Draft Supplemental Upland Data Collection Technical Memorandum

for the Upland Portion of the Study Area
Port Angeles Rayonier Mill Site
Port Angeles, Washington

for
Rayonier Inc.

June 15, 2011

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1.0 INTRODUCTION

This technical memorandum presents the results of the supplemental upland data collection field investigation conducted at the former Rayonier Inc. (Rayonier) Mill property in Port Angeles, Washington. The field investigation was completed in five phases between August 2010 and May 2011. This technical memorandum constitutes Task 1d of Agreed Order No. DE 6815 (the Agreed Order) between the Washington State Department of Ecology (Ecology) and Rayonier (Ecology, 2010a).

1.1. Background and Regulatory Framework

The former Rayonier Mill property, located at 700 North Ennis Street in Port Angeles, Washington, comprises approximately 80 acres on the northern coast of Washington's Olympic Peninsula bordering on the Strait of Juan de Fuca (Figure 1). From 1930 until 1997, the mill operated as a dissolving sulfite pulp mill that produced acetate, specialty paper, fluff, and viscose-grade pulps for industrial use. The mill was dismantled in 1997.

A Study Area has been defined to allow cleanup actions to proceed prior to Ecology's determination of the boundaries of the "Site" as defined under the Washington State Model Toxics Control Act (MTCA). The "Study Area" refers to the former Rayonier Mill property and a portion of Port Angeles Harbor. Remedial actions within the Study Area are being conducted under the Agreed Order. The upland portion of the Study Area (Upland Study Area) includes parcels comprising the Rayonier Mill property that are owned or leased by Rayonier, as well as a parcel previously owned by Rayonier that was purchased by the City of Port Angeles (the City) in 2011 (the "City Purchase Area;" Figure 2). This technical memorandum addresses data gaps in the characterization of the nature and extent of contamination in the Upland Study Area. These data gaps were identified by Ecology in Exhibit B of the Agreed Order.

The results and preliminary conclusions of the supplemental upland investigation presented in this technical memorandum will be incorporated in the *Interim Action Report Volume I: Upland Data Summary Report for the Study Area* (Task 2 of the Agreed Order). The *Upland Data Summary Report* will document the contaminant transport pathways and potential risks to human health and the environment associated with the Upland Study Area. The results of the supplemental upland investigation also will be used to support the development and evaluation of cleanup action alternatives in the *Interim Action Report Volume III: Interim Action Alternatives Evaluation Report for the Study Area* (Task 4 of the Agreed Order).

1.2. Purpose and Objectives

Previous investigations and interim actions completed through 2006 generated a considerable amount of data relating to soil and groundwater quality within the Upland Study Area. However, Ecology identified data gaps in the characterization of the nature and extent of contamination, requiring further work to complete the *Upland Data Summary Report* and *Interim Action Alternatives Evaluation Report*. The purpose of the Upland Study Area data collection effort is to collect sufficient information to allow for completion of the *Interim Action Alternatives Evaluation Report* that will outline cleanup action alternatives for the Study Area. The objective of the

supplemental upland data collection field investigation described in this technical memorandum was to complete the characterization of the nature and extent of contamination within the Upland Study Area, with a focus on filling data gaps identified in Exhibit B of the Agreed Order.

This technical memorandum includes a description of the field investigation activities and a summary of the investigation results relative to the ten data gaps identified in Exhibit B of the Agreed Order.

2.0 SUPPLEMENTAL UPLAND DATA COLLECTION FIELD INVESTIGATION

This section describes the field investigation completed to address the data gaps identified in Exhibit B of the Agreed Order. The data gaps and main elements of the supplemental upland data collection field investigation are summarized in the *Supplemental Upland Data Collection Work Plan* (the Work Plan; GeoEngineers, 2010). Work conducted for the field investigation was performed in general accordance with the Work Plan and Ecology's conditional Work Plan approval letter dated August 10, 2010 (Ecology, 2010b).

2.1. General Approach and Sampling Design

The field investigation was conducted in five phases. The work performed during each phase is summarized in Section 2.2 below; sampling locations are shown in Figure 2. As detailed in the Work Plan, results from each phase of the investigation were used to inform the scope and locations of additional sampling and analyses performed during subsequent phases. The scope and schedule of each investigation phase were reviewed with Ecology before each phase was initiated, and the results and analytical data from each phase were submitted for Ecology review prior to conducting the next phase. Further details regarding the investigation approach and sampling design can be found in the Work Plan.

2.2. Field Program

The field investigation was conducted in five phases that were completed between August 2010 and May 2011 and are designated as follows:

- Phase 1 – Baseline Groundwater Sampling, Seep Survey, and Surface Water Sampling.
- Phase 2 – Groundwater Grab Sampling, Soil Borings, and Monitoring Well Installation and Sampling.
- Phase 3 – Process Piping Contents Sampling and Targeted Soil Sampling/Soil Removal in Interim Action Areas.
- Phase 4 – "Infill" Monitoring Well Installation and Sampling and Additional Groundwater Characterization for Volatile Organic Compounds (VOCs).
- Phase 5 – Quarterly Groundwater Monitoring (four quarters).

The soil, groundwater, and surface water samples collected during the supplemental upland investigation are listed in Tables 1, 2, and 3, along with the analyses performed on each sample. All chemical analyses except dioxins/furans were performed by Analytical Resources, Inc. in Tukwila, Washington (ARI). Dioxin/furan analyses were performed by Frontier Analytical Laboratory

in El Dorado Hills, California, under subcontract to ARI. GeoEngineers' soils laboratory in Tacoma, Washington, performed grain size (sieve analyses) on select soil samples.

2.2.1. Phase 1 – Baseline Groundwater Sampling, Seep Survey, and Surface Water Sampling

Phase 1 of the supplemental upland investigation was completed between August 23 and August 28, 2010. Activities performed during Phase 1 included measuring groundwater levels and checking for the presence of non-aqueous phase liquid (NAPL) in existing groundwater monitoring wells; redevelopment and baseline sampling of the existing monitoring wells; a groundwater seep survey along the shoreline of the Upland Study Area; and surface water sampling in Ennis Creek and White Creek. Figure 2 shows the sampling locations.

2.2.1.1. GROUNDWATER LEVEL MEASUREMENT AND WELL DEVELOPMENT

Twenty-three existing monitoring wells (PA-19 and existing "MW" and "PZ" wells) were redeveloped between August 23 and August 25, 2010, approximately 48 hours in advance of the baseline groundwater sampling conducted at each well. One well, PZ-13, was dry and could not be developed (the lower half of this well appeared to be filled with filter-pack sand, indicating the well's casing had been compromised). Prior to redevelopment, each well was gauged using an oil/water interface probe to check for the presence of NAPL. NAPL was not observed in any of the monitoring wells. In addition to checking for NAPL, the depth to water and the total depth of each well were measured.

The wells were redeveloped by surging the screened interval with a decontaminated stainless steel bailer for approximately five minutes, then purging two casing volumes of water using a decontaminated submersible pump and disposable tubing. After two casing volumes were purged, the screened interval was surged for five more minutes, followed by purging an additional three casing volumes. The groundwater field parameters pH, turbidity, dissolved oxygen, temperature, total dissolved solids, oxidation/reduction (redox) potential, salinity, and sea water potential were monitored during purging using a Horiba U-22 water quality meter with a flow-through cell and a Hach 2100P turbidimeter. If field parameters were stable (as defined in the *Sampling and Analysis Plan* [SAP]; Appendix A of the Work Plan) after removal of five casing volumes, well development ceased. If field parameters were not stable, well development continued until field parameters stabilized or until a total of approximately ten casing volumes were removed. The bailer and submersible pump were decontaminated before and after use at each well. Purge water handling and disposal is discussed in Section 2.4 below.

2.2.1.2. BASELINE GROUNDWATER SAMPLING

The baseline groundwater sampling of the existing monitoring wells was performed to address Data Gap 10 identified in Exhibit B of the Agreed Order ("Groundwater data are no longer current, nor sufficient for evaluating trends"). The baseline groundwater sampling was conducted between August 25 and August 27, 2010. Wells known or suspected to be influenced by tidal fluctuations based on previous remedial investigation (RI) tidal studies or proximity to the shoreline (wells MW-51, MW-53, MW-54, MW-55, MW-56, MW-57, MW-58, MW-59, and PZ-3) were sampled as close to low tide as possible (generally within two hours of lower-low tide) in order to minimize the effects of potential saltwater intrusion.

Groundwater was sampled using low-flow sampling techniques, with a purge rate ranging between approximately 250 and 500 milliliters per minute. The pumping rate was reduced to approximately 100 milliliters per minute when collecting samples for VOC analysis. The groundwater sampling equipment included a submersible pump with a flow controller valve and dedicated tubing, a Horiba U-22 water quality meter with a flow-through cell, and a Hach 2100P turbidimeter. The groundwater field parameter stabilization criteria used during low-flow sampling were the same as the criteria used during well development (see the SAP for details).

Following field parameter stabilization at each well, groundwater samples were collected in laboratory-supplied containers, placed in coolers containing ice, and transported to a secure on-site building, where the samples were stored in a refrigerator or an iced cooler pending shipment to the analytical laboratory (ARI). The samples were repackaged in coolers containing fresh ice for transport to the laboratory, and were delivered to the laboratory under chain-of-custody by either a courier service or GeoEngineers personnel.

Groundwater levels in all 23 monitoring wells were measured again on August 28, 2010 after the baseline groundwater samples had been collected. The groundwater level data are presented in Table 4.

2.2.1.3. GROUNDWATER SEEP SURVEY

The groundwater seep survey was performed to address Data Gap 1 identified in Exhibit B of the Agreed Order ("Groundwater to surface water/sediment pathway is not adequately characterized"). GeoEngineers conducted reconnaissance surveys of the intertidal zone along the entire shoreline of the mill property on May 11, 2010 and August 27, 2010 to look for visual evidence of groundwater seeps that may be discharging to the marine environment. The May 11, 2010 survey was conducted between approximately 10:00 and 11:50 a.m.; measured tidal elevations during this period ranged from approximately +1.0 feet to +2.8 feet above mean lower low water (MLLW). Lower-low tide on May 11 occurred at approximately 8:15 a.m. and had an elevation of -0.2 feet MLLW; lower-high tide on May 11 occurred at approximately 3:00 p.m. and had an elevation of +4.8 feet MLLW. The August 27, 2010 survey was conducted between approximately 11:00 a.m. and 12:00 p.m.; measured tidal elevations during this period ranged from approximately +1.8 to +2.2 feet MLLW. Lower-low tide on August 27 occurred at approximately 11:00 a.m. and had an elevation of +1.85 MLLW; higher-high tide on August 27 occurred at approximately 5:15 PM and had an elevation of +6.4 feet MLLW. A memorandum detailing the scope and results of the seep survey is contained in Appendix A.

2.2.1.4. SURFACE WATER SAMPLING

The surface water sampling was performed to address Data Gap 1 identified in Exhibit B of the Agreed Order ("Groundwater to surface water/sediment pathway is not adequately characterized"). Five surface water samples were collected by GeoEngineers personnel on August 26 and 27, 2010. Three of the samples were collected from the mouth of Ennis Creek (samples SW-1, SW-2, and SW-3); the other two samples were collected from White Creek and Ennis Creek near the southern boundary of the mill property (samples SW-4 and SW-5, respectively). The sampling locations are shown in Figure 2. The samples were collected from just below the water surface using a polyethylene dip sampler and transferred to laboratory-supplied containers. The dip sampler was decontaminated between each sample collected. The samples were placed in a cooler containing ice and transported to a secure on-site building, where they were stored in a

refrigerator or iced cooler pending shipment to the analytical laboratory (ARI). The samples were repackaged in coolers containing fresh ice for transport to the laboratory, and were delivered to the laboratory under chain-of-custody by either a courier service or GeoEngineers personnel.

2.2.2. Phase 2 – Groundwater Grab Sampling, Soil Borings, and Monitoring Well Installation and Sampling

Phase 2 of the supplemental upland investigation was completed between October 14 and November 5, 2010. Activities performed during Phase 2 included a pre-construction site walk to inspect the planned sampling locations and locate utilities; collection of groundwater grab samples from nine locations (groundwater grab borings GWG-1 through GWG-9); collection of discrete-depth soil samples at ten locations (supplemental soil borings SSB-1 through SSB-10); and collection of discrete-depth soil samples and installation of groundwater monitoring wells at five locations (monitoring wells MW-60 through MW-64). The sampling locations are shown in Figure 2.

