Gravel (GP)*; moist; angular, coarse gravel up to 1.5 inches (crushed rock). (Fill) - Black geotextile at 5 feet. - Geosynthetic clay liner at 6 feet.	6.0
Brown, *Silty Sand (SM)*; moist; fine sand.	11.0
Dark gray, *Poorly Graded Sand (SP)*; wet; fine to coarse sand.	



CONTINUED NEXT SHEET

LEGEND

- * Sample Not Recovered
- Soil Core (as in Sonic Core Borings)
- Well Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout
- Ground Water Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

AS/SVE System Extension and Modification
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LOG OF BORING ASW-48

September 2023 108056-04

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

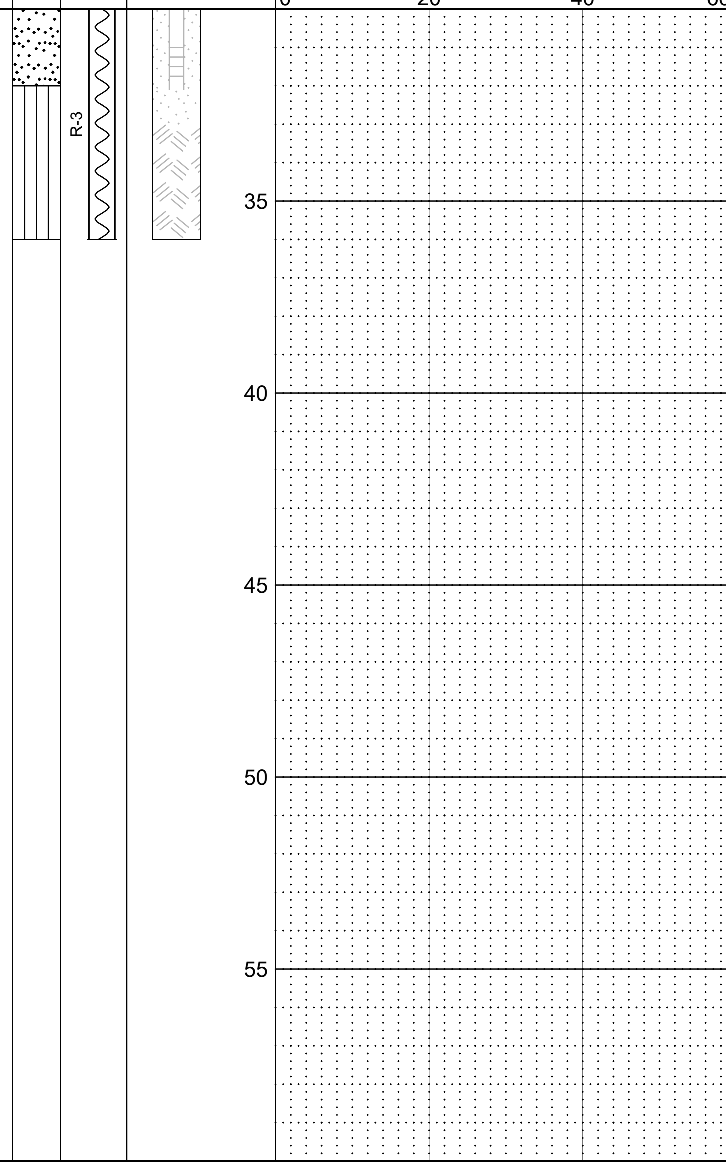
FIG. E-15
Sheet 1 of 2

Total Depth:	*36 ft.*	Northing:	*194,027 ft.*	Drilling Method:	*Sonic Core*	Hole Diam.:	*5 in.*
Top Elevation:	*12.3 ft.*	Easting:	*1,276,398 ft.*	Drilling Company:	*AEC*	Rod Diam.:	*3 in.*
Vert. Datum:	*NGVD 1929*	Station:	*N/A*	Drill Rig Equipment:	*Terra Sonic 150cc*	Hammer Type:	
Horiz. Datum:	*State WA-N*	Offset:	*N/A*	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Soil Description	Depth, ft.	Symbol	Samples	Ground Water	Depth, ft.
Gray, *Sandy Silt (ML)*; wet; fine sand; trace pieces of organics (twigs, stems).	32.0		R-3		35
BOTTOM OF BORING COMPLETED 3/6/2023	36.0				40, 45, 50, 55



◇ % Fines (<0.075mm)
● % Water Content

0 20 40 60

Well Construction Details:
Flush-mount 24"-diameter green HDPE lid.
1" Sch. 80 PVC casing and screen.
0.020" slot screen at 31 to 32 feet depth.
Ecology well tag BNM-789.

LEGEND

- * Sample Not Recovered
- Soil Core (as in Sonic Core Borings)
- Well Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout
- Ground Water Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

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LOG OF BORING ASW-48

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Geotechnical and Environmental Consultants

FIG. E-15
Sheet 2 of 2

Total Depth:	36 ft.	Northing:	194,042 ft.	Drilling Method:	Sonic Core	Hole Diam.:	5 in.
Top Elevation:	12.3 ft.	Easting:	1,276,394 ft.	Drilling Company:	AEC	Rod Diam.:	3 in.
Vert. Datum:	NGVD 1929	Station:	N/A	Drill Rig Equipment:	Terra Sonic 150cc	Hammer Type:	
Horiz. Datum:	State WA-N	Offset:	N/A	Other Comments:			

SOIL DESCRIPTION *Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.*	Depth, ft.	Samples
Brown, *Silty Sand (SM)*; moist; trace fine gravel; mostly fine to coarse sand; some silt; some organics (roots, twigs, wood chips, bark). (Fill)	1.0	
Gray *Silt with Sand and Gravel (ML)*; moist. (Fill)	5.0	R-1
Gray, *Poorly Graded Gravel (GP)*; moist; angular, coarse gravel up to 1.5 inches (crushed rock). (Fill) - Black geotextile at 5 feet. - Geosynthetic clay liner at 6 feet.	6.0	
Brown, *Silty Sand (SM)*; moist; fine sand.	11.0	
Dark gray, *Poorly Graded Sand (SP)*; wet; fine to coarse sand.		R-2

Ground Water: During Drilling ⊻

Depth, ft.: 5, 10, 15, 20, 25

◇ % Fines (<0.075mm)
● % Water Content

0 20 40 60

CONTINUED NEXT SHEET

LEGEND

- * Sample Not Recovered
- Soil Core (as in Sonic Core Borings)
- Well Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout
- ⊻ Ground Water Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

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SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. E-16
Sheet 1 of 2

VERSION 1
FINAL

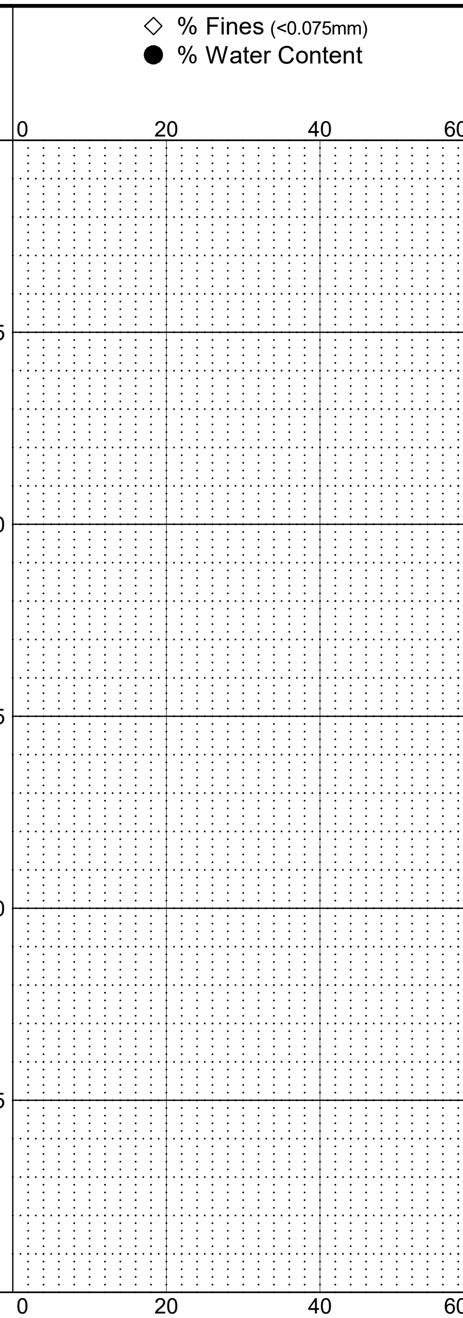
Total Depth:	36 ft.	Northing:	194,042 ft.	Drilling Method:	Sonic Core	Hole Diam.:	5 in.
Top Elevation:	12.3 ft.	Easting:	1,276,394 ft.	Drilling Company:	AEC	Rod Diam.:	3 in.
Vert. Datum:	NGVD 1929	Station:	N/A	Drill Rig Equipment:	Terra Sonic 150cc	Hammer Type:	
Horiz. Datum:	State WA-N	Offset:	N/A	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Soil Description	Depth, ft.	Samples
Dark gray, *Silty Sand (SM)*; wet; fine to coarse sand.	33.0	R-3
BOTTOM OF BORING COMPLETED 3/3/2023	36.0	

Well Construction Details:
Flush-mount 24"-diameter green HDPE lid.
1" Sch. 80 PVC casing and screen.
0.020" slot screen at 32 to 33 feet depth.
Ecology well tag BNM-790.



LEGEND

- * Sample Not Recovered
- Soil Core (as in Sonic Core Borings)
- Well Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout
- Ground Water Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

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SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. E-16
Sheet 2 of 2

VERSION 1
FINAL

Total Depth:	36 ft.	Northing:	194,057 ft.	Drilling Method:	Sonic Core	Hole Diam.:	5 in.
Top Elevation:	12.5 ft.	Easting:	1,276,391 ft.	Drilling Company:	AEC	Rod Diam.:	3 in.
Vert. Datum:	NGVD 1929	Station:	N/A	Drill Rig Equipment:	Terra Sonic 150cc	Hammer Type:	
Horiz. Datum:	State WA-N	Offset:	N/A	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Soil Description	Depth, ft.	Samples
Brown, *Silty Sand (SM)*; moist; trace fine gravel; mostly fine to coarse sand; some silt; some organics (roots, twigs, wood chips, bark). (Fill)	1.0	R-1
Gray *Silt with Sand and Gravel (ML)*; moist. (Fill)	5.0	
Gray, *Poorly Graded Gravel (GP)*; moist; angular, coarse gravel up to 1.5 inches (crushed rock). (Fill) - Black geotextile at 5 feet. - Geosynthetic clay liner at 6 feet.	6.0	
Brown, *Silty Sand (SM)*; moist; fine sand.	11.0	R-2
Dark gray, *Poorly Graded Sand (SP)*; wet; fine to coarse sand.		

Ground Water: During Drilling ∇ (approx. 11 ft)

◇ % Fines (<0.075mm)
● % Water Content

CONTINUED NEXT SHEET

LEGEND

- * Sample Not Recovered
- Soil Core (as in Sonic Core Borings)
- Well Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout
- ∇ Ground Water Level ATD

NOTES
1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

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LOG OF BORING ASW-50

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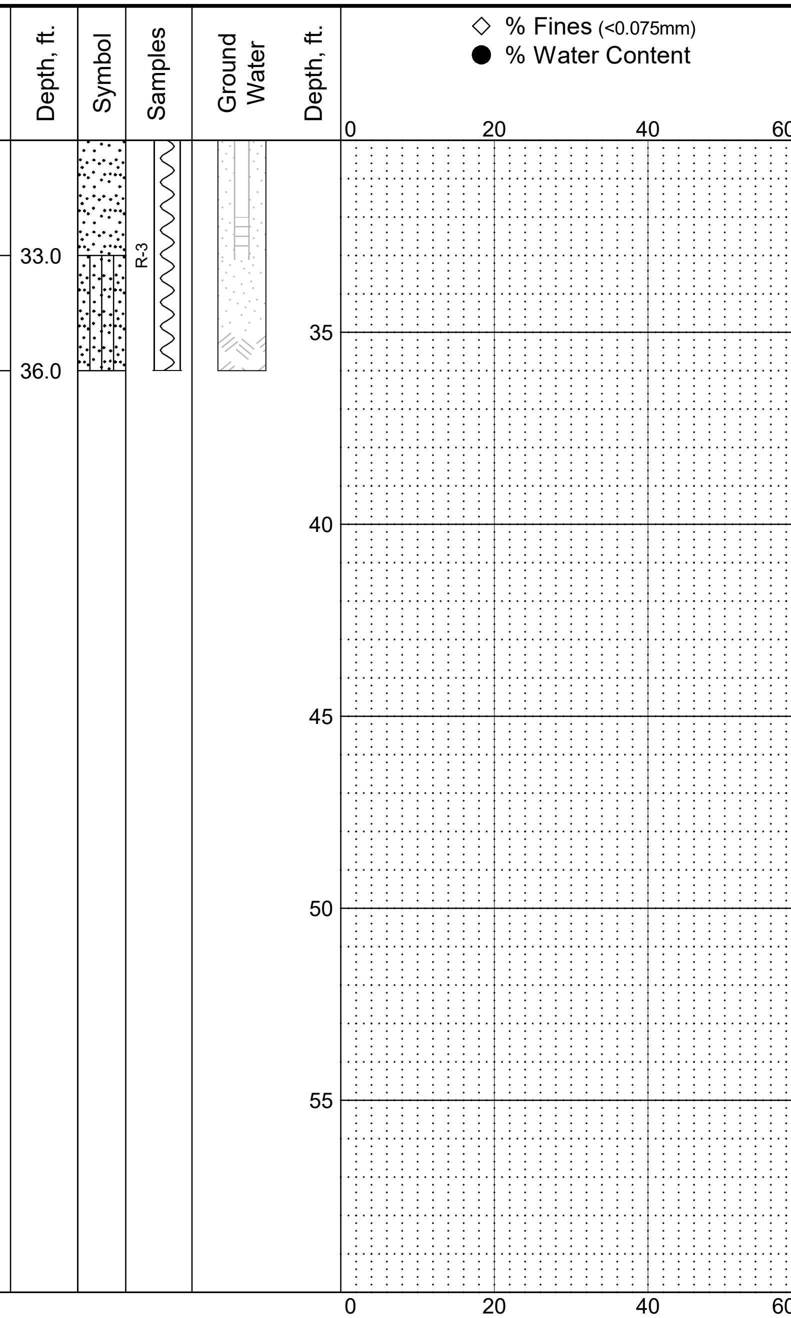
Geotechnical and Environmental Consultants

FIG. E-17
Sheet 1 of 2

Total Depth:	*36 ft.*	Northing:	*194,057 ft.*	Drilling Method:	*Sonic Core*	Hole Diam.:	*5 in.*
Top Elevation:	*12.5 ft.*	Easting:	*1,276,391 ft.*	Drilling Company:	*AEC*	Rod Diam.:	*3 in.*
Vert. Datum:	*NGVD 1929*	Station:	*N/A*	Drill Rig Equipment:	*Terra Sonic 150cc*	Hammer Type:	
Horiz. Datum:	*State WA-N*	Offset:	*N/A*	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.



Dark gray, *Silty Sand (SM)*; wet; fine to coarse sand.

BOTTOM OF BORING
COMPLETED 3/3/2023

Well Construction Details:
Flush-mount 24"-diameter green HDPE lid.
1" Sch. 80 PVC casing and screen.
0.020" slot screen at 32 to 33 feet.
Ecology well tag BNM-791.

