APEX

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Supplementary Groundwater Source Control Evaluation Sampling Work Plan
Willamette Cove Upland Facility
Portland, Oregon

Prepared for:
Port of Portland and Metro

November 14, 2024
320001056-17 Task 3

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Abbreviations/Acronyms

BaP Eq	Benzo(a)pyrene Toxicity Equivalent
bgs	Below Ground Surface
BNSF	Burlington Northern Santa Fe
CDC	Centers for Disease Control and Prevention
CL	Cleanup Level
COC	Chemical of Concern
COI	Chemical of Interest
COPC	Chemical of Potential Concern
cPAHs	Carcinogenic Polycyclic Aromatic Hydrocarbons
CSM	Conceptual Site Model
cy	Cubic Yards
DEQ	Oregon Department of Environmental Quality
DDD	Dicholorodiphenyldichloroethane
ECSI	Environmental Cleanup Site Information
EPA	U.S. Environmental Protection Agency
Facility	Willamette Cove Upland Facility
FS	Feasibility Study
HPAHs	High Molecular Weight Polycyclic Aromatic Hydrocarbons
JSCS	Joint Source Control Strategy
LPAH	Lower Molecular Weight Polycyclic Aromatic Hydrocarbons
LWG	Lower Willamette Group
McCormick & Baxter	McCormick & Baxter Creosoting Company Superfund Site
MHW	Mean High Water
MLW	Mean Low Water
MOU	Memorandum of Understanding
NAPL	Non-Aqueous Phase Liquid
NAVD88	North American Vertical Datum 88
ng/kg	Nanograms per kilogram
NOAA	National Oceanic and Atmospheric Administration
NPL	National Priorities List
ODFW	Oregon Department of Fish and Wildlife
OLWL	Ordinary Low Water Line
OS	Open Space
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PDC	Portland Development Commission
PDI	Pre-Design Investigation

PHSS	Portland Harbor Superfund Site
Port	Port of Portland
PRG	Preliminary Remediation Goal
PTW	Principal Threat Waste
RAL	Remedial Action Level
RBC	Risk-Based Concentration
RDI	Remedial Design Investigation
RERA	Residual Ecological Risk Assessment
RHHRA	Residual Human Health Risk Assessment
RI	Remedial Investigation
ROD	Record of Decision
sf	Square Feet
SLV	Screening Level Value
SVOCs	Semi-Volatile Organic Compounds
TOB	Top of Bank
TPH	Total Petroleum Hydrocarbons
UPRR	Union Pacific Railroad
VCP	Voluntary Cleanup Program
VOCs	Volatile Organic Compound

1.0 Introduction

This *Supplementary Groundwater Source Control Evaluation Work Plan* (Work Plan) was prepared for the Willamette Cove Upland Facility (the Facility). The Work Plan was prepared as part of a Voluntary Cleanup Program (VCP) Agreement EC-NWR-00-26 between the Port of Portland (Port), Metro, and the Oregon Department of Environmental Quality (DEQ). The Facility is defined in the DEQ Environmental Cleanup Site Information (ECSI) database as ECSI No. 2066.

The Port submitted the *Updated Source Control Evaluation (Updated SCE*, Apex, 2023) to DEQ in response to a request by DEQ to identify and evaluate sources of groundwater contamination that may reach the Willamette River, and (if necessary) recommend remedial actions, consistent with the DEQ-U.S. Environmental Protection Agency (EPA) Portland Harbor Joint Source Control Strategy (JSCS; DEQ/EPA, 2005). Recommendations presented in the Updated SCE included collection and analysis of groundwater samples between the West Parcel upland monitoring wells and the locations of sediment and porewater samples collected by the in-water design team offshore of the West Parcel. Based on discussions with DEQ (meeting on February 1, 2024) and comments on the Updated SCE received from the EPA (memorandum to DEQ dated April 23, 2024), DEQ and EPA generally concur with the recommendation for additional groundwater sampling.

This Work Plan summarizes existing data and Facility characteristics, presents the investigation approach, and describes field sampling activities and laboratory analyses to be completed to collect the additional groundwater data.

1.1 Purpose and Objectives

The purpose of this supplementary groundwater sampling is to further assess whether chemicals of concern (COCs) detected above screening levels in upland monitoring wells on the West Parcel of the Facility are adversely impacting the Willamette River sediments or surface water. The specific objective of the supplementary investigation is the collection and analysis of groundwater samples between the upland monitoring wells on the West Parcel and the offshore sediment and porewater sampling locations.

1.2 Work Plan Organization

This document is organized in the following manner:

- Section 2 provides a description of the Site and summarizes the results of the groundwater source control evaluation.
- Section 3 presents the current hydrogeological CSM.
- Section 4 presents the proposed chemical characterization of groundwater.

- Section 5 summarizes historical surface sediment and porewater sample results adjacent to the West Parcel.
- Section 6 presents the proposed schedule and reporting deliverables.
- Section 7 lists the references cited in this Work Plan.

Appendix A is the Sampling and Analysis Plan (SAP). Health and safety documents are provided in Appendix B.

2.0 Background

2.1 Site Description

A detailed description of the Site and history is provided in the *Updated SCE* (Apex, 2023) and is summarized in this section.

The Facility is located along the northeast bank of the Willamette River in the St. Johns area of Portland, Oregon. Figure 1 shows the location of the Facility. The Facility is situated between River Miles 6 and 7 on the Willamette River and is mostly in Section 12 of Township 1 North, Range 1 West, Willamette Meridian. Figure 2 provides a current plan of the Facility, Site, and the surrounding area. For purposes of describing the Facility, it has been divided into West, Central, and East Parcels as shown on Figure 2. The facility is vegetated with a mix of grasses, shrubs, and trees of varying sizes. Prior to the start of work, vegetation must be cleared from the upland drill sites and paths for equipment access. A level, compacted area must be provided to stage the drill rig at each of the three upland drilling locations.

Extent of Upland Facility. The upland portion of the Facility is approximately 3,000 feet long and varies from 110 to 700 feet in width. The Facility as defined in the VCP Agreement covers approximately 24 acres of upland area that is inland from the ordinary low water line (OLWL). However, the scope of work for the VCP Agreement limits the work to inland from the mean high water (MHW) line (defined as 13.3 feet, North American Vertical Datum 88 [NAVD88]) to the property line with the Union Pacific Railroad (UPRR). DEQ, EPA, Metro, and the Port have agreed that the site riverbank at the Facility (defined as the area from the waterline to the top of bank [TOB]) will be addressed as part of in-water activity associated with the Portland Harbor Superfund Site (PHSS).

Access. The Facility will be accessible by vehicle from North Richmond Avenue. A construction entrance will be created at the north end of the West Parcel for access. Access to the area by foot or from the river is possible.

Structures and Improvements. There are no structures on the Facility. Indications of previous structures include a large concrete foundation and a paved roadway in the eastern portion of the Facility, several smaller

concrete structures or foundations, and structural piling within the cove and along the riverbank. Riprap is present along much of the riverbank. Sandy beaches are present at the west end of the Central Parcel and at the inner portion of the cove on the East Parcel.

Topography. The Site is situated on a terrace created by historical filling. Overall, the topography of this terrace is flat, with an elevation ranging between 30 and 45 feet (all elevations in the report refer to NAVD88 unless otherwise noted). The southern portion of the West Parcel is slightly higher, at elevation 50 to 55 feet. Berms and hummocks are occasionally present. Uneven terrain, primarily in the West Parcel, may limit vehicle access. Use of tracked vehicles may be required in some areas.

Surrounding Properties. The Site is bordered on the northeast by the UPRR tracks. Farther to the northeast is a vegetated bluff. A residential area is present on top of the bluff and farther inland. Bordering the northwest side of the Site is a vacated portion of North Richmond Avenue with industrial property beyond. To the southeast is an embankment for the BNSF railroad bridge over the Willamette River. On the opposite side of this embankment is the former McCormick & Baxter Creosoting Company, a federal Superfund Site. Toward the river, the Site is bordered by the riverbank and the surface water of the cove and Willamette River.

2.2 2023 Updated Groundwater Source Control Evaluation

As indicated in Section 1, an Updated SCE was prepared (Apex, 2023) to identify the potential for adverse effects on surface water or sediments from groundwater. Considering multiple lines of evidence, the Updated SCE did not identify potential adverse effects or groundwater source control concerns. However, polycyclic aromatic hydrocarbons (PAHs) and dicholorodiphenyldichloroethane (DDD) are present above CULs in groundwater at the West Parcel and in sediment and porewater adjacent to the West Parcel. Although these spatially correlated impacts in groundwater, sediment, and porewater may be from a common source, additional evaluation of the groundwater concentrations of PAHs and DDD between the West Parcel upland monitoring wells and the offshore sampling locations is recommended to better understand fate and transport of COPCs in groundwater from the West Parcel. Additionally, the DEQ and/or EPA have requested that arsenic and PCBs be included in the groundwater sample analyses.

3.0 Hydrogeological Conceptual Site Model

A detailed Conceptual Site Model (CSM) is presented in the *Updated SCE* (Apex, 2023) including a description of the regional and site geology and hydrogeology. The Facility conditions are summarized below.

3.1 Site Geology

The geology beneath the Facility consists of fill and alluvial deposits overlying Troutdale Formation. The thickness of the fill across the Facility is generally in the range of 20 to 30 feet; however, in places, it could be up to 60 feet (such as in a former log pond on the West Parcel filled in the early 1970s).

The West Parcel consists of a mixture of roughly equal amounts of silty sand, sandy silt, and silt with some clean sand. The clean sand is located closer to the river but constitutes less than 10 percent of the volume of soil within the upper 40 feet of the soil profile. Within the saturated zone, soils consist of silt, sandy silt, and silty sand (nearer the river in the vicinity of MW-2). Sand was present in the bottom few feet of MW-3. Off-shore, geotechnical borings encountered Columbia River Basalt in the elevation range of -20 to -40 feet.

The Central and East Parcels consist mostly of sand or silty sand. A silt layer was encountered at the bottom of MW-8 and MW-9. In addition, silty sand and sandy silt were encountered at shallower depths farther from the river (these siltier soils may represent native alluvium versus fill material). Within the saturated zone, the soils consist primarily of sand. Off-shore, geotechnical borings encountered Columbia River Basalt in the elevation range of -20 to -170 feet (from west to east).

The observed soil types are consistent with the known fill history where much of the Central and East Parcels were filled in a few large events (likely from dredge sands), but the West Parcel was filled in multiple small events from a variety of sources (Apex, 2019).

The observed clean sands within the saturated zone on the Central and East Parcels imply that groundwater flow would be relatively uniform in these areas. The more heterogeneous nature of the fill on the West Parcel implies more complicated groundwater flow.

3.2 Site Hydrology and Hydrogeology

3.2.1 Surface Water Levels

The mean high water (MHW) is a tidal datum and is the arithmetic mean of the lower of the two daily high tide heights. The MHW elevation at the Facility is 13.3 feet based on the NAVD88 datum and is the boundary of the upland source control Facility. Ordinary high water (OHW) is the boundary of the active channel and is based largely on identification of a break in slope and change in sediment and vegetation characteristics (USACE, 2014). The OHW at the Facility is 20.1 feet (NAVD88). Ordinary low water (OLW) is the line to which low water ordinarily recedes annually in season (Oregon Revised Statute 274.005) and is at an elevation of 6.9 feet (NAVD88) at the Facility. These demarcations are shown on Figure 2.

River levels fluctuate due to daily tides, seasonal changes, and weather events. Tides generally affect the Willamette River levels when river stages (Columbia River Datum [CRD]) are less than 12 feet and tides are

pronounced when the river stage falls below 6 feet (DEQ, 2003). Continuous water level monitoring of the river level was conducted by the in-water design team for the period from November 2020 to March 2023. During that period, the mean river level was 9.51 feet with extremes of 21.40 feet in June 2022 and 4.83 feet in October 2021 as shown on Figures 3, 4, and 5 (cross section locations are shown on Figure 2).

In general, groundwater is expected to discharge to the Willamette River (see discussion below). No seeps have been observed on the riverbank, indicating that groundwater discharge is generally at or below the river surface. In unusual short-term circumstances (e.g., at extreme low tides during seasonally falling river conditions), groundwater may discharge on the riverbank/beach slightly above the river level.

3.2.2 Geometry of Riverbank and Riverbed

The approximate profiles of the riverbank to the bottom of the river in the West Parcel are presented on Figures 3, 4, and 5. The slope from the top of bank to the river in the West and Central Parcels is steeper (ranging from 20% to 60% slope) than the slope from the top of bank to the river in the East Parcel (averages approximately 15 percent). The riverbed is also steeper adjacent to the West and Central Parcels and slopes at approximately 10 percent for approximately 300 feet towards the center of the river where the riverbed levels off at approximately -40 feet (David Evans and Associates, 2018).

Explorations conducted by the in-water team encountered basalt at relatively shallow intervals near the West Parcel and suggests that faulting may have brought the basalt nearer the surface in that area. Bathymetry data collected during the Portland Harbor RI shows a linear feature approximately 200 feet offshore of the West Parcel that is apparently resistant to erosion, consistent with basalt thrust upward in that area.

Grainsize characteristics of the sediment on the riverbed can impact the amount and location of groundwater discharge to the river. Data collected during the Portland Harbor RI show that riverbed sediments are primarily sand (less than 20 percent fines) adjacent to the west end of the Central Parcel and the West Parcel, and riverbed sediments are primarily silt adjacent to the rest of the Facility (greater than 50 percent fines).

In general, the characteristics of the river geometry and riverbed suggest that groundwater discharge to the river will be relatively greater in areas near the west end of the Central Parcel and the West Parcel.

3.2.3 Groundwater Level Measurements

Nine groundwater monitoring wells are present at the site: MW-1 through MW-7 were installed in 2002, and MW-8 and MW-9 were installed in 2016. As part of the in-water investigation, continuous water level monitoring using pressure transducers was conducted in four monitoring wells (MW-1, MW-3, MW-5, and MW-9) and the river at the Facility (GSI, 2021 and 2023). Depth to groundwater at the Facility has ranged from 21 to 37 feet bgs. Groundwater elevations have ranged from 7.1 to 21.7 feet (NAVD88). Summary groundwater levels are presented on the cross-sections on Figures 3, 4, and 5.

3.2.4 Groundwater Gradients

Given the long, narrow shape of the Facility, groundwater monitoring wells were installed generally along the top of bank, as close as practicable to the river which preclude direct calculation of horizontal groundwater gradients in the upland. Additionally, wells are installed only within the first encountered groundwater, preventing direct measurement of vertical groundwater gradients. However, an analysis using multiple lines of evidence to estimate horizontal and vertical groundwater gradients is presented in the Updated SCE (Apex, 2023) and summarized below.

Horizontal Groundwater Gradient. Horizontal groundwater gradients were estimated by comparing groundwater levels in the various monitoring wells to each other and to river levels. Assuming homogeneous soil conditions, water levels in groundwater monitoring wells would be a function of distance from the river and the average river level.

The overall horizontal gradient at the Facility is characterized as follows: the general gradient is perpendicular to the river, downward toward the river at a magnitude in the range of 0.006 to 0.02 (winter/spring to summer/fall). Mounded groundwater in the vicinity of MW-2 has the effect of deflecting the overall gradient around the vicinity of MW-2. Groundwater in the immediate vicinity of MW-2 has a steeper gradient toward the river (ranging from 0.07 to 0.13). These results are consistent with the Facility geology showing relatively homogeneous sand deposits in the Central and East Parcels (resulting in relatively regular groundwater contours) and a mixture of deposits in the West Parcel (resulting in some irregular groundwater contours around MW-2).

Vertical Groundwater Gradient. As stated above, there are no data on site-specific vertical groundwater gradients, but the general direction of vertical gradients may be inferred from published regional groundwater studies. Explorations on the Facility have been conducted to depths of up to 40 feet. An aquitard has not been identified on the Facility within that depth. Given the uncertainty of whether an aquitard is present beneath the Facility, two scenarios are considered for assessing potential vertical gradients: 1) an aquitard is not present beneath the Facility; and 2) an aquitard is present beneath the Facility.

Under the first scenario where an aquitard is not present, the water table aquifer is connected to the regional aquifer, and it would be subject to the gradients of the regional aquifer. Regionally, groundwater gradients along the margins of the Willamette River are upward (McFarland and Morgan, 1996; pg. 20). Therefore, dissolved contamination would not migrate downward.

Under the second scenario where an aquitard is present, the water table aquifer would be perched on the aquitard. Although the vertical gradient is unknown in this case, the perched aquifer (containing the dissolved COCs) is by definition vertically isolated from regional aquifers by the underlying aquitard (McFarland and

Morgan, 1996; pg. 18). In that event, regardless of the vertical gradient direction, transport of groundwater contaminants from the water table aquifer to an underlying aquifer would be inhibited by the aquitard.

In either scenario, the primary flow would be lateral, characterized by the horizontal gradient. This conclusion is supported by vertical chemical sampling from DP-5. Detected concentrations of COCs in the lower sample (separated from the upper sample by 15 feet) were 26 to 99 percent less than in the upper sample (Apex, 2017).

3.2.5 Groundwater Velocities and River Level Effects

A detailed analysis of groundwater velocities was presented in the Updated SCE (updated based on comments received from the Five Tribes and EPA). Based on the analysis, the long-term mean estimated groundwater velocities are toward the river and range from 0.009 feet per day (ft/day; MW-2) to 5 ft/day (MW-5). On the Central and East Parcels, estimated water particle travel times from monitoring wells to the river range from one to five weeks. On the West Parcel, the estimated travel times range from 5 months (MW-3) to 20 years (MW-2).

Short-term changes in river levels (e.g., tidal cycles, flood events, and seasonal changes) can greatly impact instantaneous velocities, potentially reversing groundwater flow near the river. The groundwater velocity analysis showed that in the over 2-year period of monitoring, meaningful groundwater reversals occurred only in MW-4 and MW-5 on the Central Parcel (from May to July 2022).

3.2.6 Groundwater Seepage Measurements

The in-water design team conducted indirect and direct measurement of groundwater seepage to the river using a Trident Probe (direct push integrated sampler) to screen surface water and transition zone water (TZW) for specific conductivity and temperature and seepage meters to measure specific discharge.

In general, the specific discharge data are relatively uniform: 21 of 22 locations adjacent to the Facility had specific discharge values in the range of 0.23 to 1.98 cm/day with a mean value of 0.9 cm/day. Location B-10 off the Central Parcel has a specific discharge value of 20.8 cm/day. Sample locations within the cove have lower specific discharges (range from 0.03 to 0.09 cm/day). That is consistent with the finer-grained sediment in that area.

Using the specific discharge data and mean groundwater gradients (from Table 3 of the Updated SCE), the estimated hydraulic conductivities for soils at the West, Central, and East Parcels are 0.9, 1.6, and 2.1 ft/day, respectively.

3.3 Groundwater Discharge Model

Based on the hydrogeological model developed in the Updated SCE and summarized above, Figures 6 and 7 show the predicted flow paths for groundwater discharging from Willamette Cove in plan and cross section. The plan view shows that groundwater typically discharges to the nearest point in the river except near MW-2 where the discharge of groundwater upgradient of that location is deflected slightly up- or downriver.

Figure 7 shows that, assuming no anisotropy, groundwater within the upper 100 feet discharges within 140 feet of the river edge. The groundwater zone known to be impacted with COCs (estimated to be the upper 50 feet of groundwater), discharges within 25 feet of the river edge. Considering potential anisotropy of the soils, the primary discharge of groundwater with COCs would be within 150 feet of the shoreline, and the discharge of the upper 100 feet of groundwater would be within less than 400 feet of the shoreline.[1] This evaluation indicates that groundwater with COCs at concentrations with the potential to impact surface water will discharge to the river within approximately 150 feet of the shoreline (with uncertainty in the range of -100 to +250 feet). Figure 6 shows the estimated location of this discharge zone of groundwater to the river.

Near the West Parcel, site-specific data from the in-water geotechnical borings show a clayey layer 2 to 9 feet thick near elevation -10 feet, and the Columbia River Basalt near elevation -30 feet. These layers may act as an aquitard in the vicinity of the West Parcel. The -10-foot and -30-foot contours offshore of the West Parcel are approximately 60 to 200 feet from the shoreline, suggesting that groundwater discharge in the vicinity of the West Parcel would be within as little as 60 feet to as much as 200 feet from the shore. This is consistent with the estimate of 150 feet discussed above.

4.0 Summary of Sediment and Porewater Results

Relevant sediment and porewater sample results are discussed in detail in the Updated SCE and summarized below:

- Arsenic – Arsenic is present above the background concentration in groundwater at the West Parcel, likely resulting from organics in fill creating reducing conditions that leach naturally-occurring arsenic from soil. The spatial distributions of arsenic in sediment and porewater do not indicate that arsenic concentrations are elevated adjacent to the West Parcel relative to other areas of the in-water site.

[1] The flow net modeled on Figure 7 implicitly assumes an infinitely wide river. This assumption is suitable for evaluating impacts near each shoreline. The upper limit for the predicted discharge zone using this model is on the order of 800 feet, over halfway across the river. The net effect of considering flow from the opposite shoreline would be to compress the outer limits of the discharge zone by a factor of two. Additionally, because the flow through each flow channel of the flow net is equal, the flow rate per unit area decreases as the flow tubes get larger (i.e., farther from shore). This has the effect of decreasing the concentration of COCs in the surface water from the lower flow channels. Given that the concentrations of COCs are less in the lower flow channels, the outer limits of the modeled discharge zone have a small contribution to the overall COC loading from groundwater.

This is consistent with groundwater returning to a more oxidized state prior to reaching porewater. Therefore, arsenic is not a groundwater source control concern.

- PAHs – PAHs are present above CULs in groundwater at the West Parcel and in sediment and porewater adjacent to the West Parcel. The presence of PAHs in riverbank soil above CULs is a strong line of evidence that impacts to all these media are from a common historical source. Regardless, except for one sediment sample and one porewater sample, exceedance factors in sediment and porewater are in the range of 1 to 7. It is inconclusive if PAHs in groundwater are adversely impacting sediment or porewater, but that impact, if any, is relatively modest.
- TPH (C10-C12 aliphatics) – TPH was detected in one out of three samples from each groundwater well on the West Parcel. When detected, TPH was above the CUL. TPH is not a COC in sediment and was not analyzed in sediment or porewater samples. However, using the measured attenuation for BaP Eq as a surrogate to estimate attenuation of TPH, porewater concentrations for TPH are estimated to exceed the CUL by a factor of 1.4 or less. Based on the relatively infrequent detection, the lack of concern in sediment, and the low estimated porewater concentrations, TPH (C10-C12 aliphatics) is not a groundwater source control concern.
- Total PCBs – Total PCBs are present above CULs in groundwater beneath the West Parcel. Nineteen of 21 groundwater samples exceeded the CUL by factors of 1 to 8. Sediment and porewater exceedances do not spatially correlate with higher groundwater concentrations. Concentrations in filtered groundwater samples and in porewater are strong lines of evidence that impacts to porewater from groundwater are less than the CUL. Detections of PCBs in riverbank soil and sediment at similar concentrations is a strong line of evidence that impacts to sediments are not from groundwater. Based on these lines of evidence, total PCBs are not a groundwater source control concern.
- Dioxin/Furan TEQ – Dioxin/furan TEQ is present above the JSCS screening level value in groundwater beneath the West Parcel and likely the western portion of the Central Parcel. Exceedances of the CUL in sediment near the West Parcel are in the range of 1 to 6. Sediment and porewater exceedances do not spatially correlate with higher groundwater concentrations. Impacts to surface sediment are consistent with known source areas at McCormick & Baxter and riverbank soil at the Central Parcel. Based on these lines of evidence, dioxin/furan TEQ is not a groundwater source control concern.
- DDD – DDD is present above CULs in groundwater at the West Parcel and in sediment and porewater adjacent to the West Parcel. These spatially correlated impacts in groundwater, sediment, and porewater may be from a common source. Only two of 16 surface sediment samples exceeded the CUL adjacent to the West Parcel (exceedance factors of 6 and 9). Five of nine porewater samples exceeded the CUL adjacent to the West Parcel (exceedance factors of 2 to 94). It is inconclusive if DDD in groundwater is adversely impacting sediment or porewater, but that impact, if any, is relatively modest.