Boart Longyear of Fife, Washington was contracted to drill and install the Phase 2 groundwater grab borings, supplemental soil borings, and monitoring wells. Boart Longyear used a Mobile B59 hollow-stem auger (HSA) drilling rig equipped with 4.25-inch inner diameter augers. Soil samples were obtained with an 18-inch Dames and Moore split-barrel sampler driven with a 300-pound wire-line hammer. The number of hammer blows required to drive the sampler 12 inches was recorded on boring logs by the field geologist, along with sampling intervals, lithologic descriptions, and field screening results. Boring logs are included in Appendix B.

Soil samples from all borings were generally obtained at 2 feet and 5 feet below the ground surface (bgs) or below the historical working surface (i.e., beneath demolition fill from mill decommissioning activities, if present), and then at 5-foot intervals to the total depth of each boring. The split-barrel sampler was decontaminated before and after use at each sampling interval by washing in an aqueous solution of LiquiNox detergent, rinsing with potable water, and performing a final rinse with distilled water. Drilling equipment was cleaned between each boring location using a hot-water pressure washer. The soil samples were submitted for chemical analysis of contaminants of potential concern (COPCs). In addition, select samples obtained from the surficial fill unit and/or underlying glacial deposits were also submitted for laboratory analysis of grain size (sieve analysis), total organic carbon (TOC), and hydraulic conductivity (permeability). The sieve analyses were performed by GeoEngineers' soils laboratory in Tacoma, Washington; the TOC and permeability testing were performed by ARI.

2.2.2.1. PRE-CONSTRUCTION SITE WALK AND UTILITY LOCATE

GeoEngineers conducted a pre-construction site walk with Rayonier, the drilling contractor, and a private utility locating contractor (Applied Professional Services, Inc.) on October 14, 2010. The purpose of the site walk was to identify potential access issues at each of the pre-surveyed drilling locations and to screen the drilling locations for potential underground or aboveground utilities. Several of the locations were adjusted based on access and/or potential utilities; all of the final adjusted locations were within 30 feet of the original surveyed location.

2.2.2.2. GROUNDWATER GRAB SAMPLING

The groundwater grab sampling (and concurrent, collocated soil sampling) was performed to address the following data gaps identified in Exhibit B of the Agreed Order: Data Gap 2 ("Sources of

groundwater contamination are not adequately characterized"), Data Gap 3 ("Soil contamination near process piping has not been adequately characterized"), and Data Gap 9 ("Well construction information has not been evaluated for adequacy to detect dense non-aqueous phase liquids [DNAPLs]").

Groundwater grab samples were collected from nine HSA borings during the Phase 2 field investigation (borings GWG-1 through GWG-9). The grab samples were obtained using a 3.5-foot long, stainless steel, temporary well point with a machine-slotted screen. The screen had a retractable outer sleeve. The well point was driven ahead of the augers to the desired sampling depth and then the sleeve was retracted (by pulling up the drill rods) to expose the screen. A peristaltic pump fitted with new disposable polyethylene tubing was used to purge groundwater from the well point at approximately 250 to 500 milliliters per minute until the turbidity readings dropped below 10 nephelometric turbidity units (NTU) or stabilized with less than 10 percent variance. Turbidity was used as the primary means of monitoring field parameter stabilization because the water quality meter flow-through cell used to monitor other parameters typically silted up during groundwater grab sampling. The pumping rate was reduced to approximately 100 milliliters per minute when collecting samples for VOC analysis.

Soil samples were collected from groundwater grab borings GWG-1, GWG-4, GWG-5, GWG-6, GWG-7, and GWG-8. Soil samples also were collected from boring GWG-5A; this boring was completed approximately 80 feet northeast of boring GWG-5 after the augers hit refusal in boring GWG-5 following collection of the groundwater grab sample. Soil sampling was not performed at boring locations GWG-2, GWG-3, or GWG-9; consequently, boring logs were not prepared for these borings.

The soil and groundwater grab samples collected for chemical analysis were placed in a cooler containing ice and transported to a secure on-site building, where they were stored in a refrigerator or iced cooler pending shipment to the analytical laboratory (ARI). The samples were repackaged in coolers containing fresh ice for transport to the laboratory, and were delivered to the laboratory under chain-of-custody by either a courier service or GeoEngineers personnel.

2.2.2.3. SUPPLEMENTAL SOIL BORINGS

Ten supplemental soil borings were completed during the Phase 2 field investigation (borings SSB-1 through SSB-10) to address Data Gap 2 identified in Exhibit B of the Agreed Order ("Sources of groundwater contamination are not adequately characterized"). Boring SSB-6 encountered significant shell detritus (see the Archaeological Monitoring Report in Appendix G for details), and was re-drilled following review by the archaeological monitoring contractor (Cascadia Archaeology) and consultation with archaeologists from the City and the Lower Elwha Klallam Tribe, who agreed that the shell detritus was unlikely to be shell midden.

The soil samples collected for chemical analysis were placed in a cooler containing ice and transported to a secure on-site building, where they were stored in a refrigerator or iced cooler pending shipment to the analytical laboratory (ARI). The samples were repackaged in coolers containing fresh ice for transport to the laboratory, and were delivered to the laboratory under chain-of-custody by either a courier service or GeoEngineers personnel.

2.2.2.4. MONITORING WELL INSTALLATION

Five new groundwater monitoring wells were installed (and soil samples were collected) during the Phase 2 field investigation (wells MW-60 through MW-64) to address the following data gaps identified in Exhibit B of the Agreed Order: Data Gap 2 ("Sources of groundwater contamination are not adequately characterized"), Data Gap 4 ("The extent of residual soil contamination remaining after the interim actions in the interim action areas is not clearly delineated"), Data Gap 5 ("The characterization of lateral and vertical groundwater contamination downgradient of the Fuel Oil Tank No. 2 and Hog Fuel Pile interim action areas is inadequate"), Data Gap 7 ("Groundwater characterization in the area and immediately downgradient of the Finishing Room is inadequate"), Data Gap 8 ("The characterization of lateral and vertical groundwater contamination downgradient of the Fuel Oil Tank No. 1 is inadequate), and Data Gap 9 ("Well construction information has not been evaluated for adequacy to detect DNAPLs").

The monitoring wells were constructed of 2-inch, Schedule 40 PVC casing and screens. The wells were completed with 14 to 20 feet of machine-slotted screen that extended from the shallow vadose zone above the water table to the top of the glacial deposits beneath the surficial fill unit. The surface completions consisted of flush-mount well boxes set in concrete. Drilling activities conformed to State and local regulations including WAC 173-160, *Minimum Standards for Construction and Maintenance of Wells*. Well construction details are presented on the well logs contained in Appendix B. The monitoring wells were developed on October 28, 2010 using the same method used to redevelop the existing monitoring wells in August 2010 (Phase 1).

The soil samples collected for chemical analysis were placed in a cooler containing ice and transported to a secure on-site building, where they were stored in a refrigerator or iced cooler pending shipment to the analytical laboratory (ARI). The samples were repackaged in coolers containing fresh ice for transport to the laboratory, and were delivered to the laboratory under chain-of-custody by either a courier service or GeoEngineers personnel.

2.2.3. Phase 3 – Process Piping Contents Sampling and Targeted Soil Sampling/Soil Removal in Interim Action Areas

Phase 3 of the supplemental upland investigation was completed between January 4 and January 8, 2011. Activities performed during Phase 3 included excavating 21 test pits (locations TP-1 through TP-21; includes 17 locations originally scoped in the Work Plan and four additional "step-out" locations); removing visibly impacted soil where encountered in the test pits; and digging an exploratory trench in an effort to locate and sample the contents of a buried pipe (assumed to be a former process pipe) in the Main Process Area that was encountered during the 2003 Upland Study Area RI (location PIPE-1-SR23). Soil descriptions and other test pit observations were logged by the field geologist; the test pit logs are included in Appendix B. Sampling locations are shown in Figure 2.

2.2.3.1. TEST PITS

Twenty-one test pits were completed during the Phase 3 field investigation (test pits TP-1 through TP-21) to address the following data gaps identified in Exhibit B of the Agreed Order: Data Gap 4 ("The extent of residual soil contamination remaining after the interim actions in the interim action areas is not clearly delineated") and Data Gap 6 ("The characterization of lateral and vertical groundwater contamination in the vicinity of MW-11 is inadequate"). The test pits were excavated

by Bruch and Bruch Construction, Inc. of Port Angeles, Washington using an excavator. Each test pit was excavated to the approximate depth of the water table unless relict subsurface structures (e.g., wooden piles, concrete walls and footings) prevented excavation to this depth. The excavated material was temporarily stockpiled on plastic sheeting adjacent to each test pit.

Soil samples were not obtained at all test pit locations. At locations TP-13 and TP-17, concrete rubble (demolition fill) was encountered from the ground surface to the depth of the water table (4 feet bgs), and there was not enough granular matrix to obtain a sample. Soil with apparent petroleum hydrocarbon staining was encountered in test pits TP-18 and TP-19, and field screening results at these locations were similar to the results at adjacent test pit TP-11, where petroleum-stained soil also was observed. Based on field observations, it was inferred that the COPC concentrations in soil at locations TP-18 and TP-19 would be similar to the concentrations in the soil samples collected from test pit TP-11; accordingly samples were not obtained from TP-18 and TP-19. A closely-spaced grid of concrete footings encountered in test pit TP-20 prevented excavation or sampling below a depth of 3.5 feet bgs. Field screening evidence of contamination was not detected in the soil and concrete rubble/debris above 3.5 feet bgs in TP-20.

At test pits where soil samples were collected, the samples were obtained from locations in the vadose zone and/or saturated zone where field screening (visual observation, photoionization detector readings, and/or sheen testing) indicated potential contamination. Samples obtained from depths shallower than 4 feet bgs were collected manually (with a gloved hand) from the exposed test pit sidewalls by the field geologist. Samples obtained from depths greater than 4 feet bgs were obtained using the excavator bucket. Only soil that did not come in contact with the excavator bucket was used to fill sample containers for chemical analysis. After the test pits were logged and soil samples were collected, the excavated material was placed back in the test pits in the reverse order that the material was removed. The excavator bucket was cleaned between each test pit location using a high-pressure, potable water spray.

The soil samples were submitted for chemical analysis of COPCs. In addition, select samples were also submitted for sieve, TOC, and bulk density analyses. All of the Phase 3 soil samples were analyzed by ARI. The soil samples collected for chemical analysis were placed in a cooler containing ice and transported to a secure on-site building, where they were stored in a refrigerator or iced cooler pending shipment to the analytical laboratory. The samples were repackaged in coolers containing fresh ice for transport to the laboratory, and were delivered to the laboratory under chain-of-custody by GeoEngineers personnel.

2.2.3.2. CONTAMINATED SOIL REMOVAL

Soil with apparent petroleum staining was encountered in test pits TP-2, TP-3, TP-8, TP-11, TP-14, and TP-18. This visibly impacted soil was segregated from other soil during excavation and placed in roll-off bins for subsequent characterization and disposal at Waste Management's Columbia Ridge Landfill in Oregon. Approximately 10 cubic yards of visibly impacted soil was removed from test pit TP-8. This soil contained residual heavy oil-range petroleum product and was previously encountered during the 2006 interim action completed in the Fuel Oil Tank No. 1 area (GeoEngineers, 2006). The impacted soil at location TP-8 was not removed during the 2006 interim action because it was at the base of a utility pole and could not be removed without compromising the pole. As part of the Phase 3 field investigation, the utility pole was removed

prior to excavating test pit TP-8 to allow the impacted soil to be removed. Once visibly clean limits were achieved, a verification soil sample was collected from the south sidewall of TP-8.

A total of approximately 22 cubic yards of visibly impacted soil was removed from test pits TP-2, TP-3, TP-8, TP-11, TP-14, and TP-18 for off-site disposal. Additional information regarding disposal of this soil is provided in Section 2.4.

2.2.3.3. EXPLORATORY TRENCH AT LOCATION PIPE-1-SR23

A green-colored buried pipe reportedly encountered at a depth of approximately 6 feet bgs at Upland Study Area RI sampling location SR23 in 2003 was identified in the Work Plan as a possible former wastewater drain pipe that could potentially contain hazardous substances. An attempt was made to locate this pipe on January 7, 2011 by excavating a trench approximately 30 feet long by 8 feet wide by 8 feet deep centered on the surveyed location of the SR23 sample. The trench generally trended east to west. The expected green pipe was not encountered. However, a 10-inch diameter ductile iron pipe with belled joints was observed along the base of the northern sidewall of the trench, at an approximate depth of 6 feet bgs. It is believed that this pipe may be a remnant of the mill's water supply or fire suppression system, and not related to the former wastewater drainage system. The pipe had separated at one of the bell joints, allowing the inside of the pipe to be observed. No residual material was visible in the pipe. A grab sample of groundwater in the bottom of the trench was obtained from directly below the separated bell joint using a peristaltic pump and disposable tubing. The groundwater sample was placed in a cooler containing ice and delivered to the analytical laboratory (ARI) under chain-of-custody.