LEGEND

- * Sample Not Recovered
- Soil Core (as in Sonic Core Borings)
- Well Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout
- Ground Water Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

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LOG OF BORING ASW-50

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FIG. E-17
Sheet 2 of 2

MASTER_LOG_E 103485-008.GPJ SHAN_WIL.GDT 9/25/23 Log: RBP Rev: JXS Typ: LKN

VERSION 1
FINAL

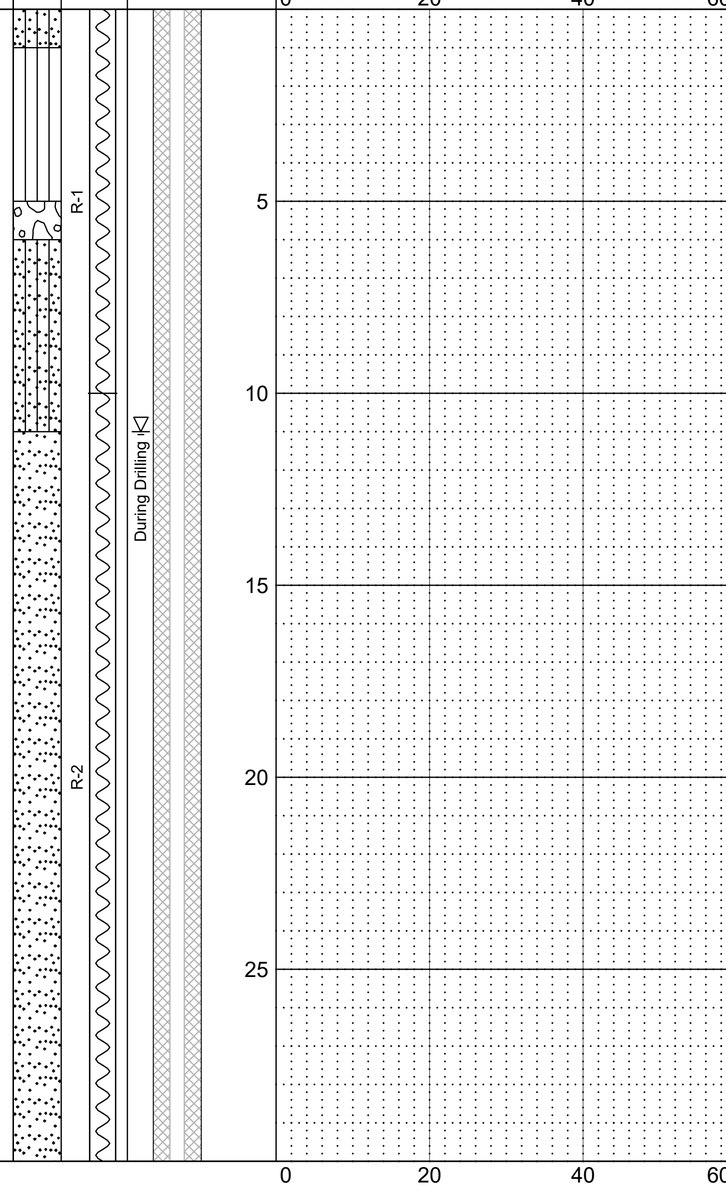
Total Depth:	*36 ft.*	Northing:	*194,071 ft.*	Drilling Method:	*Sonic Core*	Hole Diam.:	*5 in.*
Top Elevation:	*12.4 ft.*	Easting:	*1,276,387 ft.*	Drilling Company:	*AEC*	Rod Diam.:	*3 in.*
Vert. Datum:	*NGVD 1929*	Station:	*N/A*	Drill Rig Equipment:	*Terra Sonic 150cc*	Hammer Type:	
Horiz. Datum:	*State WA-N*	Offset:	*N/A*	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Depth, ft. | Symbol | Samples | Ground Water | Depth, ft. | ◇ % Fines (<0.075mm) ● % Water Content (0, 20, 40, 60)

Soil Description	Depth, ft.
Brown, *Silty Sand (SM)*; moist; trace fine gravel; mostly fine to coarse sand; some silt; some organics (roots, twigs, wood chips, bark). (Fill)	1.0
Gray *Silt with Sand and Gravel (ML)*; moist. (Fill)	5.0
Gray, *Poorly Graded Gravel (GP)*; moist; angular, coarse gravel up to 1.5 inches (crushed rock). (Fill) - Black geotextile at 5 feet. - Geosynthetic clay liner at 6 feet.	6.0
Brown, *Silty Sand (SM)*; moist; fine sand. (Fill)	11.0
Dark gray, *Poorly Graded Sand (SP)*; wet; fine to coarse sand.	



CONTINUED NEXT SHEET

LEGEND

- * Sample Not Recovered
- Soil Core (as in Sonic Core Borings)
- Well Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout
- Ground Water Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

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LOG OF BORING ASW-51

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FIG. E-18
Sheet 1 of 2

VERSION 1
FINAL

Total Depth:	*36 ft.*	Northing:	*194,071 ft.*	Drilling Method:	*Sonic Core*	Hole Diam.:	*5 in.*
Top Elevation:	*12.4 ft.*	Easting:	*1,276,387 ft.*	Drilling Company:	*AEC*	Rod Diam.:	*3 in.*
Vert. Datum:	*NGVD 1929*	Station:	*N/A*	Drill Rig Equipment:	*Terra Sonic 150cc*	Hammer Type:	
Horiz. Datum:	*State WA-N*	Offset:	*N/A*	Other Comments:			

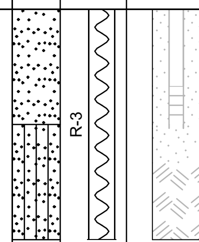
SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Depth, ft. | Symbol | Samples | Ground Water | Depth, ft.

◇ % Fines (<0.075mm)
● % Water Content

0 20 40 60



Soil Description	Depth, ft.
Dark gray, *Silty Sand (SM)*; wet; fine to coarse sand.	33.0
BOTTOM OF BORING COMPLETED 3/3/2023	36.0

Depth, ft.: 35, 40, 45, 50, 55

0 20 40 60

Well Construction Details:
Flush-mount 24"-diameter green HDPE lid.
1" Sch. 80 PVC casing and screen.
0.020" slot screen at 32 to 33 feet.
Ecology well tag BNM-792.

LEGEND

* Sample Not Recovered
Soil Core (as in Sonic Core Borings)
Well Screen and Sand Filter
Bentonite-Cement Grout
Bentonite Chips/Pellets
Bentonite Grout
Ground Water Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

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LOG OF BORING ASW-51

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SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. E-18
Sheet 2 of 2

Total Depth:	36 ft.	Northing:	194,085 ft.	Drilling Method:	Sonic Core	Hole Diam.:	5 in.
Top Elevation:	12.2 ft.	Easting:	1,276,384 ft.	Drilling Company:	AEC	Rod Diam.:	3 in.
Vert. Datum:	NGVD 1929	Station:	N/A	Drill Rig Equipment:	Terra Sonic 150cc	Hammer Type:	
Horiz. Datum:	State WA-N	Offset:	N/A	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Soil Description	Depth, ft.	Samples	Ground Water
Brown, *Silty Sand (SM)*; moist; trace fine gravel; mostly fine to coarse sand; some silt; some organics (roots, twigs, wood chips, bark). (Fill)	1.0		
Gray *Silt with Sand and Gravel (ML)*; moist. (Fill)	5.0	R-1	
Gray, *Poorly Graded Gravel (GP)*; moist; angular, coarse gravel up to 1.5 inches (crushed rock). (Fill) - Black geotextile at 5 feet. - Geosynthetic clay liner at 6 feet.	6.0		
Brown, *Silty Sand (SM)*; moist; fine sand.	11.0		During Drilling ∇
Dark gray, *Poorly Graded Sand (SP)*; wet; fine to coarse sand.		R-2	

◇ % Fines (<0.075mm)
● % Water Content

Depth, ft.: 5, 10, 15, 20, 25

0 20 40 60

CONTINUED NEXT SHEET

LEGEND

- * Sample Not Recovered
- Soil Core (as in Sonic Core Borings)
- Well Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout
- ∇ Ground Water Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

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LOG OF BORING ASW-52

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FIG. E-19
Sheet 1 of 2

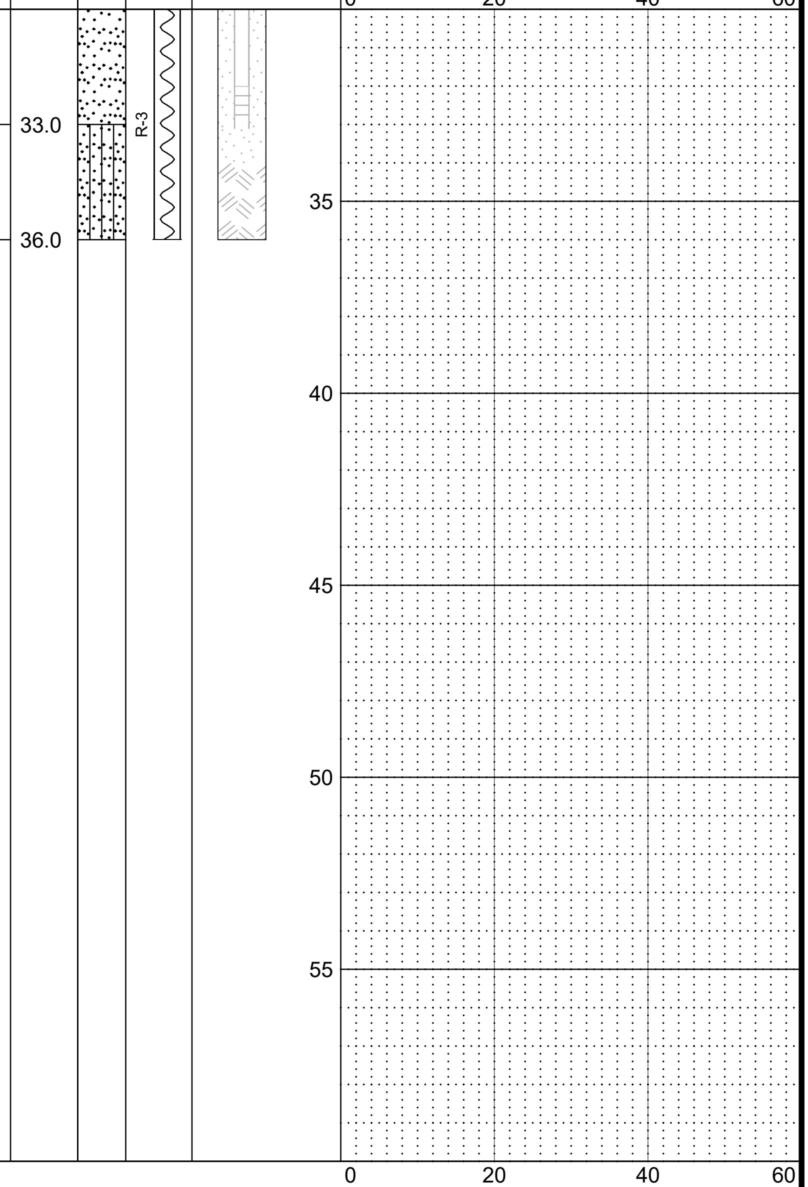
Total Depth:	36 ft.	Northing:	194,085 ft.	Drilling Method:	Sonic Core	Hole Diam.:	5 in.
Top Elevation:	12.2 ft.	Easting:	1,276,384 ft.	Drilling Company:	AEC	Rod Diam.:	3 in.
Vert. Datum:	NGVD 1929	Station:	N/A	Drill Rig Equipment:	Terra Sonic 150cc	Hammer Type:	
Horiz. Datum:	State WA-N	Offset:	N/A	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Depth, ft. | Symbol | Samples | Ground Water | Depth, ft.

◇ % Fines (<0.075mm)
● % Water Content



33.0 — Dark gray, *Silty Sand (SM)*; wet; fine to coarse sand.

36.0 — BOTTOM OF BORING
COMPLETED 3/3/2023

Well Construction Details:
Flush-mount 24"-diameter green HDPE lid.
1" Sch. 80 PVC casing and screen.
0.020" slot screen at 32 to 33 feet.
Ecology well tag BNM-793.

Log: RBP Rev: JXS Typ: LKN

LEGEND

- * Sample Not Recovered
- Soil Core (as in Sonic Core Borings)
- Well Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout
- Ground Water Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

AS/SVE System Extension and Modification
Final Compliance Monitoring Report
8801 East Marginal Way S.

LOG OF BORING ASW-52

September 2023 108056-04

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. E-19
Sheet 2 of 2

MASTER_LOG_E 103485-008.GPJ SHAN_WIL.GDT 9/25/23

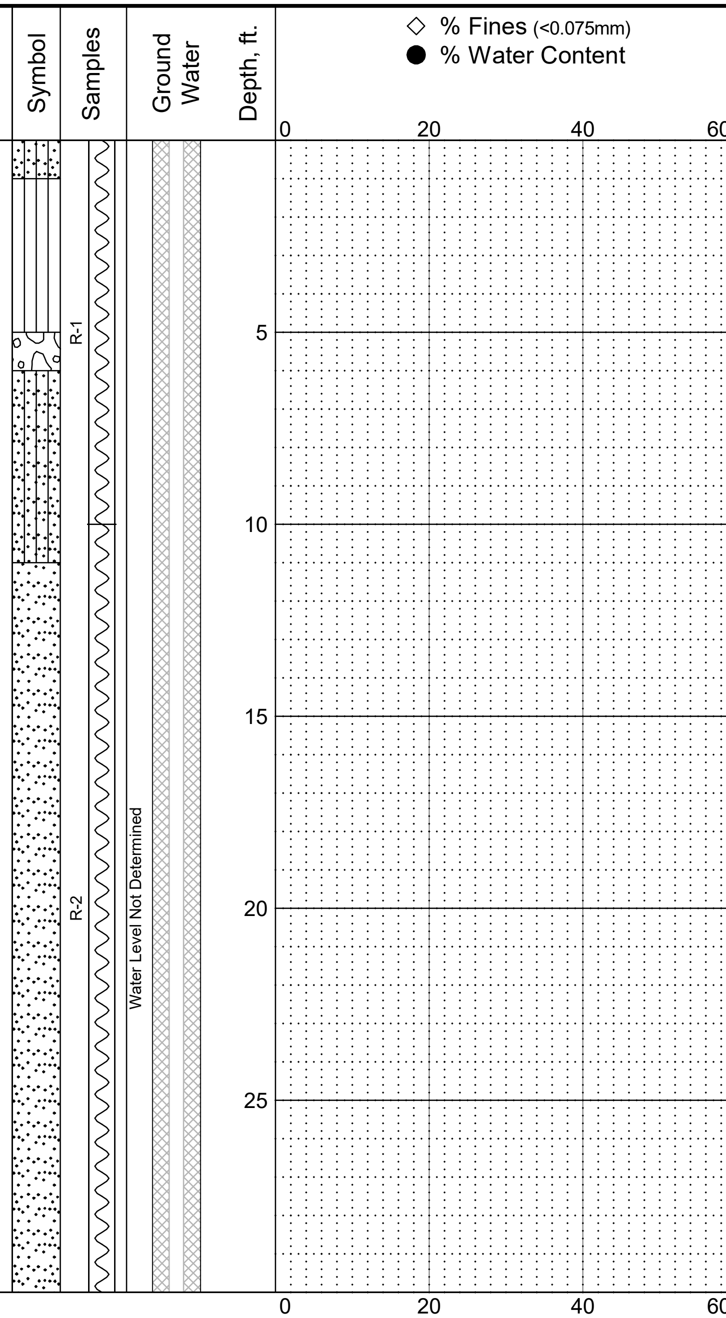
VERSION 1
FINAL

Total Depth:	36 ft.	Northing:	194,100 ft.	Drilling Method:	Sonic Core	Hole Diam.:	5 in.
Top Elevation:	12.3 ft.	Easting:	1,276,380 ft.	Drilling Company:	AEC	Rod Diam.:	3 in.
Vert. Datum:	NGVD 1929	Station:	N/A	Drill Rig Equipment:	Terra Sonic 150cc	Hammer Type:	
Horiz. Datum:	State WA-N	Offset:	N/A	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

SOIL DESCRIPTION	Depth, ft.
Brown, *Silty Sand (SM)*; moist; trace fine gravel; mostly fine to coarse sand; some silt; some organics (roots, twigs, wood chips, bark). (Fill)	1.0
Gray *Silt with Sand and Gravel (ML)*; moist. (Fill)	5.0
Gray, *Poorly Graded Gravel (GP)*; moist; angular, coarse gravel up to 1.5 inches (crushed rock). (Fill) - Black geotextile at 5 feet. - Geosynthetic clay liner at 6 feet.	6.0
Brown, *Silty Sand (SM)*; moist; fine sand.	11.0
Dark gray, *Poorly Graded Sand (SP)*; moist.	



CONTINUED NEXT SHEET

LEGEND

- * Sample Not Recovered
- Soil Core (as in Sonic Core Borings)
- Well Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

AS/SVE System Extension and Modification
Final Compliance Monitoring Report
8801 East Marginal Way S.