Except for possibly PAHs and DDD, COCs in groundwater from the Willamette Cove Upland Facility are not having adverse effects on surface water or sediments.

Figures 8 through 11 summarize cPAH and DDD results for sediment and porewater samples collected adjacent to the West Parcel. The corresponding data are shown on the cross sections on Figures 3, 4, and 5.

5.0 Chemical Characterization of Groundwater

The goal of the additional groundwater characterization is to better define the extent of groundwater with PAH, DDD, arsenic, and PCB concentrations exceeding CULs or background to supplement the source control evaluation. Specific sampling locations and methodologies were developed to meet these goals and address the data gaps identified in the Updated SCE.

5.1 Preparatory Activities

Preparatory activities for groundwater characterization efforts include coordinating property access with Metro personnel, clearing proposed sample locations of underground utility conflicts, and coordinating drilling and sampling activity. These activities are discussed in more detail in the SAP (Appendix A). In addition, as described in Section 2.1, clearing of vegetation at each drill site and equipment pathways will be required prior to initiation of the work.

5.2 Sampling Approach

The overall approach for the additional groundwater sampling will be to collect groundwater samples from the West Parcel monitoring wells and from locations between the upland groundwater monitoring wells on the West Parcel and adjacent offshore sample points. A total of nine borings are proposed to be advanced in the locations shown on Figure 12. Figures 13, 14, and 15 show the proposed borings and sampling depths on the cross sections reproduced from Figures 3 through 5. The results of the additional groundwater sampling will be used to supplement and complete the Updated SCE (Apex, 2023).

5.3 Sampling Plan

A detailed discussion of the sampling and methods, protocols for sample collection, and quality assurance are provided in the SAP (Appendix A).

5.3.1 Riverbank Groundwater Sampling

A total of three temporary borings will be installed at an angle (up to 40 degrees from vertical) from the top of the bank to evaluate groundwater conditions within the riverbank. Borings will be located near the existing upland monitoring wells and will be installed using sonic drilling methods. Each boring will be advanced to a maximum drill length of approximately 80 feet from the entrance point, or to equipment refusal. Soil conditions directly beneath the riverbank are unknown, but given the fill history on the West Parcel, it is possible that rock dikes were placed to contain filling that occurred below the river level. Groundwater grab samples will be collected from three discrete depth intervals in each boring. Groundwater levels will be measured at the time of drilling; the first sample will be collected near the mean groundwater level in the monitoring wells, or within the first five feet of encountering groundwater if the water level is lower. The next two samples will be collected at 12-foot (plus/minus 2 feet) depth intervals thereafter (approximately 15.7 feet along the borehole). Figures 13, 14, and 15 show the proposed sampling locations in relation to the monitoring wells and sediment/porewater samples. In the event that refusal is encountered before the planned terminus, a groundwater grab sample will be collected at the boring terminus if the boring has penetrated at least half way between the prior sample and next planned sample. Each boring will be continuously cored, and the soil cores will be logged and recorded using the Unified Soil Classification System. No soil samples will be collected for laboratory analysis.

The In-Water Group is planning riverbank characterization activities that will include advancement of angle borings, some of which will be co-located with the groundwater sample borings described above (In-Water Group transects 1, 3 and 5). To the extent practical, the upland groundwater sample collection will be conducted in coordination with the In-Water Group borings.

5.3.2 In-Water Sampling

Temporary in-water borings will be installed using a barge-mounted sonic drill rig. Two borings will be installed offshore from each upland groundwater monitoring well, for a total of six borings. Each nearshore boring will be advanced at the approximate mudline elevation of 5 feet (corresponding to the minimum river level during the monitoring period). The riverward sample will be collected between approximately 130 to 150 feet from the monitoring wells (expected mudline elevations in the range of -6 to -14 feet). The borings will be advanced to a depth of approximately 20 feet below the mud line, or to equipment refusal. Groundwater grab samples will be collected from two discrete depth intervals in each boring, at approximately 5 feet (top of sampling screen) below mudline and at the bottom of the boring. Samples will be collected using a drive-ahead groundwater sampling point. As with the riverbank borings, the in-water borings will be continuously cored for lithologic identification, but no sediment/soil samples will be collected for laboratory analysis.

The Oregon Department of Fish and Wildlife has established in-water work windows to minimize the potential impacts to important fish, wildlife and habitat resources. The In-water work window for the Willamette River

from the mouth to Willamette Falls is July 1 through October 31. A second In-water work window occurs from December 1 through January 31. However, work in this window is limited to activities below -20 NGVD 1947, which is well below the proposed in-water sampling locations. If the in-water sampling will be conducted outside the July 1 through October 31 work window, a variance will be obtained through the U.S. Army Corps of Engineers and DSL (joint variance request).

In addition, as the mainstem of the Willamette River is designated essential salmonid habitat, an Oregon Department of State Lands (DSL) Removal/Fill permit is required for removing, filling or moving any amount of material in accordance with Oregon Revised Statute 196-810.

5.3.3 Monitoring Well Sampling

Groundwater monitoring will consist of measuring groundwater levels and collecting samples for chemical analysis from wells MW-1 through MW-3 on the West Parcel. The monitoring well sampling will be conducted immediately prior to the upland boring activities.

Groundwater levels will be measured in wells prior to sampling. After water levels are measured, the wells will be purged using a low-flow submersible pump with new tubing. Groundwater field parameters (pH, oxidative-reductive potential, dissolved oxygen, specific conductivity, temperature, ferrous iron and turbidity) will be measured using a flow cell connected to the discharge tubing of the sample pump. Purging will be considered complete when these water quality parameters have stabilized to within 10 percent for three consecutive three-minute intervals, at which time samples will be collected.

5.4 Analytical Testing Program

Groundwater samples will be analyzed for the following:

- PAHs by EPA Method 8270E-SIM;
- DDD by EPA Method 8081B;
- PCBs by EPA Method 8082A and
- Total and dissolved arsenic by EPA Method 6020B.

In addition, samples will be analyzed for geochemical parameters of total and dissolved iron and manganese, nitrate (as nitrogen), sulfate, carbon dioxide (total organic carbon) and ferrous iron to evaluate the oxidation/reduction conditions. Laboratory analysis will be performed by Apex Laboratories of Tigard, Oregon (Apex Lab, OR01039) or a laboratory subcontracted by Apex Lab. The SAP in Appendix A includes a detailed discussion of the analytical testing plan.

6.0 Schedule and Reporting

6.1 Schedule

The anticipated schedule is shown below (assumes a variance will be granted in a timely manner for work outside the fish window).

Proposed Activity	Anticipated Schedule
Submit Draft Work Plan	November 2024
Submit Final Work Plan	December 2024
Permitting and Coordination	Winter/Spring 2025
Conduct field work	Spring 2025
Submit Draft Evaluation Report	November 2025
Submit Final Evaluation Report	January 2026

6.2 Reporting

The results of the additional sampling will be presented in a Supplemental Groundwater Source Control Evaluation Report in general accordance with the following outline.

1. Introduction
2. Background
    a. Site Description
    b. Previous Investigations and Historical Data
    c. Summary of Prior Groundwater Source Control Evaluation
3. Activities Completed
    a. Pre-field Activities
    b. Groundwater Sampling and Analysis
4. Supplemental Groundwater Source Control Evaluation
    a. Chemical Characterization of Groundwater
    b. Evaluation of Groundwater COCs Discharging to the River
5. Conclusion
6. Appendices
    a. Groundwater Sampling Field Documentation and Exploration Logs
    b. Analytical Laboratory Sample Analysis Report/Quality Assurance Review

c. Photographs

7.0 References

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David Evans and Associates, 2018. *Willamette River Oregon, River Mile 1.9 to 11.8, Hydrographic Survey Report*. July 2018.

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McFarland, W.D. and Morgan, D.S., 1996. Description of the Ground-Water Flow System in the Portland Basin, Oregon and Washington, U.S. Geological Survey Water-Supply Paper 2470-A.

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DEQ, 2003. *"Upland" versus "In-water" Definition and Portland Harbor Elevation Datums, Portland Harbor Superfund Project*. Memorandum dated July 9, 2003.

U.S. Army Corps of Engineers (USACE), 2014. *Portland-Vancouver Harbor Information Package Third Edition Reservoir Regulation and Water Quality Section.* October 2014.

Note: Base map prepared from USGS 7.5-minute quadrangles of Linnton and Portland, OR, dated 2020 as provided by USGS.gov.

0 2,000 4,000

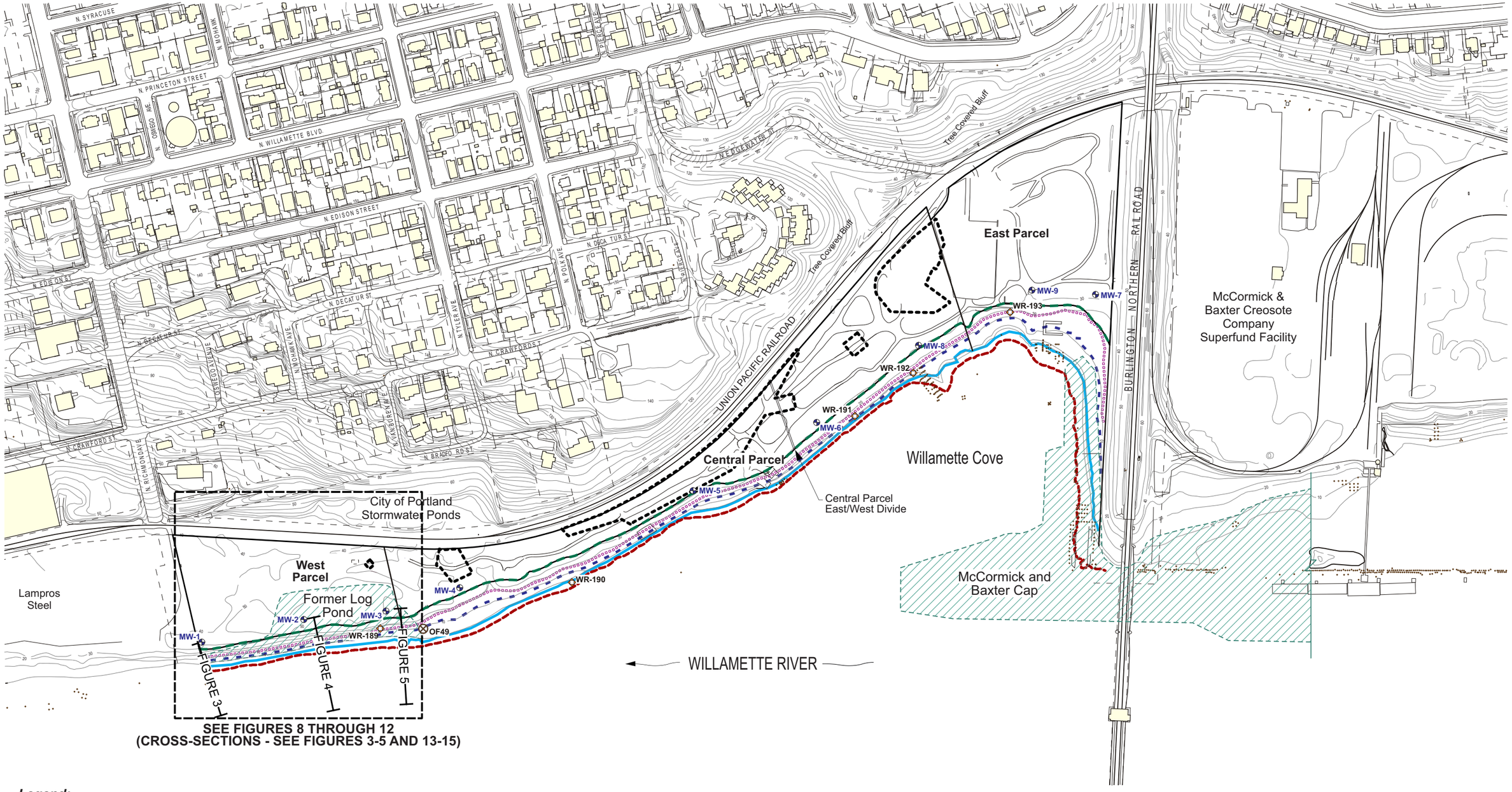
Approximate Scale in Feet

Facility Location Map

2024 Additional Sampling
Willamette Cove Upland Facility
Portland, Oregon

Apex Companies, LLC 15618 SW 72nd Avenue Tigard, Oregon 97224	Project Number: 320001056-17	Drawn: JP	Approved: SM	Figure 1
	November 2024			

I:\Client\Port of Portland\00-PH905\05 WC\01 Repts and Wk Plans\19 GW SCE_SCAE\2024 Add'l Sampling\320001056-17 01 (Facility Location Map).des



Legend:

- MW-1 — Monitoring Well Location
- OF49 — City of Portland Outfall
- WR-189 — Potential Historical Outfall (Inactive)
- 2008 and 2015 Removal Action Areas
- MW-1 — Cross-Section Location (See Figures 3 through 5)
- Upper Source Control Screening Boundary (Corresponds to Top of Bank Plus Areas of Potentially Erodible Soil)
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)
- -2 Columbia River Datum (3.2NAVD88)

0 300 600

Approximate Scale in Feet

N

Source: Base map prepared from an electronic file provided by Hart Crowser.

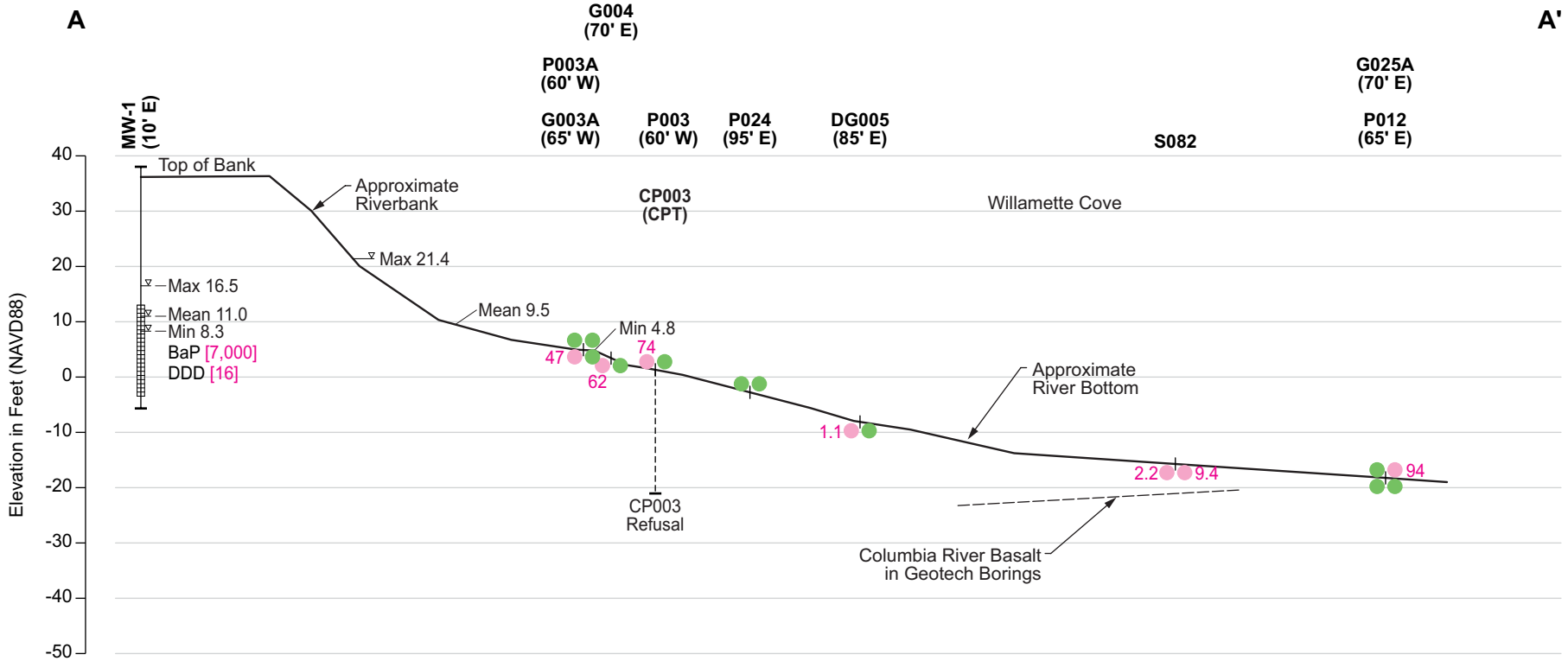
Facility Plan

2024 Additional Sampling
Willamette Cove Upland Facility
Portland, Oregon

Apex Companies, LLC
15618 SW 72nd Avenue
Tigard, Oregon 97224

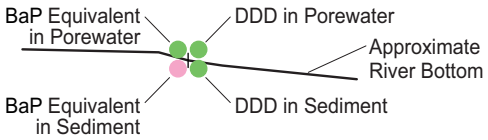
Project Number:	Drawn:	Approved:	Figure
320001056-17	JP	SM	2
November 2024			

I:\Client\Port of Portland\00-PH905\05 WC\01 Repts and Wk Plans\19 GW SCE_SCAE\2024 Add'l Sampling\320001056-17 02 (Facility Plan).des



Legend:

- [16] Mean Groundwater Exceedance Factor (EF)
- 47 EF Greater than 1
- EF Less than 1
- BaP Benzo(a)Pyrene
- DDD Dichlorodiphenyldichloroethane
- Water Level



NOTE: Water level monitoring period is from November 2020 to June 2023.

0 30 60

Approximate Scale in Feet

MW-1 Cross-Section

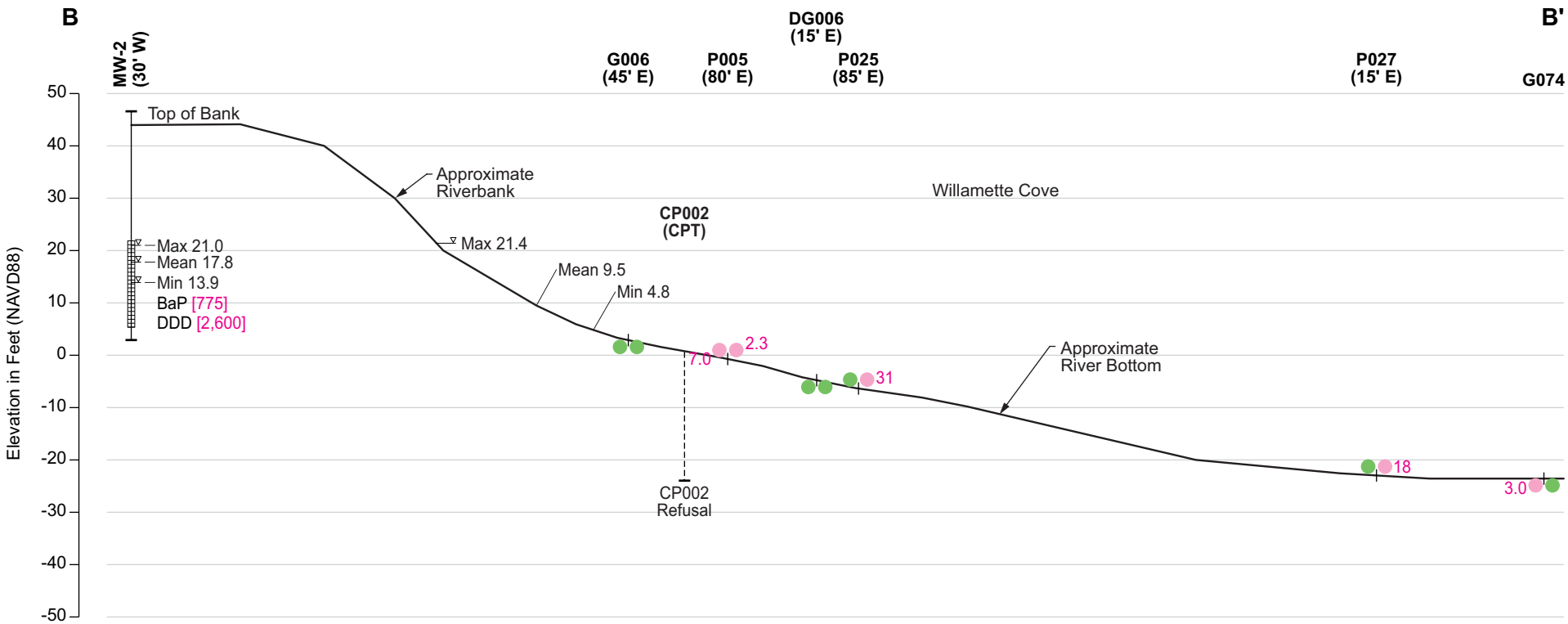
2024 Additional Sampling
Willamette Cove Upland Facility
Portland, Oregon

Apex Companies, LLC
15618 SW 72nd Avenue
Tigard, Oregon 97224

Project Number:	Drawn:	Approved:	Figure
320001056-17	JP	SM	3

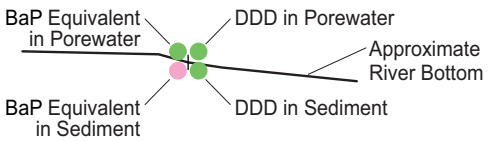
November 2024

I:\Client\Port of Portland\00-PH905\05 WC\01 Repts and Wk Plans\19 GW SCE_SCAE\2024 Add'l Sampling\320001056-17 03-05 (Riverbank X-Sections).des



Legend:

- [775] Mean Groundwater Exceedance Factor (EF)
- 7.0 EF Greater than 1
- EF Less than 1
- BaP Benzo(a)Pyrene
- DDD Dichlorodiphenyldichloroethane
- Water Level



NOTE: Water level monitoring period is from November 2021 to June 2023.