2.2.4. Phase 4 – "Infill" Monitoring Well Installation and Sampling and Additional Groundwater Characterization for VOCs

Phase 4 of the supplemental upland investigation was performed to address the following data gaps identified in Exhibit B of the Agreed Order: Data Gap 1 ("Groundwater to surface water/sediment pathway is not adequately characterized"), Data Gap 2 ("Sources of groundwater contamination are not adequately characterized"), and Data Gap 9 ("Well construction information has not been evaluated for adequacy to detect DNAPLs"). The Phase 4 field investigation was completed in two phases. Phase 4A was completed between March 9 and March 11, 2011, and consisted of installing three "infill" groundwater monitoring wells (wells MW-65, MW-66, and MW-67) to fill spatial gaps in the monitoring well network. Phase 4B was completed on May 17 and 18, 2011, and consisted of constructing a deep monitoring well (well MW-68) to a total depth of 58.5 feet bgs to assess groundwater below the top of the glacial deposits (i.e., beneath the surficial fill unit) in the vicinity of former well MW-13. The well locations are shown in Figure 2.

Cascade Drilling, L.P. of Woodinville, Washington (Cascade) was contracted to drill and install the Phase 4 monitoring wells. Drilling activities conformed to State and local regulations including WAC 173-160, *Minimum Standards for Construction and Maintenance of Wells*. Cascade used a CME 75 HSA drilling rig equipped with 4.25-inch inner diameter augers to install the wells. Soil samples were obtained from the boreholes with an 18-inch Dames and Moore split-barrel sampler driven with a 300-pound auto-hammer. The soil sampling equipment was decontaminated before and after use at each sampling interval by washing in an aqueous solution of LiquiNox detergent, rinsing with potable water, and performing a final rinse with distilled water. Drilling equipment was cleaned between each boring location using a hot-water pressure washer.

During drilling of wells MW-65, MW-66, and MW-67, soil samples were obtained at 2 feet and 5 feet bgs or below the historical working surface (i.e., beneath demolition fill from mill decommissioning activities, if present), and then at 5-foot intervals to the total depth of each boring.

Three unsuccessful attempts were made to drill and install monitoring well MW-68 prior to the fourth (successful) attempt on May 17 and 18, 2011. The first attempt was completed on May 4 and 5, 2011 by Cascade using a rotosonic drilling rig. Continuous soil cores were collected from the ground surface to the total depth of this boring (100 feet bgs) for lithologic description and possible chemical analysis. During drilling, potable water was pumped through the drill casing and into the surrounding formation to remove excess drill cuttings/slough as the casing was advanced from approximately 30 feet bgs to 85 feet bgs. At a drilling depth of approximately 85 feet bgs, turbid water (assumed to be drilling return water) was observed bubbling out of cracks in the pavement near the drilling rig, suggesting a temporary increased hydraulic connection/exchange between shallow and deeper groundwater proximal to the borehole. Due to concern that groundwater sampling results from well MW-68 may not be representative if the well were installed in this borehole, the borehole was abandoned by filling it with hydrated bentonite chips. The second and third attempts to construct monitoring well MW-68 were completed on May 16 and 17, 2011 by Cascade using a CME 75 HSA drilling rig. These boreholes were drilled approximately 36 to 38 feet northwest of the initial (abandoned) borehole completed on May 4 and 5. However, large cobbles were encountered in the second and third boreholes at depths of 21 feet bgs and 5 feet bgs, respectively, resulting in drilling refusal. These boreholes also were abandoned by filling with bentonite.

During the final (successful) attempt at drilling and installing well MW-68, a 10.25-inch diameter auger was advanced to a depth of 3 feet below the top of the glacial deposits (i.e., 32 feet bgs), and a 5-foot-thick hydrated bentonite seal was installed at the bottom of the borehole before advancing the 4.25-inch diameter auger deeper into the glacial unit. Soil samples were collected at 5-foot intervals from a depth of 5 feet bgs to 30 feet bgs, and then continuously from 55 to 60.5 feet bgs. Select soil samples collected from the first (unsuccessful) boring and the final monitoring well location were submitted to ARI for laboratory analysis. Analytical results for these soil samples were not available at the time this technical memorandum was prepared; these results will be submitted as an addendum.

The field geologist maintained boring logs to record soil sampling intervals, lithologic descriptions, field screening results, and the number of hammer blows required to drive the split-barrel sampler 12 inches. Boring logs are included in Appendix B. Select soil samples obtained from the monitoring well borings were submitted to ARI for chemical analysis of COPCs. In addition, select soil samples obtained from the glacial deposits in boring MW-68 were submitted to GeoEngineers' soils laboratory for sieve analysis.

Monitoring wells MW-65 through MW-67 were constructed of 2-inch diameter, Schedule 40 PVC casing and screens. These wells were completed with 20-foot, machine-slotted screens that extended from the shallow vadose zone above the water table to the top of the glacial deposits. The surface completions for wells MW-65 through MW-67 consisted of flush-mount well boxes set in concrete. Well construction details are presented on the well logs contained in Appendix B.

Monitoring well MW-68 was constructed of 2-inch diameter, Schedule 40 PVC casing and screen. This well was completed with a 5-foot, machine-slotted screen installed at the bottom of the well. The surface completion for well MW-68 consisted of an aboveground, steel, outer protective casing set in concrete. Three steel bollards were installed around the aboveground casing to protect the wellhead. Well construction details are presented on the well log contained in Appendix B.

Wells MW-65, MW-66, and MW-67 were developed on March 10, 2011, and were sampled on March 11, 2011, within two hours of the recorded lower-low tide that day. The wells were developed using the same general method used to redevelop the existing monitoring wells in August 2010 (see Section 2.2.1). A stainless steel bailer was used to surge the wells and a Waterra check-valve pump was used for well purging.

Well MW-68 was developed on May 18, 2011. This well was developed using the same general method used to redevelop the existing monitoring wells in August 2010 (see Section 2.2.1). A stainless steel bailer was used to surge the well and a submersible pump and stainless steel bailer were used for well purging. Well MW-68 was first sampled on June 7, 2011; results from this initial sampling event were not available at the time this technical memorandum was prepared. The groundwater sampling results for well MW-68 will be submitted as an addendum.

The soil and groundwater samples collected for chemical analysis were placed in a cooler containing ice and transported to a secure on-site building, where they were stored in a refrigerator or iced cooler pending shipment to the analytical laboratory (ARI). The samples were repackaged in coolers containing fresh ice for transport to the laboratory, and were delivered to the laboratory under chain-of-custody by GeoEngineers personnel.

2.2.5. Phase 5 – Quarterly Groundwater Monitoring (Four Quarters)

In addition to the baseline groundwater sampling conducted in August 2010 (Phase 1), three additional quarterly monitoring events were completed November 8-12, 2010, February 7-11, 2011, and May 17-20, 2011. The quarterly groundwater monitoring was performed to address Data Gap 10 identified in Exhibit B of the Agreed Order ("Groundwater data are no longer current, nor sufficient for evaluating trends").

Similar to the August 2010 baseline event, during the February 2011 and May 2011 monitoring events, wells known or suspected to be influenced by tidal fluctuations based on previous RI tidal studies or proximity to the shoreline (wells MW-51, MW-53, MW-54, MW-55, MW-56, MW-57, MW-58, MW-59, MW-61, MW-62, MW-66, MW-67, and PZ-3) were sampled as close to low tide as possible (generally within two hours of lower-low tide) in order to minimize the effects of potential saltwater intrusion. During the November 2010 monitoring event, diurnal lower-low tides in the Port Angeles area occurred between the hours of 10 p.m. and 1 a.m. For safety reasons, the November 2010 groundwater sampling was conducted during daylight hours, when tidal elevations ranged from approximately +3 to +8 feet above MLLW.

The depth to groundwater in the monitoring wells was measured using an oil/water interface probe during the November 2010 monitoring event to check for the presence of NAPL. NAPL was not observed in any wells during either the November 2010 monitoring event or the baseline (August 2010) event. Consequently, an electronic water level indicator was used to gauge the monitoring

wells (with the exception of MW-60) during the February 2011 and May 2011 monitoring events. During each monitoring event, groundwater levels were measured in the shortest amount of time possible, focusing on the near-shore and known tidally-influenced wells first, followed by the wells located farther inland. The quarterly groundwater level data (presented in Table 4) were used to develop potentiometric surface maps for each monitoring event. The potentiometric maps are shown in Figures 3 through 6.

Groundwater was sampled using low-flow sampling techniques, with purge rates generally ranging between 250 and 500 milliliters per minute. The pumping rate was reduced to approximately 100 milliliters per minute for samples collected for VOC analysis. The groundwater samples were obtained with either a submersible pump with a flow controller valve (used in wells sampled for VOCs) or a peristaltic pump; dedicated tubing was used at each well. Sampling equipment also included a Horiba U-22 water quality meter with a flow-through cell and a Hach 2100P turbidimeter. The field parameter stabilization criteria used for groundwater monitoring were the same as those used for well development (stabilization criteria are defined in the SAP; Appendix A of the Work Plan).

Following field parameter stabilization at each well, groundwater samples were collected in laboratory-supplied containers, placed in coolers containing ice, and transported to a secure on-site building, where the samples were stored in a refrigerator or an iced cooler pending shipment to the analytical laboratory (ARI). The samples were repackaged in coolers containing fresh ice for transport to the laboratory, and were delivered to the laboratory under chain-of-custody by either a courier service or GeoEngineers personnel.

Analytical results for the May 2011 monitoring event were not available at the time this technical memorandum was prepared. Accordingly, only the groundwater analytical data for the August 2010, November 2010, and February 2011 quarterly monitoring events are presented and discussed in this document. Analytical results for groundwater samples collected from wells MW-65, MW-66, and MW-67 in March 2011, immediately following installation and development of these wells, also are discussed.

2.3. Archaeological and Historical Preservation

Drilling and excavation activities conducted during Phases 2, 3, and 4 of the supplemental upland investigation were observed by an archaeologist from Cascadia Archaeology of Seattle, Washington (Cascadia). The purpose and objectives of the archaeological monitoring are described in the Work Plan. The archaeological monitoring was performed in accordance with the archaeological monitoring plan contained in Appendix D of the Work Plan. Cascadia prepared an archaeological monitoring report detailing their field observations; this report is included in Appendix G. In addition to Cascadia's oversight, periodic site visits were made by archaeologists representing the City and the Lower Elwha Klallam Tribe. No culturally significant artifacts were observed in the soil borings or test pits completed during the investigation.

2.4. Investigation-Derived Waste Management

Investigation-derived waste (IDW) in the form of drill cuttings, petroleum-stained soil excavated from test pits, well development and purge water, and equipment decontamination water was

generated during the supplemental upland investigation. The handling and disposition of these materials is summarized below.

2.4.1. Soil

Soil IDW was generated by drilling and test pit excavation activities. Soil generated by drilling (drill cuttings) was placed in 55-gallon drums and staged near the former secondary wastewater treatment plant pending receipt of chemical analytical results for project soil samples. Petroleum-stained soil generated during test pit excavation was placed in roll-off bins temporarily staged in the former Log Yard near the test pits. Test pit soil samples representative of the material placed in the roll-off bins were analyzed for total petroleum hydrocarbons (TPH) and toxicity characteristic list metals to characterize the soil for disposal. The drummed soil was placed in the roll-off bins and the roll-off bins were then transported to Waste Management's Columbia Ridge Landfill in Arlington, Oregon, for disposal. The Columbia Ridge Landfill is a Resource Conservation and Recovery Act Subtitle D/non-hazardous waste disposal facility.

2.4.2. Water

Water IDW was generated by well purging during monitoring well development and groundwater sampling activities, and by drilling and sampling equipment decontamination activities. The water was temporarily stored in 275-gallon plastic totes and 55-gallon drums and staged near the former secondary wastewater treatment plant pending approval from the City to discharge the water IDW to the City's sanitary sewer system. All water IDW was discharged in this manner via a wastewater discharge sump located at the southeastern boundary of the mill property adjacent to the City's wastewater treatment plant.