LOG OF BORING ASW-53

September 2023 108056-04

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. E-20
Sheet 1 of 2

VERSION 1
FINAL

MASTER_LOG_E 103485-008.GPJ SHAN_WIL.GDT 9/25/23 Log: RBP Rev: JXS Typ: LKN

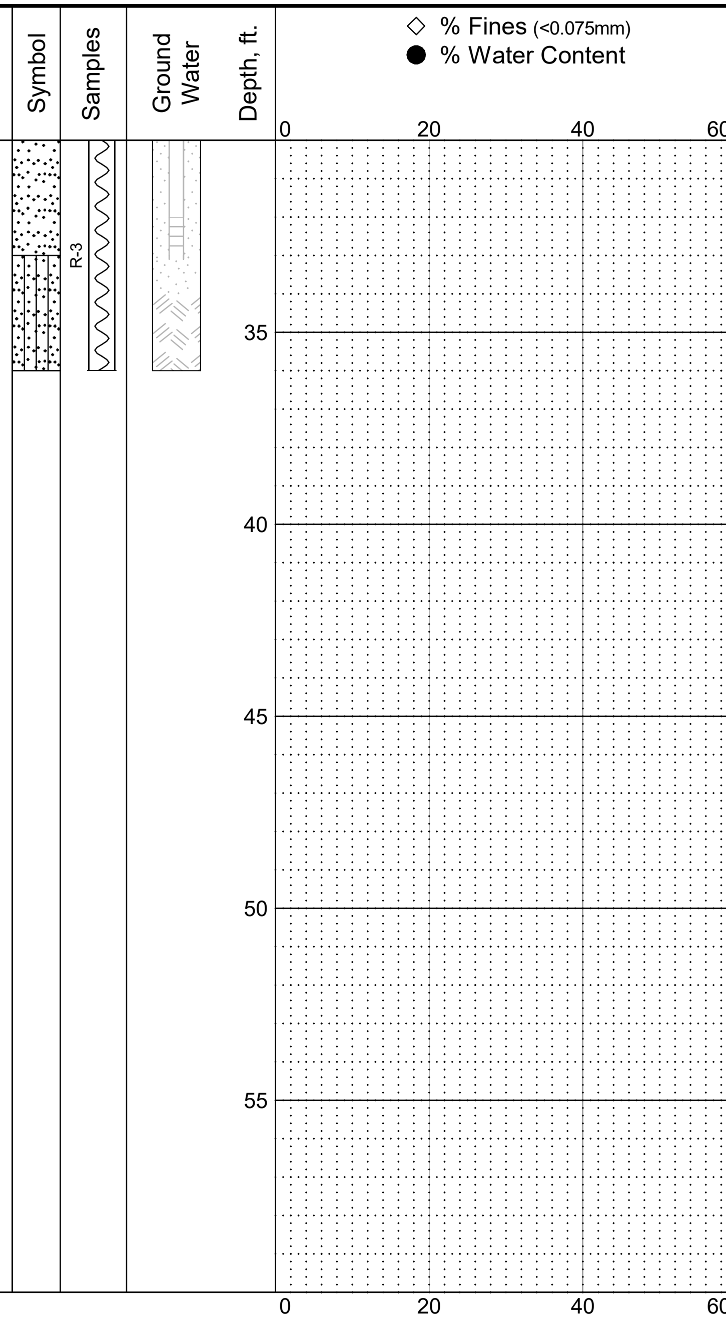
Total Depth:	*36 ft.*	Northing:	*194,100 ft.*	Drilling Method:	*Sonic Core*	Hole Diam.:	*5 in.*
Top Elevation:	*12.3 ft.*	Easting:	*1,276,380 ft.*	Drilling Company:	*AEC*	Rod Diam.:	*3 in.*
Vert. Datum:	*NGVD 1929*	Station:	*N/A*	Drill Rig Equipment:	*Terra Sonic 150cc*	Hammer Type:	
Horiz. Datum:	*State WA-N*	Offset:	*N/A*	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

SOIL DESCRIPTION	Depth, ft.
Dark gray, *Silty Sand (SM)*; moist.	33.0
BOTTOM OF BORING COMPLETED 3/3/2023	36.0

Well Construction Details:
Flush-mount 24"-diameter green HDPE lid.
1" Sch. 80 PVC casing and screen.
0.020" slot screen at 32 to 33 feet.
Ecology well tag BNM-794.



LEGEND

- * Sample Not Recovered
- Soil Core (as in Sonic Core Borings)
- Well Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

AS/SVE System Extension and Modification
Final Compliance Monitoring Report
8801 East Marginal Way S.

LOG OF BORING ASW-53

September 2023 — 108056-04

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

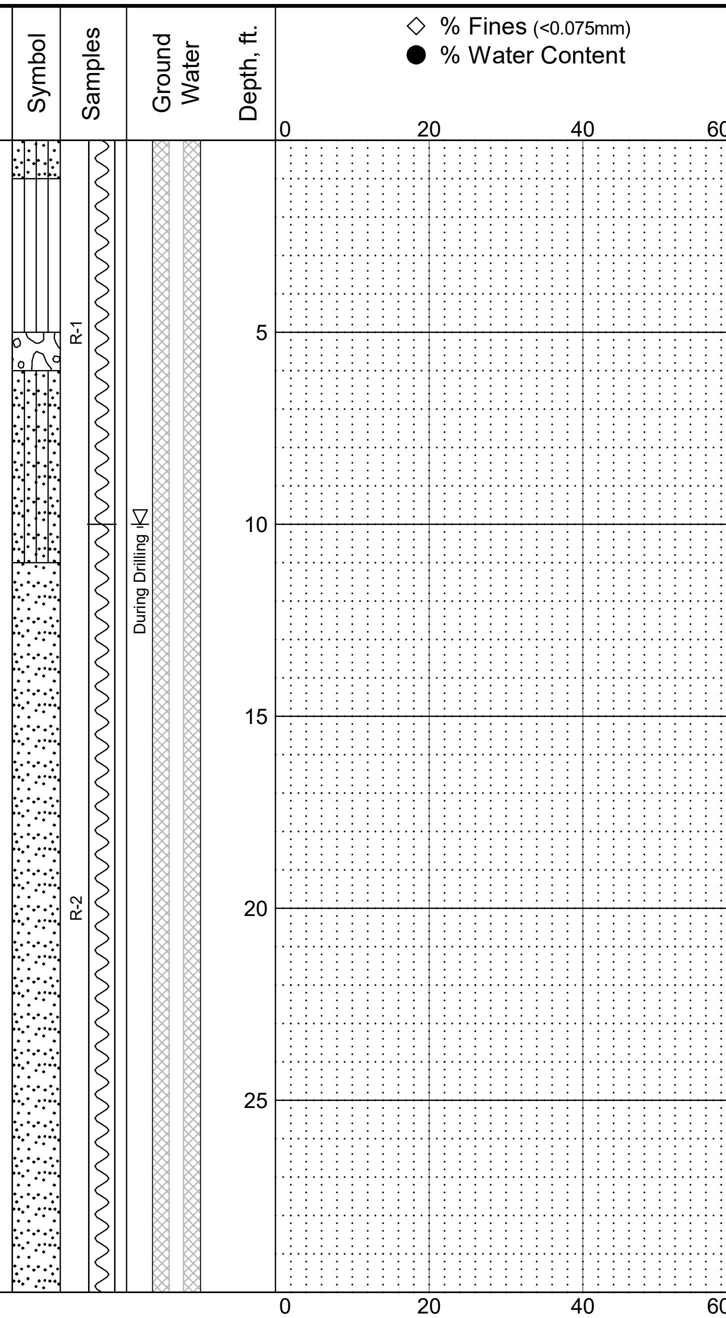
FIG. E-20
Sheet 2 of 2

Total Depth:	36 ft.	Northing:	194,114 ft.	Drilling Method:	Sonic Core	Hole Diam.:	5 in.
Top Elevation:	12.6 ft.	Easting:	1,276,376 ft.	Drilling Company:	AEC	Rod Diam.:	3 in.
Vert. Datum:	NGVD 1929	Station:	N/A	Drill Rig Equipment:	Terra Sonic 150cc	Hammer Type:	
Horiz. Datum:	State WA-N	Offset:	N/A	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Soil Description	Depth, ft.
Brown, *Silty Sand (SM)*; moist; trace fine gravel; mostly fine to coarse sand; some silt; some organics (roots, twigs, wood chips, bark). (Fill)	1.0
Gray *Silt with Sand and Gravel (ML)*; moist. (Fill)	5.0
Gray, *Poorly Graded Gravel (GP)*; moist; angular, coarse gravel up to 1.5 inches (crushed rock). (Fill) - Black geotextile at 5 feet. - Geosynthetic clay liner at 6 feet.	6.0
Brown, *Silty Sand (SM)*; moist. - Wet at 10 feet.	11.0
Dark gray, *Poorly Graded Sand (SP)*; moist.	



CONTINUED NEXT SHEET

LEGEND

- * Sample Not Recovered
- Soil Core (as in Sonic Core Borings)
- Well Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout
- Ground Water Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

AS/SVE System Extension and Modification
Final Compliance Monitoring Report
8801 East Marginal Way S.

LOG OF BORING ASW-54

September 2023 108056-04

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

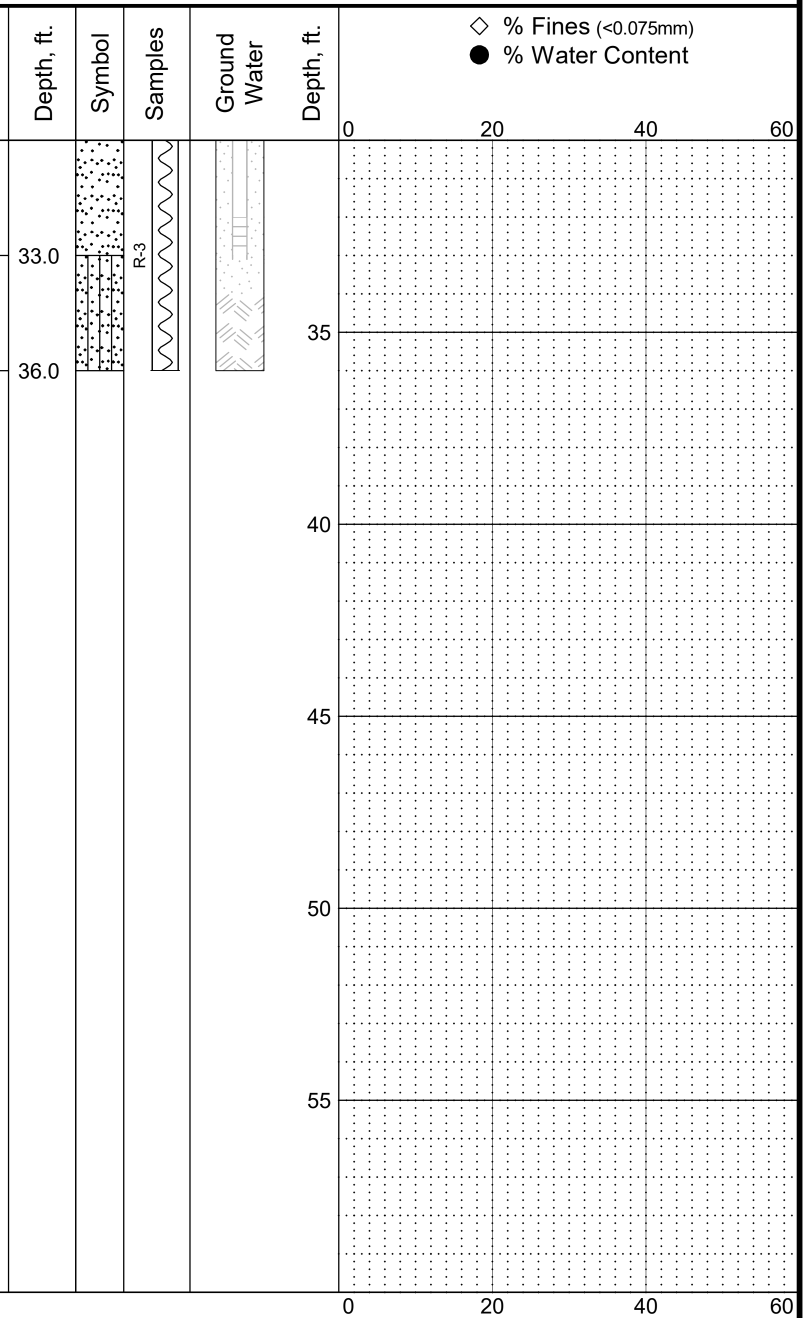
FIG. E-21
Sheet 1 of 2

Total Depth:	36 ft.	Northing:	194,114 ft.	Drilling Method:	Sonic Core	Hole Diam.:	5 in.
Top Elevation:	12.6 ft.	Easting:	1,276,376 ft.	Drilling Company:	AEC	Rod Diam.:	3 in.
Vert. Datum:	NGVD 1929	Station:	N/A	Drill Rig Equipment:	Terra Sonic 150cc	Hammer Type:	
Horiz. Datum:	State WA-N	Offset:	N/A	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Depth, ft.	Description
33.0	Dark gray, *Silty Sand (SM)*; wet.
36.0	BOTTOM OF BORING COMPLETED 3/3/2023



Well Construction Details:
Flush-mount 24"-diameter green HDPE lid.
1" Sch. 80 PVC casing and screen.
0.020" slot screen at 32 to 33 feet.
Ecology well tag BNM-795.

LEGEND

- * Sample Not Recovered
- Soil Core (as in Sonic Core Borings)
- Well Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout
- Ground Water Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

AS/SVE System Extension and Modification
Final Compliance Monitoring Report
8801 East Marginal Way S.

LOG OF BORING ASW-54

September 2023 108056-04

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. E-21
Sheet 2 of 2

Total Depth:	41 ft.	Northing:	194,129 ft.	Drilling Method:	Sonic Core	Hole Diam.:	5 in.
Top Elevation:	12.5 ft.	Easting:	1,276,372 ft.	Drilling Company:	AEC	Rod Diam.:	3 in.
Vert. Datum:	NGVD 1929	Station:	N/A	Drill Rig Equipment:	Terra Sonic 150cc	Hammer Type:	
Horiz. Datum:	State WA-N	Offset:	N/A	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Soil Description	Depth, ft.	Samples
Brown, *Silty Sand (SM)*; moist; trace fine gravel; mostly fine to coarse sand; some silt; some organics (roots, twigs, wood chips, bark). (Fill)	1.0	
Gray *Silt with Sand and Gravel (ML)*; moist. (Fill)	5.0	R-1
Gray, *Poorly Graded Gravel (GP)*; moist; angular, coarse gravel up to 1.5 inches (crushed rock). (Fill) - Black geotextile at 5 feet. - Geosynthetic clay liner at 6 feet.	6.0	
Brown, *Silty Sand (SM)*; moist; fine sand.	11.0	
Dark gray, *Poorly Graded Sand (SP)*; moist; trace fines.		R-2, R-3, R-4

Ground Water: Water Level Not Determined

Depth, ft.: 5, 10, 15, 20, 25

◇ % Fines (<0.075mm)
● % Water Content

0 20 40 60

CONTINUED NEXT SHEET

LEGEND

* Sample Not Recovered
Soil Core (as in Sonic Core Borings)
Well Screen and Sand Filter
Bentonite-Cement Grout
Bentonite Chips/Pellets
Bentonite Grout

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

AS/SVE System Extension and Modification
Final Compliance Monitoring Report
8801 East Marginal Way S.

LOG OF BORING ASW-55

September 2023 108056-04

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. E-22
Sheet 1 of 2

VERSION 1
FINAL

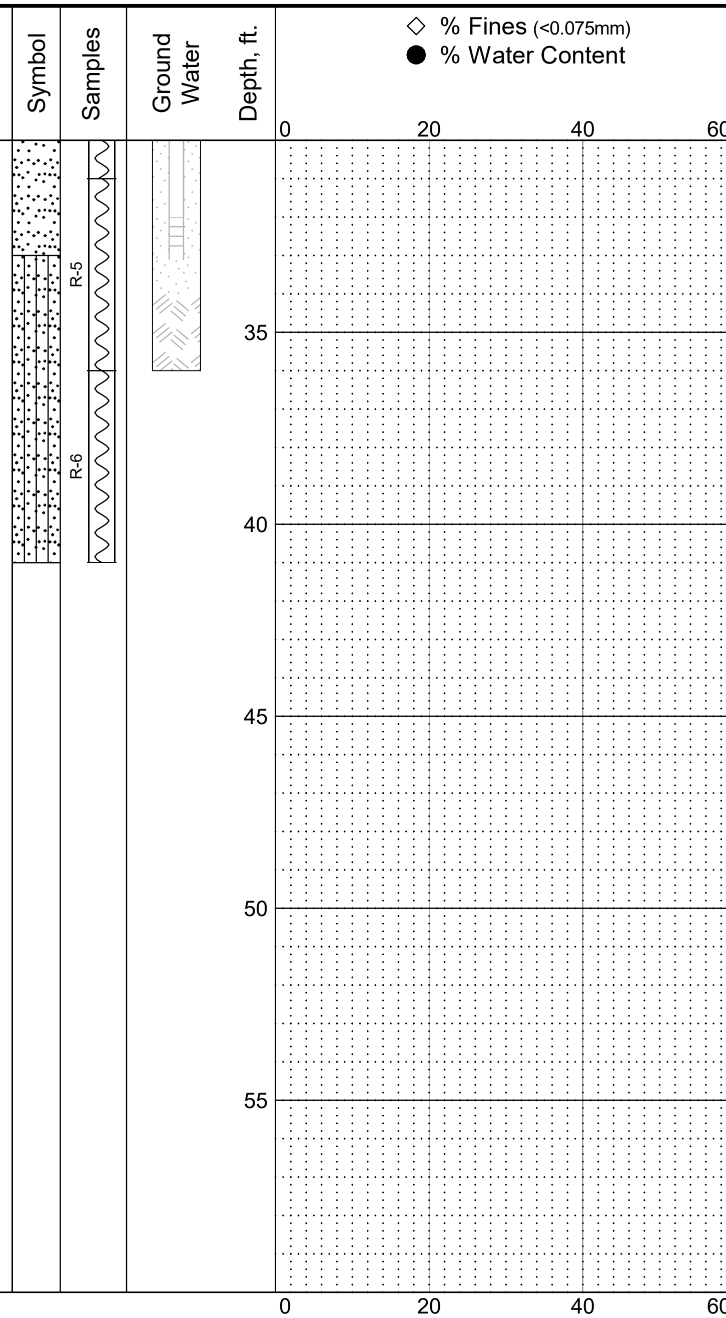
Total Depth:	*41 ft.*	Northing:	*194,129 ft.*	Drilling Method:	*Sonic Core*	Hole Diam.:	*5 in.*
Top Elevation:	*12.5 ft.*	Easting:	*1,276,372 ft.*	Drilling Company:	*AEC*	Rod Diam.:	*3 in.*
Vert. Datum:	*NGVD 1929*	Station:	*N/A*	Drill Rig Equipment:	*Terra Sonic 150cc*	Hammer Type:	
Horiz. Datum:	*State WA-N*	Offset:	*N/A*	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Soil Description	Depth, ft.
Dark gray, *Silty Sand (SM)*; wet.	33.0
BOTTOM OF BORING COMPLETED 3/2/2023	41.0

Well Construction Details:
Flush-mount 24"-diameter green HDPE lid.
1" Sch. 80 PVC casing and screen.
0.020" slot screen at 32 to 33 feet.
Ecology well tag BNM-796.