0 30 60

Approximate Scale in Feet

MW-2 Cross-Section

2024 Additional Sampling
Willamette Cove Upland Facility
Portland, Oregon

Apex Companies, LLC
15618 SW 72nd Avenue
Tigard, Oregon 97224

Project Number:	Drawn:	Approved:	Figure
320001056-17	JP	SM	4

November 2024

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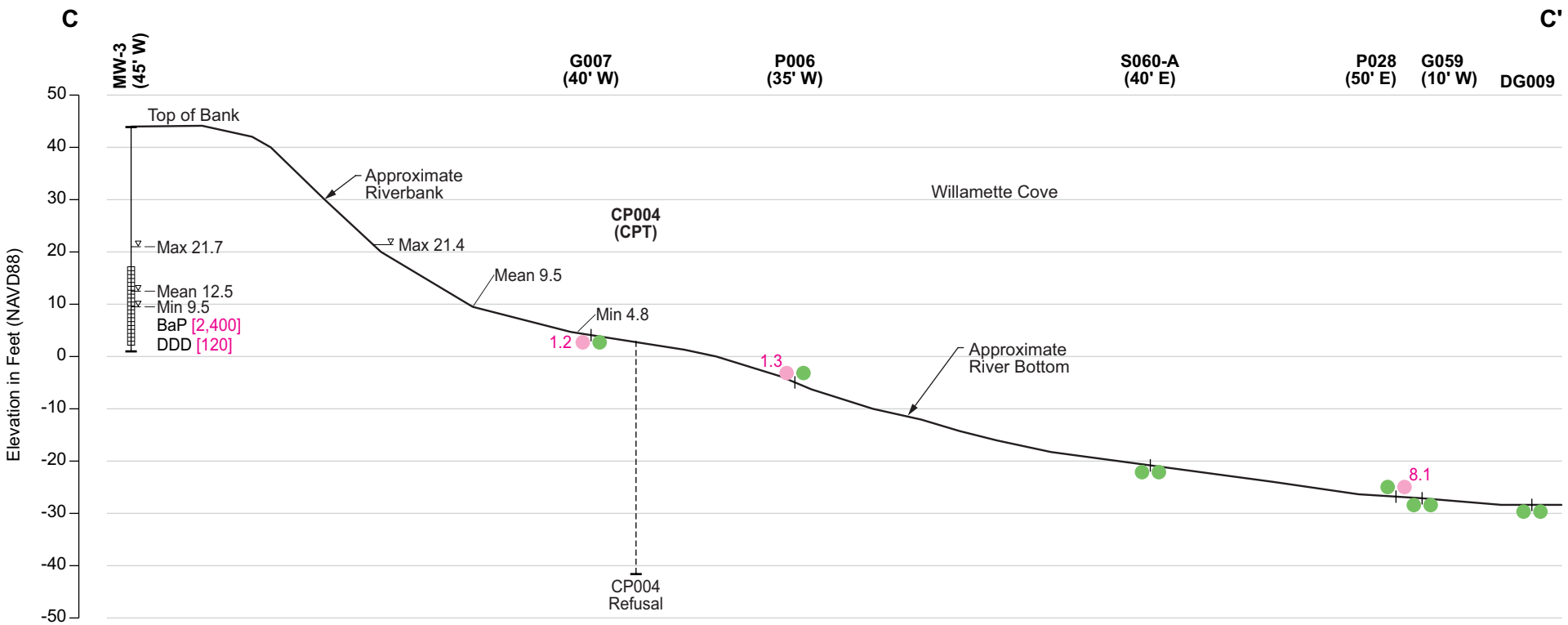
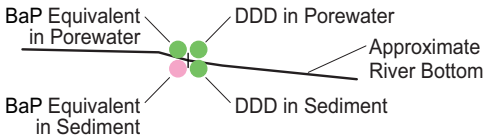


Legend:

- [775] Mean Groundwater Exceedance Factor (EF)
- 7.0 EF Greater than 1
- EF Less than 1
- BaP Benzo(a)Pyrene
- DDD Dichlorodiphenyldichloroethane
- Water Level



NOTE: Water level monitoring period is from November 2021 to June 2023.

0 30 60

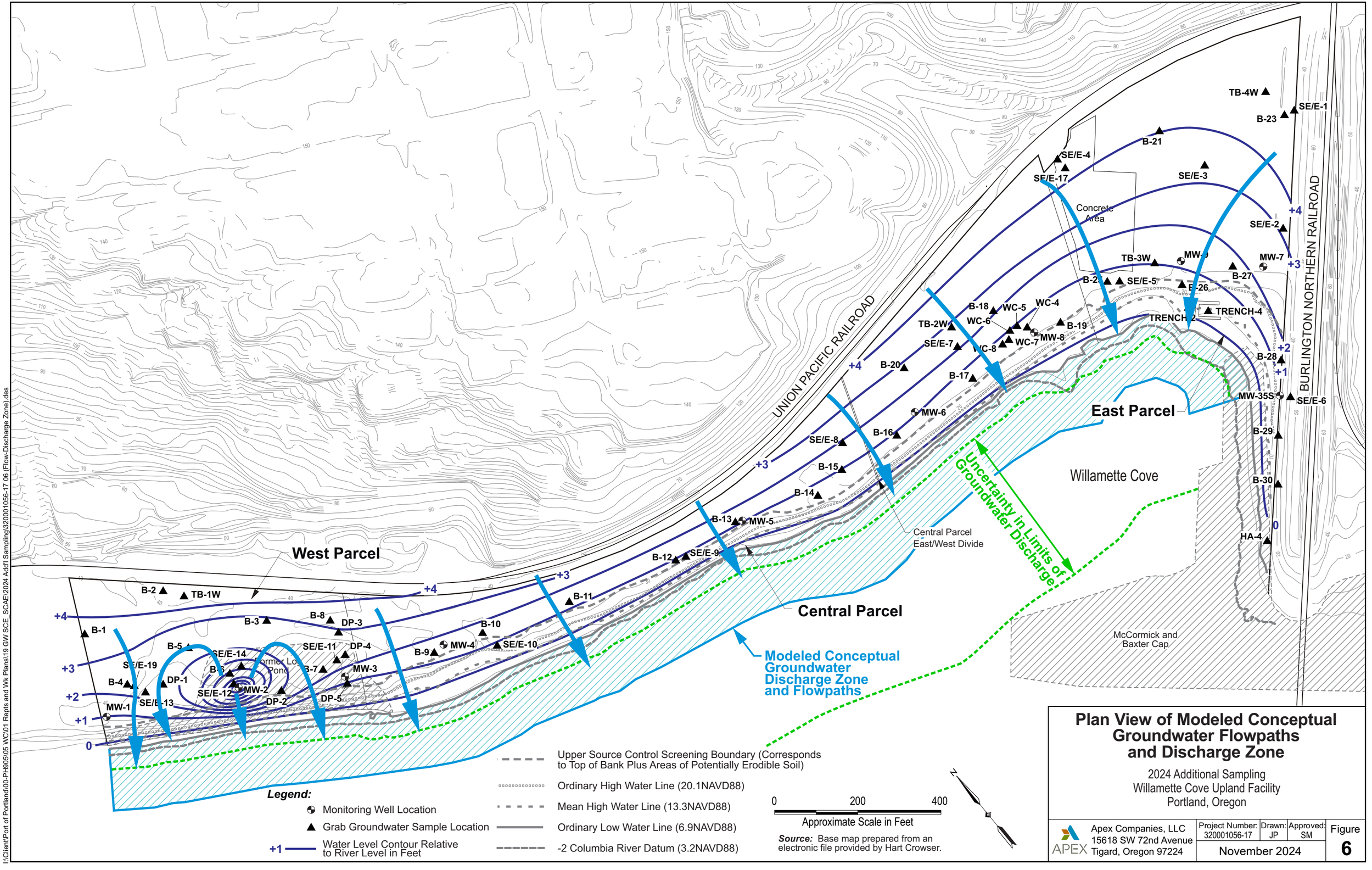
Approximate Scale in Feet

MW-3 Cross-Section

2024 Additional Sampling
Willamette Cove Upland Facility
Portland, Oregon

Apex Companies, LLC 15618 SW 72nd Avenue Tigard, Oregon 97224	Project Number: 320001056-17	Drawn: JP	Approved: SM	Figure 5
	November 2024			

I:\Client\Port of Portland\00-PH905\05 WC\01 Repts and Wk Plans\19 GW SCE_SCAE\2024 Add'l Sampling\320001056-17 03-05 (Riverbank X-Sections).des



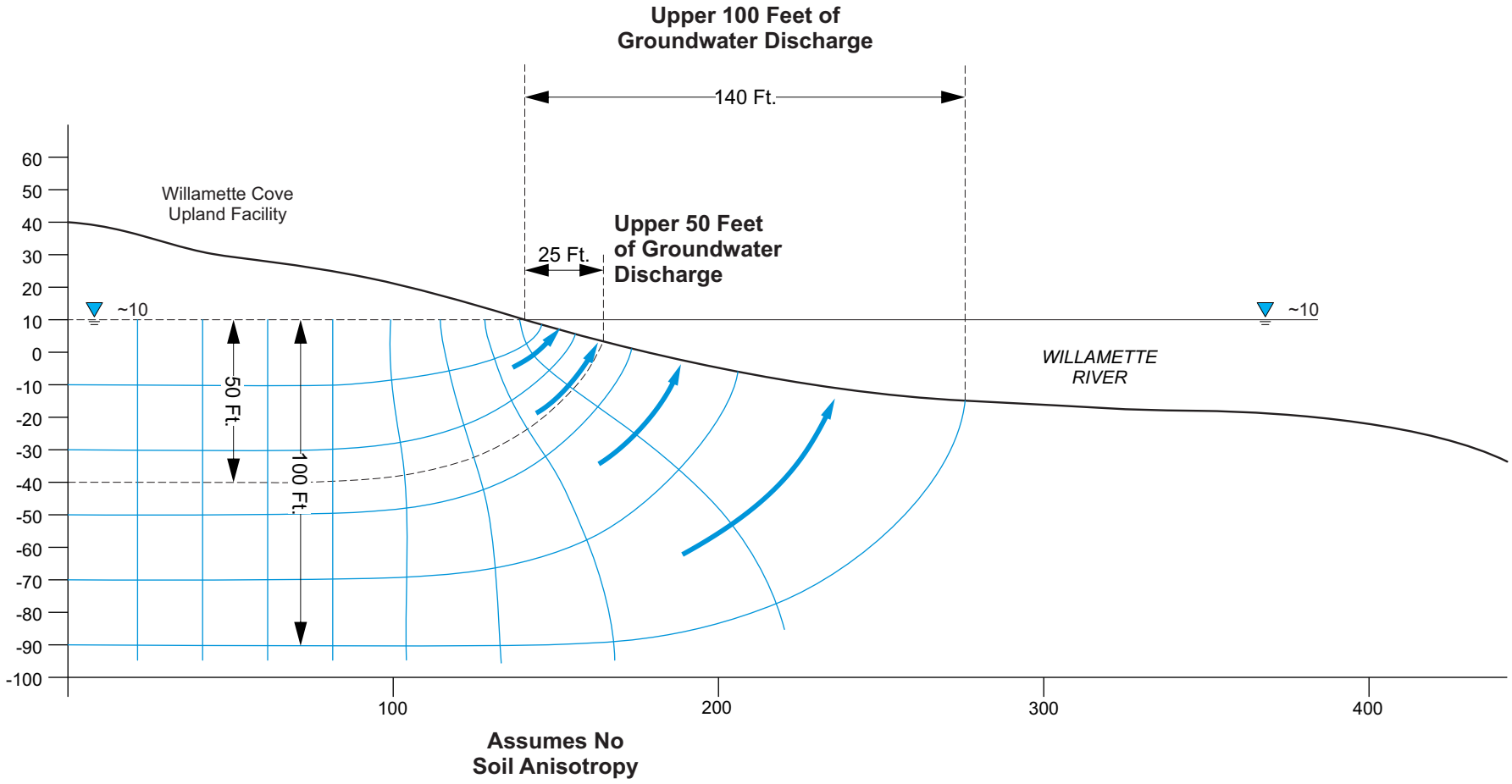
Source: Base map prepared from an electronic file provided by Hart Crowser.

Plan View of Modeled Conceptual Groundwater Flowpaths and Discharge Zone

2024 Additional Sampling
Willamette Cove Upland Facility
Portland, Oregon

Apex Companies, LLC 15618 SW 72nd Avenue Tigard, Oregon 97224	Project Number: 320001056-17	Drawn: JP	Approved: SM	Figure 6
	November 2024			

I:\Client\Port of Portland\00-PH905\05 WC\01 Repts and Wk Plans\19 GW SCE_SCAEI2024 Add'l Sampling\320001056-17 06 (Flow-Discharge Zone).des



Legend:

Groundwater Elevation

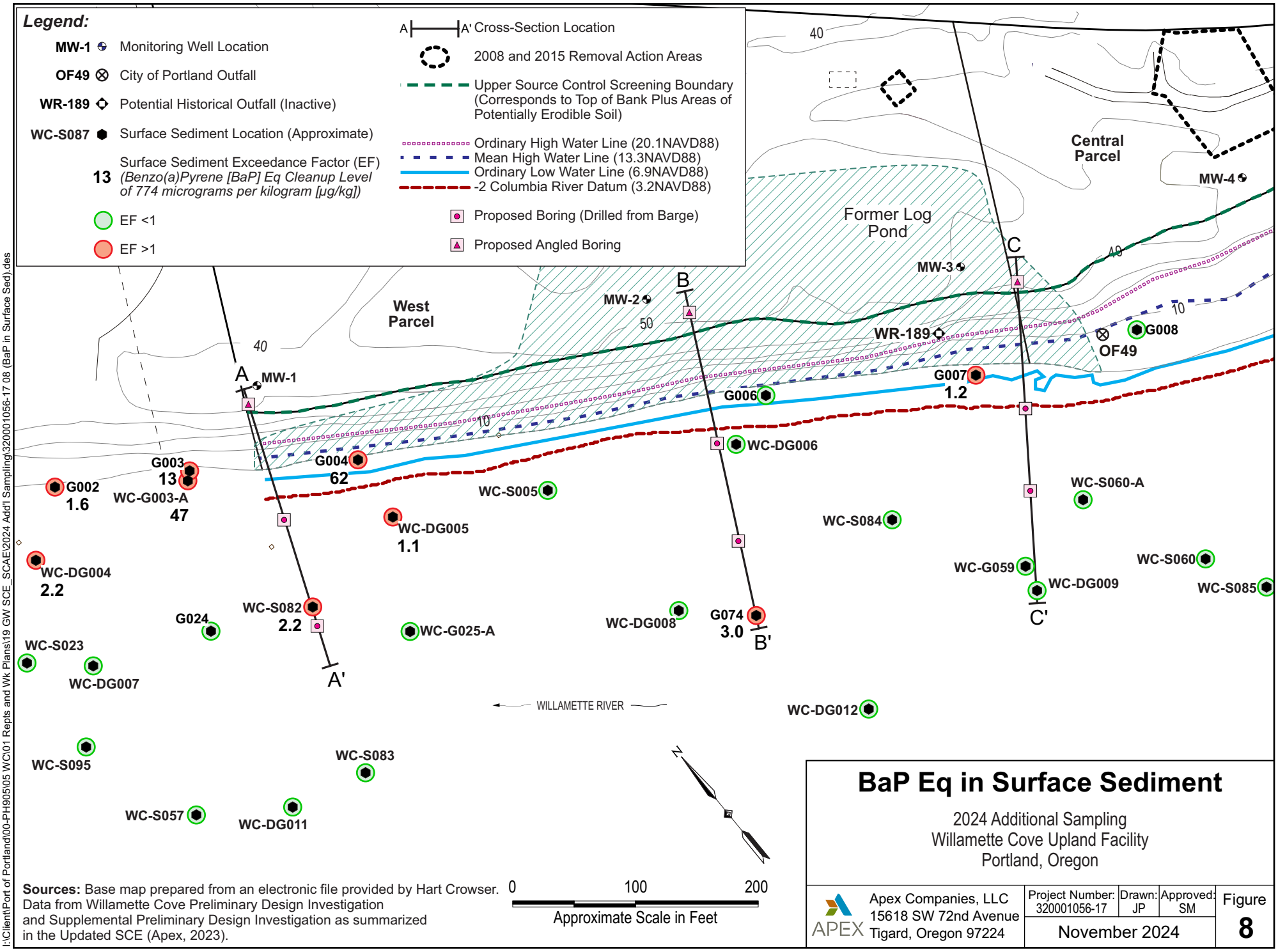
Approximate Horizontal Scale in Feet
0 50 100
0 50 100
Approximate Vertical Scale in Feet

Cross-Sectional View of Approximate Groundwater Flowpaths and Discharge Zone

2024 Additional Sampling
Willamette Cove Upland Facility
Portland, Oregon

Apex Companies, LLC 15618 SW 72nd Avenue Tigard, Oregon 97224	Project Number: 320001056-17	Drawn: JP	Approved: SM	Figure **7**
	November 2024			

I:\Client\Port of Portland\00-PH905\05 WC\01 Repts and Wk Plans\19 GW SCE_SCAE\2024 Add'l Sampling\320001056-17 07 (Flowpaths).des



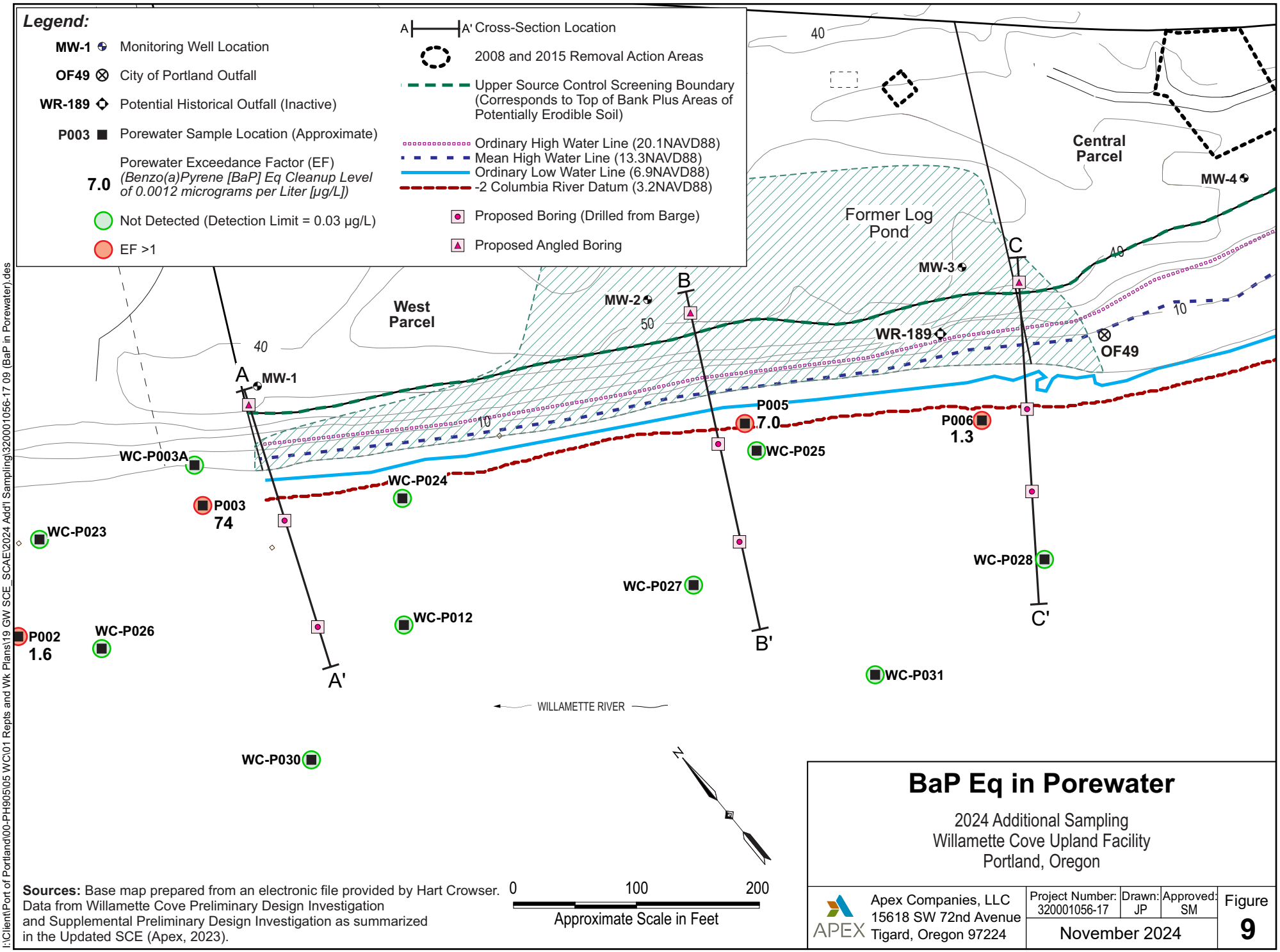
Sources: Base map prepared from an electronic file provided by Hart Crowser. Data from Willamette Cove Preliminary Design Investigation and Supplemental Preliminary Design Investigation as summarized in the Updated SCE (Apex, 2023).

BaP Eq in Surface Sediment

2024 Additional Sampling
Willamette Cove Upland Facility
Portland, Oregon

APEX Apex Companies, LLC 15618 SW 72nd Avenue Tigard, Oregon 97224	Project Number: 320001056-17	Drawn: JP	Approved: SM	Figure 8
	November 2024			

I:\Client\Port of Portland\00-PH905\05 WC\01 Repts and Wk Plans\19 GW SCE_SCAE\2024 Add'l Sampling\320001056-17 08 (BaP in Surface Sed).des



Sources: Base map prepared from an electronic file provided by Hart Crowser. Data from Willamette Cove Preliminary Design Investigation and Supplemental Preliminary Design Investigation as summarized in the Updated SCE (Apex, 2023).

BaP Eq in Porewater

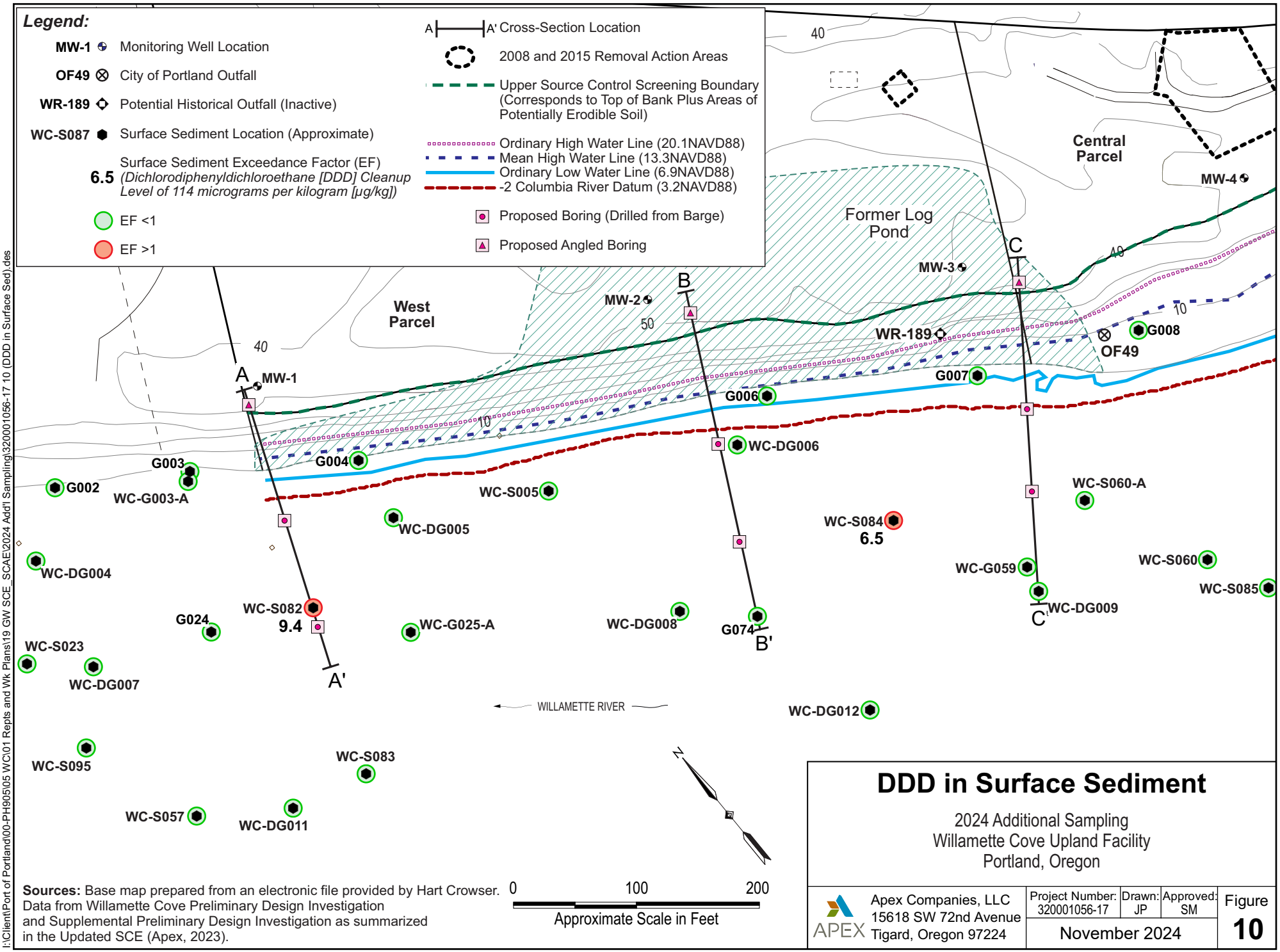
2024 Additional Sampling
Willamette Cove Upland Facility
Portland, Oregon

Apex Companies, LLC
15618 SW 72nd Avenue
Tigard, Oregon 97224

Project Number:	Drawn:	Approved:	Figure
320001056-17	JP	SM	9

November 2024

I:\Client\Port of Portland\00-PH905\05 WC\01 Repts and Wk Plans\19 GW SCE_SCAE\2024 Add'l Sampling\320001056-17 09 (BaP in Porewater).des



Sources: Base map prepared from an electronic file provided by Hart Crowser. Data from Willamette Cove Preliminary Design Investigation and Supplemental Preliminary Design Investigation as summarized in the Updated SCE (Apex, 2023).