2.5. Surveying

Professional land surveying services were provided by Northwest Territories, Inc. (NTI) of Port Angeles, Washington. NTI surveyed the location and elevation of all groundwater grab borings, supplemental soil borings, and monitoring wells MW-60 through MW-68. NTI also surveyed the location and elevation of the "PA" monitoring wells installed on mill property by the City in 2009 as part of planning studies for the City's CSO project. The horizontal coordinates of the sampling locations were surveyed relative to the Washington State Plane North (NAD 83[91]) coordinate system; vertical coordinates (elevations) were surveyed relative to the National Geodetic Vertical Datum of 1929. The coordinates of test pits TP-1 through TP-21 and the PIPE-1-SR23 exploratory trench were recorded by GeoEngineers personnel using a handheld Trimble global positioning system unit with sub-meter accuracy.

3.0 SUPPLEMENTAL UPLAND DATA COLLECTION RESULTS

This section presents the results of the supplemental upland field investigation. For the majority of samples collected during the supplemental upland investigation, the analytical laboratories achieved analytical method reporting limits (MRLs) that were less than or equal to the soil and groundwater screening levels established in the Work Plan. The laboratories achieved the lowest sample-specific MRLs consistent with the analytical method and any analytical constraints imposed by the sample matrix, such as matrix interferences, elevated analyte concentrations requiring sample dilutions, etc. For a small number of samples, the MRLs for certain analytes exceeded

screening levels due to matrix interference, necessary sample dilutions, or other analytical constraints. Appendix F contains data quality assessment reports for the laboratory analytical data generated during the supplemental upland investigation.

3.1. Groundwater to Surface Water Pathway Evaluation (Data Gap 1)

The groundwater to surface water/sediment pathway evaluation included performance of a seep survey, collection of surface water samples from Ennis Creek, evaluation of monitoring well coverage along the shoreline, installation of new monitoring wells along the shoreline, and collection and laboratory analysis of groundwater samples from shoreline monitoring wells. The results are summarized in the following sections.

3.1.1. Seep Survey Results

Field reconnaissance was conducted along the beach and intertidal zone adjacent to the mill property on May 11, 2010 and August 27, 2010 to conduct a visual survey for groundwater seeps that may be discharging to the marine environment along the shoreline. General shoreline conditions were noted, and the exposed portions of the beach and intertidal zone were visually surveyed for indications of seeps and/or runoff. Groundwater seeps were not observed during the field reconnaissance. Consequently, in accordance with the Work Plan, seep monitoring stations were not installed. The Work Plan indicated that if seeps were not observed, the coverage of shoreline monitoring wells would be evaluated. New shoreline wells are discussed in Section 3.1.3. A memorandum summarizing the seep survey methods and results is contained in Appendix A.

3.1.2. Surface Water Sampling Results

Five surface water samples were collected from Ennis Creek and White Creek in August 2010 as described in Section 2.2.1. The laboratory analytical results for surface water samples collected to address Data Gap 1 are presented in Appendix C. The surface water sample collection locations are shown in Figure 2.

The significant findings of the August 2010 surface water sampling event are as follows:

- The only analytes detected in the surface water samples were metals (arsenic, copper, manganese, and nickel) and dioxins/furans. TPH, semivolatile organic compounds (SVOCs) (including carcinogenic polycyclic aromatic hydrocarbons [cPAHs]), pesticides, and polychlorinated biphenyls (PCBs) were not detected in surface water.
- The detected concentrations of arsenic, copper, manganese and nickel did not exceed the respective groundwater screening levels protective of surface water, which are based on surface water regulatory criteria.
- Dioxins/furans were detected at concentrations slightly above the laboratory MRLs in all five surface water samples. The detected concentrations ranged from 1.07 picograms per liter total toxic equivalent concentration (pg/l TEC) to 1.30 pg/l TEC. These concentrations exceed the associated conservative regulatory criterion for the protection of surface water (0.0051 pg/l TEC).

- There was no significant difference between the metals and dioxin/furan concentrations detected in the surface water samples collected upstream (SW-4, SW-5) and downstream (SW-1, SW-2, SW-3) of the former mill operations areas.

The similar analytical results for the surface water samples collected upstream and downstream of the former mill operations areas, and the low or non-detect COPC concentrations detected in the samples, indicate that surface water in Ennis Creek is not impaired by the historical mill operations or by discharge of groundwater to the creek from the former mill operations areas adjacent to the creek. Therefore, the concentrations of metals and dioxins/furans detected in the August 2010 surface water samples are considered to be representative of background concentrations in surface water in the Port Angeles area.

3.1.3. Shoreline Groundwater Monitoring Well Sampling Results

Three new shoreline monitoring wells were installed during the supplemental upland investigation (wells MW-61, MW-62, and MW-67; Figure 2) to fill spatial data gaps in the monitoring well coverage along the shoreline. These three wells and eight previously installed monitoring wells (MW-51, MW-53 through MW-56, MW-59, PZ-9, and PA-24) were sampled to evaluate the groundwater to surface water/sediment pathway. The laboratory analytical results for groundwater samples collected from the shoreline monitoring wells between August 2010 and March 2011 indicate that:

- TPH, SVOCs (not including cPAHs), VOCs, pesticides, and PCBs were not detected in the shoreline wells at concentrations above the respective groundwater screening levels protective of surface water.
- cPAHs were detected at concentrations above the associated screening level protective of surface water (0.018 micrograms per liter [ug/l]) in shoreline wells MW-51 and MW-54.
- Arsenic, copper, mercury, and nickel were detected at concentrations above the respective screening levels protective of surface water in one or more of the following shoreline monitoring wells: MW-51, MW-54, MW-55, MW-56, MW-59, MW-62, and PZ-9. Additionally, manganese was detected at concentrations above the screening level protective of surface water in all of the shoreline monitoring wells except MW-56.
- Dioxins/furans were detected at concentrations above the associated screening level protective of surface water (0.0051 pg/l TEC) in all of the shoreline monitoring wells except MW-61. However, as discussed in Section 3.2.1, the cumulative groundwater and surface water sampling results from the supplemental upland investigation suggest that the dioxin/furan detections in groundwater are likely representative of background concentrations, and are unrelated to the former mill activities.

These results indicate that a complete migration pathway from groundwater to surface water/sediment may exist for a limited number of COPCs (e.g., cPAHs and metals) in limited locations. Temporal trends in groundwater COPC concentrations are discussed in Section 3.4.

3.2. Evaluation of Potential Groundwater Contamination Sources (Data Gaps 2 and 3)

Potential sources of groundwater contamination were evaluated by conducting discrete-depth soil sampling at multiple locations in former mill operations areas, collecting and analyzing soil and

groundwater samples in the vicinity of former buried process/wastewater drain piping to assess potential releases from this piping, and sampling groundwater near the upgradient (southern) boundary of the Upland Study Area to assess the potential migration of COPCs in groundwater onto the mill property from off-property sources. The scope and findings of these investigation activities are summarized below.

3.2.1. Discrete-Depth Soil Sampling (Data Gap 2)

The scope of work to evaluate potential groundwater contamination sources in Upland Study Area soil included the completion of ten soil borings (SSB-1 through SSB-10) at select locations where COPCs were previously detected in shallow soil (<2 feet bgs) at concentrations greater than ten times the respective soil screening levels. Discrete soil samples were collected at 5-foot intervals (or less) in these borings to evaluate the vertical extent of COPCs in soil that may be a source of contamination to groundwater. In addition, discrete soil samples were collected and analyzed from groundwater grab borings and monitoring well borings. The locations of soil borings, groundwater grab borings, and monitoring wells are shown in Figure 2. The laboratory analytical results for soil samples collected from these borings are summarized in Appendix C. The analytical results are discussed below by analyte group.

3.2.1.1. SVOCs (NOT INCLUDING cPAHs)

Discrete-depth soil samples were collected from soil borings SSB-1, SSB-2, SSB-3, SSB-7, and SSB-10, and groundwater grab borings GWG-5, GWG-5A, GWG-6, GWG-7, and GWG-8, to evaluate the vertical extent of SVOCs in soil that may be a source of contamination to groundwater. Additionally, the laboratory analytical results for soil samples collected from monitoring well borings MW-60, MW-61, MW-62, MW-65, MW-66, MW-67, and MW-68 were evaluated to identify potential residual soil contamination in the interim action areas that may be a source of contamination to groundwater (note: analytical results for the samples obtained from MW-68 were not available at the time this technical memorandum was prepared). SVOCs were not detected above the respective screening levels in the primary soil samples obtained from these borings, with the exception of pentachlorophenol (PCP), which was detected above the screening level in borings GWG-5, MW-60, MW-66, and SSB-1 (Appendix C). Consistent with the distribution of PCP previously documented in soil during the Upland Study Area RI, the concentrations of PCP exceeding the screening level were limited to soil samples obtained from depths shallower than 10 feet bgs. PCP was not detected in soil samples obtained from depths of 10 feet bgs or deeper.

The highest concentration of PCP (260 micrograms per kilogram [ug/kg]) was detected in the soil sample obtained from a depth of 2 feet bgs in monitoring well boring MW-60. The soil screening level for PCP (48 ug/kg) is a conservative value, calculated using the MTCA three-phase partitioning model, that is intended to be protective of groundwater as marine surface water. PCP was not detected in the quarterly groundwater samples collected from well MW-60 in November 2010 and February 2011. This indicates that the PCP detected in soil at this location is not a source of contamination to groundwater. Furthermore, there were no PCP exceedances in groundwater in any monitoring wells in August 2010, November 2010, February 2011, and/or March 2011. This suggests that there are no sources of significant PCP contamination to groundwater in soil anywhere within the Upland Study Area.

3.2.1.2. cPAHs

The vertical extent of cPAHs in soil was evaluated by collecting and analyzing discrete soil samples from soil borings SSB-1, SSB-2, SSB-3, SSB-7, and SSB-10, groundwater grab borings GWG-5, GWG-5A, GWG-6, GWG-7, and GWG-8, and monitoring well borings MW-60, MW-61, MW-62, MW-65, MW-66, MW-67, and MW-68 (note: analytical results for the samples obtained from MW-68 were not available at the time this technical memorandum was prepared). The soil screening level for total cPAHs (140 ug/kg TEC), which is based on protection of human health via direct contact, was exceeded in soil samples obtained from borings GWG-5, MW-60, MW-66, SSB-2, and SSB-7. With one exception, the cPAH exceedances were limited to soil samples obtained from depths of 5 feet bgs or shallower. The exception was the soil sample obtained from 10 feet bgs in boring MW-60; in addition to exceeding the direct contact-based screening level, the cPAH concentration in this sample also exceeded the regulatory criterion protective of groundwater (350 ug/kg TEC). No other soil samples had cPAH concentrations that exceeded the criterion protective of groundwater.

The concentration of cPAHs detected in the groundwater sample collected from well MW-60 in November 2010 (0.0195 ug/l TEC) slightly exceeded the screening level of 0.018 ug/l TEC. However, cPAHs were not detected in the groundwater sample collected from well MW-60 in February 2011 (Appendix C). These results indicate that the cPAHs detected in soil in boring MW-60 are not a significant source of contamination to groundwater. The lack of soil cPAH detections exceeding the regulatory criterion protective of groundwater in the other borings suggests that there are no sources of significant cPAH contamination to groundwater in soil anywhere within the Upland Study Area.

3.2.1.3. TPH

The vertical extent of TPH in soil was evaluated by collecting and analyzing discrete soil samples from soil borings SSB-1, SSB-2, and SSB-7, groundwater grab borings GWG-4, GWG-6, GWG-7, and GWG-8, and monitoring well borings MW-60, MW-61, MW-62, MW-65, MW-67, and MW-68 (note: analytical results for the samples obtained from MW-68 were not available at the time this technical memorandum was prepared). Diesel- and heavy oil-range TPH were detected at concentrations exceeding screening levels in soil samples obtained from depths of 2 to 15 feet bgs in borings MW-60 and SSB-1 (Appendix C). Deeper soil samples collected from these borings did not contain TPH concentrations above the screening levels.

The soil screening levels for diesel- and heavy oil-range TPH (200 milligrams per kilogram [mg/kg]) are based on protection of terrestrial ecological receptors. The soil concentration of diesel- and heavy oil-range TPH established in the Work Plan for protection of groundwater as marine surface water is 2,000 mg/kg (GeoEngineers, 2010). Only the concentrations of TPH detected at 10 feet bgs in boring MW-60 exceeded 2,000 mg/kg. Diesel- and heavy oil-range TPH were not detected in the quarterly groundwater samples collected from well MW-60 in November 2010 and February 2011, indicating that the TPH detected in soil at this location is not a source of contamination to groundwater.