LEGEND

* Sample Not Recovered
Soil Core (as in Sonic Core Borings)
Well Screen and Sand Filter
Bentonite-Cement Grout
Bentonite Chips/Pellets
Bentonite Grout

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
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AS/SVE System Extension and Modification
Final Compliance Monitoring Report
8801 East Marginal Way S.

LOG OF BORING ASW-55

September 2023 108056-04

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. E-22
Sheet 2 of 2

MASTER_LOG_E 103485-008.GPJ SHAN_WIL.GDT 9/25/23 Log: RBP Rev: JXS Typ: LKN

VERSION 1
FINAL

APPENDIX F: PRODUCT DATA SHEETS

Appendix F

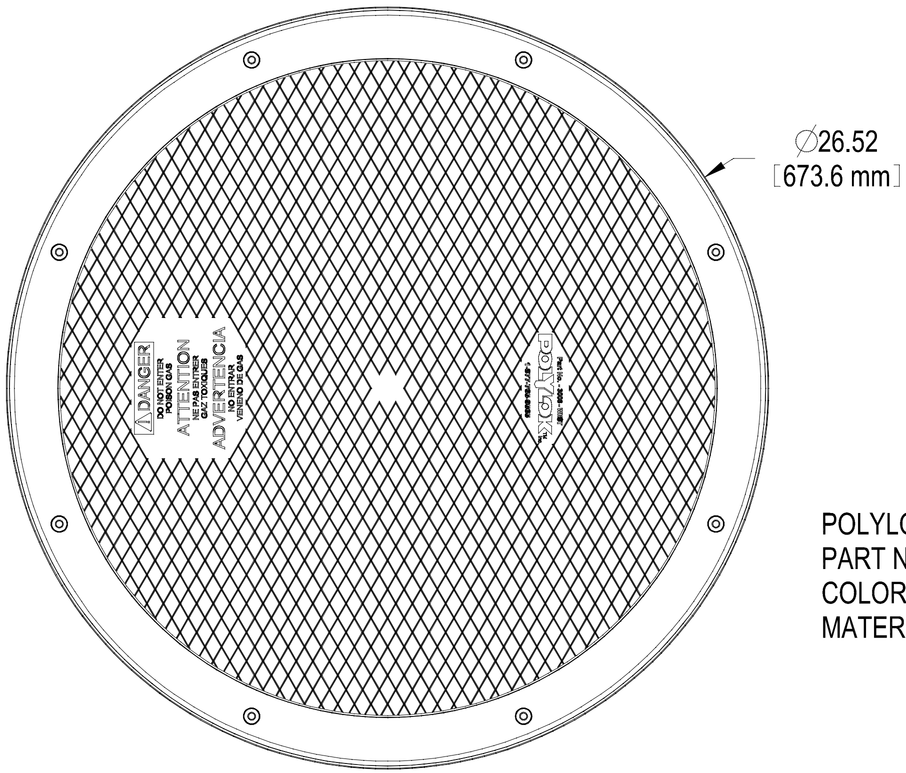
Product Data Sheets

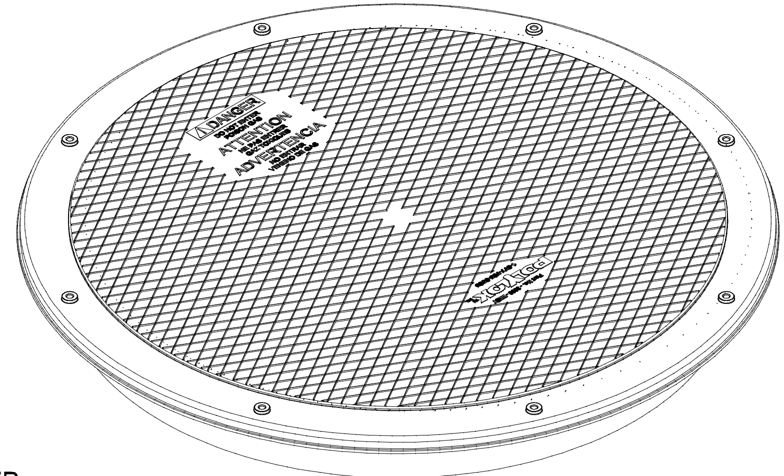
Air Sparging (AS) System

- 24” HDPE Well Lid, Polylok, part no. 3008-West
- Concrete Well Monument, Cuz Concrete Products, CB Type 30
- Flowmeter, Dwyer, Visi-Float® Flowmeter, VFC with 1” FNPT End Connections
- Electric Ball Valve, Triac Controls, Series 22
- Pressure Gauge, Grainger Approved

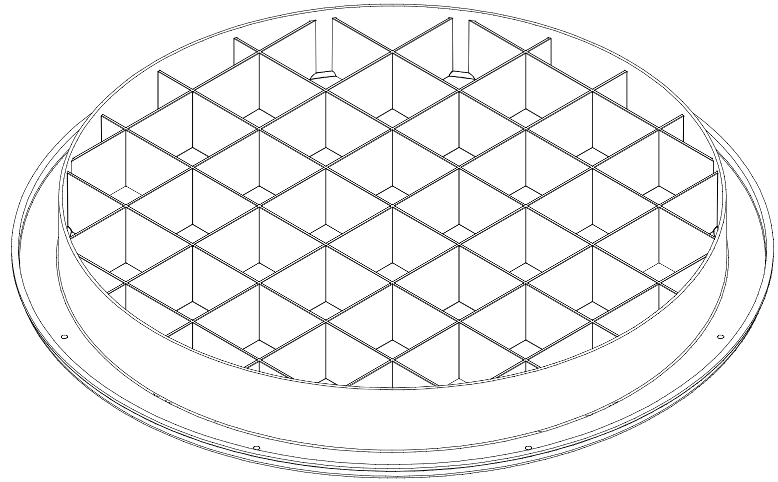
Soil Vapor Extraction (SVE) System

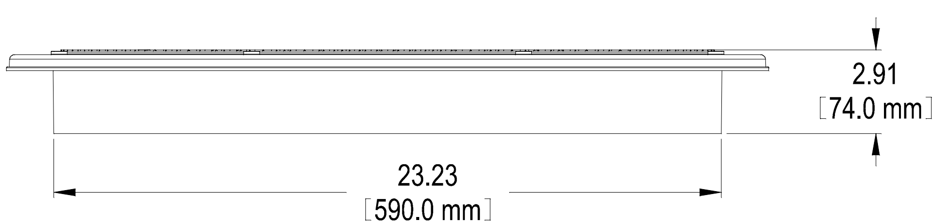
- Filter Fabric for SVE Screens, WSF 200 Woven Geotextile,
- Vacuum Gauges, PASCO Specialty & Mfg., Inc.
- Storage Tank Manufacturer’s Drawing, Greer Steel, dated October 4, 2022
- Liquid Level Gauge Stick Port, Morrison Bros. Co., part no. 178GSP0100 AC
- Emergency Pressure Relief, Morrison Bros. Co., part no. 244OM-0200 AV
- Annual Space Leak Detector, Krueger Sentry Gauge, Type K
- Pressure Vacuum Vent, Morrison Bros. Co., part no. 749-0100 AV
- High Level Float Switch, Madison, part no. M4302-7807-x





POLYLOK 24" FLAT COVER
PART NO. 3008-WEST
COLOR - DARK GREEN
MATERIAL - HDPE





CONCRETE PRODUCTS

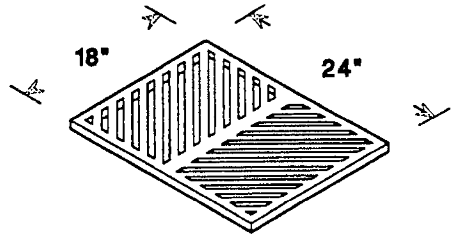
CB TYPE 30

19604 - 67th Ave NE Arlington, Wa. 98223 Telephone (360) 435-5531 Fax (360) 435-8575

	W	L	H
I.D.	16"	22"	32"
O.D.	24"	30"	36"

Grate

* Base and risers are designed for use of the grate with or without the frame.

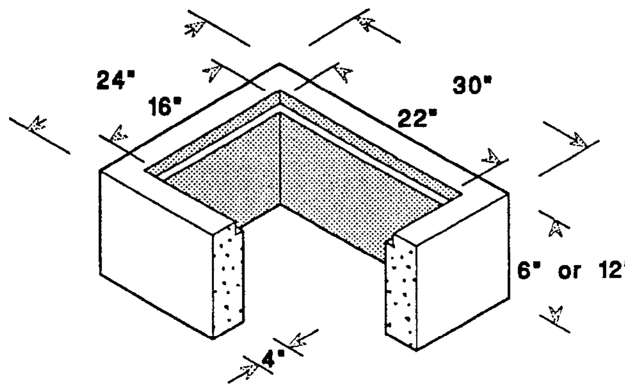


6" Riser Section

* Weight 205 lbs.

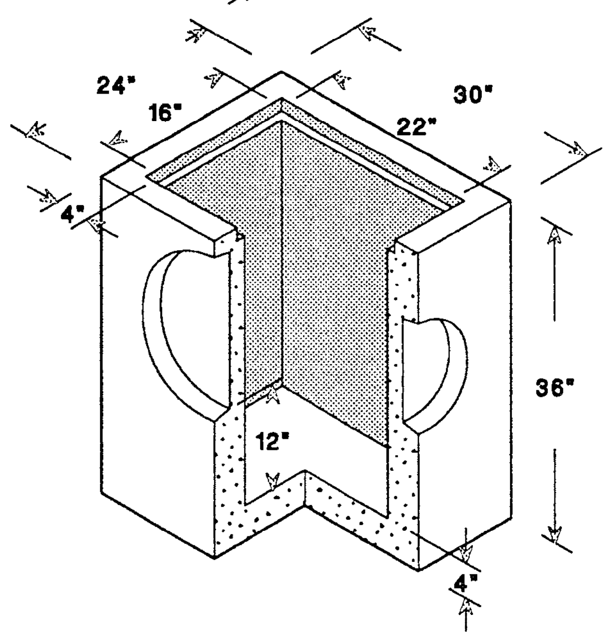
12" Riser Section

* Weight 410 lbs.



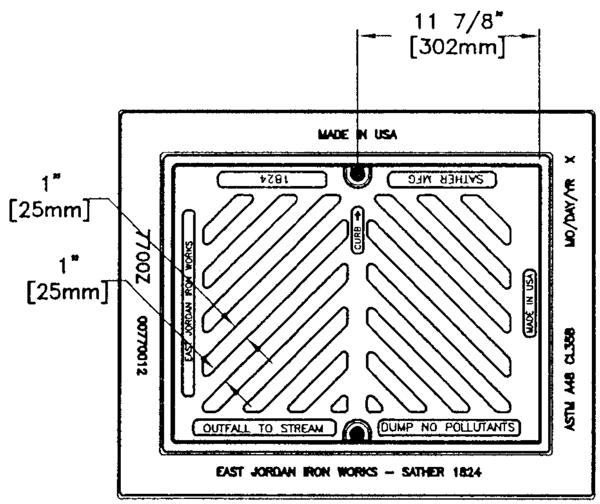
Precast Base Section

* Weight 1250 lbs.
* Two 17" and two 12" knockouts provided for pipe entry.

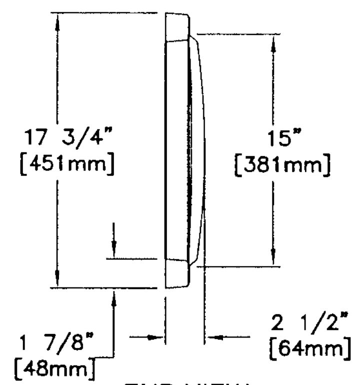


Reinforcing

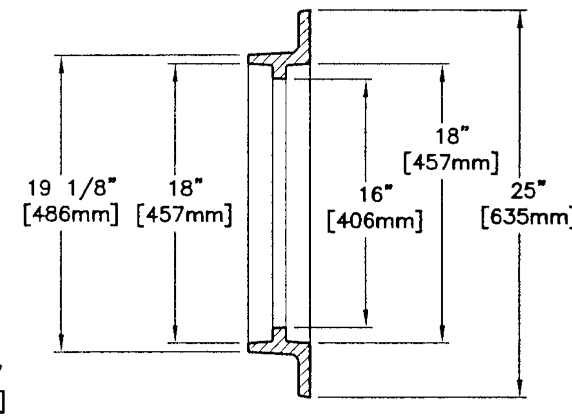
* 0.12 sq. in. per foot. (all components)



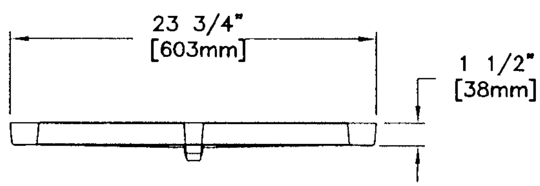
PLAN VIEW



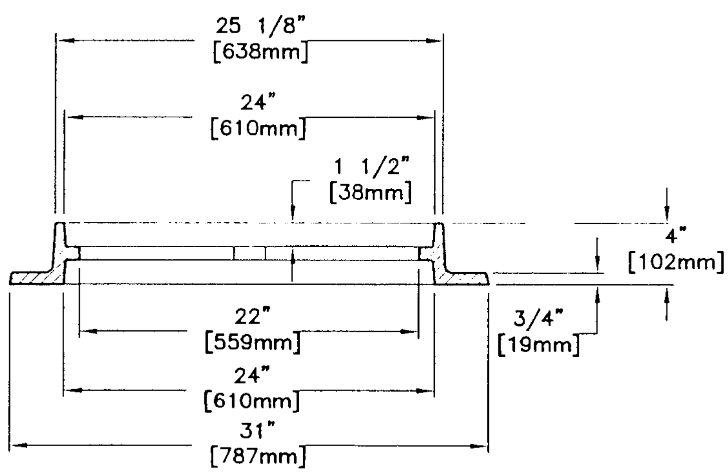
END VIEW



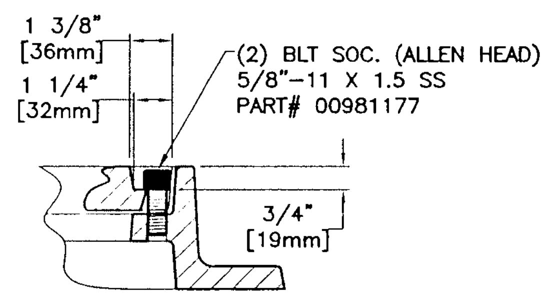
SECTION OF FRAME



SIDE VIEW OF GRATE



SECTION OF FRAME



BOLTING DETAIL

EAST JORDAN
IRON WORKS, INC.
P.O. BOX 439
EAST JORDAN, MI. 49727
1-800-874-4100
FAX 231-536-4458

DRAWN TCL	DATE 02/24/02
APPROVED	DATE

GRATE & FRAME ASSEMBLY DIPPED

PRODUCT NO.

00770072

CATALOG NO.

7700M1 DI
7700Z REVERSIBLE

REF. PRODUCT NO.

00770012
00770032

EST. WT.

GRATE: 108 LBS 49kg
FRAME: 132 LBS 60kg
UNIT: 240 LBS 109kg

OPEN AREA

128 SQ. INCHES

MAT'L SPEC.