DDD in Surface Sediment

2024 Additional Sampling
Willamette Cove Upland Facility
Portland, Oregon

Apex Companies, LLC
15618 SW 72nd Avenue
Tigard, Oregon 97224

Project Number:	Drawn:	Approved:	Figure
320001056-17	JP	SM	10

November 2024

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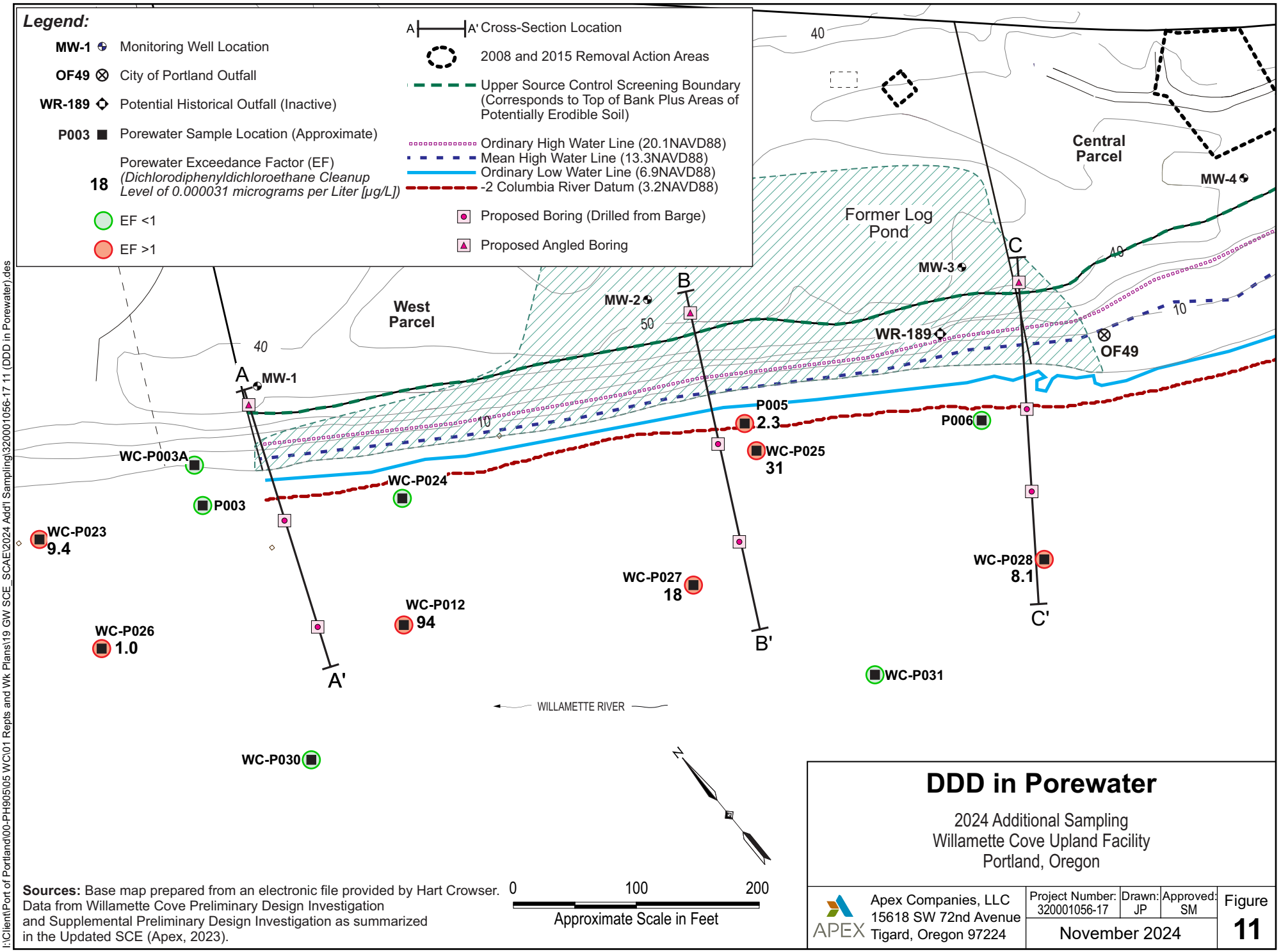

Sources: Base map prepared from an electronic file provided by Hart Crowser. Data from Willamette Cove Preliminary Design Investigation and Supplemental Preliminary Design Investigation as summarized in the Updated SCE (Apex, 2023).

DDD in Porewater

2024 Additional Sampling
Willamette Cove Upland Facility
Portland, Oregon

Apex Companies, LLC
15618 SW 72nd Avenue
Tigard, Oregon 97224

Project Number:	Drawn:	Approved:	Figure
320001056-17	JP	SM	11

November 2024

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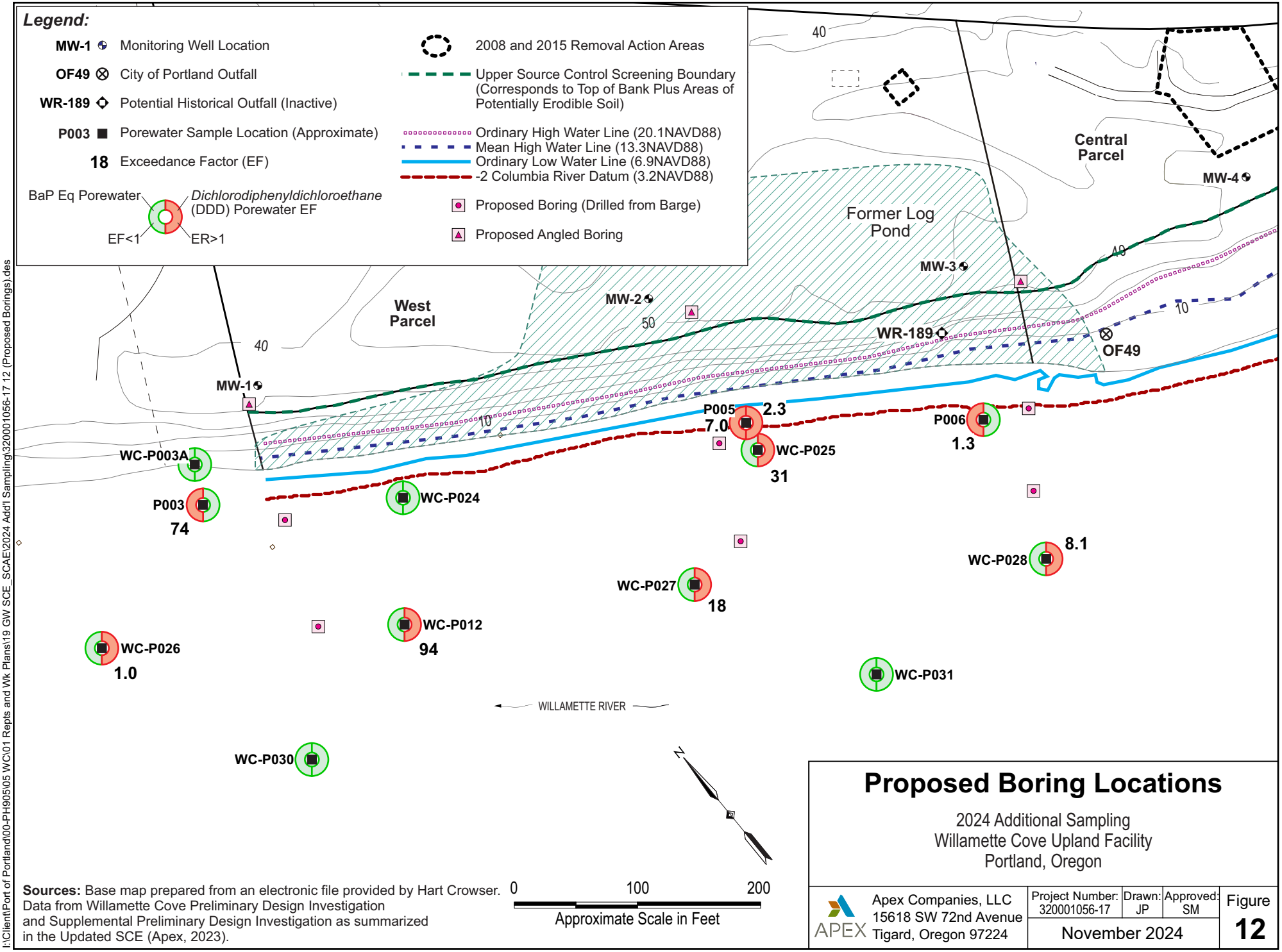

Proposed Boring Locations

2024 Additional Sampling
Willamette Cove Upland Facility
Portland, Oregon

Sources: Base map prepared from an electronic file provided by Hart Crowser. Data from Willamette Cove Preliminary Design Investigation and Supplemental Preliminary Design Investigation as summarized in the Updated SCE (Apex, 2023).

Apex Companies, LLC
15618 SW 72nd Avenue
Tigard, Oregon 97224

Project Number:	Drawn:	Approved:	Figure
320001056-17	JP	SM	12

November 2024

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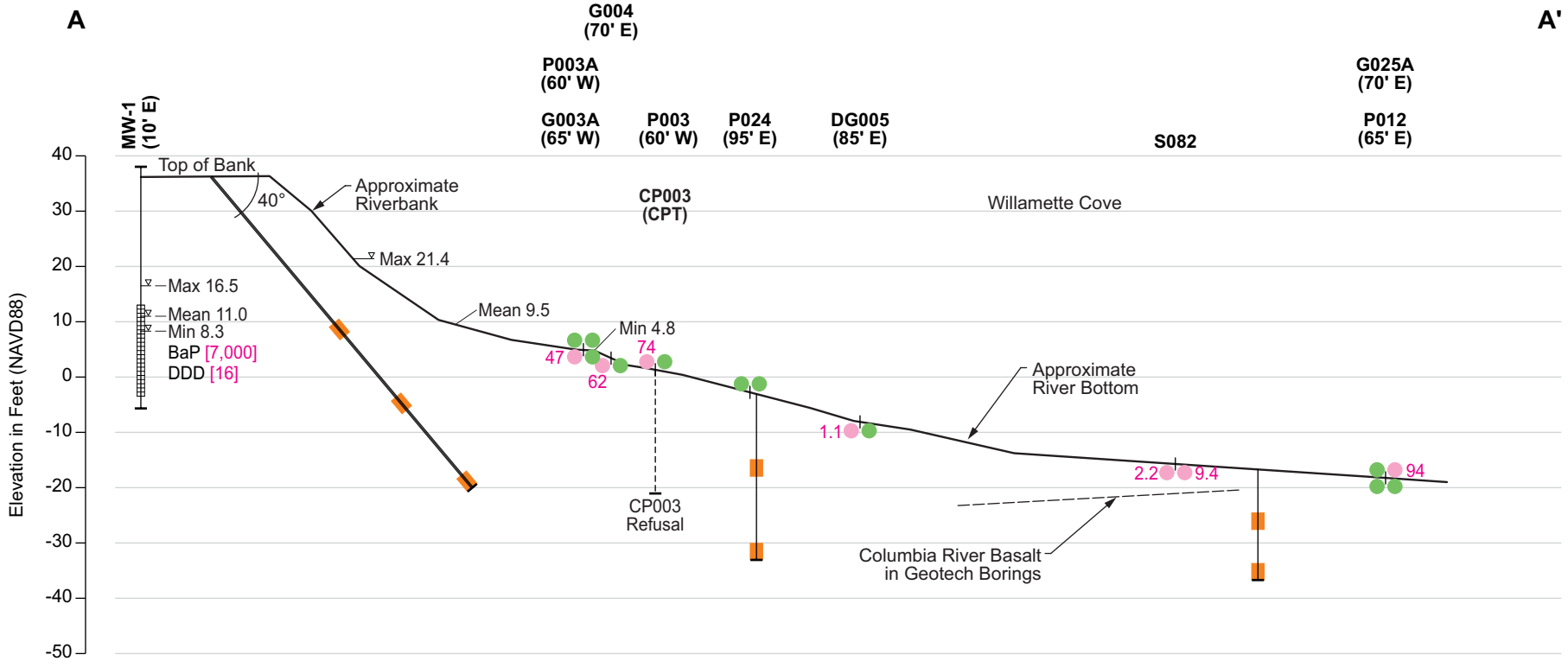
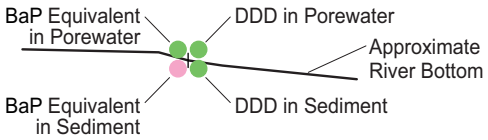


Legend:

- [16] Mean Groundwater Exceedance Factor (EF)
- 47 EF Greater than 1
- EF Less than 1
- BaP Benzo(a)Pyrene
- DDD Dichlorodiphenyldichloroethane
- Water Level



Proposed Angled Boring Location and Discrete Groundwater Sample (From Top of Bank)

Proposed Boring Location and Discrete Groundwater Sample (From Barge)

0 30 60

Approximate Scale in Feet

NOTE: Water level monitoring period is from November 2020 to June 2023.

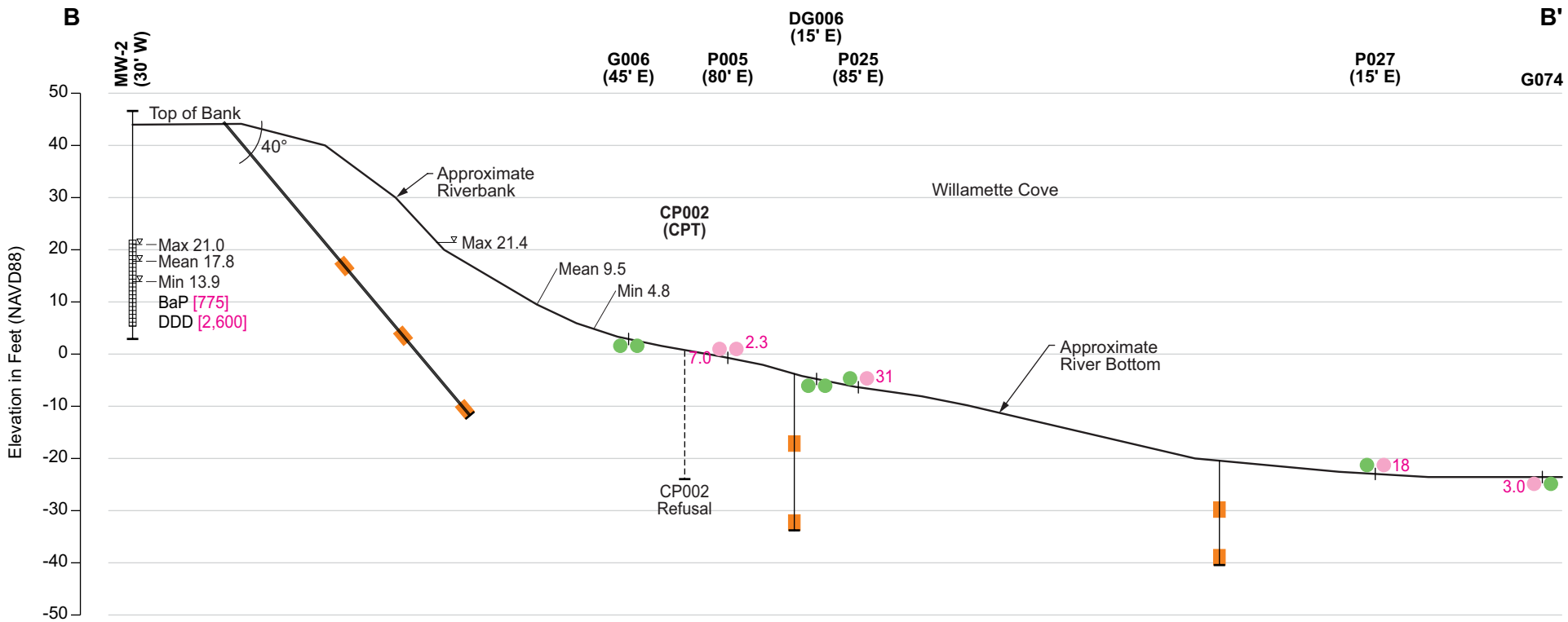
MW-1 Cross-Section with Proposed Borings

2024 Additional Sampling
Willamette Cove Upland Facility
Portland, Oregon

Apex Companies, LLC
15618 SW 72nd Avenue
Tigard, Oregon 97224

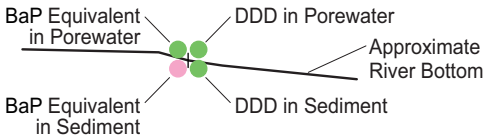
Project Number:	Drawn:	Approved:	Figure
320001056-17	JP	SM	13

November 2024



Legend:

- [775] Mean Groundwater Exceedance Factor (EF)
- 7.0 EF Greater than 1
- EF Less than 1
- BaP Benzo(a)Pyrene
- DDD Dichlorodiphenyldichloroethane
- Water Level



Proposed Angled Boring Location and Discrete Groundwater Sample (From Top of Bank)

Proposed Boring Location and Discrete Groundwater Sample (From Barge)

0 30 60

Approximate Scale in Feet

NOTE: Water level monitoring period is from November 2021 to June 2023.

MW-2 Cross-Section with Proposed Borings

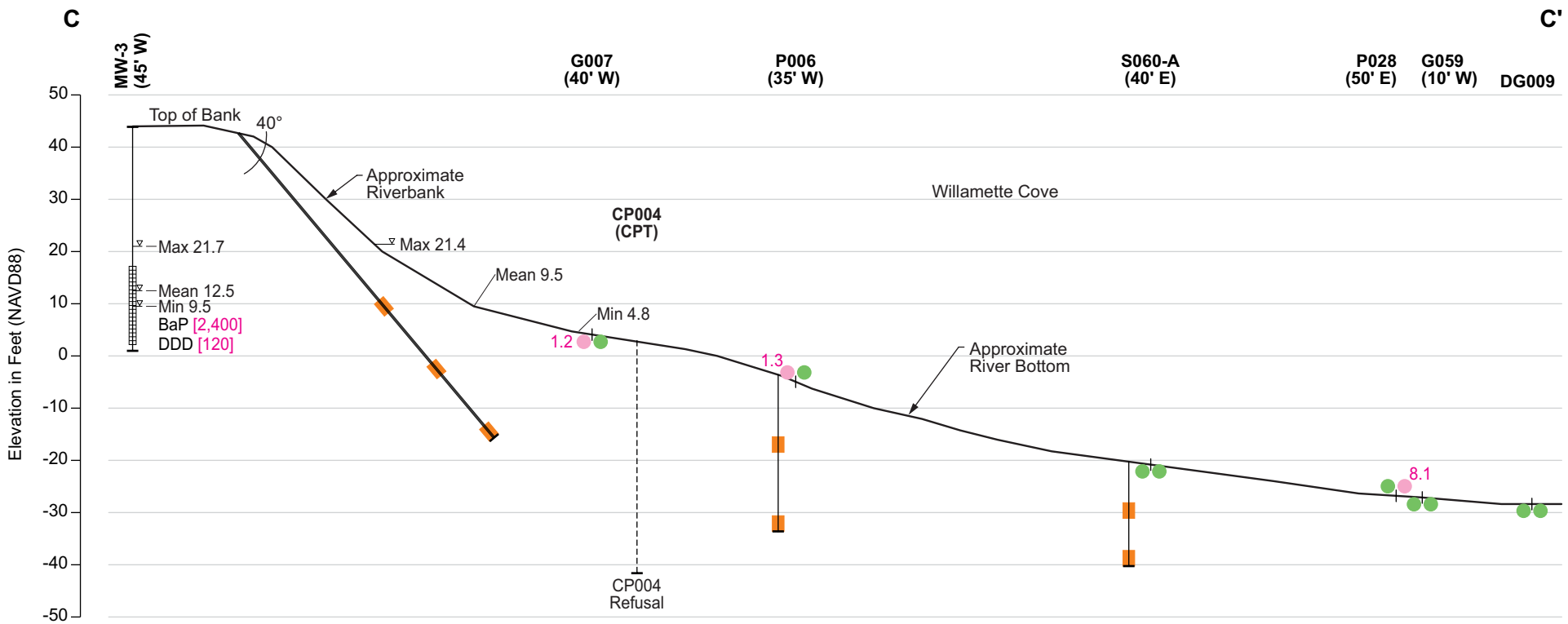
2024 Additional Sampling
Willamette Cove Upland Facility
Portland, Oregon

Apex Companies, LLC
15618 SW 72nd Avenue
Tigard, Oregon 97224

Project Number:	Drawn:	Approved:	Figure
320001056-17	JP	SM	14

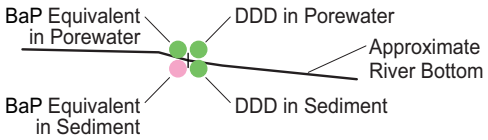
November 2024

I:\Client\Port of Portland\00-PH905\05 WC\01 Repts and Wk Plans\19 GW SCE_SCAE\2024 Add'l Sampling\320001056-17 13-15 (Riverbank X-Sections with Proposed).des



Legend:

- [775] Mean Groundwater Exceedance Factor (EF)
- 7.0 EF Greater than 1
- EF Less than 1
- BaP Benzo(a)Pyrene
- DDD Dichlorodiphenyldichloroethane
- Water Level



Proposed Angled Boring Location and Discrete Groundwater Sample (From Top of Bank)

Proposed Boring Location and Discrete Groundwater Sample (From Barge)

0 30 60

Approximate Scale in Feet

NOTE: Water level monitoring period is from November 2021 to June 2023.