Soil and groundwater sampling was conducted at groundwater grab boring locations GWG-6, GWG-7, andGWG-8 in the vicinity of City monitoring well PA-19 to assess the potential presence of diesel- and heavy oil-range TPH exceeding screening levels in this area. Diesel-range TPH was reportedly detected at a concentration of 3.0 milligrams per liter (mg/l) in a groundwater sample

collected from well PA-19 by the City in 2009. Diesel- and/or heavy oil-range TPH was detected in soil at 2 feet bgs in borings GWG-6, GWG-7, and GWG-8, but the detected concentrations did not exceed screening levels. Diesel- and heavy oil-range TPH were not detected in the groundwater grab samples obtained from borings GWG-6, GWG-7, and GWG-8. The quarterly groundwater samples collected from well PA-19 in August 2010, November 2010, and February 2011 also did not contain detectable concentrations of TPH (Appendix C). These results indicate that only minor TPH detections below screening levels exist in soil and groundwater in the vicinity of City monitoring well PA-19.

TPH was not detected in groundwater in any monitoring wells in August 2010, November 2010, February 2011, and/or March 2011. This suggests that there are no sources of significant TPH contamination to groundwater in soil anywhere within the Upland Study Area.

3.2.1.4. PCBs

The vertical extent of PCBs in soil was evaluated by collecting and analyzing discrete soil samples from soil borings SSB-1, SSB-2, SSB-4, SSB-5, SSB-6, SSB-7, and SSB-10, groundwater grab borings GWG-4, GWG-5, GWG-5A, GWG-6, GWG-7, and GWG-8, and monitoring well borings MW-60, MW-61, MW-62, MW-65, and MW-66. Concentrations of total PCBs exceeding the screening level of 0.004 mg/kg were detected in soil samples collected from all the borings except GWG-6, GWG-7, GWG-8, MW-65, and SSB-4. The soil screening level for PCBs is based on the protection of groundwater as marine surface water, adjusted for the laboratory practical quantitation limit. The soil PCB exceedances were detected at depths of 2 to 25 feet bgs, and consisted of Aroclor-1254 and/or Aroclor-1260. The PCB exceedances in soil at locations GWG-4, GWG-5, and MW-66 were collocated with PCB exceedances in groundwater samples collected at these locations, suggesting that the PCBs detected in soil at these locations may be a localized source of contamination to groundwater. However, PCBs were not detected in the groundwater samples collected from monitoring wells MW-60, MW-61, and MW-62 in November 2010, February 2011, and/or March 2011 (Appendix C), which indicates that the PCBs detected in soil at these locations are not a source of contamination to groundwater. The apparent correlation of PCB exceedances in soil with PCB exceedances in groundwater in some locations, but not in others, suggests that there are isolated areas of elevated PCB concentrations in soil that may act as localized sources of contamination to groundwater but not surface water. The existing sampling data suggest that these isolated areas of contamination are relatively small and are distributed heterogeneously in soil.

3.2.1.5. PESTICIDES

The vertical extent of pesticides in soil was evaluated by collecting and analyzing discrete soil samples from soil borings SSB-1, SSB-2, SSB-6, SSB-7, and SSB-10, and groundwater grab borings GWG-4, GWG-5, and GWG-5A. Pesticides were not detected in any of the soil samples. Select non-detect pesticide results for some of the soil samples (especially the two samples obtained from boring GWG-5) had elevated laboratory MRLs that exceeded screening levels due to matrix interferences. Pesticides were not detected in groundwater in any monitoring wells in August 2010, November 2010, or February 2011. This fact, combined with the lack of pesticide detections in soil, suggests that there are no sources of pesticide contamination to groundwater in soil anywhere within the Upland Study Area.

3.2.1.6. METALS

The vertical extent of metals in soil was evaluated by collecting and analyzing discrete soil samples from soil borings SSB-1, SSB-2, SSB-4, SSB-7, SSB-8, SSB-9, and SSB-10, groundwater grab borings GWG-5, GWG-5A, GWG-6, GWG-7, and GWG-8, and monitoring well borings MW-60, MW-61, MW-65, MW-66, and MW-67. With the exception of samples from borings MW-60 and MW-61, which were analyzed only for lead, concentrations of metals exceeding the respective screening levels were detected in one or more soil samples collected from all the borings. The metals that exceeded screening levels include arsenic, barium, cadmium (one sample only), chromium, cobalt, copper, lead, manganese, mercury, nickel, selenium, vanadium, and zinc. The majority of the metals exceedances were detected in samples obtained from depths of 10 feet bgs or less. However, chromium exceedances were detected at depths up to 20 feet bgs, nickel exceedances were detected at depths up to 24 feet bgs, and copper and vanadium exceedances were detected at depths up to 30 feet bgs (the maximum depth sampled in any boring).

Screening level exceedances of barium, chromium, cobalt, copper, nickel, and vanadium were detected in soil samples obtained in upgradient/background monitoring well boring MW-64 (this well is discussed further in Section 3.2.3), and the concentrations of these metals detected in MW-64 were similar to the concentrations detected in the majority of the borings in the former mill operations areas. Therefore, with limited exceptions (nickel in shallow soil at boring GWG-5; chromium, copper, nickel, and vanadium in shallow soil at boring GWG-5A; barium, chromium, and copper in shallow soil at boring SSB-2; and barium, copper, and nickel in shallow soil at boring SSB-10), the concentrations of barium, chromium, cobalt, copper, nickel, and vanadium detected in soil in the Upland Study Area appear to reflect site-specific background concentrations.

Among those metals that were detected above screening levels and appear to be present at concentrations greater than site-specific and Puget Sound regional background levels (arsenic, cadmium, lead, manganese, mercury, selenium, and zinc), four metals – arsenic, cadmium, manganese, and mercury – have screening levels that are based on protection of groundwater as marine surface water. The other three metals – lead, selenium, and zinc – have screening levels that are based on protection of terrestrial ecological receptors (the terrestrial ecological-based soil screening levels for these metals are more stringent than the regulatory criteria protective of human health direct-contact and groundwater as marine surface water). Metals that have been detected in groundwater at concentrations exceeding screening levels include arsenic, copper, lead, manganese, mercury, nickel, and zinc. Cadmium and selenium have not been detected above screening levels in groundwater; this indicates that the existing concentrations of these metals in soil are protective of groundwater. With the limited exceptions identified above, the concentrations of copper and nickel detected in soil appear to reflect site-specific background concentrations. Of the remaining metals detected above screening levels in groundwater, only arsenic, manganese, mercury, and zinc were detected in soil at concentrations exceeding regulatory criteria protective of groundwater as marine surface water; the lead concentrations detected in soil do not exceed the associated criterion protective of groundwater (1,600 mg/kg).

The cumulative soil and groundwater sampling results indicate that arsenic, copper, manganese, mercury, nickel, and zinc are present in Upland Study Area soil at concentrations that may represent a source of contamination to groundwater. Although lead has been detected above screening levels in groundwater, lead was not detected in soil at concentrations exceeding the

regulatory criterion protective of groundwater during the supplemental upland field investigation. The arsenic and manganese concentrations that may represent a source of contamination to groundwater, and the possible mill-related copper and nickel concentrations that may represent a source of contamination to groundwater, are limited to the upper 5 feet of soil. The mercury and zinc concentrations that may represent a source of contamination to groundwater are limited to the upper 10 feet of soil. The sampling results further suggest that shallow soil concentrations of arsenic, manganese, mercury, and zinc exceeding regulatory criteria protective of groundwater are nearly ubiquitous throughout the former mill operations areas and appear to be elevated relative to background levels, whereas shallow soil concentrations of copper and nickel that exceed criteria protective of groundwater, and that may be related to former mill operations, are more localized. During the supplemental upland field investigation, detections of possible mill-related copper and nickel exceedances were limited to the upper 5 feet of soil at boring locations GWG-5, GWG-5A, SSB-2, and/or SSB-10. Copper, but not nickel, was detected above the associated groundwater screening level in monitoring well MW-65, which is near borings GWG-5 and GWG-5A (Figure 2). Copper and nickel were not detected above groundwater screening levels in monitoring well MW-23 during the investigation; well MW-23 is adjacent to boring SSB-2 (Figure 2). Copper and nickel were both detected in at least one groundwater sample obtained from well PZ-11 during the investigation; well PZ-11 is near boring SSB-10.

3.2.1.7. DIOXINS/FURANS

The existing soil analytical data, including the results of the supplemental upland investigation and previous investigations, suggest that the highest dioxin/furan concentrations detected in soil generally occur in shallow, near-surface soil. The data further suggest that dioxin/furan concentrations decrease with depth. Dioxin/furan concentrations exceeding the associated screening level are generally limited to the upper 10 feet of soil.

The vertical extent of dioxins/furans in soil was evaluated by collecting and analyzing discrete soil samples from soil borings SSB-1, SSB-7, and SSB-10, groundwater grab boring GWG-1, and monitoring well borings MW-65, MW-66, and MW-67. Dioxins/furans were detected at concentrations exceeding the screening level in soil samples obtained from 2.5 feet bgs in boring MW-66, 7 feet bgs in boring SSB-1, 10 feet bgs in boring SSB-7, and 2 feet and 5 feet bgs in boring SSB-10. The dioxin/furan concentrations detected in deeper soil samples obtained from these borings, and in all of the samples obtained from borings GWG-1, MW-65, and MW-67 were less than the screening level. The soil screening level for dioxins/furans (5.2 nanograms per kilogram [ng/kg] TEC) is based on the protection of groundwater as marine surface water, adjusted for the Washington state background concentration.

Dioxins/furans were detected in the majority of the groundwater samples analyzed for this COPC during the supplemental upland investigation. However, the groundwater analytical data suggest that the dioxin/furan concentrations detected in groundwater samples are highly sensitive to the suspended solids content of the (unfiltered) samples. The highest dioxin/furan concentrations were detected in the baseline groundwater samples collected from the existing monitoring wells in August 2010, shortly after the wells were redeveloped. The measured turbidities of the samples collected in November 2010 and February 2011 were consistently lower than the turbidities measured in August 2010. Similarly, the dioxin/furan concentrations detected in the November 2010 and February 2011 groundwater samples were consistently lower than the concentrations

detected in August 2010. In August 2010, dioxins/furans were detected in all 23 samples analyzed for this COPC, and the detected concentrations ranged from 1.28 to 62.4 pg/l TEC. In November 2010, dioxins/furans were detected in 9 of the 11 samples analyzed for this COPC, and the detected concentrations ranged from 1.29 to 4.43 pg/l TEC. In February 2011, dioxins/furans were detected in 9 of the 17 samples analyzed for this COPC, and the detected concentrations ranged from 1.32 to 2.07 pg/l TEC. All of the dioxin/furan detections in groundwater exceed the conservative regulatory criterion for the protection of marine surface water (0.0051 pg/l TEC). However, the dioxin/furan concentrations detected in the November 2010 and February 2011 groundwater samples are similar to the concentrations detected in the surface water samples collected from Ennis Creek and White Creek in August 2010, which are considered representative of background conditions (see Section 3.1.2). This similarity in concentrations suggests that the dioxin/furan detections in groundwater in November 2010 and February 2011 are likely representative of background concentrations.

The higher dioxin/furan concentrations detected in many of the August 2010 groundwater samples (43 percent of these samples had concentrations greater than 3 pg/l TEC, and 26 percent had concentrations greater than 10 pg/l TEC) were likely biased high as a result of contribution from adsorbed-phase dioxins/furans on fine-grained suspended solids (silt and clay particles) in the samples. The August 2010 groundwater samples likely contained more suspended solids than the samples analyzed during subsequent quarters because they were collected approximately 2 to 3 days after the monitoring wells were redeveloped. Well development can lead to a temporary increase in suspended solids in the well, and these solids can remain suspended for weeks or months if they are small enough (e.g., clay particles). This explanation for the higher dioxin/furan concentrations in August 2010 is generally supported by field measurements of groundwater turbidity. In August 2010, the measured turbidities of the 23 groundwater samples analyzed for dioxins/furans ranged from 3.0 to 320 NTU, and 74 percent of the samples (17 samples) had turbidities greater than 10 NTU. In November 2010, the measured turbidities of the 11 groundwater samples analyzed for dioxins/furans ranged from 1.0 to 278 NTU, and only 18 percent of the samples (two samples) had turbidities greater than 10 NTU. In February 2011, the measured turbidities of the 17 groundwater samples analyzed for dioxins/furans ranged from 0.33 to 27.3 NTU, and 24 percent of the samples (four samples) had turbidities greater than 10 NTU.