GRATE – DUCTILE IRON ASTM 536
FRAME – GRAY IRON ASTM A48 CL35

LOAD RATING

HEAVY DUTY

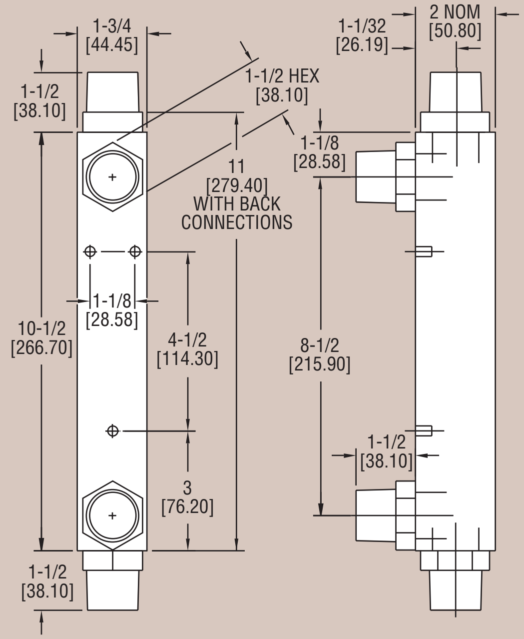
Series VFC & VFCII Visi-Float® Flowmeters

Used to Indicate Air or Water Flow

VFCII with 1″ MNPT End Connections

VFC with 1″ FNPT End Connections

VFC with 1″ FNPT Back Connections



Scan here to watch product video

The accurate and durable VFC Visi-Float® flowmeter contains a stainless steel guide rod and large diameter float for excellent stability and visibility in high flow rates. The large 5″ scale provides a ±2% full-scale accuracy for precision measurement required in medical or laboratory applications. The VFC models have PVC 1″ female NPT connections. VFC II units are equipped with acetal thermoplastic 1″ male NPT fittings. VFC II fittings also include hex wrench flats to prevent stripped threads. All models have metal mounting inserts on the back for panel mounting. Units may also be supported directly by system piping.

How To Order
Series—Range No.—Option
Example: VFC-123-EC
Series VFC with 10-100 SCFM Air Range and 1″ female NPT End Connections

VFC

Model	Thread Type	Process Connection
VFC-X	1″ FNPT	Back
VFCII-X	1″ MNPT	Back
VFC-X-EC	1″ FNPT	In-Line End
VFCII-X-EC	1″ MNPT	In-Line End

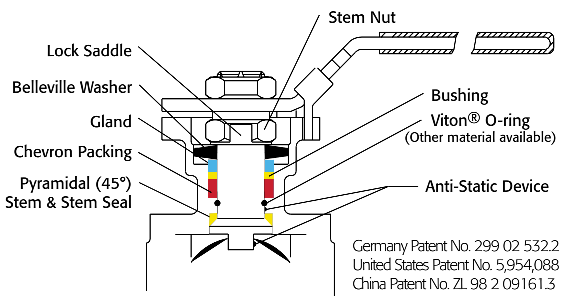
Popular Ranges

Model VFC — 5″ Scale			
Range No.	**Range SCFM Air**	**Range No.**	**Range GPM Water**
121	4-25	141	.5-5
122	5-50	142	1-10
123	10-100	143	2-20
	LPM Air		**LPM Water**
131	100-700	151	2-20
132	200-1400	152	4-40
133	300-2800	153	10-75

SPECIFICATIONS
Service: Compatible gases & liquids.
Wetted Materials:
Body: Acrylic plastic;
O-ring: Buna-N (fluoroelastomer available);
Metal parts: SS;
Float: SS.
Fittings: VFC: PVC; VFCII: Acetal thermoplastic.
Temperature & Pressure Limits: 100 psig (6.9 bar) @ 120°F (48°C).
Accuracy: 2% of full scale.
Process Connection: VFC: 1″ female NPT back connections. End connections optional; VFCII: 1″ male NPT back connections. End connections optional.
Scale Length: 5″ typical length.
Mounting Orientation: Mount in vertical position.
Weight: 24 to 25 oz (.68 to .71 kg).

OPTIONS
-VIT, Fluoroelastomer O-Rings
-FDA, 316 SS Float & Guide Rod (only available on VFCII with fluoroelastomer O-Rings)
-NIST, NIST traceable calibration certificate

Triac Series 22 Ball Valves feature a high quality investment cast body and end. They are available in sizes from 1/4" to 3". Superior leak protection is accomplished by using our patented "Pyramidal" stem seal system shown in the graphic below. This advanced system protects against wear and leakage experienced by other ordinary ball valves.



VALVE SIZE	VALVE Cv
1/4"	7
3/8"	8
1/2"	15
3/4"	40
1"	70
1-1/4"	110
1-1/2"	250
2"	350
2-1/2"	600
3"	900

TA-Luft 2002, Sec.5.3.6.4
TA-Luft Certified for Low Emissions
VDI 2440 Nov.2000, Sec.3.3.1.3

Easy to Automate!

See automated data sheets for pre-sized assemblies

Pneumatic

Electric

TRIAC® CONTROLS

Series 22

DIRECT MOUNT
2-Piece Design

- **Sizes 1/4"- 3"**
- **Available in 316SST**
- **Full Port Valve**
- **Threaded Ends**
- **1000 psi WOG**
- **NACE MR-0175**
- **2-piece High Cycle Design**
- **ISO 5211 Direct Actuator Mount**
- **Blowout Proof Stem w/ Dual Anti-Static Devices**
- **RTFE Seats Standard**
- **Pyramidal Stem Seal Packing System**
- **Lockable Manual Handle**

STANDARDS

Design	ANSI/ASME B16.34
End Connections	ASME B1.20.1
Sulfide Stress Protection	NACE MR0175
Mounting	ISO 5211
Marking System for Valves	MSS SP-25, MSS SP-55
Safety Integrity	IEC 61508:2010; SIL 3
Material Certification	EN 10204-3.1 MTR
Quality Assurance	ISO 9001:2008

HOW TO ORDER MANUAL VALVES

SAMPLE PART #

22-TH-0200-XXX

Valve Series
End Connection
Valve Size
Seat Material
Special Designation
Additional Special Designation

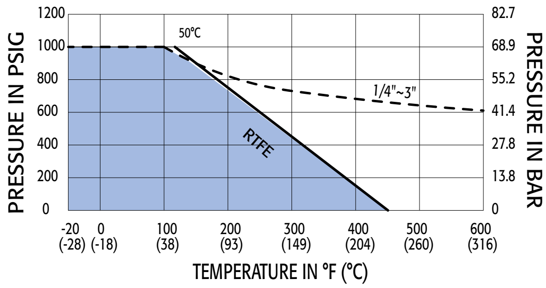
See part number matrix for itemized options

A-T Controls, Inc.
9955 International Blvd.
Cincinnati, Ohio 45246
www.atcontrols.com
PHONE (513) 247-5465
FAX (513) 247-5462
sales@atcontrols.com

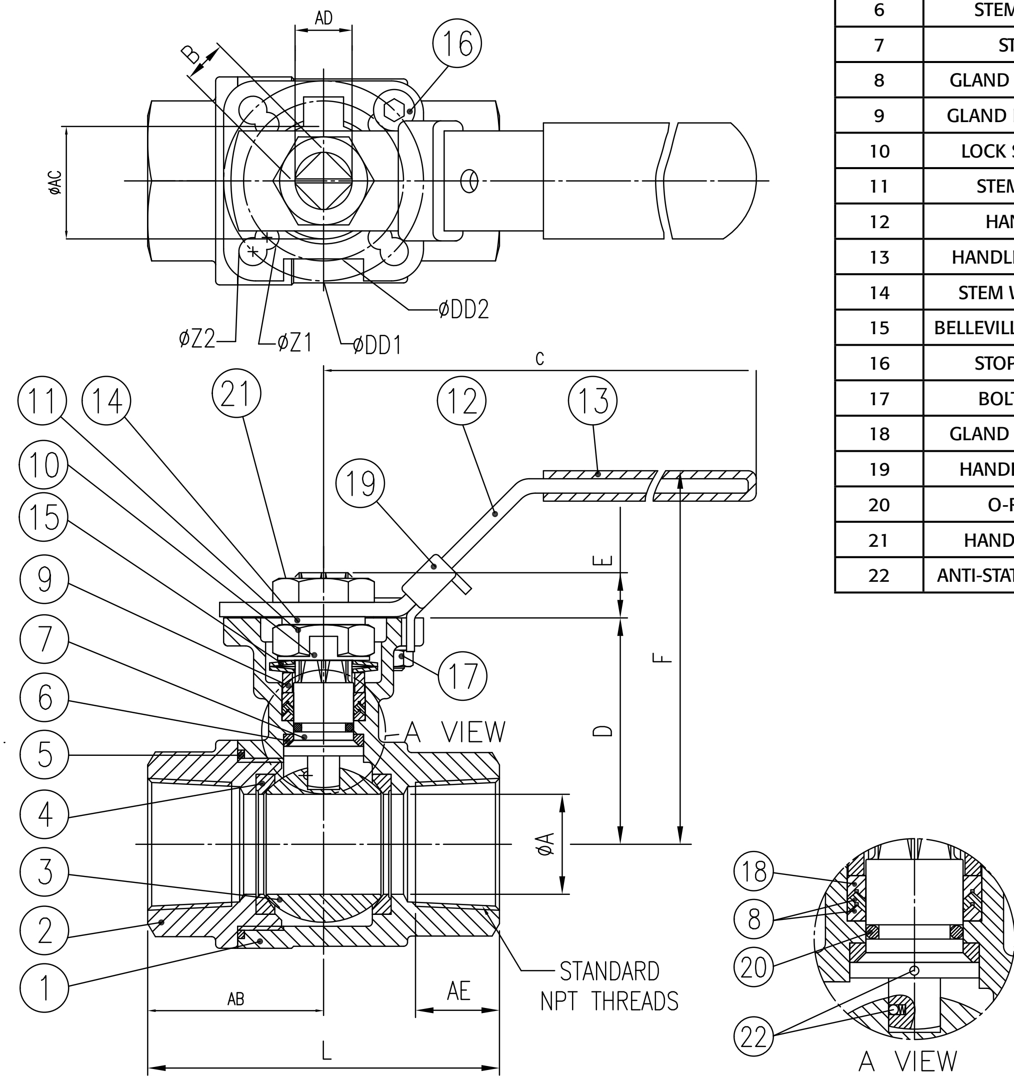
Series 22

Direct Mount High Cycle Full Port Ball Valve

Pressure vs. Temperature Chart



NOTE: Dotted line shows the rating for valve body. Solid line shows the rating for valve seat. Both ratings need to be considered when determining the limitation of the valve for specific application. Consult factory for other seat materials.



MATERIALS LIST

NO.	PART NAME	QTY	MATERIAL
1	BODY	1	ASTM A351 GRADE CF8M
2	END CAP	1	ASTM A351 GRADE CF8M
3	BALL	1	1/4" THRU 3/8" ASTM A276 SS316
3	BALL	1	1/2" THRU 3" ASTM A351 GRADE CF8M
4	SEAT	2	RTFE
5	JOINT GASKET	1	PTFE
6	STEM SEAL	1	RTFE
7	STEM	1	ASTM A276 SS316
8	GLAND PACKING	1	PTFE
9	GLAND BUSHING	1	AISI 304
10	LOCK SADDLE	1	AISI 304
11	STEM NUT	1	AISI 304
12	HANDLE	1	AISI 304
13	HANDLE SLEEVE	1	VINYL
14	STEM WASHER	1	AISI 304
15	BELLEVILLE WASHER	2	AISI 301
16	STOP BOLT	1	AISI 304
17	BOLT NUT	1	AISI 304
18	GLAND PACKING	1	RTFE
19	HANDLE LOCK	1	AISI 304
20	O-RING	1	VITON®
21	HANDLE NUT	1	AISI 304
22	ANTI-STATIC DEVICE	2	AISI 316

Break Away Torque for RTFE Seats

SIZE	IN-LBS.
1/4"	62
3/8"	62
1/2"	62
3/4"	71
1"	124
1-1/4"	159
1-1/2"	230
2"	319
2-1/2"	487
3"	770

NOTE: For other seat material, consult factory

DIMENSIONS (IN)

SIZE	A	B	C	D	E	F	L	Z1	Z2	AB	AC	AD	AE	DD1	DD2	LBS	ISO 5211
1/4"	0.45	0.354	5.88	1.53	0.26	2.99	2.56	0.26	0.28	1.28	0.92	0.43	0.55	1.417	1.969	1.23	F03/F04/F05
3/8"	0.49	0.354	6.12	1.52	0.26	2.99	2.56	0.26	0.28	1.28	0.92	0.43	0.53	1.417	1.969	1.23	F03/F04/F05
1/2"	0.59	0.354	5.83	1.60	0.26	3.05	2.56	0.26	0.28	1.28	0.92	0.43	0.53	1.417	1.969	1.23	F03/F04/F05
3/4"	0.79	0.354	5.88	1.82	0.28	3.23	2.94	0.26	0.28	1.47	0.91	0.43	0.61	1.417	1.969	1.32	F03/F04/F05
1"	0.98	0.433	6.77	2.24	0.43	3.74	3.46	0.26	0.28	1.73	1.26	0.56	0.72	1.654	1.969	2.40	F04/F05
1-1/4"	1.26	0.433	6.77	2.40	0.43	3.92	4.02	0.24	0.27	2.01	1.26	0.56	0.81	1.654	1.969	3.31	F04/F05
1-1/2"	1.50	0.551	8.51	3.06	0.55	4.00	4.33	0.29	0.35	2.17	1.53	0.75	0.76	1.969	2.756	5.62	F05/F07
2"	1.97	0.551	8.51	3.35	0.56	5.16	4.92	0.29	0.35	2.46	1.53	0.75	0.89	1.969	2.756	7.93	F05/F07
2-1/2"	2.56	0.669	10.53	4.31	0.67	6.18	6.32	0.39	0.48	3.16	2.07	0.88	1.09	2.756	4.016	16.38	F07/F10
3"	3.15	0.669	11.88	4.63	0.71	6.80	7.01	0.39	0.48	3.51	2.08	0.88	1.19	2.756	4.016	22.81	F07/F10

A-T Controls, Inc.
9955 International Blvd.
Cincinnati, Ohio 45246
www.atcontrols.com
PHONE (513) 247-5465
FAX (513) 247-5462
sales@atcontrols.com

TRIAC® CONTROLS

Electric

Automated Ball Valve Package

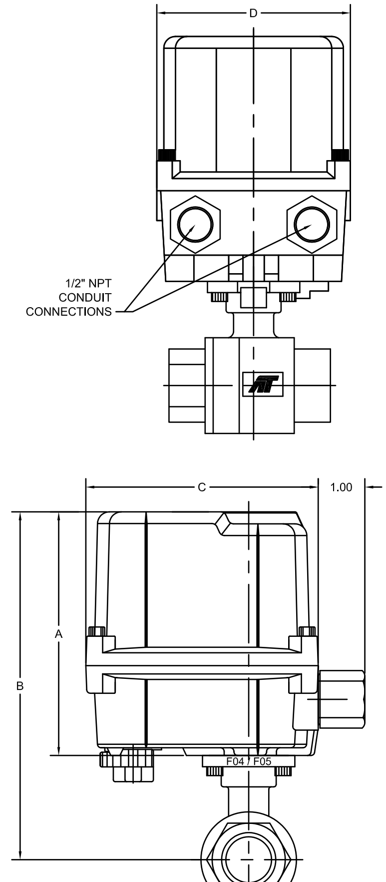
Series 22
Direct Mount

- Available in 316SST
- Sizes 1/4"– 3"
- Full Port Valve
- Threaded Ends
- 1000 psi WOG
- NACE MR-0175
- 2-piece High Cycle Design
- Blowout Proof Stem w/ Dual Anti-Static Devices
- RTFE Seats Standard
- Pyramidal Stem Seal Design

STANDARDS

Design	ANSI/ASME B16.34
End Connections	ASME B1.20.1
Sulfide Stress Protection	NACE MR0175
Mounting	ISO 5211
Marking System for Valves	MSS SP-25, MSS SP-55
Safety Integrity	IEC 61508:2010; SIL 3
Material Certification	EN 10204-3.1 MTR
Quality Assurance	ISO 9001:2008

Direct Mount



SERIES 22 2-Piece Direct Mount

DIMENSIONS (IN)

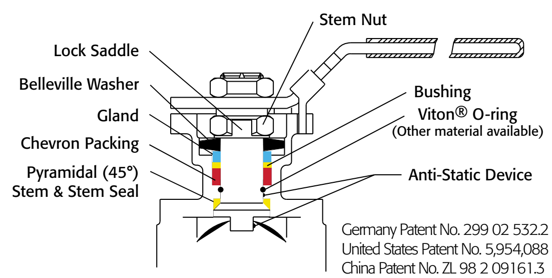
VALVE SIZE	A	B	C	D	VALVE Cv
1/4"	5.24	6.77	4.94	4.08	7
3/8"	5.24	6.77	4.94	4.08	8
1/2"	5.24	6.84	4.94	4.08	15
3/4"	5.24	7.06	4.94	4.08	40
1"	5.24	7.48	4.94	4.08	70
1-1/4"	5.24	7.64	4.94	4.08	110
1-1/2"	5.24	8.30	4.94	4.08	250
2"	5.24	8.59	4.94	4.08	350
2-1/2"	9.25	13.56	6.69	10.16	600
3"	10.55	15.18	9.02	13.31	900

ON-OFF

SIZE	MODEL
1/4"	22-TX-025/WEA1-XX
3/8"	22-TX-038/WEA1-XX
1/2"	22-TX-050/WEA1-XX
3/4"	22-TX-075/WEA1-XX
1"	22-TX-100/WEA1-XX
1-1/4"	22-TX-125/WEA1-XX
1-1/2"	22-TX-150/WEA1-XX
2"	22-TX-200/WEA1-XX
2-1/2"	22-TX-250/WEB1-XX
3"	22-TX-300/WEC1-XX

MODULATING

SIZE	MODEL
1/4"	22-TX-025/WEA2-XX
3/8"	22-TX-038/WEA2-XX
1/2"	22-TX-050/WEA2-XX
3/4"	22-TX-075/WEA2-XX
1"	22-TX-100/WEA2-XX
1-1/4"	22-TX-125/WEA2-XX
1-1/2"	22-TX-150/WEA2-XX
2"	22-TX-200/WEA2-XX
2-1/2"	22-TX-250/WEB2-XX
3"	22-TX-300/WEC2-XX



Germany Patent No. 299 02 532.2
United States Patent No. 5,954,088
China Patent No. ZL 98 2 09161.3

SAMPLE PART #
22-TX-100/WEA1-XX

- Valve Series
- End Connections
- Seat Material
- Valve Size
- TRIAC Actuator Series
- Actuator Size
- On-Off
- Voltage
- Options

See valve part number matrix for complete part number and options.