MW-3 Cross-Section with Proposed Borings

2024 Additional Sampling
Willamette Cove Upland Facility
Portland, Oregon

APEX
Apex Companies, LLC
15618 SW 72nd Avenue
Tigard, Oregon 97224

Project Number:	Drawn:	Approved:	Figure
320001056-17	JP	SM	15

November 2024

I:\Client\Port of Portland\00-PH905\05 WC\01 Repts and Wk Plans\19 GW SCE_SCAE\2024 Add'l Sampling\320001056-17 13-15 (Riverbank X-Sections with Proposed).des

Appendix A

Sampling and Analysis Plan

1.0 Introduction

This appendix presents the field and sampling procedures and the analytical testing program that will be used to complete the field and analytical work during the Supplementary Groundwater Source Control Evaluation (SGSCE) Work Plan activities proposed for the Willamette Cove Upland Facility (the Facility), in Multnomah County, Portland, Oregon. The SGSCE is being conducted as part of a Voluntary Cleanup Program (VCP) Agreement EC-NWR-00-26 between the Port of Portland (Port), Metro, and the Oregon Department of Environmental Quality (DEQ). The Facility is defined in the DEQ Environmental Cleanup Site Information (ECSI) database as ECSI No. 2066.

2.0 Field and Sampling Procedures

The scope of work (SOW) for the SGSCE includes groundwater sampling only. Data from sampling activities will be used to supplement existing groundwater source control assessment data.

The field and sampling procedures include the following:

- Installation of three (3) upland borings and six (6) in-water borings for collection of groundwater samples;
- Sample management (e.g., containers, storage, and shipment);
- Decontamination procedures; and
- Handling of investigation-derived waste (IDW).

2.1 Preparatory Activities

Site Health and Safety Plan. A Site-specific health and safety plan (HASP) has been prepared for the proposed activities. Appendix B of the Work Plan includes a copy of the HASP. The HASP was prepared in general accordance with the Occupational Safety and Health Administration (OSHA) and the Oregon Administrative Rules (OAR). Job Safety Analysis (JSAs) for each task (including working over water) are included as attachments to the HASP. A copy of the HASP will be maintained on-site during the field activities.

Property Access. Access to the facility will be from North Richmond Avenue, using a construction entrance that will be created at the north end of the West Parcel. Limited clearing of trees, brush and other vegetation will be necessary to facilitate access for the drilling equipment to the upland boring locations. To the extent practical, the upland boring locations will be co-located with soil borings that are proposed as part of the riverbank characterization activities for the In-Water group.

Subcontractor Procurement. Subcontracted services that will be required to complete this work will include utility locating, drilling services and IDW disposal. Laboratory services will be provided by Apex Laboratories of Tigard, Oregon. Drilling and other services (utility locating and IDW disposal) will be procured via email quote requests. The IDW disposal subcontractor will be procured after the work is complete and the volume of waste generated is known.

Underground Utility Location. Prior to drilling, Apex will contact the Oregon Utility Notification Center, who will, in turn, notify the various utilities in the area to mark any underground installations. Apex will also procure a private utility locator to survey the area of each exploration for underground utilities. In addition, borehole pre-clearance will be conducted using vacuum extraction and/or hand tools (e.g., hand auger) for the upland borings. No borehole pre-clearance will be conducted for the in-water borings.

2.2 Collection of Groundwater Samples

The field and groundwater sampling procedures include the following:

- Utilizing sonic drilling methods, advance a total of nine (9) borings to collect groundwater:
    - Three (3) borings will be advanced at an angle (up to 40-degreesfrom vertical) from the top of the riverbank towards the river channel. Upland borings will be advanced to a maximum distance of 75 feet or to equipment refusal.
    - Six (6) borings will be advanced from a barge in the river channel; two in-line with each of the three monitoring wells located at the top of the riverbank. Nearshore borings will be placed at the approximate mudline. Outer borings will be placed approximately 130 to 150 feet from the monitoring wells in the river channel. In-channel borings will be advanced to a depth of approximately 20-feet below the mudline, or to equipment refusal.
- Collect groundwater grab samples from riverbank borings, as follows:
    - Up to three (3) groundwater grab samples will be collected from discrete depth intervals in riverbank groundwater borings. No soil samples will be collected from the borings.
    - Groundwater depths will be measured in riverbank monitoring wells on the day of sampling to assist in evaluating the anticipated depth of groundwater in the riverbank borings.
    - The first sample interval will be located at the approximate mean groundwater depth measured in the monitoring wells, or within the first five feet of encountering groundwater if the water level is lower. The depth to first water will be evaluated based on observations of the continuous soil core during drilling and estimated based on the depth to water in the adjacent monitoring well. The two subsequent samples will be

collected vertical depth intervals of approximately 12 feet, or 15.7 feet along the borehole.

- Groundwater samples will be collected by advancing a drive-point ahead of the drill bit and installing a temporary screen. The groundwater will be purged using a peristaltic pump. During purging, field parameters of temperature, electrical conductivity, dissolved oxygen, oxygen reduction potential and ferrous iron will be monitored. Groundwater samples will be collected when the field parameter measurements are within 10% of each other.
- In the event that refusal is encountered below the water table, at a distance at least halfway between planned sample points, a groundwater grab sample will be collected at the boring terminus.

- Collect six groundwater grab samples from in-water borings, as follows:
  - Two temporary borings will be installed, from a barge, off-shore from each upland groundwater monitoring well.
  - Up to two (2) groundwater grab samples will be collected from discrete depth intervals in each boring. The first groundwater sample interval will be located approximately 5 feet below the mudline, and the second sample will be collected at the boring terminus. The in-water groundwater samples will be collected using the methods described above. No soil samples will be collected from the borings.

2.3 Sample Location Control

Horizontal sample location control will be achieved using a high-accuracy, handheld global positioning system device (GPS; Trimble© Gwo7X™ or equivalent instrumentation) with sub meter accuracy. The target coordinates will be entered into the GPS device prior to mobilizing to facilitate locating and marking them in the field. For the borings advanced within the river, the barge-mounted drilling equipment will be positioned on the pre-entered coordinates of each location.

2.4 Sample Management

Groundwater Sample Containers. Clean sample containers will be provided by the analytical laboratory ready for sample collection, including preservative if required (the container requirements are listed in Table C-1). Specific container requirements for samples that will undergo multiple analyses will be discussed with the analytical laboratory prior to sample collection.

Labeling Requirements. A sample label will be affixed to each sample container before sample collection. Containers will be marked with the project number, a sample number, date of collection, and the sampler's initials.

Sample Storage and Shipment. Groundwater samples will be stored in a cooler chilled with ice or blue ice to 4±2 degrees Celsius (°C). Samples will be shipped overnight or delivered to the analytical laboratory for chemical analysis. Chain of custody will be maintained and documented using signatures and time stamps.

2.6 Decontamination Procedures

Personnel Decontamination. Personnel decontamination procedures depend on the level of protection specified for a given activity. The HASP (Appendix B) identifies the appropriate level of protection for the type of work and expected field conditions involved in this project. In general, clothing and other protective equipment can be removed from the investigation area. Field personnel should thoroughly wash their hands and faces at the end of each day and before taking any work breaks.

Sampling Equipment Decontamination. To prevent cross-contamination between sampling events, clean, dedicated sampling equipment will be used when possible for each sampling location and will be discarded after use. Cleaning of non-disposable items will consist of washing in a detergent (Alconox®) solution, rinsing with tap water, then rinsing with deionized (DI) water. Decontamination water will be collected and handled in accordance with Section 2.8 (below).

Drilling Equipment and Materials. Decontamination procedures are designed to remove trace-level contaminants from drilling equipment to prevent the cross-contamination of exploration locations and samples. Drilling equipment shall be decontaminated using high-pressure washing, steam cleaning, or cleaning with detergent before use and between locations. Decontamination water from the drill tooling will be collected and handled in accordance with Section 2.8 (below).

2.7 Handling of Investigation-Derived Waste

Investigation-derived waste (IDW) will consist of soil cuttings, decontamination water and purge water. IDW will be placed in Department of Transportation (DOT)-approved drums. Each drum will be labeled with the project name, general contents, and date.

The drummed IDW will be left on Site pending pickup/disposal by the IDW subcontractor. A sample of the IDW will be collected and analyzed for metals and PAHs for disposal profiling purposes. Arrangement with a waste disposal subcontractor will be made to dispose of the IDW after chemical analysis results have been received.

Disposable items, such as sample tubing, gloves, protective overalls (e.g., Tyvek®), paper towels, etc., will be placed in plastic bags after use and deposited in trash receptacles for disposal.

3.0 Analytical Testing Program

An analytical testing program will be performed to assess the chemical quality of groundwater samples collected as part of this project. Analytical laboratory QA/QC procedures are discussed in Section 5 of this appendix.

Tables A-1 and A-2 list the proposed analytical methods and detection limit goals. Samples will be collected and handled using methods described in Section 2 of this appendix. Specific container and storage requirements for samples will be discussed with the analytical laboratory prior to sample collection and will be in accordance with the container requirements presented in Table A-1.

Groundwater samples collected from each of the borings will be analyzed for the following:

- PAHs by EPA Method 8270E-SIM;
- DDD by EPA Method 8081B;
- PCBs by EPA Method 8082A; and,
- Total and Dissolved Arsenic by EPA Method 6020B.

In addition, samples will be analyzed for geochemical parameters of total and dissolved iron and manganese, nitrate (as nitrogen), sulfate, carbon dioxide (total organic carbon) and ferrous iron to evaluate the oxidation/reduction conditions.

4.0 Field Quality Assurance Program

Field Chain of Custody. A chain-of-custody form will be used to record possession of a sample and to document analyses requested. Each time the sample bottles or samples are transferred between individuals, both the sender and receiver sign and date the chain-of-custody form. When a sample shipment is transported to the laboratory, a copy of the chain-of-custody form is included in the transport container (e.g., ice chest).

Field Duplicate Samples. One field duplicate soil sample will be collected during the GSCE as shown in Table C-3. The field duplicate will consist of two samples collected sequentially from one sample location to assess data variability. The field duplicate will be analyzed by the same analytical methods used for primary samples. Relative percent differences (RPDs) for field duplicate will be calculated to assess the data precision and accuracy and potential variability caused by sample handling.

5.0 Laboratory Quality Control

The laboratory maintains an internal quality assurance program as documented in its laboratory quality assurance manual. The laboratory uses a combination of blanks, surrogate recoveries, duplicates, matrix spike recoveries, matrix spike duplicate recoveries, blank spike recoveries, and blank spike duplicate recoveries to evaluate the analytical results. The laboratory also uses data quality goals for individual chemicals or groups of chemicals based on the long-term performance of the test methods.

Table A-1
Analytical Methods – Sample Container Requirements
Willamette Cove Upland Facility
Portland, Oregon

Analysis	Method	Container	Preservative	Storage Temperature	Holding Time
Total/Dissolved Metals	EPA 200.8	500 mL Plastic	HNO_3	4°C	180 days
PAHs	EPA 8270D LL	215 mL Plastic	None	4°C	14 days
PCB Aroclors	EPA 1668C	1 L Amber	None	4°C	7 days
Organochlorine Pesticides	EPA 1699	1 L Amber	None	4°C	14 days

Notes:

1. EPA = U.S. Environmental Protection Agency.
2. PAHs = Polycyclic aromatic hydrocarbons.
3. PCBs = Polychlorinated biphenyls.
4. °C = Degrees Celsius.
5. L = Liter.
6. mL = Milliliter.

Table A-2
Analytical Methods – Detection Limit Goals
Willamette Cove Upland Facility
Portland, Oregon

Analyte	Method	Units	Method Detection Limit	Method Reporting Limit
Total and Dissolved Metals				
Arsenic	EPA 200.8	mg/L	0.000010	0.00100
Iron	EPA 200.8	mg/L	0.000500	0.00100
Manganese	EPA 200.8	mg/L	0.00100	0.00200
Polycyclic Aromatic Hydrocarbons				
Acenaphthene	EPA 8270D LL	µg/L	0.0160	0.0320
Acenaphthylene	EPA 8270D LL	µg/L	0.0160	0.0320
Anthracene	EPA 8270D LL	µg/L	0.0160	0.0320
Benz(a)anthracene	EPA 8270D LL	µg/L	0.00800	0.0160
Benzo(a)pyrene	EPA 8270D LL	µg/L	0.00800	0.0160
Benzo(b)fluoranthene	EPA 8270D LL	µg/L	0.00800	0.0160
Benzo(k)fluoranthene	EPA 8270D LL	µg/L	0.00800	0.0160
Benzo(g,h,i)perylene	EPA 8270D LL	µg/L	0.0160	0.0320
Chrysene	EPA 8270D LL	µg/L	0.00800	0.0160
Carbazole	EPA 8270D LL	µg/L	0.0160	0.0320
Dibenzo(a,h)anthracene	EPA 8270D LL	µg/L	0.00800	0.0160
Dibenzofuran	EPA 8270D LL	µg/L	0.0160	0.0320
Fluoranthene	EPA 8270D LL	µg/L	0.0160	0.0320
Fluorene	EPA 8270D LL	µg/L	0.0160	0.0320
Indeno(1,2,3-cd)pyrene	EPA 8270D LL	µg/L	0.00800	0.0160
1-Methylnaphthalene	EPA 8270D LL	µg/L	0.0320	0.0640
2-Methylnaphthalene	EPA 8270D LL	µg/L	0.0320	0.0640
Naphthalene	EPA 8270D LL	µg/L	0.0320	0.0640
Phenanthrene	EPA 8270D LL	µg/L	0.0320	0.0640
Pyrene	EPA 8270D LL	µg/L	0.0160	0.0320
Organochlorine Pesticides				
Aldrin	EPA 1699	µg/L	0.000006	0.000090
alpha-BHC	EPA 1699	µg/L	0.000007	0.000060
beta-BHC	EPA 1699	µg/L	0.000006	0.000060
delta-BHC	EPA 1699	µg/L	0.000005	0.000060
gamma-BHC	EPA 1699	µg/L	0.000009	0.000060
cis-Chlordane	EPA 1699	µg/L	0.000007	0.000030
trans-Chlordane	EPA 1699	µg/L	0.000006	0.000050
2,4-DDD	EPA 1699	µg/L	0.000003	0.000030
2,4-DDE	EPA 1699	µg/L	0.000003	0.000030
2,4-DDT	EPA 1699	µg/L	0.000002	0.000030
4,4'-DDD	EPA 1699	µg/L	0.000005	0.000030
4,4-DDE	EPA 1699	µg/L	0.000006	0.000030
4,4'-DDT	EPA 1699	µg/L	0.000001	0.000030
Dieldrin	EPA 1699	µg/L	0.000005	0.000030
Endosulfan I	EPA 1699	µg/L	0.000024	0.000100
Endosulfan II	EPA 1699	µg/L	0.000030	0.000100
Endosulfan sulfate	EPA 1699	µg/L	0.000013	0.000040
Endrin	EPA 1699	µg/L	0.000003	0.000030
Endrin Ketone	EPA 1699	µg/L	0.000012	0.000040
Heptachlor	EPA 1699	µg/L	0.000007	0.000030
Heptachlor epoxide	EPA 1699	µg/L	0.000012	0.000040
Hexachlorobenzene	EPA 1699	µg/L	0.000004	0.000040
Methoxychlor	EPA 1699	µg/L	0.000007	0.000030

Table A-2
Analytical Methods – Detection Limit Goals
Willamette Cove Upland Facility
Portland, Oregon

Analyte	Method	Units	Method Detection Limit	Method Reporting Limit
cis-Nonachlor	EPA 1699	µg/L	0.000004	0.000040
trans-Nonachlor	EPA 1699	µg/L	0.000011	0.000040
Oxychlordane	EPA 1699	µg/L	0.000007	0.000060
Polychlorinated Biphenyl (PCB) Aroclors				
Aroclor 1016	EPA 8082A	ug/L	0.05	0.1
Aroclor 1221	EPA 8082A	ug/L	0.05	0.1
Aroclor 1232	EPA 8082A	ug/L	0.05	0.1
Aroclor 1242	EPA 8082A	ug/L	0.05	0.1
Aroclor 1248	EPA 8082A	ug/L	0.05	0.1
Aroclor 1254	EPA 8082A	ug/L	0.05	0.1
Aroclor 1260	EPA 8082A	ug/L	0.05	0.1

Notes:

1. mg/L = Milligrams per liter.
2. ug/L = Micrograms per liter
3. ng/L = Nanograms per liter
4. EPA = U.S. Environmental Protection Agency

Appendix B

Health and Safety Plan

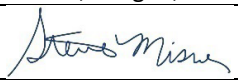
TABLE OF CONTENTS

Section 1.0 - Project information

Project Number	1056-17
Site Number	Willamette Cove Upland Facility
Site Owner/Representative: Port of Portland	Contact Information: Dwight Leisle
Site Address/Location: South end of North Edgewater Street, Portland, Oregon	
Starting Work Date: June 2025	Ending Work Date: TBD
HASP Prepared By: Steve Misner and Chris Weer	HASP Reviewed By: Steve Misner

Site Description: Willamette Cove Natural Area – Vacant, Vegetated
Site History: Former Industrial Site, Primarily Wood Products Manufacturing
Proposed Onsite Activities: Collect groundwater samples from the West Parcel monitoring wells and from soil boring locations between the upland groundwater monitoring wells on the West Parcel and adjacent offshore sample points. Offshore sample points will be completed over water from a barge.

Section 2.0 - EMERGENCY INFORMATION AND TELEPHONE NUMBERS

Ambulance Company or Public EMS	Portland Fire Department
Hospital/Emergency Room Name and Address	Legacy Emanuel Hospital 2801 N. Gantenbein Portland, Oregon, 97227
Signature from individual who verified Hospital Services	
Local Police Number	911
Local Fire Dept Number	911
Poison Control Center	1-800-222-1222
WorkCare	1-888-449-7787

2.1 Hospital Directions

See attached figure. Hospital is approximately a 17 minute drive southeast of the Site.

2.2 Emergency Procedures

The following standard emergency procedures will be used by onsite personnel. While onsite, the site health and safety coordinator shall be notified of any onsite emergency and shall be responsible for ensuring that the appropriate procedures are followed. If a medical emergency occurs, Apex field staff will call 911, WorkCare, and the Apex project manager. If another Site emergency is observed (such as fire, flood, etc.), field staff will evacuate the Site and call the Apex project manager (and 911, if necessary) once at a safe location.

2.3 Active Facility Emergency Action Plan

If the site is an active facility, Apex will follow established onsite evacuation procedures. Facility evacuation procedures have been reviewed (if applicable)

☐ Reviewed

☒ Not Applicable

Verification initials (by a person assigned to the project): N/A

(No review means no work can be conducted)

The Site is inactive; therefore, it is the sole responsibility of Apex Management to have an evacuation procedure/plan in place and cover it daily during the Tailgate Safety Meetings.

In the event an emergency evacuation should take place Apex Management can use the daily Tailgate Safety Meeting for a headcount.

2.4 Air Release or Fire/Explosion

On notification of an air release or a fire/explosion, all personnel will travel in the upwind direction. The site health and safety officer will then account for all personnel and notify the proper emergency

agencies. If the site health and safety officer is not available, the task manager or appropriate field personnel will assume these responsibilities.

In the event an emergency evacuation should take place Apex Management can use the daily Tailgate Safety Meeting for a headcount.

Section 3.0 - First Aid/CPR

ALL FIELD STAFF WORKING UNDER THIS HASP WILL HAVE THE FOLLOWING TRAINING BEFORE CONDUCTING FIELD ASSIGNMENTS	▪ First-aid/CPR

3.1 First Aid Kit Components:

At least 1 Apex employee on site must have a First Aid Kit	Minimum Contents: • 1 Absorbent compress, 32 square inches (sq. in.) (81.3 sq. centimeters [cm]) with no side smaller than 4 in. (10 cm) • 16 Adhesive bandages, 1 in. x 3 in. (2.5 cm x 7.5 cm) • 1 Adhesive tape, 5 yd. (457.2 cm) total • 10 Antiseptic, 0.5g (0.14 fluid ounce [fl oz.]) applications • 6 Burn treatment, 0.5 g (0.14 fl. oz.) applications • 4 Sterile pads, 3 in. x 3 in. (7.5 x 7.5 cm) • 1 Triangular bandage, 40 in. x 40 in. x 56 in. (101 cmx 101 cm x 142 cm)

3.2 Basic First Aid Procedures:

Skin Contact	Remove any contaminated clothing. Wash immediately with water for at least 15 minutes. If needed call 911
Inhalation	Remove from contaminated atmosphere. Call 911
Ingestion	Never induce vomiting on an unconscious person. Never induce vomiting when acids, alkalis, or petroleum products are suspected. Call 911

Section 4.0 - Personnel and Responsibility

Personnel	Responsibility
Herb Clough	Program Manager
Steve Misner	Project Manager
Steve Misner	Site Health and Safety Coordinator (SHSC)
Chris Weer	Field Lead
TBD	Field Staff
TBD	Field Staff
TBD	Field Staff
TBD	Field Staff

4.1 Personnel and Responsibility Roles

See Appendix A for full description of Personnel and Responsibility Roles.

4.2 Onsite Control

Tailgate safety meetings will be conducted at the start of each working day and recorded on the Daily Tailgate Safety Meeting form in Appendix B. Forecasted wind and weather conditions should be discussed during the Tailgate Safety Meeting.

All Apex employees are responsible for onsite control. During work activities, the following zones will be established:

Field staff will place cones and/or construction tape as needed to delineate the work zone. A 10-foot exclusion zone will be formed around subcontractors operating heavy equipment, if applicable. Apex will intercept any visitors and direct them away from the exclusion zone.

Decontamination procedures will generally be conducted near each sample unit, before moving to the next sample unit.

Generally, the support zone will be near the work vehicle. In addition, a job site trailer may be employed as part of the support zone.

The Site is secured, and Apex will be provided a key or code for the security gate. In addition, temporary fencing will be erected surrounding the job trailer.

Section 5.0 - Safety Training

ALL FIELD STAFF WORKING UNDER THIS HASP WILL HAVE THE FOLLOWING MINIMUM TRAINING BEFORE CONDUCTING FIELD ASSIGNMENTS:

- First-aid/CPR
- Hearing conservation
- PPE
- Utility clearance
- Recognition and Prevention of Slips Trips and Falls

Review and mark the following additional training required for the tasks included in this site-specific HASP.

Training	Req*	Rec*	NA*	Training	Req*	Rec*	NA*
40 Hour Hazwoper	☒	☐	☐	Lead Exposure	☐	☒	☐
Current 8 Hour Hazwoper	☒	☐	☐	Benzene Exposure	☐	☐	☒
24 Hour Hazwoper	☐	☐	☒	Hydrogen Sulfide Exposure	☐	☐	☒
10 Hour Construction	☐	☐	☒	Fall Protection	☐	☐	☒
Respiratory Protection	☐	☐	☒	LOTO/Electrical	☐	☐	☒
Confined Space Entry	☐	☐	☒	Hand/Power Tools	☒	☐	☐
Cold/Heat Stress	☒	☐	☐	Other	☐	☐	☐
Bloodborne Pathogens	☐	☒	☐	Other	☐	☐	☐

At no time will employees or Work Directed Subs (WDS) perform activities that they have not been properly trained to perform. It is the Hiring Managers responsibility to ensure that the appropriate training has been provided to new employees and WDSs prior to the start of their roles. It is the Project/Program/Field Manager's responsibility to ensure new hires and WDS are performing their job duties according to the training requirements.

Section 6.0 - Personal Protective Equipment (PPE)

The level of PPE selected for a task is based on the following:

- Administrative and engineering controls currently in place
- Potential physical hazards that may be encountered while completing the task
- Type and measured concentration of the chemical substance in the ambient atmosphere and its toxicity
- Potential for exposure to substances in air, splashes of liquids, or other direct contact with material due to work being done
- Knowledge of chemicals on-site along with properties such as toxicity, route of exposure, and contaminant matrix.

In situations where the type of chemical, concentration, and possibilities of contact are not known, the appropriate level of protection must be selected based on professional experience and judgment until the hazards can be better identified.