In summary, no sources of significant dioxin/furan contamination to groundwater were identified in soil during the supplemental upland investigation. The similarity of dioxin/furan concentrations detected in groundwater in November 2010 and February 2011 to the concentrations detected in surface water (Ennis Creek and White Creek) in August 2010 suggests that the low-level dioxin/furan detections in groundwater are likely attributable to the presence of small quantities of suspended solids containing adsorbed dioxins/furans or to background dissolved concentrations. The elevated dioxin/furan concentrations detected in many of the August 2010 groundwater samples were likely biased high due to greater quantities of suspended solids in the August 2010 samples.

3.2.1.8. SUMMARY

The results of the discrete-depth soil sampling completed to evaluate the vertical extent of COPCs in soil and their potential to act as a source of contamination to groundwater indicate that, in general, COPC concentrations are highest in shallow soil (i.e., in the upper 5 to 10 feet of soil) and

decrease with depth. Additional findings from the evaluation of discrete-depth soil data and groundwater monitoring data include:

- No source areas of pesticide contamination or significant TPH or SVOC (including cPAHs) contamination to groundwater were identified in soil within the Upland Study Area.
- Isolated areas of elevated PCB concentrations appear to exist in soil that may act as localized sources of contamination to groundwater. The existing sampling data suggest that these isolated areas of contamination are relatively small and are distributed heterogeneously in soil.
- With limited exceptions, the concentrations of barium, chromium, cobalt, copper, nickel, and vanadium detected in soil in the Upland Study Area appear to reflect site-specific background concentrations.
- The cumulative soil and groundwater sampling results indicate that several metals that may be related to former mill operations – arsenic, copper, manganese, mercury, nickel, and zinc – are present in Upland Study Area soil at concentrations that may represent a source of contamination to groundwater. The possible mill-related arsenic, copper, manganese, and nickel concentrations that may represent a source of contamination to groundwater are limited to the upper 5 feet of soil. The mercury and zinc concentrations that may represent a source of contamination to groundwater are limited to the upper 10 feet of soil.
- Shallow soil concentrations of arsenic, manganese, mercury, and zinc that exceed regulatory criteria protective of groundwater are nearly ubiquitous throughout the former mill operations areas and appear to be elevated relative to background levels. Shallow soil concentrations of copper and nickel that exceed criteria protective of groundwater, and that appear to be elevated relative to background levels, are more localized.
- No sources of significant dioxin/furan contamination to groundwater were identified in soil during the supplemental upland investigation. The similarity of dioxin/furan concentrations detected in groundwater in November 2010 and February 2011 to the concentrations detected in surface water (Ennis Creek and White Creek) in August 2010 suggests that the dioxin/furan detections in groundwater are likely attributable to suspended solids or background dissolved concentrations. The elevated dioxin/furan concentrations detected in many of the August 2010 groundwater samples were likely biased high due to greater quantities of suspended solids in the August 2010 samples.

3.2.2. Process Piping Assessment (Data Gap 3)

Soil and groundwater sampling was conducted in the vicinity of the former underground wastewater drain piping network in the Main Former Mill Area (Figure 2) to assess potential releases from the piping. In addition, an attempt was made to expose and sample the residual contents (e.g., liquid, sludge) of a fiberglass or plastic pipe (presumed to be a wastewater drain pipe) that was encountered at a depth of 6 feet bgs during the 2003 Upland Study Area RI. Trenching performed during the supplemental upland investigation was unsuccessful in locating this pipe. However, an iron pipe with belled joints was discovered (possibly a remnant of the mill's water supply or fire suppression system), and a grab sample of groundwater was collected and analyzed from the exploration trench, directly below a separated joint in this pipe. The results of the process piping assessment are summarized below.

3.2.2.1. SOIL AND GROUNDWATER SAMPLING

Discrete soil samples were collected and analyzed from soil boring SSB-6, groundwater grab borings GWG-1, GWG-4, GWG-5, and GWG-5A, and monitoring well borings MW-65 and MW-66 in the vicinity of the former wastewater drain piping network. Groundwater sampling locations in the vicinity of the former wastewater drain piping include groundwater grab borings GWG-1 through GWG-5 and monitoring wells MW-51, MW-56, MW-58, MW-65, and MW-66. The analytical results for soil and groundwater samples collected from these locations were evaluated to assess potential releases that may have occurred from the former wastewater drain piping.

The soil samples were analyzed for TPH, SVOCs, PCBs, pesticides, metals, and/or dioxins/furans. The groundwater grab samples were analyzed for PCBs, metals, dioxins/furans, and ammonia, and the groundwater grab sample from boring GWG-1 was analyzed for the additional parameters TPH, VOCs, SVOCs, and pesticides based on the anomalous dark brown color of this sample. The groundwater samples collected from monitoring wells were analyzed for TPH, VOCs, SVOCs, PCBs, pesticides, metals, dioxins/furans, and/or ammonia.

COPCs detected at concentrations exceeding screening levels in both soil and groundwater in the vicinity of the former wastewater drain piping network include cPAHs, PCBs, dioxins/furans, and metals. In addition, ammonia (un-ionized) was detected above the screening level in several groundwater samples collected from groundwater grab borings and monitoring wells (soil samples were not analyzed for ammonia). Taken alone, the locations, depths, and relative magnitudes of these COPC exceedances suggest that the elevated concentrations of cPAHs, PCBs, metals, and ammonia detected in soil and/or groundwater in the vicinity of the wastewater drain piping network may be at least partially related to past releases from the piping. However, as discussed in the Work Plan (GeoEngineers, 2010), organic pollutants in wastewater from the pulp production process mainly consisted of dissolved sugars and organic acids; the wastewater would not have contained cPAHs or PCBs. Furthermore, because metals exceedances are widely distributed in soil and groundwater across the mill property, it is unlikely that the metals detected in the vicinity of the former wastewater drain piping are related to piping releases. It is more likely that elevated metals concentrations in soil and groundwater are the result of corrosion of metal infrastructure (tanks, piping, etc.) over years of operation of the mill facility.

No significant “hot spots” of contamination were discovered in the vicinity of the former wastewater drain piping, such as might be expected had there been a large leak or rupture in the piping. Rather, the data suggest that if the detected COPC exceedances were caused by releases from the wastewater drain piping, the releases likely occurred through small leaks over a large area of piping during the course of normal mill operations.

3.2.2.2. PROCESS PIPING SAMPLING

The groundwater grab sample collected from the trench that was excavated to explore for the presumed wastewater drain pipe encountered during the 2003 Upland Study Area RI (sample PIPE-1-SR23) had the same dark brown color as the groundwater grab sample obtained from boring GWG-1. Sample PIPE-1-SR23 also appeared to be highly turbid due to groundwater disturbance and mixing with soil during the trenching activities. The sample was analyzed for TPH, VOCs, SVOCs, PCBs, metals, dioxins/furans, and ammonia. The sample aliquot analyzed for metals was field-filtered to remove suspended solids. COPCs detected above groundwater screening levels in grab sample PIPE-1-SR23 include cPAHs, PCBs, metals (arsenic, copper, lead,

manganese, and nickel), dioxins/furans, and ammonia. The relatively high concentration of dioxins/furans detected in the sample (678 pg/l TEC) is likely attributable to the significant volume of suspended solids in the sample, and is not considered representative of groundwater or liquids that may have been present historically in the pipe. The analytical results for groundwater grab sample PIPE-1-SR23 are consistent with the interpretation of the soil and groundwater sampling results presented above; that is, the elevated concentrations of cPAHs, PCBs, and ammonia detected in soil and/or groundwater in the vicinity of the wastewater drain piping network may be at least partially related to past releases from the piping. Based on Rayonier's knowledge of the pulp production process, ammonia could have been present in the process wastewater, but cPAHs and PCBs were not typical wastewater constituents; these constituents were more commonly associated with petroleum products (e.g., Bunker C and hydraulic oil) that were used at the mill. The distribution of metals and dioxin/furan concentrations in soil and groundwater indicate that these COPCs are likely unrelated to piping releases.

3.2.2.3. SUMMARY

The results of the sampling completed to evaluate potential releases from the wastewater drain piping suggest that the distribution of COPCs in the subsurface beneath the Main Former Mill Area is heterogeneous. Concentrations of COPCs exceeding screening levels appear to occur in isolated areas of contamination; there is no evidence that broad plumes of COPCs exist in soil or groundwater. Elevated concentrations of ammonia detected in groundwater in the vicinity of the wastewater drain piping network may be related to past releases from the piping. Elevated concentrations of cPAHs, PCBs, metals, and dioxins/furans detected in the vicinity of the wastewater drain piping network are likely unrelated to piping releases.

3.2.3. Potential Migration from Off-Property Sources (Data Gap 2)

Monitoring well MW-64 was installed near the upgradient (southern) boundary of the Upland Study Area (Figure 2) to assess the potential migration of COPCs in groundwater onto the mill property from off-property sources. Soil samples were collected during drilling, and groundwater samples were collected from well MW-64 in November 2010 and February 2011. The soil and groundwater samples were analyzed for pesticides, metals, and dioxins/furans.

Pesticides and dioxins/furans were not detected in either the soil or groundwater samples collected from well MW-64. Barium, chromium, cobalt, copper, nickel, and vanadium were detected above the respective soil screening levels in select soil samples. In general, the exceedances of these metals were not significantly elevated relative to the screening levels (vanadium was the exception), and the detected concentrations are assumed to represent site-specific background concentrations in soil. Metals were not detected above screening levels in the groundwater samples collected from well MW-64. Based on the results of the soil and groundwater sampling at upgradient well MW-64, there is no evidence that COPCs are migrating onto the mill property from off-property sources.

3.2.4. Summary of Potential Groundwater Contamination Sources Evaluation

The results of the discrete-depth soil sampling completed to evaluate the vertical extent of COPCs in soil and their potential to act as a source of contamination to groundwater indicate that, in general, COPC concentrations are highest in shallow soil (i.e., in the upper 5 to 10 feet of soil) and

decrease with depth. Additional findings from the evaluation of discrete-depth soil data and groundwater monitoring data include:

- The subsurface in former mill process areas is heterogeneous; concrete footings, foundations, wood pilings, cribbing, and other structures are common. As a result, COPCs in the subsurface in the former process areas typically exist in isolated areas of contamination in and around these structures.
- No source areas of pesticide contamination or significant TPH or SVOC (including cPAHs) contamination to groundwater were identified in soil within the Upland Study Area.
- Isolated areas of elevated PCB concentrations appear to exist in soil that may act as localized sources of contamination to groundwater. The existing sampling data suggest that these isolated areas of contamination are relatively small and are distributed heterogeneously in soil.
- With limited exceptions, the concentrations of barium, chromium, cobalt, copper, nickel, and vanadium detected in soil in the Upland Study Area appear to reflect site-specific background concentrations.
- The cumulative soil and groundwater sampling results indicate that several metals that may be related to former mill operations – arsenic, copper, manganese, mercury, nickel, and zinc – are present in Upland Study Area soil at concentrations that may represent a source of contamination to groundwater. The possible mill-related arsenic, copper, manganese, and nickel concentrations that may represent a source of contamination to groundwater are limited to the upper 5 feet of soil. The mercury and zinc concentrations that may represent a source of contamination to groundwater are limited to the upper 10 feet of soil.
- Shallow soil concentrations of arsenic, manganese, mercury, and zinc that exceed regulatory criteria protective of groundwater are nearly ubiquitous throughout the former mill operations areas and appear to be elevated relative to background levels. Shallow soil concentrations of copper and nickel that exceed criteria protective of groundwater, and that appear to be elevated relative to background levels, are more localized.
- No sources of significant dioxin/furan contamination to groundwater were identified in soil during the supplemental upland investigation. The similarity of dioxin/furan concentrations detected in groundwater in November 2010 and February 2011 to the concentrations detected in surface water (Ennis Creek and White Creek) in August 2010 suggests that the dioxin/furan detections in groundwater are likely attributable to suspended solids or background dissolved concentrations. The elevated dioxin/furan concentrations detected in many of the August 2010 groundwater samples were likely biased high due to greater quantities of suspended solids in the August 2010 samples.

The results of the sampling completed to evaluate potential releases from the wastewater drain piping suggest that the distribution of COPCs in the subsurface beneath the Main Former Mill Area is heterogeneous. Concentrations of COPCs exceeding screening levels appear to occur in isolated areas of contamination; there is no evidence that broad plumes of COPCs exist in soil or groundwater. Elevated concentrations of ammonia detected in groundwater in the vicinity of the wastewater drain piping network may be related to past releases from the piping. Elevated concentrations of cPAHs, PCBs, metals, and dioxins/furans detected in the vicinity of the wastewater drain piping network are likely unrelated to piping releases.