OPTIONS

DESCRIPTION
24 VAC/24 VDC/220VAC
Feedback potentiometer

Other options available - call for details
Actuators are sized based on clean/clear fluid.

TA-Luft 2002, Sec.5.3.6.4
TA-Luft Certified for Low Emissions
VDI 2440 Nov.2000, Sec.3.3.1.3

A-T Controls, Inc.
9955 International Blvd.
Cincinnati, Ohio 45246
www.atcontrols.com
PHONE (513) 247-5465
FAX (513) 247-5462
sales@atcontrols.com

22EL-20150921

GRAINGER

Products Based on Your Search

GRAINGER APPROVED Commercial Pressure...

Compare

Web Price
$14.53 / each

GRAINGER APPROVED Commercial Pressure...

Compare

Web Price
$20.02 / each

GRAINGER APPROVED Commercial Pressure...

Compare

Web Price
$10.36 / each

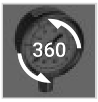
Related Categories

Light-Duty General Purpose Pressure Gauges

Light-Duty Pressure Gauges

Pressure & Vacuum Gauges

Light-Duty General Purpose Pressure Gauges / GRAINGER APPROVED Commercial Pressure...



GRAINGER APPROVED Commercial Pressure Gauge: 0 to 100 psi, 2 in Dial, 1/4 in NPT Male, Bottom, Dual

Item **4FLU1** Mfr. Model **4FLU1**

Web Price
$12.69 / each

Qty 1

Add to Cart

Ship Pickup

Expected to arrive **Thu. Jun 15.**

Ship to **97301** | Change

Shipping Weight **0.16 lbs**

Ship Availability Terms

Add to List

Compare

Product Details

Catalog Page 570 Catalog Group D1338

Pressure Gauge Type **Commercial Pressure Gauge**

Pressure Range Type **Pressure**

Scale Type **Dual**

Pressure Range **0 to 100 psi**

Secondary Range **0 to 700 kPa**

Nominal Dial Size **2 in**

Process Connection Location **Bottom**

Process Connection Size **1/4 in**

Process Connection Type **NPT**

Compliance & Restrictions

WARNING: Cancer and Reproductive Harm - www.P65Warnings.ca.gov

Documents

Chat with an Agent

ACF West Inc. is a D.B.A. name for Northwest Geosynthetics Inc.
8951 SE 76th Drive, Portland, OR 97206 (503) 771-5115, (800) 878-5115, (503)771-1161 fax

Product Data Sheet

WSF 200 (ACF 200) Woven Geotextile

WSF 200 is a woven slit film geotextile, and will meet the following physical properties when tested in accordance with the methods listed below. The individual slit films are woven together in such a manner as to provide dimensional stability relative to each other. The construction of the geotextile makes WSF 200 ideal for soil separation and stabilization. The geotextile is resistant to ultraviolet degradation and to biological and chemical environments normally found in soils.

WSF 200 Woven Geotextile conforms to the following physical properties:

Property	Test Method	English (MARV)[1]
Weight (Typical)	ASTM D-5261	4.0 oz./SY
Grab Tensile Strength	ASTM D-4632	200 lbs
CBR Puncture	ASTM D-6241	700 lbs
Trapezoidal Tear	ASTM D-4533	80 lbs
UV Resistance	ASTM D-4355	80%
Apparent Opening Size (AOS)[2]	ASTM D-4751	50 US Std. Sieve
CBR Puncture Strength	ASTM D-6241	700 lbs
Permittivity	ASTM D-4491	0.05 sec^{-1}
Water Flow	ASTM D-4491	4 gpm/ft^2
Roll Sizes		12.5' x 432' 15' x 360' 17.5'x 309'

1) All values listed are Minimum Average Roll Value (MARV) unless otherwise noted, calculated as the typical minus two standard deviations. Statistically, it yields 97.7% degree of confidence that any sample taken during quality assurance testing will exceed the value reported.
2) Values for Apparent Opening size are Maximum Average Roll Values (MaxARV), typical value plus two standard deviations.

Note: WSF 200 fabric is manufactured and imported for ACF West Inc. by Gia Loi Joint Stock Company. Phuoc Thai Hamlet, Tahi Hoa Tan Uyen District. Binh Duon Province, Vietnam. ACF 200 is a trade name of ACF West Inc. and any use of this name without the expressed written consent of ACF West Inc. is strictly prohibited. The property values listed above are effective 11-1-2010 and subject to change without notice.

PASCO

PASCO Specialty & Mfg., Inc.

P.O. Box 1667
South Gate, CA 90280
Phone (310) 537-7782
Fax (800) 737-2726

7529 Perryman Court
Curtis Bay, MD 21226
Phone (410) 360-5010
Fax (877) 377-6466

www.pascospecialty.com

TECHNICAL SPECIFICATION SUBMITTAL
2 - 1/2" diameter glycerine filled stainless steel pressure gauges.

Job Name ______________________ Date ____________

Model Specified ______________________ Quantity ____________

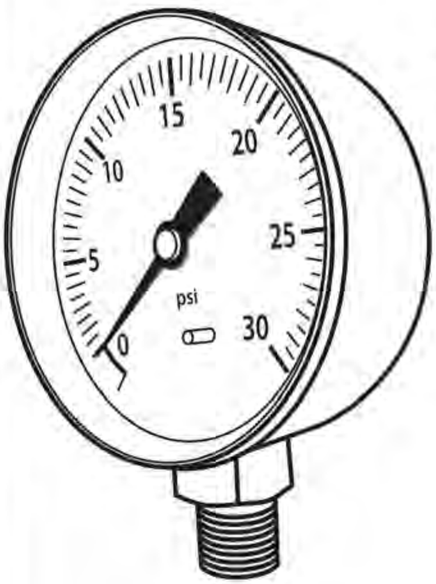
Customer/Wholesaler ______________________

Contractor ______________________

Architect/Engineer ______________________

Engineering Specification: Glycerine filled pressure gauges with stainless steel housing for use in applications where mechanical vibrations or corrosion may affect the accurate reading or the pressure gauge indicating arrow.

Glycerine Filled Pressure Gauge



- **Accuracy to 3-2-3% of scale**
- **Complies with ASTM B-40 for B grade pressure gauges**
- **2-1/2" case diameter**
- **304 stainless steel case**
- **1/4" MPT brass lower mount**
- **Brass internals**
- **Plastic lens**
- **Five PSI ranges 30# to 300#**
- **Non-domestic manufacturer**

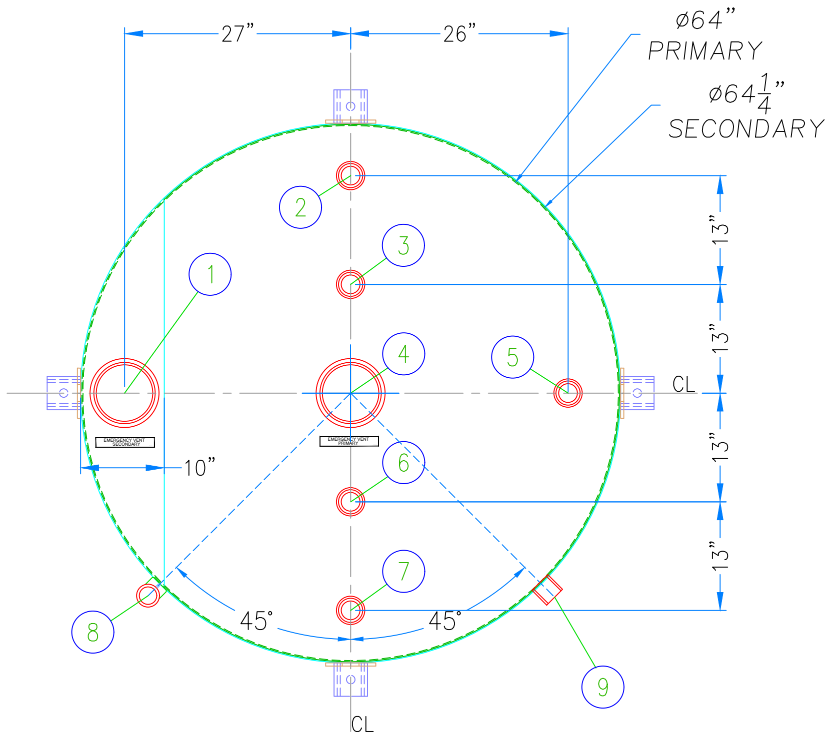
PART NUMBER	SIZE
1772	0-30#
1773	0-60#
1774	0-100#
1776	0-200#
1777	0-300#

Commercial Gauges:
Gauges found on much of the equipment used in manufacturing plants, stores, garages, etc. are classified as commercial gauges or general gauges. Typical equipment uses include refrigeration units, pumps, compressors and fire extinguishers. In such applications, although the gauges may be ruggedly built, service conditions are not expected to be severe. These gauges are of Grade B accuracy and could have metal or plastic cases and glass or plastic faces.

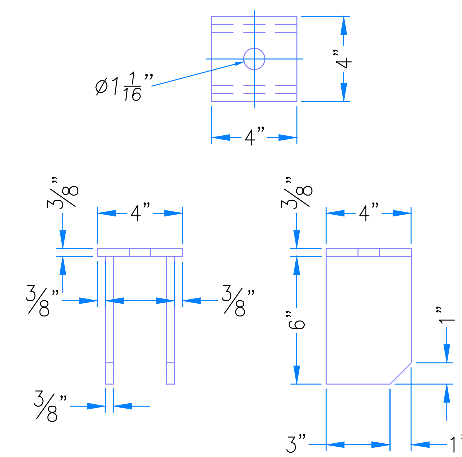
Grade B Gauges:
Grade B Gauges are used in the above mentioned general purpose applications. These gauges are often referred to a 3-2-3 gauges. The reason is that they have a accuracy of 2% of span over the middle half of the scale and #% of span over the first and last quarters of the scale. Grade B Gauges are not high accuracy gauges, but suitable for commercial installations.

Installation:
In all installations, ANSI B40 must be strictly followed. Always use the wrench flat on the gauge stem to tighten the gauge into the fitting. Never APPLY TORQUE TO THE GAUGE CASE. It is suggestion that a joint compound instead of thread sealing tape be used. Tape shreads can get into the pressure gauge port of the gauge causing blockage

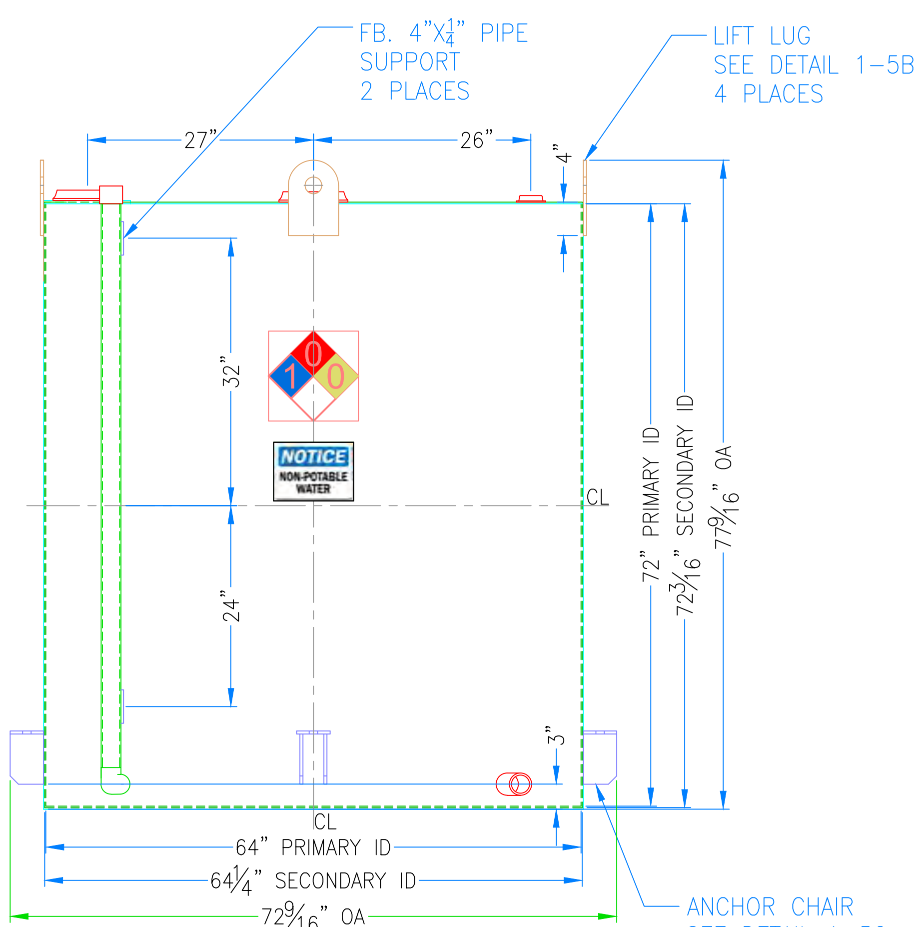
WARNING: Birth Defects, Reproductive Harm, and Cancer. www.p65warnings.ca.gov.



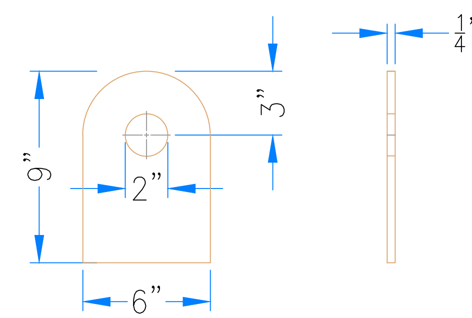
PLAN 1-7C
FITTING SCHEDULE/FITTING LAYOUT



ELEVATION 1-5C
RIGHT SIDE VIEW



ELEVATION 1-7A
TANK OVERVIEW



ELEVATION 1-5B
TANK OVERVIEW

TANK PARTICULARS

NOMINAL TANK SIZE	1000 GALLONS
INSIDE DIMENSIONS	
INNER TANK HEIGHT	72"
INNER TANK DIAMETER	64"
OUTER TANK HEIGHT	72 3/16"
OUTER TANK DIAMETER	64 1/4"
OVERALL	
72 9/16"W X 77 9/16"H	
CAPACITIES	
PRIMARY TANK (GALLONS)	1003
SECONDARY TANK (GALLONS)	1013
MATERIALS	
PRIMARY SHELL	10ga"
PRIMARY BOTTOM	3/16"
SECONDARY SHELL	10ga"
SECONDARY BOTTOM	3/16"
TOP	3/16"
MINIMUM WORKING VENT SIZE	1 1/4"
Cu Ft/Hr INNER TANK	129,150
Cu Ft/Hr OUTER TANK	130,200
E. VENT INNER TANK	6"
E. VENT OUTER TANK	6"
APPROX. WEIGHT	1907 LBS.