PPE	Req*	Rec*	NA*	PPE	Req*	Rec*	NA*
Steel Toed Boots	☒	☐	☐	Work Gloves (mechanical/leather gloves)	☒	☐	☐
Safety Glasses	☒	☐	☐	Indirect Vented Goggles	☐	☐	☒
Face Shield	☐	☐	☒	Fire Resistant Clothing (FRC)	☐	☒	☒
Hard Hat	☒	☐	☐	Outer Chemical Resistant Gloves	☐	☐	☒
Hi Vis Vest/Shirt	☒	☐	☐	Chemical Resistant Suit	☐	☐	☒
Hearing Protection	☒	☐	☐	Tyvek Suit	☐	☐	☒
Respiratory Protection	☐	☐	☒	Poly-Coated Tyvek	☐	☐	☒
Work Gloves (Nitrile gloves)	☒	☐	☐	Fire Extinguisher	☒	☐	☐
Dust Mask	☐	☒	☐	Other: Tecnu skin cleanser, face mask, hand sanitizer	☒	☐	☐
Half-Face Respirator	☐	☐	☒	Long pants and long sleeves	☒	☐	☐
Full-Face Respirator	☐	☐	☒	PFD for all near/on water work	☒	☐	☐

6.1 PERSONAL PROTECTIVE EQUIPMENT PRECAUTIONS

The following work practices **must be observed** during Site activities:

- Avoid contact with debris of unknown origins.
- Wear appropriate personal protective equipment (PPE); gloves, ear plugs, PFD, disposable boot covers, Tyvek, etc., in specified areas and during specified tasks as defined in this HASP and the JSAs. Personal floatation devices (PFD) must be worn at all times for all on or near water work.
- If PPE is multi-use, such as a personal floatation device or leather gloves, please inspect for tears or broken buckles prior to each use.

- Practice hazardous material avoidance - soil and liquid samples should be collected in such a manner as to minimize contact with the material.
- Exercise caution when handling sample bottles, as the lids may not be properly sealed.
- Chemicals of Concern can be listed on chart found in Appendix C*

6.2 Personal Protective Equipment Failure

If any worker experiences a failure or alteration of protective equipment that affects the protection factor, that person and his or her buddy shall immediately leave the exclusion zone. Reentry shall not be permitted until the equipment has been replaced or repaired.

6.3 Monitoring Requirements

Air monitoring is not required during the proposed Site activities, as field staff are not expected to encounter volatile dust or volatile chemicals. Potentially encountered materials in soil include petroleum hydrocarbons, polycyclic aromatic hydrocarbons (PAHs), dioxins/furans, and polychlorinated biphenyls (PCBs) (see Appendix C).

6.4 Decontamination Procedures

In the event that an exposure/contamination should occur, follow the guidelines below. Level D contamination procedures will be used at the Site during the sampling event.

PPE	Detergent and water will be used as the decontamination solution unless otherwise specified. Decontamination procedures will include the following (describe onsite decon procedures for PPE and personnel; for example [e.g., boot wash]):
Equipment	Decontamination Procedures will be conducted in accordance with Apex's Standard Operating Procedures

Section 7.0 - Site Conditions/Additional Factors

Although this list is not all encompassing the purpose to help identify hazards present on the job site(s).

Slips, Trips, Falls☒	Cold Stress☒	Heat Stress ☒	Buried or Overhead Utilities ☒
Biological ☒	Organic/Inorganic Chemicals ☒	High Noise ☒	Aerial Lift ☐
Vehicular Traffic ☐	Respirable Particles☐	Excavations ☐	Construction ☐
Non-Ionizing Radiation☐	Security ☒	UTVs/Side by Sides☐	Chemical Mixing ☐
Work Over 6ft High☐	Hand/Portable Power Tools☒	Oxygen Deficiency ☐	Drone Operation ☐
Blasting Agents☐	Confined Space☐	Welding/Hot Work ☐	Working on/near Water ☒
Lock Out Tag Out☐	Forklifts☐	Extreme Weather ☒	Other☐
Scaffolding ☐	Portable Ladders ☐	Construction Traffic ☐	Other☐

Due to the nature of the Site, Apex field staff may encounter poison oak or other poisonous plants at the Site. Workers can prevent contact with poisonous plants by taking the following steps:

- Wear long sleeves, long pants, boots, and gloves.
- Wash exposed clothing separately in hot water with detergent.

- Barrier skin creams, such as a lotion containing bentoquatum, may offer some protection before contact.
- Barrier creams should be washed off and reapplied twice a day.
- After use, clean tools with rubbing alcohol (isopropanol or isopropyl alcohol) or soap and lots of water. Urushiol can remain active on the surface of objects for up to 5 years.
- Wear disposable gloves during this process.

Workers who have come in contact with poisonous plants should:

- Immediately rinse skin with rubbing alcohol, specialized poison plant washes, degreasing soap (such as dishwashing soap or Technu) or detergent, and lots of water.
- Rinse frequently so that wash solutions do not dry on the skin and further spread the urushiol.
- Scrub under nails with a brush.

In addition, thick vegetation may have ticks. Workers will take precautions to prevent tick bite by wearing long sleeves and long pants, and using insect spray or cream. Workers may also consider wearing Tyvek if vegetation is thick, and/or taping sleeves and pants down around the wrists and ankles to prevent entry to the skin via clothing openings. Following fieldwork, all workers will inspect their person for ticks.

Potential for heat and/or cold related illness will be of concern during the project. Workers can prevent heat related illness through the following measures:

- Drink plenty of fluids. Water and electrolyte containing beverages will be made available to all workers on site.
- In warm weather, wear light colored clothing that is loose and lightweight.
- In cold weather, wear multiple layers of clothing and remove as needed.
- Monitor weather forecasts and adjust work schedule accordingly.
- Provide shade or climate-controlled rest area.
- Take frequent breaks, if needed to adjust internal temperature.
- Use the buddy system.

Additional heat illness prevention information is provided in Appendix D.

Section 8.0 - Communication Procedures

All onsite personnel will practice constant communication with other Apex personnel, subcontractors, and facility personnel during active work. Generally, verbal and/or cellular telephone communication will be used while onsite. Additional communication devices such as air horns can be used in loud environments or when confined space entry is being conducted.

Under special circumstances it is permissible to use Special Communication Procedures (e.g., two-way radios for large sites with multiple workers).

Field staff will check in with the project manager daily by 11:00 and again by 16:00 (or before leaving the Site). If the project manager does not hear from field staff by the designated times, the project manager

will call the field staff. In the case of no answer, project manager will consult with the Division Health and Safety Contact and may elect to travel to the Site.

8.1 Lone Working Communication Procedures

No lone working will be permitted at the Site due to the isolated nature of the Site and the potential to encounter persons experiencing homelessness at the Site. A minimum of two field staff is required at all times. Apex staff will not approach camps or singular living spaces of persons experiencing homelessness. This may mean re-locating a sample position or abandoning a sampling area. If a camp is prohibiting access to locations on the other side of the camp, Apex will attempt to find an alternative safe access route. If no other route is identified, Apex field staff will contact the project manager to discuss the situation. This may mean abandoning a sampling area.

8.2 Emergency Hand Signals

The following standard hand signals will be used in case injury or circumstance does not allow for verbal or other communication:

- Hand gripping throat = Out of air, can't breathe
- Grip partner's wrist or both hands around waist = Leave area immediately
- Hands on top of head = Need assistance
- Thumbs up = Ok, I'm all right, I understand
- Thumbs down = No, negative

Section 9.0 - Standard Operating Procedures

- Whenever possible, use the buddy system.
- Conduct a daily tailgate meeting before beginning site activities each day and record in field book
- Practice good work practice controls:
    - Never sit down or kneel in contaminated areas
    - Never lay equipment on the ground where contaminated groundwater or soil may be present
    - Avoid unnecessary contact with onsite contaminated objects.
- Do not eat, drink, or use tobacco products outside the designated support zone(s).
- Whenever possible, do not use contact lenses while onsite.
- Thoroughly wash hands and face before eating, drinking, etc.
- Keep copies of the HASP available in the support zone.
- In the event PPE is ripped or torn, stop work and remove and replace PPE as soon as possible.
- In the event of direct skin contact, immediately wash the affected area with soap and water.
- If contaminated media comes in contact with eyes flush with clean water for 15 minutes.
- Ensure that all subcontractors have their own site-specific HASP that is maintained onsite
- Report all accidents, injuries, and environmental releases to the project/program manager.

Specific Job Safety Analysis are included in Appendix E.

Section 10.0 - Personal Injury in the Work/Exclusion Zone with Buddy System/Onsite Contractor

Only persons directly involved with the soil sampling work will be permitted to enter the Exclusion Zone.

If onsite personnel require emergency medical treatment, and the buddy system is used, the following steps will be taken:

- Evaluate the nature of the injury and obtain the onsite copy of this HASP
- Contact local emergency service
- Decontaminate to the extent possible before administration of first aid
- Stay with the injured person.

All work-related incidents must be reported. For all medical emergencies, call 911 or the local emergency number. For non-emergency incidents, you must:

- Give appropriate first aid care to the injured or ill individual and secure the scene.
- Immediately call WorkCare at (888) 449-7787 (available 24 hours/7 days per week) if the injured person is an Apex employee.
- Notify the Project Manager and/or SSO after calling WorkCare.
- Enter the safety incident into the Apex Incident Report and submit to incidents@apexcos.com within 24 hours.

In the event of an emergency that necessitates evacuation of the work task area or the entire site, the following procedures shall occur:

- The Apex site supervisor or Project Manager will contact all nearby personnel using the onsite communications system to advise of the emergency.
- Personnel will proceed along site roads to a safe distance upwind from the hazard source to a pre-determined assembly area.
- Call 911
- Personnel will remain in that area until the site supervisor or Project Manager or other authorized individual provides further instruction.

In the event of a severe spill or leak, site personnel will follow the procedures listed below:

- Evacuate the affected area and relocate personnel to an upwind, pre-determined assembly area.
- Inform the Apex site supervisor or Project Manager, an Apex office, and a site representative immediately.
- Locate the source of the spill or leak and stop the source if it is safe to do so until appropriately trained personnel are onsite to do so.
- Begin containment of spilled or leaked materials. If a spill is 1 gallon or less Apex employees can contain and clean up the spill. If spill is larger a contractor may be called in to conduct containment and clean up services. If a contractor is on site containment and clean-up is their responsibility. If there is no contractor on site it will be the responsibility of Apex management to call in a contractor to provide containment and clean up services.
- Notify appropriate local, state, and federal agencies after obtaining client consent to do so.

In the event of severe weather, site personnel will follow the procedures listed below:

- Site work shall not be conducted during severe weather, including high winds and lightning.
- In the event of severe weather, stop work, lower any equipment (drill rigs), and evacuate the affected area.
- Monitor internet or other sources for sever weather alerts before resuming work.
- In the event of lightning, outdoor work must be halted for a minimum of 30 minutes from the last lightening observation.
- Ensure cell phones have Alert Media install along with an additional weather app

Apex personnel will also follow the Employee Incident Intervention Procedures in Appendix F.

10.1 Personal Injury in the Work/Exclusion Zone

The following steps will be taken before beginning work each day:

- The following communication procedures MUST BE COMPLETED
- The employee MUST always keep a cellular telephone with them (before starting work, ensure that there is emergency service at a minimum)
- Inform an onsite contact (if they will be present throughout all active work activities) or senior member of Apex of your plans for the day and your expected active work schedule.
- If on water work is to be completed, please inform the site contact that work will be done on the water.

If an injury has occurred:

- Evaluate the injury and decide whether emergency services are required
- Contact emergency services, if necessary, with cell phone
- If emergency services are not necessary, attempt first aid alone or contact an onsite contact or Apex contact for assistance.
- Contact supervisor to determine need to contact WorkCare

Section 11.0 - Medical Surveillance

All employees, regardless of the exposure involved, are required to participate in the medical monitoring program established by Apex. OSHA regulations state that employees involved in certain activities that may expose them to hazardous materials at or above permissible exposure limits (PELs) or above the published exposure limit for greater than 30 days per year, or all employees who wear a respirator are required to participate in the monitoring program. The purposes of the medical monitoring program are to identify any illness or condition that might be aggravated by exposure to hazardous materials or work conditions; to certify that each employee can use negative-pressure respirators as required by OSHA and withstand heat or cold stress; to ensure that employees are able to physically perform their assigned tasks and to establish and maintain a medical record to monitor for abnormalities that may be related to work exposure that could increase injury risk for the employee. Apex's medical monitoring program includes the following:

- a baseline physical examination
- annual physical examination

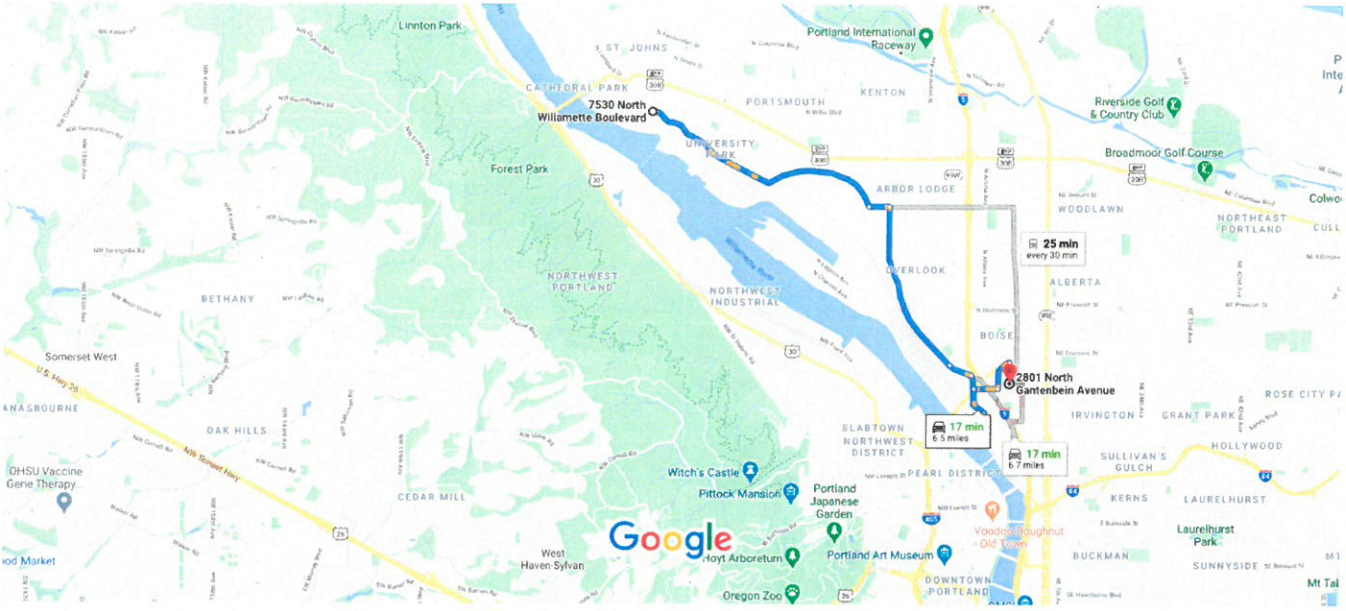
- a medical determination of fitness for duty, including work restrictions after any injury or illness that may affect employee safety
- a review of potential exposures to determine the need for specific biological and medical monitoring

Section 12.0 - Certification and Signatures

All site personnel MUST sign this page to acknowledge the requirements of this HASP.

Signature	Date	Print Name	Title/Project Role

Google Maps 7530 N Willamette Blvd, Portland, OR 97203 Drive 6.5 miles, 17 min to 2801 North Gantenbein Avenue, Portland, OR



Map data ©2020 Google 5000 ft

7530 N Willamette Blvd

Portland, OR 97203

Take N Willamette Blvd and N Greeley Ave to N Graham St

13 min (5.7 mi)

1. Head southeast on N Willamette Blvd toward N Buchanan Ave

2.7 mi

2. N Willamette Blvd turns slightly left and becomes N Rosa Parks Way

0.2 mi

3. Turn right onto N Greeley Ave

1.8 mi

4. Keep left to stay on N Greeley Ave

0.2 mi

5. Turn right onto N Interstate Ave/Pacific Hwy W

0.4 mi

6. Make a U-turn at N Albina Ave

0.3 mi

Continue on N Graham St to your destination

4 min (0.8 mi)

7. Turn right onto N Graham St

0.2 mi

8. Turn left onto N Kerby Ave

0.3 mi

9. Turn right onto N Gantenbein Ave

0.2 mi

10. Turn right at N Stanton St

Destination will be on the right

102 ft

2801 N Gantenbein Ave

Portland, OR 97227

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.

Appendix A – Personnel and Responsibility Roles

OSHA requires that a chain of command with lines of authority, responsibility, and communication is established for each project with a HASP. Therefore, APEX will establish a chain of command that ensures that all site operations will be conducted safely.

Project/Task Manager: (also referred to as the General Supervisor). This person is the project director who is ultimately responsible for the overall implementation of the project. This individual is responsible for the proper implementation of the comprehensive work plan. In all cases, the project director will ensure that the site work is staffed appropriately to safely and effectively implement the work plan. They will also ensure that company funds are available for the site project/task manager to provide appropriate personal protective equipment (PPE) and monitoring equipment to safely implement this HASP. The Site project/task manager will be responsible for the safe and proper implementation of the work plan. They will have the authority to expend company resources to ensure that PPE and other safety equipment are available and in good working order. They will communicate with the Program Manager regarding implementation of the work plan

Site Health and Safety Coordinator: (SHSC) has the responsibility and authority to implement the site HASP and verify compliance with the plan. Additionally, other personnel that are needed to conduct the proposed work will be assigned. The site health and safety coordinator (SHSC) is responsible for the implementation of this HASP. The SHSC will communicate any issues with changing site conditions, upgrades in PPE, decontamination procedures and needs for monitoring equipment with the site project/task manager. The SHSC will ensure that other workers assigned to the project are following the HASP. It is expected that all other employees assigned to the project will follow the HASP and report any and all potential safety concerns to the SHSC.

Visitors: **Authorized visitors** (e.g., client representatives, regulators, management or subcontractor management staff, etc.) requiring entry to any work location on the site will be briefed by the PM on the hazards present at that location. Visitors will be escorted at all times at the work location and will be responsible for compliance with their employer's health and safety policies. In addition, this HASP specifies the minimum acceptable qualifications, training and personal protective equipment which are required for entry to any controlled work area; visitors must comply with these requirements at all times. **Unauthorized visitors, and visitors not meeting the specified qualifications or not wearing the PPE outlined in the HASP, will not be permitted within established controlled work areas.**

Example of Authorized vs Unauthorized Worker:

Unauthorized Worker has completed OSHA 24 Hour Training which allows them to be on site conducting tasks that will not allow them to come directly in contact with hazardous materials.

Authorized Worker has completed the OSHA 40 Hour Training requirement which allows them to be on site conducting tasks where they may come in direct contact with hazardous materials.

Some site examples where this type of work may take place can be abandoned such as Superfund sites OR they could be at an existing facility where they fall under a RCRA Corrective Action.

Appendix B – Daily Tailgate Form

DAILY TAILGATE MEETING FORM

Instructions: *Field completion of a tailgate meeting form is required daily prior to starting ANY field activities. All field personnel, including work-directed subs and subcontractors, involved in the day's activities must be present for the meeting or presented with the information discussed in the meeting. Keep forms with the project files.*

DATE:	**TIME:**	**PROJECT NO:**	**CLIENT:**
PROJECT SITE:		**MEETING CONDUCTED BY:**	**SIGNATURE:**

LIST ALL PROJECT TASKS IN BOXES BELOW:

1.	3.	5.
2.	4.	6.

SUPPLIES AND MATERIALS NEEDED FOR PROJECT – ADD SPECIFICS		**EQUIPMENT NEEDED FOR PROJECT – ADD SPECIFICS**	
☐ Fuel:	☐ Contech Filter:	☐ Chain saw:	☐ String trimmer
☐ Cones:	☐ Catch Basin Box:	☐ Ride-on mower:	☐ Lid/Cover puller:
☐ Barricade:	☐ Other:	☐ Stand-on mower:	☐ Other:
☐ Fall Protection:	☐ Other:	☐ Slope mower:	☒ Other:

Apex Companies COVID-19 AHA Notice

- If you are sick, you must stay home. Avoid close contact with people who are sick. If you were in contact with a confirmed or suspected COVID-19 individual, you must immediately report it to your supervisor.
- If you become ill while on the jobsite, you will immediately contact your supervisor who will then notify the project supervisor. The employee will also immediately provide any potential staff and equipment exposures to his supervisor.
- Frequently wash your hands with soap and water for at least 20 seconds. When soap and running water are unavailable, use an alcohol-based hand rub with at least 60% alcohol. Always wash hands that are visibly soiled.
- Ensure that you have, hand sanitizer, soap/water, wipes, etc, so it will available onsite where the hand washing stations are not present.
- Wear nitrile gloves when operating any equipment and wipe down equipment with sanitizing towels at the beginning and end of every shift. This includes hand tools, power tools, etc. The key is to avoid multiple use of the single hand tool by others when it hasn't been cleaned first.
- Use proper hygiene practices: keep your hands clean, do not touch your face, and if you must use your cell phone, two-way radio or other devices, please sanitize and sterilize them as frequently as possible. Avoid touching your eyes, nose, or mouth with unwashed hands.
- Personnel in job trailers will be restricted.
- JSAs and Stretch and Flex exercises will be conducted outside.
- No handshaking. Please avoid any personal contact and be aware of the 6-foot separation rule.
- Food preparation will require extra cleaning and sanitizing of surfaces and appliances.

If you need anything or have any questions, don't hesitate to reach out to me, John Strecker, at (703)-898-0825.

MANDATORY SAFETY TOPICS – ALL PROJECTS	**SWPs / PERMITS / PLANS REQUIRED**		**DAILY WEATHER CONDITIONS**
☐ Emergency Contacts & Procedures (muster points)	☐ JSA Review		☐ Current temperature: __ °F
☐ GOAL – Get Out And Look	☐ HASP Review		☐ Forecast high temperature:__ °F
☐ Stop Work Authority	☐ Site-specific PPE	☐ NA	☐ Heat Index/Feels like high:__ °F
☐ 4Sigtht 4Safety	☐ Manual lifting plan	☐ NA	☐ Relative humidity:__ %
☐ Incident Intervention Procedures (WorkCare)	☐ Housekeeping	☐ NA	☐ Forecast Precipitation/Storms: _____

☐ First Aid Kit & Eye Wash / Station Location	☐ Noise	☐ NA
☐ Heat/cold stress	☐ Utility Clearance/GDP	☐ NA
☐ Fire Extinguisher Location	☐ Fall protection plan	☐ NA
☐ Safety Data Sheets (SDSs) and chemical hazards	☐ Silica Exposure Control Plan	☐ NA
☐ Minimum PPE (safety boots, safety glasses)	☐ LOTO/machine-specific	☐ NA
☐ Medical & Training Requirements	☐ Hot Work Permit	☐ NA
	☐ Confined space entry permit	☐ NA
	☐ Excavation/trenching plan	☐ NA
	☐ Traffic control plan	☐ NA
	☐ Breathing zone monitoring plan	☐ NA

KEY REMINDERS:

- **WATER**:
  - **1 QT / employee / hr** & **increase by 1 GALLON** at **80°F**
  - Replenish when supply drops to 50%
- **SHADE**: required at **85°F** or hotter
- Review procedures & importance of rest breaks & water
  - Set alarms to take breaks & drink water
  - **NIOSH work**-rest tables
- Monitor employees for alertness, dizziness, nausea, weakness, clumsiness, unsteady walk, muscle cramps, headaches
- Record employees rest periods and water inta

STOP WORK AUTHORITY

I will **STOP** the job any time anyone is concerned or uncertain about safety.
I will **STOP** the project if anyone identifies a hazard or additional mitigation not already presented.
If it is necessary to **STOP WORK**, I will reassess the task, hazards, and mitigations, and amend documentation.