Based on the results of the soil and groundwater sampling at upgradient well MW-64, there is no evidence that COPCs are migrating onto the mill property from off-property sources.

3.3. Former Interim Action Areas Characterization (Data Gaps 4, 5, 6, 7, and 8)

Twenty-one test pits were completed to evaluate the extent of residual soil contamination in the former interim action areas, in accordance with the Work Plan. The test pit excavation and soil sampling methods are summarized in Section 2.2.3. In addition, groundwater quality downgradient of the interim action areas was assessed by evaluating the results of groundwater monitoring conducted at downgradient monitoring wells in 2010 and 2011. This section summarizes the results of the former interim action areas characterization.

3.3.1. Wood Mill Area (Data Gap 4)

Test pits TP-01 through TP-03 and TP-20 were completed beyond the eastern limit of the Wood Mill interim action area to evaluate the extent of residual soil contamination (Figure 2). The following COPCs were detected at concentrations exceeding screening levels in soil samples collected from test pits TP-01 through TP-03 (see tables in Appendix C for concentrations and sample depths):

- TP-01: PCBs
- TP-02: diesel- and heavy oil-range TPH; copper, mercury, vanadium, and zinc; PCBs
- TP-03: diesel- and heavy oil-range TPH; lead; cPAHs; PCBs

No soil samples were obtained from test pit TP-20. A large number of closely-spaced concrete footings were encountered in this test pit below a depth of approximately 3.5 feet bgs and prevented excavation and sampling below this depth. There was no field screening evidence of contamination in the concrete rubble, debris, and fill soil above 3.5 feet bgs in test pit TP-20.

The results of groundwater monitoring conducted at wells MW-54, MW-55, and PZ-3 between August 2010 and February 2011 were evaluated to assess the extent of downgradient groundwater impacts associated with potential residual soil contamination in the Wood Mill interim action area. The primary organic COPCs of interest in this interim action area (TPH, SVOCs, and PCBs) were not detected in wells MW-54, MW-55, and PZ-3 at concentrations exceeding the screening levels, with the exception of bis(2-ethylhexyl)phthalate, which was detected slightly above the screening level in well PZ-3 in August 2010, and cPAHs, which were detected above the screening level in well MW-54 in August 2010. Copper was detected above the screening level in two or more quarterly groundwater samples obtained from each of the wells, and mercury was detected above the screening level in well PZ-3 in August 2010. Lead and zinc were not detected above screening levels, although the laboratory MRLs for lead in the samples obtained from wells MW-54 and MW-55 were higher than the screening level. Vanadium does not have an established screening level.

Metals and residual contamination consisting of TPH, cPAHs, and PCBs is present in soil at concentrations exceeding the respective screening levels to the east of the Wood Mill interim action area. Based on groundwater monitoring conducted at downgradient wells MW-54, MW-55, and PZ-3 between August 2010 and February 2011, the residual soil contamination does not appear to be a significant source of COPCs to groundwater. Likewise, with the possible exception

of copper, the metals detected in the Wood Mill area soil do not appear to be a significant source of metals to groundwater.

3.3.2. Machine Shop Area (Data Gap 4)

Test pits TP-09, TP-10, TP-14, and TP-21 were completed beyond the eastern, southern, and western limits of the Machine Shop interim action area to evaluate the extent of residual soil contamination (Figure 2). Soil sampling results from soil boring SSB-4 also were used to assess this area. The following COPCs were detected at concentrations exceeding screening levels in soil samples collected from these explorations (see tables in Appendix C for concentrations and sample depths):

- TP-09: no exceedances
- TP-10: lead and PCBs
- TP-14: diesel- and heavy oil-range TPH; lead; PCBs
- TP-21: no exceedances
- SSB-4: chromium, copper, nickel, and vanadium

Following receipt of the initial soil analytical results, follow-up analysis for lead was performed on select soil samples from test pits TP-10 and TP-14 using the toxicity characteristic leaching procedure (TCLP) to characterize soil in the roll-off bins for disposal (see Sections 2.2.3 and 2.4.1). Concentrations of lead exceeding the dangerous waste threshold (WAC 173-303) were not detected in the TCLP extract.

The results of groundwater monitoring conducted at well PZ-4 between August 2010 and February 2011 were evaluated to assess the extent of downgradient groundwater impacts associated with potential residual soil contamination in the Machine Shop interim action area. The primary organic COPCs of interest in this interim action area (TPH, SVOCs, and PCBs) were not detected in well PZ-4. Copper, lead, and nickel were each detected above screening levels at least once in unfiltered quarterly groundwater samples collected from well PZ-4; however, these metals were not detected above screening levels in filtered samples. Chromium was not detected above the screening level; vanadium does not have an established screening level.

Metals and residual contamination consisting of TPH and PCBs is present in soil at concentrations exceeding the respective screening levels to the southeast and west of the Machine Shop interim action area. Based on groundwater monitoring conducted at downgradient well PZ-4 between August 2010 and February 2011, the residual soil contamination does not appear to be a significant source of COPCs to groundwater. Likewise, the metals detected in the Machine Shop area soil do not appear to be a significant source of metals to groundwater.

3.3.3. Fuel Oil Tank No. 2 and Hog Fuel Pile Areas (Data Gaps 4, 5, and 6)

Test pits TP-04 through TP-07, TP-11 through TP-13, and TP-15 through TP-19 were completed in the vicinity of the Fuel Oil Tank No. 2 and Hog Fuel Pile interim action areas to evaluate the extent of residual soil contamination (Figure 2). Soil sampling results from monitoring well borings MW-60, MW-61, and MW-67 also were used to assess these areas. Soil samples were not collected from test pits TP-13 and TP-17 because concrete rubble was present from the ground

surface to the shallow groundwater table (encountered at 4 feet bgs) at these locations, and there was insufficient granular matrix to obtain a sample. Soil samples also were not collected from test pits TP-18 and TP-19 because field screening indicated that soil at these locations was likely contaminated with petroleum hydrocarbons. Based on the similarity of field screening results at test pits TP-18 and TP-19 to field screening results at test pit TP-11, it was assumed that COPC concentrations detected in soil at test pit TP-11 would be representative of concentrations at test pits TP-18 and TP-19.

The following COPCs were detected at concentrations exceeding screening levels in soil (see tables in Appendix C for concentrations and sample depths):

- TP-04: lead and PCBs
- TP-05: barium, chromium, copper, manganese, nickel, vanadium, and zinc; PCBs
- TP-06: PCBs
- TP-07: barium, chromium, copper, lead, manganese, mercury, nickel, silver, vanadium, and zinc; PCBs
- TP-11: diesel- and heavy oil-range TPH; lead; cPAHs; PCBs
- TP-12: heavy oil-range TPH; lead; cPAHs; PCP; PCBs
- TP-15: diesel- and heavy oil-range TPH; lead; cPAHs; PCBs
- TP-16: no exceedances
- MW-60: diesel- and heavy oil-range TPH; cPAHs; PCP; PCBs
- MW-61: PCBs
- MW-67: copper, lead, and vanadium

Following receipt of the initial soil analytical results, follow-up analysis for lead or chromium was performed on select soil samples from test pits TP-05, TP-07, TP-11, TP-12, and TP-15 using the TCLP to characterize soil in the roll-off bins for disposal (see Sections 2.2.3 and 2.4.1). Concentrations of lead and chromium exceeding the dangerous waste threshold (WAC 173-303) were not detected in the TCLP extract.

Test pit TP-07 was completed to a total depth of 8 feet bgs at the location of former monitoring well MW-11 (Figure 2) to evaluate the potential presence of residual petroleum contamination. Well MW-11 was removed during the 2001 interim action at Fuel Oil Tank No. 2; NAPL (oil) was previously observed in this well. Groundwater was observed entering test pit TP-07 at a depth of approximately 6 feet bgs. Field screening did not identify the presence of petroleum contamination, and TPH and SVOCs were not detected above screening levels in soil samples collected from test pit TP-07. However, as indicated above, metals and PCBs were detected above screening levels in soil at this location.

The results of groundwater monitoring conducted at monitoring wells MW-23, MW-28, MW-29, MW-60, MW-61, and MW-67 between August 2010 and March 2011 were evaluated to assess the extent of downgradient groundwater impacts associated with potential residual soil contamination in the Fuel Oil Tank No. 2 and Hog Fuel Pile interim action areas. TPH and PCP were not detected

in any of the wells. The following organic COPCs of interest were detected above screening levels in the four wells closest to the interim action areas (i.e., "near-source" wells MW-23, MW-28, MW-29, and MW-60): cPAHs (wells MW-28, MW-29, and MW-60); bis(2-ethylhexyl)phthalate (well MW-29 – one sample only); and PCBs (well MW-28 – one sample only, marginally exceeded the screening level). None of the organic COPCs of interest that were analyzed in downgradient wells MW-61 and MW-67 was detected above screening levels. Manganese was detected above the screening level in all six wells. The manganese concentrations in downgradient well MW-67 were less than the concentrations in the near-source wells closest to this well (MW-23, MW-28, and MW-29), and the manganese concentrations in downgradient well MW-61 were less than the concentrations in the near-source well closest to this well (MW-60). Copper, lead, mercury, and nickel were detected above screening levels in near-source wells MW-28, MW-29, and/or MW-60, but were not detected above screening levels in downgradient wells MW-61 and MW-67. Chromium, silver, and zinc were not detected above screening levels in any of the wells. Barium and vanadium do not have established screening levels.

Metals and residual contamination consisting of TPH, cPAHs, PCP, and PCBs is present in soil at concentrations exceeding the respective screening levels in the vicinity of the Fuel Oil Tank No. 2 and Hog Fuel Pile interim action areas. Based on groundwater monitoring conducted at downgradient wells MW-23, MW-28, MW-29, MW-60, MW-61, and MW-67 between August 2010 and March 2011, the residual soil contamination does not appear to be a significant source of TPH, PCP, or PCBs to groundwater, but may be a source of cPAHs to groundwater in the immediate vicinity of the interim action areas (i.e., in near-source wells MW-23, MW-28, MW-29, and/or MW-60). The metals detected in the Fuel Oil Tank No. 2 and Hog Fuel Pile area soil may be a source of copper, lead, mercury, and/or nickel to groundwater in the immediate vicinity of the interim action areas (i.e., in near-source wells MW-23, MW-28, MW-29, and/or MW-60) and a source of manganese to groundwater both near-source and farther downgradient (including downgradient wells MW-61 and MW-67).

3.3.4. Finishing Room Area (Data Gaps 4 and 7)

Monitoring well MW-62 was installed to the north of the Finishing Room interim action area to evaluate the extent of residual soil contamination and to assess groundwater quality between the Finishing Room Area and Port Angeles Harbor (Figure 2).

Soil samples were collected at a depth of 2 feet bgs and at 5-foot intervals from 5 feet bgs to 35 feet bgs during drilling of well MW-62. TPH and SVOCs (including cPAHs) were not detected at concentrations exceeding screening levels. PCBs were detected at concentrations exceeding the screening level in soil samples collected at depths of 2, 5, 10, and 25 feet bgs, but were not detected in soil samples collected at depths of 30 and 35 feet bgs. Metals were not analyzed in the soil samples obtained from monitoring well boring MW-62.

The results of groundwater monitoring conducted at well MW-62 in November 2010 and February 2011 were evaluated to assess the extent of groundwater impacts associated with potential residual soil contamination in the Finishing Room interim action area. The COPCs of interest in this area (TPH, SVOCs, and PCBs) were not detected in groundwater samples obtained from well MW-62.

Residual contamination consisting of PCBs is present in soil at concentrations exceeding the associated screening level to the north of the Finishing Room interim action area. Based on groundwater monitoring conducted at well MW-62, the residual soil contamination does not appear to be a significant source of PCBs to groundwater.

3.3.5. Fuel Oil Tank No. 1 Area (Data Gaps 4 and 8)

Test pit TP-08 was completed at the southeast corner of the Fuel Oil Tank No. 1 interim action area to evaluate the extent of residual soil contamination (Figure 2). Soil sampling results from monitoring well borings MW-60 and MW-61 also were used to assess this area.

As discussed in Section 2.2.3, a small quantity of residual heavy oil-range petroleum product was observed in shallow soil at the location of test pit TP-08 during the 2006 interim action, but remedial excavation was discontinued to avoid impacting an adjacent utility pole. Rayonier removed the utility pole to allow excavation of test pit TP-08. Approximately 10 cubic yards of visibly impacted soil was removed from test pit TP-08 and placed in a roll-off bin for subsequent off-site disposal (see Section 2.4.1). Once visibly clean limits were achieved, soil samples were collected from the test pit sidewall.