REVISIONS

REV	ZONE	DESCRIPTION	DATE	BY
0	ALL	INITIAL ISSUE	10/5/22	B.PROFFER
1	ALL	REMOVED CONTAINMENT % FROM DRAWING PER COMMENTS	10/24/22	B.PROFFER

FITTING SCHEDULE

NO.	DESCRIPTION
1	6" FPT TANK FLANGE – SECONDARY E-VENT
2	2" FPT TANK FLANGE
3	2" FPT TANK FLANGE
4	6" FPT TANK FLANGE – PRIMARY E-VENT
5	2" FPT TANK FLANGE
6	2" FPT TANK FLANGE
7	2" FPT TANK FLANGE
8	2" MERCHANT COUPLING / 2" SCH40 PIPE (MONITOR PIPE) / 2" 90° BW ELBOW / FB. 4"x1/4" (MONITOR PIPE SUPPORT) X2 –SECONDARY MONITOR
9	2" COUPLING– PRIMARY DRAIN

GENERAL NOTES

1. PAINT:
EXTERIOR COATING: SP6 BLAST, ONE COAT OF SHOP PRIMER, ONE COAT OF WHITE ALIPHATIC

GREER STEEL INC.
3117 107th Street S.
Lakewood, WA 98499
Phone (253)581-4100 Fax (253)581-4300

DRAWN	B.PROFFER	THIS DRAWING REPRESENTS A PROPRIETARY DESIGN OF GREER STEEL INC. AND MAY NOT BE USED FOR SOURCE DESIGN OR PROCUREMENT PURPOSES BY OTHER THAN GREER, INC.
DATE	10/4/2022	
CHECKED	P.TIMM	1000 GALLON NON UL DW VERTICAL ABOVEGROUND STORAGE TANK NORTHWEST PUMP
DATE	10/5/2022	
WO#	18899	SIZE D; DWG NO. NWP22DWVERT1K; REV 1
QUOTE#	DK001653-R2	SCALE NONE; FILE NAME NWP22DWVERT1K-R1; SHEET 1 OF 1

Model 178 Threaded Style Fill Cap

SPECIFICATION SHEET

Application

port of small storage tanks. It is lockable with a padlock. The 178 iron

The 178DT is made for a drop tube with 2" straight pipe threads and Buna-N gasket. The 178GSP is labeled "Gauge Stick Port."

Fig. 178 (2")

Fig. 178 (2")

Fig. 178AL (4")

Item Number	A	B	C	Weight
178---0100 AC	2"	IR	IR	2.0
178---0200 AC	2"	IR	BR	2.0
178---0300 AC	2"	BR	IR	2.0
178---0400 AC	2"	BR	BR	2.25
178---1200 AC	3"	BR	BR	4.25
178---1600 AC	4"	BR	BR	7.0
178AL-0900 AC	3"	AL	AL	1.54
178AL-1300 AC	4"	AL	AL	2.44
178DT-0300 AC	2"	BR	IR	2.0
178DT-0400 AC	2"	BR	BR	2.25
178GSP0100 AC	2"	BR	AL	1.0

SPECIFICATION OPTIONS:

A—Size (inches)
B—Body: Brass (BR), Iron (IR), AL (Aluminum)
C—Cap: Brass (BR), Iron (IR), AL (Aluminum)
Weight—Shipping weight (lbs)

570 E. 7th Street, P.O. Box 238 | Dubuque, IA 52004-0238
t. 563.583.5701 | 800.553.4840 | f. 563.583.5028
www.morbros.com

MORRISON BROS. CO.

Morrison Bros. Co. www.morbros.com

Fig. 244 6" Emergency Vents

Specification Sheet

UL Listed Emergency Vent (pressure relief only) used on aboveground storage tanks, as a code requirement, to help prevent the tank from becoming over-pressurized and possibly rupturing if ever exposed to fire. Vent must be used in conjunction with a "normal vent." Correct application of this vent requires proper vent size and selection for the tank system in order to meet the specific venting capacity requirement.

Morrison Bros emergency vents conform to the following codes and standards: API 2000, International Fire Code, National Fire Code of Canada, NFPA 1, 30, 30A, 31, 37, 110, PEI RP200, PEI RP800, Underwriters Laboratories Inc., UL-142 UL-2085 UL- 2244, Underwriters Laboratories of

I.D. Number	A	B	C	D	E	F	G	Diameter	Height	Weight	Screen
244O--0200 AV	6	278,660		8	I	A	AL	9.1	3.9	19	
244O--0200AVEVR	6	278,660		8	I	B	AL	9.1	3.9	19	
244O--0400 AV	6	278,660		16	I	A	AL	9.1	4.9	36	
244O--0400AVEVR	6	278,660		16	I	B	AL	9.1	4.9	36	
244OB-0200 AV	6	278,660	B	8	I	A	AL	9.1	3.9	19	
244OI-0200 AV	6	278,660		8	I	A	I	9.1	3.9	22	
244OI-0400 AV	6	278,660		16	I	A	I	9.1	4.9	39	
244OS-0200 AV	6	232,638		8	I	A	AL	9.1	3.9	19	S
244OS-0200AVEVR	6	232,638		8	I	B	AL	9.1	3.9	19	S
244OS-0400 AV	6	232,638		16	I	A	AL	9.1	4.9	36	S
244OS-0400AVEVR	6	232,638		16	I	B	AL	9.1	4.9	36	S
244OSBSP0200 AV	6	232,638	B	8	I	A	AL	9.1	3.9	19	S
244OF-0050 AV	6	278,660	F	8	I	A	AL	9.1	3.2	21	
244OF-0050 AVE	6	278,660	F	8	I	A	AL	9.1	3.2	21	
244OF-0075 AV	6	278,660	F	16	I	A	AL	9.1	4.2	38	
244OF-0075 AVE	6	278,660	F	16	I	B	AL	9.1	4.2	38	
244OFS0050 AV	6	232,638	F	8	I	A	AL	9.1	3.2	21	S
244OFS0075AV	6	232,638	F	16	I	A	AL	9.1	4.2	38	S
244OM-0200 AV	6	278,660	M	8	I	A	AL	9.1	5.9	20	
244OM-0200AVEVR	6	278,660	M	8	I	B	AL	9.1	5.9	20	
244OM-0400 AV	6	278,660	M	16	I	A	AL	9.1	6.9	37	
244OM-0400AVEVR	6	278,660	M	16	I	B	AL	9.1	6.9	37	
244OMBS0400 AV	6	232,638	M	16	I	A	AL	9.1	6.9	37	S
244OMBSP0200 AV	6	278,660	MB	8	I	A	AL	9.1	5.9	20	
244OMBSP0400 AV	6	278,660	MB	16	I	A	AL	9.1	6.9	37	
244OMI0200 AV	6	278,660	M	8	I	A	I	9.1	5.9	26	
244OMI0400 AV	6	278,660	M	16	I	A	I	9.1	6.9	43	
244OMS0200 AV	6	232,638	M	8	I	A	AL	9.1	5.9	20	S
244OMS0200AVEVR	6	232,638	M	8	I	B	AL	9.1	5.9	20	S
244OMS0400 AV	6	232,638	M	16	I	A	AL	9.1	6.9	37	S
244OMS0400AVEVR	6	232,638	M	16	I	B	AL	9.1	6.9	37	S
244OMSB0200 AV	6	232,638	MB	8	I	A	AL	9.1	5.9	20	S
Flange = 11" OD ; eight (8) .88" Diameter holes on 9.5" diameter B.C.											

c UL US LISTED

CHART KEY:
A—Size: 6"
B—Venting Capacity/CFH
C—Mounting Connection: Female N.P.T. (BLANK); Male N.P.T.(M); Flanged (F); BSP (B)
D—Pressure Settings: 8 or 16 oz/in^2. Pressure Required to Open Vent.
E—Cover: Cast Iron (I); Powder Coated
F—Seat Material: O-Ring Viton A (A) or Viton B (B)
G—Body Material: Aluminum (AL) or Iron (I)
Diameter—Dimension Across Vent
Height—Dimension from Base to Top When Closed
Weight—Shipping Weight
Screen—3 Mesh Stainless Steel
Bolt—Zinc plated steel

WARNING: DO NOT FILL OR UNLOAD FUEL FROM A STORAGE TANK UNLESS IT IS CERTAIN THAT THE TANK VENTS WILL OPERATE PROPERLY. Morrison tank vents are designed only for use on shop fabricated atmospheric tanks which have been built and tested in accordance with UL 142, NFPA 30 & 30A, and API 650 and in accordance with all applicable local, state, and federal laws. In normal operation, dust and debris can accumulate in vent openings and block air passages. Certain atmospheric conditions such as a sudden drop in temperature, below freezing temperatures, and freezing rain can cause moisture to enter the vent and freeze which can restrict internal movement of vent mechanisms and block air passages. All storage tank vent air passages must be completely free of restriction and all vent mechanisms must have free movement in order to insure proper operation. Any restriction of airflow can cause excessive pressure or vacuum to build up in the storage tank, which can result in structural damage to the tank, fuel spillage, property damage, fire, injury, and death. Monthly inspection, and immediate inspection during freezing conditions, by someone familiar with the proper operation of storage tank vents, is required to insure venting devices are functioning properly before filling or unloading a tank.

Morrison Bros. Co.
Established 1855

P.O. Box 238 • Dubuque, Iowa 52004-0238
563.583.5701 (tel) • 800.553.4840 • 563.583.5028 (fax)
www.morbros.com

The Leak Gauge—Type K

Price Book Page 6 *http://www.ksentry.com/leak.htm*

Calibration: Consists of 3 pieces. Outer plastic piece, inner plastic piece, and a piece of paper in between. Optional glass inner piece is available.

Red Lock Nut: HDPE Plastic. Also available in aluminum or PVC.

Bushing: Aluminum bushing, can be 2", 1.5". Special package allows for a Stainless Steel Bushing also.

Internal Rods: Standard construction is aluminum rods. There are no other options for this gauge due to floatation.

76" and smaller Polypropylene Float
77" and taller Poly Coated Cork Float

Part Number—
K-(size opening)-(total length)-(list options)
Sample—K-2-48-Guard

What it is:

Top mounted liquid leak gauge that can measure from 6 inches to 170 inches in depth. Bushing size can be 2" or 1.5". Gauges are custom made in house to fit your tank. This gauge is designed to monitor either the interstitial space of a double wall containment system, or it can mount into an external monitoring pipe.
http://www.ksentry.com/leak.htm

Additional Options:

Audible Alarm Accessory: This add on feature can turn your mechanical visual gauge into an audible leak detection alarm. *(price book page 8)*
http://www.ksentry.com/alarm.htm

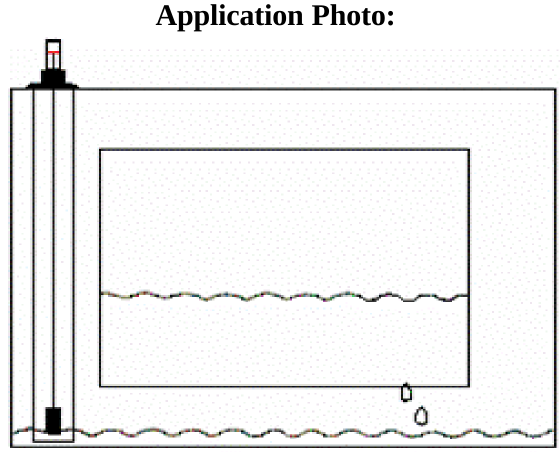
Gauge Guard: A cover that protects the exposed plastic components on top of the gauge. - http://www.ksentry.com/replace.htm

Material Choices and Limitations:

Standard choices are listed on picture to the left.

Due to floatation, this gauge does not have many material options. The leak gauge is rarely exposed to the liquid. If it is not compatible and it is exposed, the gauge must be replaced afterward.

Application Photo:



Krueger Sentry Gauge
1873 Siesta Lane
Green Bay, WI 54313

http://www.ksentry.com

Contact us for more info or a local distributor:
Ph: 920-434-8860
Fax: 920-434-8897
Email: info@ksentry.com

The Leak Gauge—Type K

Price Book Page 6 *http://www.ksentry.com/leak.htm*

Model	Calibration	Indicator	Lock Nut	Bushing	Internal Rods	Union	Floats	Gasket
Standard (6"-76")	Cellulose Acetate-Plastic	HDPE	HDPE	Aluminum	Aluminum—1/8"	Plated Nickel—1/8"	Polypropylene	Nitrile
Standard (6"-144")	Cellulose Acetate-Plastic	HDPE	HDPE	Aluminum	Aluminum—3/16"	Brass—3/16"	Poly coated cork	Nitrile
Options available for all of above	**GLC** -Glass internal, plastic external		**ALN**- Aluminum Lock Nut					**VTN**—Viton

- Sample Part Number—K-2-76-GLC

Other Options Available on the Type K Gauge

Price Book Page 6

Level Gauge Accessory	Description	Web Link
At-A-Glance Alarm	Audible Hi or Lo Level Alarm Accessory. Retrofits right to gauge. 110 decibel alarm. 9volt lithium battery.	http://www.ksentry.com/alarm.htm
Gauge Guard Aluminum or PVC	Durable sleeve that covers the plastic components on top of the gauge. Extend the life of the exposed parts of the gauge, and protect it from physical damage.	http://www.ksentry.com/replace.htm

Model 749 Pressure Vacuum Vents

SPECIFICATION SHEET

Application

Pressure vacuum vents are installed on the top of underground and low volume aboveground storage tank vent pipes. Vent allows tank

vacuum poppets seal vapors in tank when pressure is equalized. Settings are approximate.

The 749T provides the same functions as the 749 and is designed for use on underground and low volume aboveground tanks storing Diesel Exhaust Fluid (DEF) and other products requiring T stainless construction.

749

749T

Features and Details

- Screen protects the tank from debris and insects
- Integrated internal drain port channels water away from the tank
- Vent vapors up and outward per NFPA 30
- Conserves fuel
-

Materials of Construction

- Body and hood... anodized aluminum (**749T—**is T ® coated aluminum)
- Pressure poppet... anodized aluminum (**749T—**is HDPE)
- Vacuum poppet... brass vacuum (**749T—**is stainless steel)
- Body seal... Buna-N (**749T—**is Viton®)
- Screen... 40 mesh stainless steel
- Springs... stainless steel
- Set screws... Zinc-plated steel (**749T—**is Nylon)

*HDPE = High density polyethelene

WARNING

Fig. 749 P/V vent must only be used in conjunction with motor fueling . Fluid handling in lines larger than that used for retail service stations can cause tank to rupture or implode.

Certifications and Listings

CARB 95-14 (749CRB0500 model); CARB 95-15 (749CRB0600 model); CARB 96-19 (749CRBS0600 model); 749CRB Pressure Vacuum Vents (models 749CRB0600 AV, 749CRB1600 AV, 749CRBS0600 AV and 749CRBS1600 AV), meet the requirements of EPA 40 CFR part 63 for Gasoline Dispensing Facilities

WARNING: DO NOT FILL OR UNLOAD FUEL FROM A STORAGE TANK UNLESS IT IS CERTAIN THAT THE TANK VENTS WILL OPERATE PROPERLY. Morrison tank vents are designed only for use on shop fabricated atmospheric tanks which have been built and tested in accordance with UL 142, NFPA 30 & 30A, and API 650 and in accordance with all applicable local, state, and federal laws. In normal operation, dust and debris can accumulate in vent openings and block air passages. Certain atmospheric conditions such as a sudden drop in temperature, below freezing temperatures, and freezing rain can cause moisture to enter the vent and freeze which can restrict internal movement of vent mechanisms and block air passages. All storage tank vent air passages must be completely free of restriction and all vent mechanisms must have free movement in order to insure proper operation. Any restriction of can cause excessive pressure or vacuum to build up in the storage tank, which can result in structural damage to the tank, fuel spillage, property damage, injury, and death. Monthly inspection, and immediate inspection during freezing conditions, by someone familiar with the proper operation of storage tank vents, is required to insure

Item Number	A	B	C	D	E	SCFH	Height	Weight
749---0100 AV	2N	8.0 oz	0.50 oz	M	N	6200 @ 20oz./in.sq.	4.33	1.0
749---0200 AV	2N	12.0 oz	0.50 oz	M	N	7500 @ 25oz./in.sq.	4.33	1.0
749---1100 AV	3N	8.0 oz	0.50 oz	M	N	6200 @ 20oz./in.sq.	5.91	1.55
749---1200 AV	3N	12.0 oz	0.50 oz	M	N	7500 @ 25oz./in.sq.	5.91	1.55
749S--0100 AV	2S	8.0 oz	0.50 oz	M	N	6200 @ 20oz./in.sq.	4.33	1.0
749S--0200 AV	2S	12.0 oz	0.50 oz	M	N	7500 @ 25oz./in.sq.	4.33	1.0
749S--1100 AV	3S	8.0 oz	0.50 oz	M	N	6200 @ 20oz./in.sq.	6.28	1.65
749S--1200 AV	3S	12.0 oz	0.50 oz	M	N	7500 @ 25oz./in.sq.	6.28	1.65
749CRB0500 AV	2N	8.0 oz	0.50 oz	V	Y	6200 @ 20oz./in.sq.	4.33	1.45
749CRB0600 AV	2N	3″ W.C.	8″ W.C.	V	Y	3800 @ 8.2” H2O	4.33	1.95
749CRB1500 AV	3N	8.0 oz	0.50 oz	V	N	6200 @ 20oz./in.sq.	5.91	1.65
749CRB1600 AV	3N	3″ W.C.	8″ W.C.	V	N	3800 @ 8.2” H2O	5.91	1.65
749CRBS600 AV	2S	3″ W.C.	8″ W.C.	V	N	3800 @ 8.2” H2O	4.33	1.45
749CRBS1600 AV	3S	3″ W.C.	8″ W.C.	V	N	3800 @ 8.2” H2O	6.28	1.95
749BSP0100 AV	2B	8.0 oz	0.50 oz	M	N	6200 @ 20oz./in.sq.	4.33	1.0
749BSP0200 AV	2B	12.0 oz	0.50 oz	M	N	7500 @ 25oz./in.sq.	4.33	1.0
749T--0200 AV	2S	8.0 oz	0.50 oz	V	N	7500 @ 25oz./in.sq.	4.33	1.0