4SIGHT 4SAFETY

1. **What am I about to do?**
2. **What could go wrong?**
3. **What could be done to make it safe?**
4. **What have I done to communicate the hazard?**

PRINT NAME / COMPANY	SIGNATURE	PRINT NAME / COMPANY	SIGNATURE

RECORD ANY ADDITIONAL NOTES IN THIS SECTION (OR ADDITIONAL PAGES IF NECESSARY)

Appendix C – Hazardous Chemicals of Concern

Materials Present or Suspected at Site	Highest Reported Concentration (specify units and sample medium	Exposure Limit (specify ppm or mg/m3)	IDLH Level (specify ppm or mg/m3)	Primary Hazards of the Material (explosive, flammable, corrosive, toxic, volatile, radioactive, biohazard, oxidizer, or other)	Symptoms and Effects of Acute Exposure	Ionization Potential (eV)
Arsenic	28 ug/L	PEL = NA REL = NA TLV = Skin Hazard☐	NA	Toxic	Fatigue, headache, nausea, dizziness. Exposure to high levels can lead to coma or death	
PAHs (BaP Eq)	0.135 ug/L	PEL = NA REL = TLV = Skin Hazard☐	NA	Carcinogen	Eye irritation, nausea and vomiting, diarrhea, confusion	
PCBs	20.8 ug/L	PEL = NA REL = NA TLV = NA Skin Hazard☐	NA	Carcinogen	Eye irritation, chloracne, liver damage, reproductive effects, potential occupational carcinogen	

Appendix D – Heat Illness Prevention Program

Apex Companies

Heat Illness Prevention Program (HIPP)

Last Revised July 2018

TABLE OF CONTENTS

APPENDICES

1.0 BACKGROUND

1.1 Apex Safety Policy – Code of Safe Conduct

At Apex, safety is not only a part of our business, it is foundational to our culture. We understand that in order to protect our staff and stakeholders from injury, illness or other loss, safety and security must be valued as much as all of our other core values. Apex is committed to providing a safe, healthy and secure work environment for our employees, clients, subcontractors and visitors through our WorkSafe program. We achieve our WorkSafe goals through partnership with our leadership, managers, and staff. We collaborate to ensure that our overall commitment to safety is translated in a way that can easily be applied to our day-to-day working activities. Apex's WorkSafe program is based upon the following principles. At Apex we:

- Identify and communicate hazards
- Conduct training and generate awareness
- Consider the potential consequences of our actions and plan accordingly
- Seek and apply the tools and training we need to prevent any incidents or accidents
- Think and act responsibly

The integrity of our WorkSafe program is ensured through sensible hiring and employment practices including pre-employment background screening, medical monitoring, and comprehensive on-going safety training that begins on every employee's first day with Apex.

1.2 Heat Illness and Prevention Program Integration

Apex has several programs designed to provide guidance and structure for awareness, prevention, roles and responsibilities for safe work practices for specific hazards, including, but not limited to confined space entry, exposure to hazardous materials, and use of personal protective equipment.

2.0 HEAT ILLNESS SYMPTOMS

The four forms of heat stress include heat rash, heat cramps, heat exhaustion and heat stroke. It is important to be able to recognize symptoms associated with the various forms of heat stress and to know first aid measures. A summary of heat stress symptoms is presented below.

FORMS AND SYMPTOMS OF HEAT STRESS

FORM	SYMPTOMS	FIRST AID MEASURES
Heat Rash	• Prickly heat • Slight to extensive skin irritation could occur	• Keep skin clean and dry for at least 12 hours per day • Change wet clothing
Heat Cramps	• Skin is sweaty • Painful muscle spasms • Body temperature is normal	• Provide fluids • Gently massage cramped muscles
Heat Exhaustion	• Clammy or pale skin • Weakness and fatigue • Profuse sweating • Nausea, vomiting • Disorientation • Headache • Normal or slightly elevated body temperature	• Remove from heat • Loosen clothing • Sponge skin with cool water • Fan victim; stop if victim shivers or develops goose bumps • Give fluids; give victim a drink solution of one pint water and one teaspoon salt every 30 minutes until recovers • Obtain medical help if victim does not improve
Heat Stroke	• Unconsciousness or mental confusion • Dizziness • Staggered walk • Appears to be agitated • Hot, dry skin • Extremely high body temperature; could reach 105° F	• Get emergency medical aid immediately • Remove victim from heat • Remove clothing, place victim in a cool bath, or apply cool compresses • Do not give any fluids • Do not leave victim alone • Do not allow victim to become so cold that victim shivers • Do not give aspirin or other medication in an attempt to lower fever

More specific information on heat stress from the Occupational Safety and Health Administration (OSHA) is included in Appendix A for reference.

3.0 HEAT ILLNESS PREVENTION

3.1 Recognition of Heat Danger

When working outdoors all Apex employees must be aware of the dangers of heat and local climate changes. This requires the project team to review forecasted climate reports during project planning as well as during every daily tailgate briefing. These reviews will determine the need to implement work/rest break schedules beyond the normal expected breaks of 1 break approximately every 2 hours. Apex will implement the National Institute of Occupational Safety and Health- (NIOSH-) recommended work/rest schedule to evaluate the need to increase breaks during high heat days. The recommended schedule is included in Appendix B.

3.2 Provision of Water

The availability and use of potable and suitably cool (i.e., 59 degrees Fahrenheit or less) drinking water at a project site is required and is a critical factor in preventing heat stress. This is especially important for construction and environmental investigation/remediation projects that require physical labor outdoors, frequently in locations without an available on-site break room.

Drinking plenty of water frequently is vital to workers exposed to the heat. To stay appropriately hydrated, workers should drink 3 to 4 6-ounce cups of water every hour starting at the beginning of your shift. During prolonged exposure to heat, workers should also have access to drinks containing electrolytes (e.g., sports drinks). Therefore, for field projects involving physical labor and scheduled for a duration of more than two hours, the following procedures will be followed.

- The Field Supervisor is responsible for bringing to the project site, or arranging to have delivered, a minimum of 1 quart of potable water per field employee per hour for projects scheduled for more than 2 hours.

- The amount of water will be increased to a minimum of 1 gallon per person whenever the temperature equals or exceeds 80 degrees Fahrenheit.

- All workers whether working individually or in smaller crews, will have access to potable and suitably cool drinking water. When working individually, the employee is the Supervisor.

- The Field Supervisor shall implement appropriate measures to ensure that the potable water is maintained at a temperature of 59 degrees Fahrenheit or less, which may require the use of an insulated cooler and/or ice.

- All water containers will be kept in sanitary condition. The Supervisor is also responsible

for providing clean, individual drinking vessels, which may range from disposable paper or plastic cups (in an appropriate dispenser), individual water bottles, or comparable means to ensure potable water for each employee.

- Water containers will be staged at one or more conveniently accessible locations as close as practicable to where employees are working. If the crew moves during the day (such as on a pipeline project or series of small projects), the water will be restaged to remain as close as practicable to the crew.

- At a minimum, the Field Supervisor will check the remaining quantity of drinking water at the lunch break and replenish the available water at the project site to ensure that there is sufficient fresh, pure and suitably cool drinking water for field staff for the remainder of the day. The project drinking water supply will be refilled with cool water whenever the supply drops below 50%.

- During heat waves (i.e., when predicted high temperature for the day will be 80 degrees Fahrenheit or at least 10 degrees Fahrenheit higher than the average high daily temperature in the preceding five days) or during high heat conditions (i.e., when the temperature exceeds or is expected to exceed 95 degrees Fahrenheit), the Field Supervisor or his/her designee shall check the job site drinking water supply no less than once every hour.

- The Field Supervisor will include the importance of frequent drinking of water, as well as remind employees that he/she has provided drinking water and the location of the drinking water during daily tailgate safety meetings.

- When performing physically demanding work during heat waves (in California defined as any day in which the predicted high temperature for the day will be at least 80 degrees Fahrenheit or at least 10 degrees Fahrenheit higher than the average high daily temperature in the preceding five days) or during all high heat conditions (in California defined as when the temperature exceeds or is expected to exceed 95 degrees Fahrenheit):

    - The daily safety tailgate meetings will specifically emphasize the importance of drinking water, the number and schedule of water and rest breaks and the signs and symptoms of heat illness.

    - Audible devices (such as whistles or air horns) will be used to remind employees to drink water when the temperature equals or exceeds or is expected to exceed 95 degrees Fahrenheit.

- The number of water breaks and the length of the breaks will be increased, and workers will be reminded throughout the work shift to drink water.

- Avoid or limit the use of alcohol and caffeine as both dehydrate the body.

3.2 Access to Shade

Taking breaks in a cool shaded area and allowing time for recovery from the heat during the day are effective ways to avoid heat illness. Whenever possible, wear clothing that provides protection from the sun but allows airflow to the body. Protect your head and shade your eyes if working outdoors. Apex has also established the following procedures to provide for adequate shade for field projects involving physical labor and scheduled for a duration of more than two hours.

- Discussion of the availability and location of shade for relief from heat will be included in daily safety tailgate meetings. At a minimum, workers will be required to take a five minute cool-down rest in the shade. These lengths will be adjusted as needed based on the intensity of the heat. Refer to Appendix B for further guidance. However, no break will ever be shorter than 5 minutes and always in a shaded area or the interior of a building or vehicle.

- Shade structures will be opened and placed as close as practical to the workers when the temperature equals or exceeds 80 degrees Fahrenheit. When the temperature is below 80 degrees Fahrenheit, access to shade will be provided when requested by an employee.[2]

- Shade shall be provided in a location that does not deter or discourage access or use (i.e., shade should not be located next to portable toilet facilities or where employees would sit on wet or muddy ground or come in contact with branches, brush, and thorns).

- Because of the variety of Apex's work and project locations, arrangements for job-specific shade will vary significantly and include, but not be limited to use of: site structures (e.g., canopies, building shade, dedicated break rooms); air-conditioned work vehicles;

- Sufficient shade shall be provided to accommodate all of the employees on a recovery or rest period and those onsite taking meal periods at any one time such that each employee can sit in a normal posture fully in the shade without having to be in physical contact with each other.

[2] The interior of a vehicle may be used to provide shade if the vehicle is air-conditioned and the air conditioner is on.

- This shade shall be located in a safe (i.e., not in a hot zone) and practical location to afford reasonable access to site workers, such that employees do not have to cross traffic or waterways to reach the shade.

- Each employee taking a preventative cool-down rest period must be monitored for symptoms of heat illness and encouraged to remain in the shade.

- Any employee presenting any symptom of heat illness shall immediately cease activities, seek shade and sip water slowly

- Emergency medical attention may be necessary depending on the severity of the workers' symptoms. Due to the effect heat illness has on the ability to determine self-care, SSCs, project managers, task managers, or other onsite resources will be used to determine the need to call emergency services or WorkCare.

- No employee shall be ordered back to or permitted to return to active work while presenting symptoms of heat illness. Once all symptoms of heat illness have abated (i.e., are gone) an employee may return to active work after an additional 5 minutes of rest plus the time it takes to access the shade.

- In situations where it is not safe or feasible to provide access to shade (e.g., during high winds), a note will be made of these unsafe or unfeasible conditions, and of work-around accommodations, including but not limited to increased use of company vehicles, increased off-site rest periods allowing employees to take advantage of off-site shade/air-conditioned facilities, or other alternative accommodations. However, under no circumstances will the feasibility of onsite shade decrease the number or length of breaks and all available resources will be used to get workers into a cooler environment than direct sun.

3.3 Monitoring Weather

- The work schedule will be planned in advance, taking into consideration whether high temperatures or a heat wave is expected. This type of advance planning should take place for all projects between the months of April and October.

- Prior to each workday, the forecasted temperature and humidity for the worksite will be reviewed and will be compared against the National Weather Service Heat Index to evaluate the risk level for heat illness. Determination will be made of whether or not workers

will be exposed at a temperature and humidity characterized as either “danger” or “extreme danger” for heat illnesses.[3]

- Weather forecasts can be checked with the aid of the internet: http://www.nws.noaa.gov/, by calling the National Weather Service phone numbers; by checking the Weather Channel TV Network, or by checking a weather APP on your mobile device or computer.

- Prior to each workday, the supervisor will monitor the weather at the worksite (using http://www.nws.noaa.gov/ or with the aid of a simple thermometer). The current weather information will be taken into consideration to determine when it will be necessary to make modifications to the work schedule (such as stopping work early, rescheduling the job, working at night or during the cooler hours of the day, increasing the number of water and rest breaks).

- A thermometer will be used at the jobsite to monitor for sudden increases in temperature and to ensure that once the temperature equals or exceeds 80 degrees Fahrenheit, shade structures will be opened and made available to the workers. In addition, when the temperature equals or exceeds 95 degrees Fahrenheit, additional preventive measures such as the High Heat Procedures will be implemented.

3.4 Performing Physically Demanding Tasks During a Heat Wave & All High Heat Work

Apex has adopted the following additional procedures to provide extra protection to employees scheduled to perform physically demanding tasks outdoors during heat waves (i.e., any day in which the predicted high temperature for the day will be at least 80 degrees Fahrenheit or at least 10 degrees Fahrenheit higher than the average high daily temperature in the preceding five days) and for all work performed during high heat conditions (i.e., when the temperature equals or exceeds 95 degrees Fahrenheit).

- The Project Manager and Field Supervisor will consult and evaluate whether an alternative schedule for the project can be arranged to avoid the worst of the high heat conditions, such as performing the scheduled task(s) during the cooler evening hours, a through a split

[3] It is important to note that the temperature at which these warnings occur must be lowered as much as 15 degrees if the workers under consideration are in direct sunlight.

shift, or changing the sequencing of a larger project.

- Daily tailgate meetings during these conditions will emphasize the heat stress conditions and include discussion of the weather forecast, and the requirement for rest breaks that includes water intake. The OSHA "Heat Stress Awareness Card" (See Appendix C) will be reviewed during the tailgate meeting and will be physically available for reading and reviewing onsite to refresh employees' ability to readily observe signs of heat stress. Electronic versions are acceptable if saved on a local hard disk drive or mobile device; however, the reliance on internet or cell service is not an acceptable alternative.

- Employees will, at a minimum, take a 10-minute rest break and consume at least 6-ounces of water every 2 hours when site conditions are less than 80 degrees in warmer months. These frequency and length of breaks will be increased as the heat increases. Lone workers are required to contact their Supervisor to verify his or her safe condition.

- The Supervisor will communicate the required break schedule during the tailgate briefing and continue communication throughout the day by way of audible alerts that can be heard by all site workers (such as through a speaker system, two-way radio, or pre-arranged alarm system discussed during the tailgate meeting).

- Apex staff will ensure effective observation and monitoring of all employees which shall, at a minimum, include:

    - having a supervisor responsible for monitoring no more than 20 individuals;

    - prior to starting work, having the supervisor interview each employee to determine if any have worked in excessive heat, was able to rest before the work day, and/or experienced recent heat illness – those who have shall be more closely monitored;

    - having the supervisor and/or colleagues ask each employee if they are experiencing any symptoms of heat illness;

    - having the supervisor and/or colleagues monitor employees for alertness and signs of dizziness, nausea, weakness, clumsiness or unsteady walk, muscle cramps, and headaches;

    - having the supervisor record each employee's rest periods and hydration status (i.e., water intake) on the Rest and Water Intake Record form in Appendix D to ensure they are taking breaks and drinking water in accordance with the prescribed frequency above; and,

- having the supervisor periodically (no less than once every 2 hours) monitor air temperature and humidity by calling the National Weather Service (numbers provided above in Section 3.3), checking the Weather Channel TV Network, or checking a weather internet website or APP on a mobile device or computer which will then been compared to the National Weather Service Heat Index, and recording the information on the Heat Index Record form in Appendix E.

- The Supervisor will be authorized to make additional precautionary decisions to aid in proactively avoiding heat stress among Site workers, including, but not limited to terminating work early for the day.

3.5 Procedures for Working Alone

Apex staff routinely perform non-construction activities outdoors including, but not limited to inspections, valve exercising, and routine maintenance activities alone (i.e., as a sole individual). During high heat conditions, for new employees during the first 2 weeks of work, or staff that have not had at least 5 days to acclimatize , Apex will restrict 1-person field crews using a combination of the following methods to provide for additional protection against the heat:

- If feasible, the tasks will be rescheduled to be performed during the cooler morning or evening hours, or after the heat wave has passed;

- Staff the task to provide for a minimum 2-person crew to provide for a “buddy system”. When a buddy system is not feasible, a 1-person crew can proceed with work during high heat conditions only after ENSURING they can remain in effective communication by voice, observation or electronic means with a supervisor. A cell phone for calling or text messaging can only be relied upon as effective communication in areas with reliable reception. High heat condition work for a 1-person crew (i.e., a sole individual) is only permissible after CONFIRMING effective communication with a supervisor (i.e., performing a test communication contact prior to beginning work).

- The use of a 1-person crew during high heat conditions is only permissible for light to moderate effort tasks (i.e., not physically demanding work) at locations frequented by other persons or in close proximity to local emergency response (e.g., housing communities, retail shops, professional buildings, operational industrial facilities, commercial properties).

- During high heat conditions, Apex does not permit a 1-person crew to work in remote, isolated locations that are not frequented by other persons (e.g., back country, rural desolate facilities, uninhabited terrain, and abandoned facilities).

3.5 Acclimatization

Acclimatization is the temporary and gradual physiological change in the body that occurs when the environmentally induced heat load to which the body is accustomed is significantly and suddenly exceeded by sudden environmental changes.

In more common terms, the body needs time to adapt when temperatures rise suddenly, and an employee risks heat illness by not taking it easy when a heat wave strikes or when starting a new job that exposes the employee to heat to which the employee's body hasn't yet adjusted. Inadequate acclimatization can be significantly more perilous in conditions of high heat and physical stress.

- The supervisor will monitor weather at the jobsite daily and will be on the lookout for sudden heat wave(s), or increases in temperatures to which employees haven't been exposed to for several weeks or longer. If such changes in weather conditions are observed, the Supervisor will implement the additional procedures described in Section 3.4.

- The supervisor will closely monitor all employees for signs and symptoms of heat illness during work performed during a heat wave - any day in which the predicted high temperature for the day will be at least 80 degrees Fahrenheit or at least ten degrees Fahrenheit higher than the average high daily temperature in the preceding five days.

- The supervisor will be extra-vigilant with new employees (at least during their first 2 weeks of work) and stay alert to the presence of heat related symptoms. For new employees, the intensity of the work will be lessened during a break-in period (such as scheduling slower paced, less physically demanding work during the hot parts of the day and the heaviest work activities during the cooler parts of the day [e.g., early-morning or evening]). New employees (during their first 2 weeks of work) will be assigned a "buddy" or experienced coworker to watch each other closely for discomfort or signs and symptoms of heat illness.

- Let your supervisor know you are not used to the heat. If you are coming back to work from an illness or an extended break or you are just starting a job working in the heat, it is important to be aware that you are more vulnerable to heat stress until your body has time to adjust. It takes about 5-7 days for your body to adjust.

3.6 Handling a Sick Employee / Emergency Response

Apex has a company-wide established procedure for handling notification or observation of a potential workplace illness or injury. This procedure is summarized in Appendix F. The following procedures for preventing, identifying, and responding to heat illness symptoms potentially encountered on the job provide additional guidance with specific respect to heat stress.

3.6.1 Prevention

- All work will have scheduled rest breaks clearly communicated to the staff. No work in any heat will be conducted with fewer than one 10-minute break every 2-hours.

- All work sites, including those with a single individual, will have at least one person assigned to the site that is qualified and appropriately trained to render first aid and CPR if necessary.

- Prior to assigning a crew to a particular worksite, workers and the foreman will be provided a map of the site, along with clear and precise directions (such as streets or road names, distinguishing features and distances to major roads), to avoid a delay of emergency medical services.

- Apex provides cell phones with phone, texting and internet service to all field staff, in part to ensure that emergency medical services can be called. In addition, many of our field staff are equipped with web-enabled tablets. Each employee is responsible for reporting any damage to his/her company-provided mobile device.

- Apex has specific additional procedures described in Section 3.5 of this HIPP that are implemented when performing physically demanding work during heat waves and all high heat conditions to provide additional protection to field employees against heat-related illness.

3.6.2 Response

- When working in the heat be sure to pay extra attention to your co-workers. Always let your supervisor know if you or a co-worker start to feel symptoms such as nausea, dizziness, weakness or unusual fatigue, and rest in a cool shaded area. During a heat wave or hot temperatures, workers will be reminded and encouraged to immediately report to their supervisor any signs or symptoms they are experiencing.

- When an employee displays possible signs or symptoms of heat illness, a trained first aid worker or supervisor will check the sick employee and determine whether resting in the

shade and drinking cool water will suffice or if emergency service providers will need to be called. A sick worker will not be left alone, as he or she can take a turn for the worse!

- Emergency Services will be called whenever[4]:
  - An employee displays possible signs or symptoms of heat illness that resemble or are approaching heat stroke (See Section 2.0).
  - An employee displays signs or symptoms of severe heat illness (such as, but not limited to, incoherent speech, decreased level of consciousness, staggering, vomiting, disorientation, irrational behavior or convulsions, red and hot face), does not look OK or does not get better after drinking cool water and resting in the shade
    - While the ambulance is in route, first aid will be initiated (cool the worker: place the worker in the shade, remove excess layers of clothing, place ice pack in the armpits and groin area, mist or sponge the victim with cool water, and fan the victim).
    - If the worksite is located more than 20 minutes away from a hospital, call emergency service providers, communicate the signs and symptoms of the victim and request Air Ambulance.
    - A sick worker will not be left alone or allowed to leave the site unattended, as he/she can get lost or die before reaching a hospital!

[4] At remote locations such as rural farms, lots or undeveloped areas, the supervisor will designate an employee or employees to physically go to the nearest road or highway where emergency responders can see them. If daylight is diminished, the designated employee(s) shall be given reflective vest or flashlights in order to direct emergency personnel to the location of the worksite, which may not be visible form the road or highway.

4.0 TRAINING

- Supervisors will be trained prior to being assigned to supervise other workers. Training will include this company's written procedures and the steps supervisors will follow when employees' exhibit symptoms consistent with heat illness.

- Supervisors will be trained on how to track the weather at the job site (by monitoring predicted temperature highs and periodically using a thermometer). Supervisors will be instructed on how weather information will be used to modify work schedules and to increase number of water and rest breaks or cease work early if necessary.

- All employees and supervisors will be trained prior to working outside. Training will include the company's written prevention procedures.

- Employees will be trained on the steps that will be followed for contacting emergency medical services, including how they are to proceed when there are non-English speaking workers, how clear and precise directions to the site will be provided and the importance of making visual contact with emergency responders at the nearest road or landmark to direct them to their worksite.

- When the temperature exceeds 80degrees Fahrenheit, safety tailgate meetings will include review of the weather report, reinforce heat illness prevention with all workers, provide reminders to drink water frequently, inform them that shade can be made available upon request and remind them to be on the lookout for signs and symptoms of heat illness.

- During their first 2 weeks, new employees will be assigned a "buddy" or experienced coworker to ensure that they understand the training and follow company procedures.

- Supervisors and Managers will be trained to check in advance the extended weather forecast

- All employees will be trained in the importance of acclimatization, how it is developed and how these company procedures address it.

- All employees will be trained in the details of these written emergency procedures

5.0 RESPONSIBILITIES

Apex's Director of Corporate Health and Safety is responsible for administering Apex's overall safety program, which includes chairing our Central Safety Committee, managing our internal corporate safety training and educational network, and providing technical guidance and oversight to regional safety programs.

Apex's Regional Manager is responsible for regional adherence to Apex's safety programs; sponsoring and supporting regional representation in Apex's Central Safety Committee; ensuring that all regional staff, including managers, supervisors, laborers and office personnel compiles with Apex's comprehensive safety program; and receive annual performance reviews that include evaluation of their adherence to safety programs.

Each Project Manager is responsible for implementing the appropriate and relevant health and safety provisions for each project and assigning responsibility for implementation of the HIPP procedures documented herein. This individual has full authority within Apex to make decisions in the field to implement the policies and procedures documented in this HIPP.

Each staff member is responsible for following all requirements of this HIPP, the IIPP, and all applicable Apex health and safety programs, protocols, and plans. Additionally, each individual is responsible for the safety of themselves and their colleagues. It is unacceptable for an individual to decide to "work through" or "deal with" heat-related symptoms. All staff members are also responsible for taking scheduled rest breaks and consuming the recommended amount of water or sports drinks.

APPENDIX A

OSHA HEAT-RELATED ILLNESS SAFETY BULLETIN

SAFETY BULLETIN 46
Heat-Related Illnesses
Heat Cramps, Heat Exhaustion and Heat Stroke

When the weather is hot, your body works overtime trying to keep cool. Excess heat escapes through sweating, exhalation of warmed air, and increased blood flow to the skin. However, hot weather can overwhelm those cooling mechanisms leading to a wide array of uncomfortable symptoms.

Sweating is your body's main method of ridding itself of extra heat. Water evaporates from your skin when you sweat. The heat that evaporates the sweat comes mainly from your skin. As long as blood is flowing properly to your skin, extra heat from the core of your body is pumped to the skin and removed by sweat evaporation. Therefore, you cannot get rid of the extra heat effectively if you do not sweat enough or if the blood is not flowing to the skin. Moreover, dehydration may lead to heat-related illness because you won't sweat as much and your body will also try to keep blood away from the skin to keep your blood pressure at the right level in the core of your body. Therefore, dehydration avoidance is a primary method to prevent heat-related illness.

The rate of sweating is higher in humid conditions; however, humidity diminishes the body's ability to cool itself. This is because air is already very saturated with water, so sweat cannot evaporate. Sweat that beads up and rolls off does not function in the cooling process; however, this "futile sweat" does deplete the body of vital water and salt. As the dehydration progresses, cooling the body becomes more difficult.

The Three Stages of Heat Illness:

1. **Heat Cramps** - these are due to muscle spasms and often occur in the arms, legs or abdomen. They are thought to be caused by heat, dehydration and loss of salt and other electrolytes. Heat cramps usually improve with rest, drinking water, eating salty foods and moving the person to a cooler environment.
2. **Heat Exhaustion** - this is due to more profound loss of water and electrolytes. It is characterized by generalized weakness, headaches, dizziness, low blood pressure, elevated pulse, paleness, vomiting, fainting and a moderately increased body temperature (101° – 102°F) which, in this case, is not truly a fever, but is caused by the heat. Rest and water may help in mild heat exhaustion, ice packs and moving the person to a cool environment (with a fan blowing at the person) may also help. More severely heat-exhausted patients may need IV fluids.

3. **Heatstroke** - this is a life-threatening condition and the most severe form of heat illness. Severe dehydration, high body temperature, and a shut-down of the cooling systems occur. The person may be delirious or comatose, have flushed skin, be unconscious, and have seizures. Half of the victims will have stopped sweating. By now, the victim's pulse is rapid and weak, the blood pressure is low, and the body temperature is greater than 105°F and may reach as high as 110°F *(the oral temperature is notoriously inaccurate in these circumstances)*. Damage to the brain, heart, lungs, kidneys and other organs may occur. Sometimes despite the best medical care, **DEATH IS THE END RESULT**.

People suffering from heatstroke need to have their temperature reduced quickly (often with ice packs) and must also be given IV fluids for re-hydration. The victim must be taken to the hospital *as quickly as possible* (Call 911) and may have to stay in the hospital for observation since many different body organs can fail due to heatstroke.

Avoiding Heat Related Illness

The environmental conditions that lead to dehydration and heat illness are out of our control, but the following are things that we can do to help prevent dehydration and subsequent heat illness:

- **Drink plenty of fluids**. The best fluid to drink when you are sweating is water. Although there is a small amount of salt in your sweat, you do not really lose that much salt with your sweat except in special circumstances. Therefore, be careful when taking salt tablets because there is the risk that you could raise your body's sodium level to hazardous levels. "Sports drinks" such as Gatorade® are

acceptable, but water should be the main fluid used for re-hydration. Do **NOT** drink beverages with caffeine or alcohol because they are diuretics and cause your body to lose fluid. **Drink before, during and after the physical work activities**. How do you know if you are drinking enough? A good sign of hydration is the output of large volumes of clear, dilute urine. Drinking a minimum of 13 – 20 ounces of cold water or an electrolyte solution per hour will surely help delay the process of dehydration in most hot situations. If you are thirsty you are dehydrated, do not wait until you want a drink of water before you decide to dig the well!

- **The clothing you wear makes a difference**. The less clothing we have on and the lighter the clothing is, the easier it will be to cool off. Light-colored clothing reflects light and therefore is cooler than dark clothing. Loose, lightweight material allows for better air circulation and facilitates the evaporation of sweat. Clothing that is dry slows down evaporation of sweat, but once wet, cooling continues.
- **Adapt to the heat**. Heat acclimatization is a process by which the body makes adjustments to promote better cooling in hot environments. Sweat becomes more diluted and the threshold at which sweating begins is lowered as the sweat rate is increased. These and other changes take time to fully complete (about ten days of work in the heat). You must also be well hydrated for acclimatization to work.
- **Avoid taking medications**. Some medications interfere with cooling by inadvertently promoting dehydration or hindering sweating. Antihistamines and some blood pressure medications decrease sweating. **PLEASE** inform your project manager, your H&S representative, and/or Human Resources if you are currently taking these types of medications when working on projects when there is the potential of experiencing dehydration or heat illness.
- **Physical condition.** The better your physical condition = the better your body functions. If you are experiencing some type of illness do not engage in strenuous work activities that can increase your chances of suffering from dehydration and heat illness. Do not take a risk, contact your project manager, your H&S representative, and/or Human Resources prior to engaging in work if this applies.
- **Diet**. The digestive process creates heat within the body and the lighter the meal the less time required for digestion. Additionally, fruits and vegetables are the best source of both nourishment and liquids in hot weather. Each serving typically provides approximately one-third of a cup of water, which far outweighs the liquid contributions from any other food group. Avoid foods high in sugar or "bad" carbohydrates.
- **Schedule physical work activities during the cooler parts of the day**. When possible avoid working between the times of 11:00 AM and 3:00 PM. When this is not possible try to take frequent short breaks in lieu of one long break. Breaks should be taken in cool or shady environments where you can consume fluids, sit and relax.
- **Medical monitoring**. Chemical suits or other types of PPE that we may be required to wear can inhibit the body's cooling process. Medical monitoring should always be conducted in these conditions. The monitoring should include blood pressure and pulse rate. When the blood pressure (normal rate 120/80) and pulse rate (normal rate: resting 90 Beats Per Minute (BPM), Strenuous Exercise 200 -220 BPM) are above normal limits the worker should be removed from work activities until theses readings are back to normal for approximately 30 minutes.
- **Use the buddy system**. When there is the potential for exposure to hazardous materials or our health and safety could potentially be compromised we should always make sure that at least two people are working together. However, keep in mind that chemical suits also promote body heat. We can experience high ambient temperatures and humidity within this environment even when the outside environment is cooler. Workers should be watching each other to look for the symptoms of dehydration, heat illness, and/or signs of over-exposures to hazardous materials.

Be smart and anticipate what will be needed to avoid problems when working under hot and humid conditions.

Keep in mind, the higher the intensity of the physical work, the greater the heat production by the body's muscles. Overheating causes more sweat production. Never forget that how hard you push yourself during the physical work activities is under ***your*** control. *You have a choice*: Over-work yourself, dehydrate and hurt yourself OR **slow down, take a little longer to finish the work and survive**. It is important to be sensible about how much you exert yourself in hot weather. The hotter and more humid it is, the harder it will be for you to get rid of excess body heat. This is especially applicable when wearing PPE.

APPENDIX B

NIOSH Recommended Work/Rest Schedule

HEAT STRESS

Work/Rest Schedules

Using work/rest schedules can decrease the risk of heat illness

Sample Work/Rest Schedule for Workers Wearing Normal Clothing*

The NIOSH work/rest schedule is based on air temperature, with adjustments for direct sunlight and humidity. It may not be applicable to all worksites. Other work/rest schedules are available, some of which are based on Wet Bulb Globe Temperature.

See reverse for temperature adjustments for the NIOSH work/rest schedule and examples of light, moderate, and heavy work.

Temperature (°F)	Light Work Minutes Work/Rest	Moderate Work Minutes Work/Rest	Heavy Work Minutes Work/Rest
90	Normal	Normal	Normal
91	Normal	Normal	Normal
92	Normal	Normal	Normal
93	Normal	Normal	Normal
94	Normal	Normal	Normal
95	Normal	Normal	45/15
96	Normal	Normal	45/15
97	Normal	Normal	40/20
98	Normal	Normal	35/25
99	Normal	Normal	35/25
100	Normal	45/15	30/30
101	Normal	40/20	30/30
102	Normal	35/25	25/35
103	Normal	30/30	20/40
104	**Normal**	**30/30**	**20/40**
105	Normal	25/35	15/45
106	45/15	20/40	Caution
107	40/20	15/45	Caution
108	**35/25**	**Caution**	**Caution**
109	30/30	Caution	Caution
110	15/45	Caution	Caution
111	Caution	Caution	Caution
112	Caution	Caution	Caution

Things you need to know:

- Continuous work in the heat is not advisable—you must take rest breaks periodically to allow your body to cool down.
- A variety of work/rest schedules are available that can be adapted to your worksite. Relying on self-pacing alone may not be sufficient.

Example

A worker performing heavy work in 104 °F temperatures should work for 20 minutes and rest for 40 minutes.

Example

A worker performing moderate work at 108 °F should use extreme caution! The risk for heat injury is high in this situation.

* From NIOSH Criteria for a Recommended Standard, Occupational Exposure to Heat and Hot Environments, https://www.cdc.gov/niosh/docs/2016-106/pdfs/2016-106.pdf. **Assumptions:** workers are physically fit, well-rested, fully hydrated, under age 40, and environment has 30% humidity and perceptible air movement.

HEAT STRESS Work/Rest Schedules

Temperature Adjustments for this Work/Rest Schedule

Adjust the temperature in the table based on:

Environmental conditions	AND	Humidity
• Full sun (no clouds): Add 13 °F		• 40% humidity: Add 3 °F
• Partly cloudy/overcast: Add 7 °F		• 50% humidity: Add 6 °F
• No shadows visible, in the shade, or at night: No adjustment		• 60% humidity or more: Add 9 °F

Example Adjustment

Conditions at a mine are 90 °F, with partly cloudy skies and 50% humidity. Adjust the table as follows:

Add 7 °F for partly cloudy skies and 6 °F for 50% humidity, to arrive at 103 °F.

Examples of Work at Different Intensity Levels

Light work

- Operating equipment
- Inspection work
- Walking on flat, level ground
- Using light hand tools (wrench, pliers, etc.). However, this may be moderate work depending on the task
- Travel by conveyance

Moderate work

- Jack-leg drilling
- Installing ground support
- Loading explosives
- Carrying equipment/supplies weighing 20–40 pounds
- Using hand tools (shovel, fin-hoe, scaling bar) for short periods

Heavy work

- Climbing
- Carrying equipment/supplies weighing 40 pounds or more
- Installing utilities
- Using hand tools (shovel, fin-hoe, scaling bar) for extended periods

Case Study: Use of Work/Rest Schedule

A crew was shoveling ore out from under the primary conveyor at a surface mine in Arizona in August. The high temperature that day was 113 °F. The crew was rotating in 10-minute shifts and hydrating between shifts. Coworkers noticed signs of heat illness in two employees, and they were transferred to the medical station for evaluation. From there they were sent to the hospital, where they were given IV saline and released home. Both employees recovered after rehydration at the hospital.

Lessons Learned

In extreme heat, even a work/rest schedule may not eliminate the risk of heat illness. In this case, use of work/rest schedules, frequent hydration, and team monitoring helped keep this situation from becoming even more serious. Without those safety precautions the workers could have potentially suffered more severe heat illness, possibly including heat stroke, which is life threatening.

DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health

DHHS (NIOSH) Publication No. 2017-127

CDC NIOSH

APPENDIX C

OSHA QUICK CARD FOR HEAT-RELATED ILLNESS SAFETY

OSHA QUICK CARD™

Protect Yourself
Heat Stress

When the body is unable to cool itself by sweating, several heat-induced illnesses such as heat stress or heat exhaustion and the more severe heat stroke can occur, and can result in death.

Factors Leading to Heat Stress

High temperature and humidity; direct sun or heat; limited air movement; physical exertion; poor physical condition; some medicines; and inadequate tolerance for hot workplaces.

Symptoms of Heat Exhaustion

- Headaches, dizziness, lightheadedness or fainting.
- Weakness and moist skin.
- Mood changes such as irritability or confusion.
- Upset stomach or vomiting.

Symptoms of Heat Stroke

- Dry, hot skin with no sweating.
- Mental confusion or losing consciousness.
- Seizures or fits.

Preventing Heat Stress

- Know signs/symptoms of heat-related illnesses; monitor yourself and coworkers.
- Block out direct sun or other heat sources.
- Use cooling fans/air-conditioning; rest regularly.
- Drink lots of water; about 1 cup every 15 minutes.
- Wear lightweight, light colored, loose-fitting clothes.
- Avoid alcohol, caffeinated drinks, or heavy meals.

What to Do for Heat-Related Illness

- Call 911 (or local emergency number) at once.

While waiting for help to arrive:

- Move the worker to a cool, shaded area.
- Loosen or remove heavy clothing.
- Provide cool drinking water.
- Fan and mist the person with water.

For more complete information:

OSHA Occupational Safety and Health Administration
U.S. Department of Labor
www.osha.gov (800) 321-OSHA

OSHA 3154-07R-05

APPENDIX D
APEX HIPP REST & WATER INTAKE RECORD

DATE:		PROJECT:	
Employee Name	**Rest Period (record time)**	**Water Intake (record ounces)**	**Comments**

APPENDIX E
APEX HIPP HEAT INDEX RECORD

DATE:			PROJECT:		
Time	**Air Temp (ºF)**	**Relative Humidity (%)**	**Temp & Humidity Source**	**Heat Index Temp (ºF)**	**Caution/Danger Rating**

Note: temperature at which these warnings occur must be lowered by 15ºF if the workers under consideration are in direct sunlight.

National Weather Service Heat Index Chart

Temperature (°F)

Relative Humidity (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Likelihood of Heat Disorders with Prolonged Exposure and/or Strenuous Activity

Caution Extreme Caution Danger Extreme Danger

Appendix E – Job Safety Analysis

APEX

Soil Sampling
Job Safety Analysis (JSA)

Project Number:	**1056-18**	Project/Client Name:	**RDI /Port of Portland**
Project Manager:	**Steve Misner**	Project Location:	**Willamette Cove**

Specific Task:	**Soil Sampling for Remedial Design Investigation**

Minimum Required PPE for Task:

☑ Hard Hat ☐ Hearing Protection ☑ Hi-Vis Shirt ☐ Coverall ☐ Face Shield ☑ Other (specify): Personal Floatation Device (PFD)
☑ Safety Toed Boots ☑ Long Sleeved Shirt ☐ Hi-Vis Vests Class 2 ☑ Gloves (Nitrile)
☑ Safety Glasses ☐ Fire Resistant Clothing ☐ Hi-Vis Vests Class 3 ☐ Respirator

Additional Task-Step Specific PPE: (as indicated below under controls)	**PFD, leather gloves**	**Equipment/Tools Required:**	**Vehicle, hand tools**
Training Required for this Task:	**HAZWOPER**	**Permits Required for this Task: (e.g. confined space, LOTO)**	
Forms Associated with this Task:			

JSA Developed/Reviewed By:			**Date and Revision Number:**	1/18/2022
Employee Name/Job Title	Employee Name/Job Title	Employee Name/Job Title	H&S Team Leader to ensure all personnel performing this task have reviewed JSA and agree to follow it. Site specific changes to this JSA have been made as warranted based on this review. H&S Team Leader Signature/Date:	
Megan Masterson				

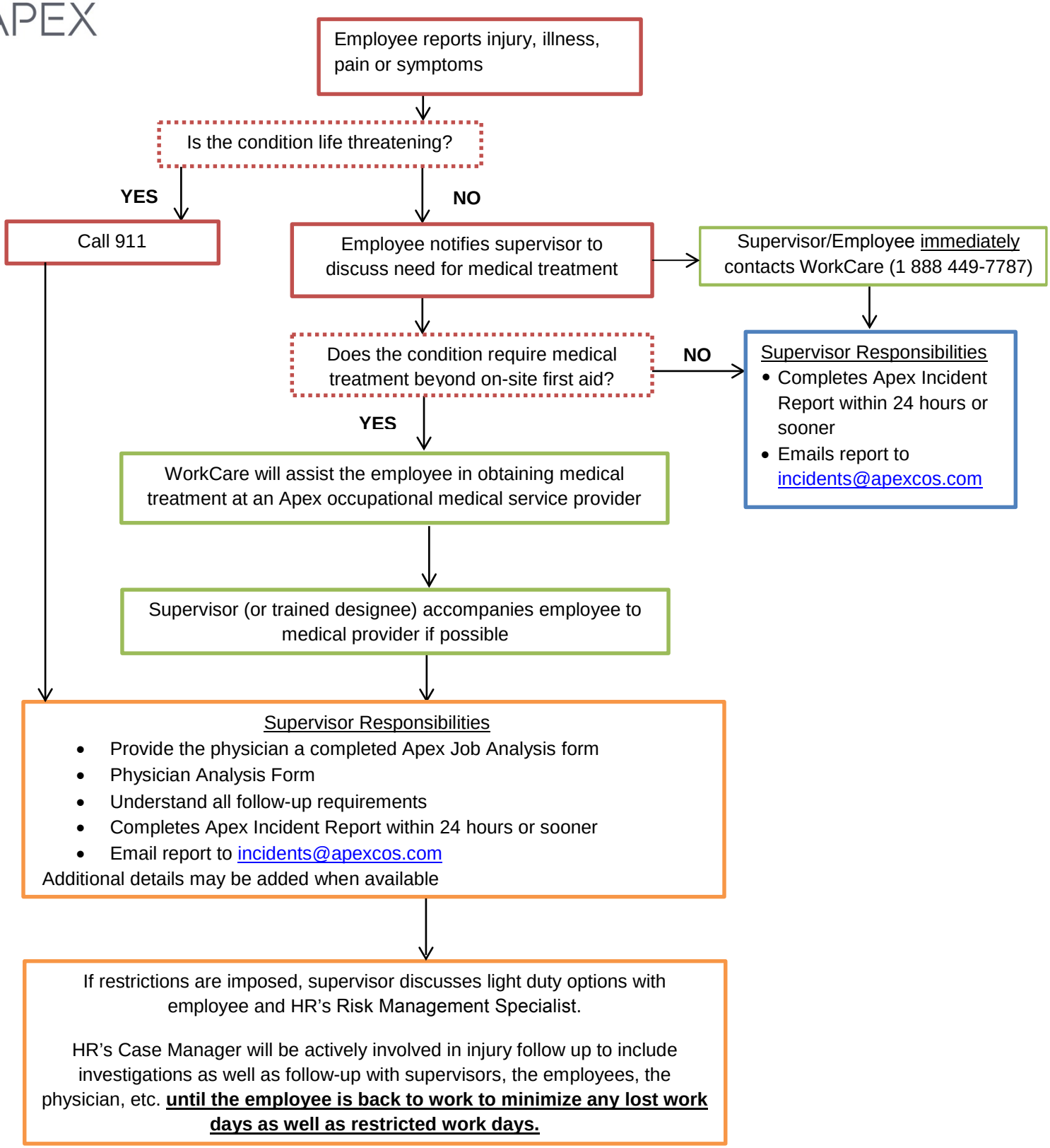
Task Steps	Potential Hazards and Consequences	Likelihood	Severity	Risk	Controls to Eliminated/Reduce Risks
Load tools in truck	slips, trips, falls and back injuries	3	2	6	Proper lifting and pay attention while walking/loading
Travelling to/from the Site	Traffic accident - Injury	1	4	4	Follow posted speed limits and traffic signs. Stay alert to other vehicles, cyclists, pedestrians and be a defensive driver by maintaining a safe distance with other vehicles on the road.
Mobilize to sample location	Uneven terrain, trip hazards	3	2	6	Carry equipment in multiple small loads, wear a backpack for smaller equipment, move slowly, do not sample without sturdy footing
Mobilize to sample location	Encounters with transient populations	3	2	6	Apex will sample in teams of at least two people. If one of the sample locations is in the vicinity of a camp, Apex staff will relocate the sampling point and notify the proper people of the change in scope. Staff are not to engage or impede upon homeless camps.
Drilling borings	slips, trips, and falls	3	2	6	Watch the ground surface while walking on uneven terrain.
Installing borings	Striking underground lines or objects	1	4	4	A public and private locator will identify active utilities entering the site and the private locator will trace those utilities throughout the Site.
Sample Collection	Contact with potentially contaminated soil or with poison oak - Exposure	2	2	4	Wear disposable gloves and safety glasses when collecting samples to minimize contact with soil. Wash exposed skin thoroughly with Tecnu following sampling activities.

APEX

Soil Sampling **Job Safety Analysis (JSA)**					
Project Number:	**1056-18**	Project/Client Name:	**RDI /Port of Portland**		
Project Manager:	**Steve Misner**	Project Location:	**Willamette Cove**		
Specific Task:	**Soil Sampling for Remedial Design Investigation**				
Sample Collection	Contact with broken sample containers - Hand laceration.	2	3	**6**	Wear gloves and check containers in cooler before grabbing them
Sample Collection	Filling and carrying soil buckets - back and muscle injury	5	1	**5**	Use proper lifting techniques.
Drilling/Sampling over water	Falling in water while working	4	2	**8**	Wear a personal floatation device at all times while working over water. Ensure that barge railings are in place and installed properly.
Load tools and samples in truck	Moving equipment or sample coolers - Back or muscle injury	3	2	**6**	Ensure proper lifting techniques. Do not attempt to bodily move large equipment. Use the buddy lift to move heavy coolers.
Site wide Activities	Slip/trips/falls - Injury	2	3	**6**	Maintain good housekeeping. Inspect the area of tripping hazards. Sturdy work boot required. Maintain 3-points of contact when using stairways.
Travelling to/from the Site	Traffic accident - Injury	1	4	**4**	Follow posted speed limits and traffic signs. Stay alert to other vehicles, cyclists, pedestrians and be a defensive driver by maintaining a safe distance with other vehicles on the road.
				0	

Appendix F – Employee Incident Intervention Procedures

Employee Incident Intervention Procedures



Contact Information

WorkCare 1-888-449-7787

Joe Schmids, Manager Corp. H&S: 610-722-9050 x5207 cell 484-467-9333