SPECIFICATION OPTIONS:

A— Body connection: 2″ NPSM (2N), 2″ Slip-on style (2S), 2″ BSP (2B), 3” NPSM (3N), or 3″ Slip-on style (3S)
B—Pressure setting: oz = oz/sq inch, wc = water column
C—Vacuum setting: oz = oz/sq inch, wc = water column
D—Pressure seal: metal-to-metal seat (M) or metal/viton® o-ring seat (V)
E—C.A.R.B. approval: yes or no (Y/N)
Height—Dimension from base to top of vent
Weight—Shipping weight (lbs)

570 E. 7th Street, P.O. Box 238 | Dubuque, IA 52004-0238
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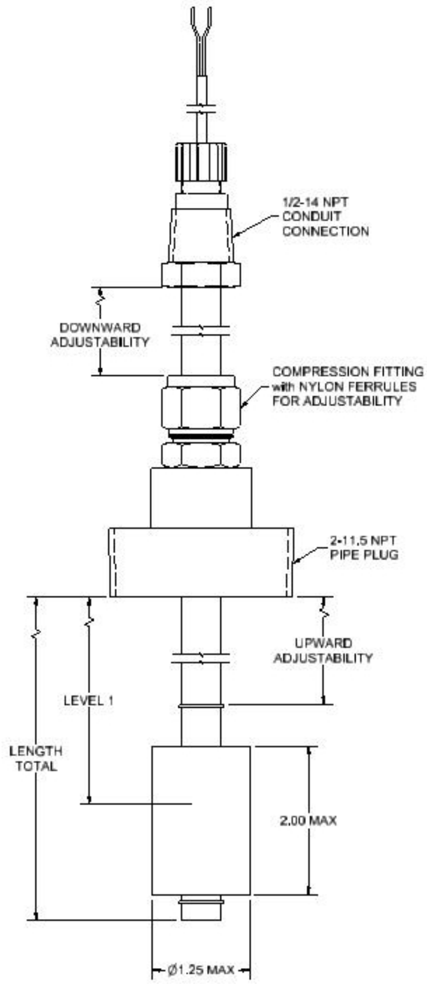
M4302-7807-x

Madison

Downward float switch height adjustment can be as much as 2”, and an upward adjustment can be as much as 9”. This allows for a series of tanks to use the same level switch configuration and provide easier field adjustments for low-level indication. Multi-level indications can also be provided.

The adjustment is made by loosening the compression fitting on the top of the 2” NPT pipe plug and moving the entire stem up or down as needed. The M4302-7807-x series is manufactured with nylon ferrules in a compression fitting. These types of ferrules allow the end-user to adjust the length multiple times.

NOTE: The retaining rings cannot be moved unless the operation needs to be changed from normally closed to normally open.



Applicable Industries

- Petroleum-based liquids, lubricating oils, gasoline and diesel fuels
- Storage tanks of vehicles, generators, transmissions, hydraulic systems
- Fluid recovery, refining and fuel processing

Features

- Allows the end-user to adjust switch depth or height
- Can overcome uneven tank stands to allow for accurate low-level indication
- Can change operation from normally closed to normally open

Operation

- Normally closed, opens on a rising level. Users can reverse operation.

Material

- Stem: Brass
- Float: Buna-N

Specifications

- Max. temperature: 221°F / 105°C
- Max. pressure: 150 psi
- Switch rating: 60 watt, 240V max. (AC/DC), SPST
- Lead wires: 72”, 22 AWG, 2 conductor, Teflon Insulated (standard)

Part Numbers	Adjustable Range	Minimum Media SG	Approvals
M4302-7807-1	1.5- 12”	0.56	CE UL CSA
M4302-7807-2	1.5- 24”		
M4302-7807-3	1.5- 36”		
M4302-7807-4	1.5- 48”		
M4302-7807-5	1.5- 60”		
M4302-7807-6	1.5- 72”		

NOTE: Other fittings and voltages are available. Contact us to discuss your application.

Custom Configurations

Contact us directly for custom solutions.
Email: info@madisonco.com

- Electrical ratings
  Switches are rated for resistive loads. The table below represents the UL guidelines for current (amperes resistive) at different voltages.

AC Voltage		DC Voltage	
60 VA nominal at 120V AC	0.50 amps max	60 watt nominal at 24V DC	0.50 amps max
60 VA nominal at 240V AC	0.40 amps max	60 watt nominal at 120V DC	0.20 amps max

Electrical Considerations

When using Madison level switches, it is important to consider the application's electrical parameters. Our level switches utilize reed switch technology, which are glass encapsulated, magnetically actuated switches. Madison generally provides electrical ratings for resistive loads; however, where the maximum current of the load permits, the switches are capable of controlling devices such as motors, solenoids or coils that produce capacitive or inductive electrical loads. Where possible, Madison recommends the use of general-purpose/isolation relays or controllers to protect the switch.

Protection Techniques and Common Failure Modes

Reed Switch protection is the most successful method of increasing the performance and life of your level sensor. Since every application varies, it is important to understand your protection options. The life of the reed switch is typically 1 million cycles, within rated load conditions. The table below is a guide to suggested protection techniques and common failure modes associated with each load type.

Load	Load Example	Protection	Diagram	Common Failure Modes	Failure Mode Description
Resistive (DC)	Indicator Lamp, Heaters	Current Limiting Resistor	A	In-rush Current (Switching)	In-rush current exceeds rating and welds switch closed
				Over-Current (Carry)	Carry-current exceeds rating and switch welds or burns open like a fuse
Inductive & Capacitative (DC)	Relay Coil, Solenoids, Motor	Reversing Diode	B	Over-Voltage (Arcing)	Voltage arcing during switching welds contacts closed
Inductive & Capacitive (AC or DC)		Resistor & Capacitor Network	C		
Resistive, Inductive & Capacitive (AC or DC)	Indicator Lamp, Heaters, Relay Coil, Solenoids, Motor	Varistor or MOV	D	Over-Voltage (Arcing)	Transients voltage spikes exceed breakdown voltage and weld switch closed

Capacitive Load

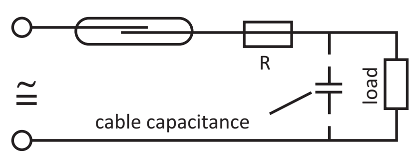


Diagram A: Current Limiting Resistor

Inductive Load

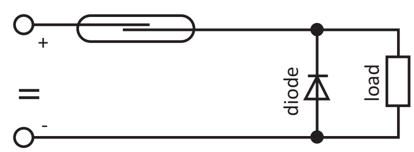


Diagram B: Reversing Diode

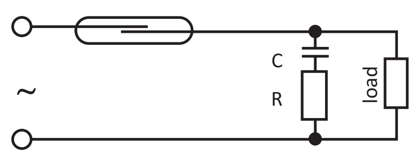


Diagram C: RC Network

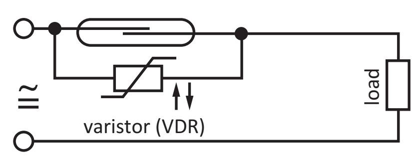


Diagram D: Varistor or MOV

For DC circuits: Insert a 1N4004 diode across the load (i.e.: relay coil) with the cathode end (marked with circular line) connected toward the positive side. This way the diode conducts only when the field collapses. General rule is to use a diode with a voltage rating at least three times the circuit voltage. A 1N4004 has a rating of 1 amp continuous, 30 amp surge, 400V max. Refer to diagram B.

For typical 120V AC circuits: Insert a 50 to 100 ohm, 1/2 watt Resistor in series with a .1 micro farad 400 to 600 volt capacitor across the switch. The capacitor is a high impedance to 60 hertz, but is essentially a short circuit to high frequencies of generated voltages. Alternately, a varistor V130LA10A by itself across the switch will also work for 120V AC. Refer to diagram D.

Appendix G

Pressure Test Logs

APPENDIX G: PRESSURE TEST LOGS

Pressure Test Log

AS/SVE System Modification
8801 East Marginal Way S.

Location	Date	Time Start	Duration (min)	Holding Pressure (p	Locations	Pass/Fail	Tested By	Observed By
SVE-4,5,6 for reconnection east of bldg	3/14/23	0736	4	5 psig		Fail-leak at test equipment	Cameron (AEC)	Ryan (S&W)
SVE-4,5,6 for reconnect east of bldg	3/14/23	0811	28	5 psig		Pass	Cameron (AEC)	Ryan (S&W)
SVE-1,2,3 for reconnection east of bldg	3/14/23	0900	15	5 psig		Pass	Cameron (AEC)	Ryan (S&W)
AS-27 reconnection east of bldg	3/14/23	1520	15	30 psig		Pass	Cameron (AEC)	Ryan (S&W)
AS-28 reconnection east of bldg	3/14/23	1520	15	30 psig		Pass	Cameron (AEC)	Ryan (S&W)
AS-29 reconnection east of bldg	3/14/23	1520	15	30 psig dropped to 28 psig		Fail → leak at test Gauge		
AS-"?" #1 for reconnection east of bldg	3/14/23	1520	15	30 psig		Pass	Cameron (AEC)	Ryan (S&W)
AS-"?" #2 for reconnection east of bldg	3/14/23	1520	15	30 psig		Pass	Cameron (AEC)	Ryan (S&W)
AS-29 for reconnection east of bldg	3/14/23	1539	15	30 psig		Pass	Cameron (AEC)	Ryan (S&W)
AS-22 for reconnection east of bldg	3/14/23	1725	15	30 psig		Pass	Cameron (AEC)	Ryan (S&W)
AS-23 for reconnection east of bldg	3/14/23	1725	15	30 psig		Pass	Cameron (AEC)	Ryan (S&W)
AS-24 for reconnection east of bldg	3/14/23	1725	15	30 psig		Pass	Cameron (AEC)	Ryan (S&W)
AS-25 for reconnection east of bldg	3/14/23	1725	15	30 psig		Pass	Cameron (AEC)	Ryan (S&W)
AS-26 for reconnection east of bldg	3/14/23	1725	15	30 psig		Pass	Cameron (AEC)	Ryan (S&W)
AS-17 for reconnection east of bldg	3/14/23	1807	15	30 psig		Pass	Cameron (AEC)	Ryan (S&W)
AS-18 for reconnection east of bldg	3/14/23	1807	15	30 psig		Pass	Cameron (AEC)	Ryan (S&W)

"?" labeled AS lines are extra, unused lines installed with the orisinial design for potential future expansion of the system.

Pressure Test Log

AS/SVE System Modification
8801 East Marginal Way S.

Location	Date	Time Start	Duration (min)	Holding Pressure (p	Locations	Pass/Fail	Tested By	Observed By
AS-19 for reconnection east of bldg.	3/14/23	1807	15	30 psig		Pass	Cameron (AEC)	Ryan (S&W)
AS-20 for reconnection east of bldg.	3/14/23	1807	15	30 psig		Pass	Cameron (AEC)	Ryan (S&W)
AS-21 for reconnection east of bldg.	3/14/23	1807	15	30 psig		Pass	Cameron (AEC)	Ryan (S&W)
AS-14 for reconnection east of bldg	3/14/23	1845	15	30 psig		Pass	Cameron (AEC)	Ryan (S&W)
AS-15 for reconnection east of bldg	3/14/23	1845	15	30 psig		Pass	Cameron (AEC)	Ryan (S&W)
AS-16 for reconnection east of bldg	3/14/23	1845	15	30 psig		Pass	Cameron (AEC)	Ryan (S&W)
AS-1 for reconnection east of bldg	3/14/23	2101	15	30 psig		Pass	Cameron (AEC)	Ryan (S&W)
AS-30 for reconnection east of bldg	3/14/23	2101	15	30 psig		Pass	Cameron (AEC)	Ryan (S&W)
AS-31 for reconnection east of bldg	3/14/23	2101	15	30 psig		Pass	Cameron (AEC)	Ryan (S&W
AS-32 for reconnection east of bldg	3/14/23	2101	14	30 psig → 25 psig		Fail → leak at test gauge		Ryan (S&W)
AS-33 for reconnection east of bldg	3/14/23	2101	15	30 psig		Pass	Cameron (AEC)	Ryan (S&W)
AS-32 for reconnection east of bldg	3/14/23	2115	15	30 psig		Pass	Cameron (AEC)	Ryan (S&W)
AS-2 for reconnection east of bldg	3/14/23	2128	15	30 psig		Pass	Cameron (AEC)	Ryan (S&W)
AS-3 for reconnection east of bldg	3/14/23	2128	15	30 psig		Pass	Cameron (AEC)	Ryan (S&W)
AS-4 for reconnection east of bldg	3/14/23	2128	15	30 psig		Pass	Cameron (AEC)	Ryan (S&W)
AS-5 for reconnection east of bldg	3/14/23	2128	15	30 psig		Pass	Cameron (AEC)	Ryan (S&W

Pressure Test Log

AS/SVE System Modification
8801 East Marginal Way S.

Location	Date	Time Start	Duration (min)	Holding Pressure (p	Locations	Pass/Fail	Tested By	Observed By
AS-6 for reconnection east of bldg	3/14/23	2134	23	32 psig		Pass	Cameron (AEC)	Ryan (S&W)
AS-7 for reconnection east of bldg	3/14/23	2158	15	30 psig		Pass	Cameron (AEC)	Ryan (S&W)
AS-8 for reconnection east of bldg	3/14/23	2158	15	30 psig		Pass	Cameron (AEC)	Ryan (S&W)
AS-9 for reconnection east of bldg	3/14/23	2158	15	30 psig		Pass	Cameron (AEC)	Ryan (S&W)
AS-10 for reconnection east of bldg	3/14/23	2158	15	30 psig		Pass	Cameron (AEC)	Ryan (S&W)
AS-11 for reconnection east of bldg	3/14/23	2224	15	30 psig		Pass	Cameron (AEC)	Ryan (S&W)
AS-12 for reconnection east of bldg	3/14/23	2224	15	30 psig		Pass	Cameron (AEC)	Ryan (S&W)
AS-13 for reconnection east of bldg	3/14/23	2224	15	30 psig		Pass	Cameron (AEC)	Ryan (S&W)
AS-"?" #3 for reconnection east of bldg	3/14/23	2224	15	30 psig		Pass	Cameron (AEC)	Ryan (S&W)
AS-"?" #4 for reconnection east of bldg	3/14/23	2224	15	30 psig		Pass	Cameron (AEC)	Ryan (S&W)
AS-55 rubber hose to well head	3/16/23	1130	15	30 psig		Pass	Cameron + Mark (AEC)	Ryan (S&W)
AS-51 rubber hose to well head	3/16/23	1130	15	30 psig		Pass	Cameron + Mark (AEC)	Ryan (S&W)
AS-47 rubber hose to well head	3/16/23	1130	15	30 psig		Pass	Cameron + Mark (AEC)	Ryan (S&W)
3 SVE lines from manifold to end of blank	3/27/23	1449	15	5psig		Pass	Cameron (AEC)	Ryan (S&W)
AS-35 thru AS-55 (odd #s only) from connection	3/28/23	1356	13 min → dropped to 29 psig	30 psig		Fail	Cameron (AEC)	Ryan (S&W)
to AS header, to AS well heads	/	/	/	/	/	/	/	/

Pressure Test Log

Location	Date	Time Start	Duration (min)	Holding Pressure (p	Locations	Pass/Fail	Tested By	Observed By
AS-35,37,39,41,43,45, 47,49,51,53,55	3/28/23	1417	15	30psig		Pass	Cameron (AEZ)	Ryan (S&W)
AS-34,36,38,40,42,44,46 48,50,52,54	3/28/23	1437	1min → leak via flow meter	30psig		Fail	Cameron (AEZ)	Ryan (S&W)
AS-34,36,38,40,42,44,46, 48,50,52,54	3/28/23	1453	15	30psig		Pass	Cameron (AEZ)	Ryan (S&W)
↳ except no flow meter at AS-46	/	/	/	/	/	/	/	/
Pipe between Condensate Tank and Transfer pump	4/4/23	1428	15	5psig		Pass	Cameron (AEZ)	Ryan (S&W)