The following COPCs were detected at concentrations exceeding screening levels in soil (see tables in Appendix C for concentrations and sample depths):

- TP-08: lead and PCBs
- MW-60: diesel- and heavy oil-range TPH; cPAHs; PCP; PCBs
- MW-61: PCBs

Following receipt of the initial soil analytical results, follow-up analysis for lead was performed on a soil sample from test pits TP-08 using the TCLP to characterize soil in the roll-off bins for disposal. Concentrations of lead exceeding the dangerous waste threshold (WAC 173-303) were not detected in the TCLP extract.

The results of groundwater monitoring conducted at monitoring wells MW-60 and MW-61 between August 2010 and February 2011 were evaluated to assess the extent of downgradient groundwater impacts associated with potential residual soil contamination in the Fuel Oil Tank No. 1 interim action area. TPH, PCP, and PCBs were not detected in these wells. cPAHs were detected marginally above the screening level in one sample obtained from well MW-60. Lead was not detected above the screening level in wells MW-60 and MW-61.

Lead and residual contamination consisting of TPH, cPAHs, PCP, and PCBs is present in soil at concentrations exceeding the respective screening levels in the vicinity of the Fuel Oil Tank No. 1 interim action area. Based on groundwater monitoring conducted at downgradient wells MW-60 and MW-61 between August 2010 and February 2011, the residual soil contamination does not appear to be a significant source of COPCs to groundwater. Likewise, the lead detected in the Fuel Oil Tank No. 1 area soil does not appear to be a significant source of lead to groundwater.

Select metals have been detected above screening levels in groundwater in wells MW-60 (arsenic, copper, manganese, and nickel) and MW-61 (manganese). Because these metals were not

analyzed in soil samples obtained from test pit TP-08 or borings MW-60 and MW-61, it is uncertain whether these metals might be related to potential residual metals contamination in the vicinity of the Fuel Oil Tank No. 1 interim action area. As discussed in Section 3.3.3, residual contamination in the vicinity of the Fuel Oil Tank No. 2 and Hog Fuel Pile interim action areas may be a source of metals to groundwater.

3.3.6. Summary of Former Interim Action Areas Characterization

The results of the investigation to evaluate the nature and extent of residual soil contamination in the former interim action areas indicate that concentrations of TPH, cPAHs, PCP, and PCBs exceeding soil screening levels are present, but laterally discontinuous, beyond the limits of the former remedial excavations. Concentrations of select metals exceeding soil screening levels also are present in the former interim action areas. Based on the locations, concentrations, and depths of the contamination identified, much of this contamination appears to be largely indistinguishable from the nearly ubiquitous presence of certain constituents – such as metals, cPAHs, and PCBs – in many of the former operations areas of the mill. It may not be possible to attribute this ubiquitous soil contamination to specific sources. With the limited exceptions noted in Sections 3.3.1 through 3.3.5, the soil contamination identified in the interim action areas does not appear to be a significant source of organic COPCs or metals to groundwater downgradient of these areas.

3.4. Groundwater Monitoring and Sampling (Data Gaps 9 and 10)

This section summarizes the results of the groundwater monitoring and sampling activities completed to address Data Gaps 9 and 10 identified in the Agreed Order.

3.4.1. Dense Non-Aqueous Phase Liquid (DNAPL) Evaluation (Data Gap 9)

Chlorinated VOCs, including trichloroethene (TCE), 1,2-dichloroethene (1,2-DCE), and vinyl chloride, were detected at concentrations ranging from 7 to 93 ug/l in groundwater samples collected from former monitoring well MW-13 during two monitoring events conducted in 1991. Former well MW-13 was screened in the upper portion of the shallow water-bearing zone, from 6 to 16 feet bgs. The potential presence of DNAPL at the former location of well MW-13 was evaluated by:

- Collecting representative soil samples from the glacial deposits immediately below the shallow water-bearing zone at 12 locations across the Upland Study Area for laboratory analysis of soil hydraulic conductivity. The hydraulic conductivity analyses were used to qualitatively assess the permeability of the glacial deposits relative to the shallow water-bearing zone, and thus provide an indication of whether or not the glacial deposits are likely to act as a low-permeability barrier to downward groundwater migration.
- Installing monitoring well MW-63 to evaluate the potential presence of VOCs and DNAPL in groundwater at the former location of well MW-13 (Figure 2). Well MW-63 is screened from 5 feet bgs to the top of the glacial deposits at 25 feet bgs. Because DNAPL would have most likely accumulated at the top of the glacial deposits if it were present (due to the low permeability of the glacial deposits), groundwater samples collected from well MW-63 were obtained by positioning the submersible sampling pump just above the bottom of the well. Low-flow methods were used to collect the samples.

- Collecting soil samples from monitoring well boring MW-63 to evaluate the potential presence of VOCs and DNAPL in soil immediately above (23 to 24.5 feet bgs) and below (26 to 27.5 feet bgs) the contact between the shallow water-bearing zone (fill unit) and the glacial deposits.
- Collecting a groundwater grab sample from the base of the shallow water-bearing zone at boring location GWG-9 to evaluate the potential presence of VOCs and DNAPL in groundwater immediately above the glacial deposits. Boring GWG-9 was completed adjacent to well MW-63 and former well MW-13 (Figure 2). The groundwater grab sample collected from boring GWG-9 was obtained using low-flow methods and a temporary well screen set at 21.5 to 25 feet bgs.
- Installing monitoring well MW-68, screened from 53 to 58 feet bgs, to evaluate the potential presence of VOCs and DNAPL in deeper groundwater within the glacial deposits.
- Collecting soil samples from monitoring well boring MW-68 to evaluate grain size distribution (sieve analysis) and the potential presence of VOCs in the glacial deposits.

The results of the hydraulic conductivity analyses (Appendix D) indicate that the hydraulic conductivity of the uppermost portion of the glacial deposits ranges from approximately 10^{-7} to 10^{-2} centimeters per second (cm/s), with the majority of the reported values falling in the range of 10^{-7} to 10^{-5} cm/s. These values correspond to published hydraulic conductivity values for glacial till and very fine sand, silt, and clay. Aquifer slug testing performed in 2001 at eight monitoring wells screening in the shallow water-bearing zone above the glacial deposits yielded hydraulic conductivity estimates of the order of 10^{-4} to 10^{-2} cm/s (Integral, 2007). The significant contrast between the hydraulic conductivities of the shallow water-bearing zone and the underlying glacial deposits suggests that the glacial deposits act as a low-permeability aquitard, restricting the downgradient migration of groundwater. Similarly, the glacial deposits would be expected to restrict the downgradient migration of any DNAPL present in the vicinity of former well MW-13. Consequently, if DNAPL were present, it would most likely accumulate at the top of the glacial deposits. This is the reason the DNAPL evaluation focused on assessing soil and groundwater quality immediately above and below the top of the glacial deposits.

VOCs were not detected in the groundwater grab sample collected immediately above the glacial deposits at boring location GWG-9. TCE, cis-1,2-DCE, and/or vinyl chloride were detected at concentrations ranging from 0.2 to 2.7 ug/l in groundwater samples collected from monitoring well MW-63 in November 2010 and February 2011; these concentrations do not exceed screening levels. Additionally, the detected concentrations of TCE, cis-1,2-DCE, and vinyl chloride in well MW-63 are significantly less than 1 percent of the aqueous solubility of these constituents; dissolved concentrations of the order of 1 percent of solubility are widely considered to be indicative of the potential presence of DNAPL. Published values for the aqueous solubilities of TCE, cis-1,2-DCE, and vinyl chloride are 1,280,000 ug/l, 5,090,000 ug/l, and 2,700,000 ug/l, respectively.

VOCs were not detected in the soil samples collected immediately above and below the top of the glacial deposits in monitoring well boring MW-63. This indicates that DNAPL is not, and has likely never been, present at this location.

The laboratory analytical results for the soil and groundwater samples collected from monitoring well MW-68 (screened from 53 to 58 feet bgs within the glacial deposits) were not available as of

the date this technical memorandum was prepared. These results will be presented in a future addendum to this document.

3.4.1.1. SUMMARY OF DNAPL EVALUATION

The laboratory analysis of groundwater samples collected from groundwater grab boring GWG-9 and monitoring well MW-63, which were screened and sampled to evaluate the potential presence of DNAPL, did not detect concentrations of chlorinated VOCs that exceed screening levels or are indicative of the potential presence of DNAPL. Additionally, soil samples collected immediately above and below the contact between the shallow water-bearing zone (fill unit) and the low-permeability glacial deposits in monitoring well boring MW-63 did not contain detectable concentrations of chlorinated VOCs. This indicates that DNAPL has likely never been present at this location.

3.4.2. Groundwater Gradients

The groundwater potentiometric maps for the groundwater monitoring events conducted in 2010 and 2011 are included as Figures 3 through 6. The inferred groundwater flow direction beneath the Upland Study Area is generally to the north, towards Port Angeles Harbor. Tidal fluctuations in Port Angeles Harbor appear to have a relatively minor influence on groundwater elevations in monitoring wells near the shoreline, and do not appear to affect the overall northerly groundwater flow direction. The groundwater gradients are locally variable, and include lateral components towards Ennis Creek in the vicinity of the creek. The estimated horizontal hydraulic gradients in the southern portion of the property generally ranged from 0.02 to 0.04 feet per foot, while gradients in the northern portion of the property ranged from 0.004 to 0.01 feet per foot.

3.4.3. Groundwater Quality/Temporal Trends (Data Gap 10)

The results of groundwater monitoring conducted between August 2010 and March 2011 indicate that:

- The following constituents either were not detected in groundwater or were detected at concentrations less than screening levels protective of marine surface water:
  - Gasoline-, diesel-, and heavy oil-range TPH (not detected in any wells).
  - Pesticides (not detected in any wells).
  - VOCs (TCE and vinyl chloride were detected below screening levels in well MW-63).
  - SVOCs (other than bis[2-ethylhexyl]phthalate) and cPAHs (2,4,6-trichlorophenol and/or pentachlorophenol were detected below screening levels in wells MW-54, MW-55, MW-56, MW-66, and PA-19).
- Bis(2-ethylhexyl)phthalate was detected slightly above the screening level in wells MW-29, PZ-3, and PZ-7. These wells are in the West Former Mill Area and Prefab Area (Figure 2). Only one of the three groundwater samples collected from each of these wells exceeded the screening level.
- cPAHs were detected above the screening level in wells MW-28, MW-29, MW-51, MW-54, MW-58, MW-60, and MW-66. These wells are in the Northwest Shoreline Area, West Former Mill Area, North Shoreline Area, and Main Former Mill Area (Figure 2).

- PCBs were detected above the screening level in wells MW-28, MW-58, MW-66, PA-19, and PZ-2. These wells are in the Northwest Shoreline Area, Main Former Mill Area, and City Purchase Area (Figure 2).
- Arsenic, copper, lead, manganese, mercury, nickel, and/or zinc were detected above screening levels in unfiltered groundwater samples obtained from all of the monitoring wells except upgradient well MW-64. With the exception of lead, these metals also were detected above screening levels in filtered groundwater samples. Results from the August 2010 baseline monitoring event indicate that for the majority of the wells and metals, the total metals concentrations in unfiltered samples were higher than the dissolved metals concentrations in filtered groundwater samples, most likely due to the contribution of suspended solids in the unfiltered samples. An exception is manganese, which had similar dissolved and total concentrations in the majority of the wells. Dissolved manganese exceeded screening levels in 18 wells; dissolved arsenic, copper, mercury, nickel, and zinc exceeded screening levels in 7 or fewer wells.
- Dioxins/furans were detected above the screening level at least once in all of the monitoring wells except wells MW-61 and PA-17 and upgradient well MW-64. The highest concentrations of dioxins/furans were detected in the August 2010 samples, which were collected from the pre-existing monitoring wells approximately 48 hours after these wells were redeveloped. The elevated dioxin/furan concentrations in the August 2010 groundwater samples were likely biased high due to the presence of suspended solids from the well redevelopment activities. The dioxin/furan concentrations detected in groundwater in November 2010 and February 2011 were significantly lower than the August 2010 results, and were similar to the concentrations detected in the surface water samples obtained from Ennis Creek and White Creek in August 2010. The nearly ubiquitous presence of dioxins/furans in groundwater across the Upland Study Area at concentrations similar to the concentrations detected in surface water suggests that the dioxin/furan detections in groundwater are likely representative of background concentrations in the Port Angeles area.
- Ammonia was detected above the screening level in wells MW-28, MW-29, MW-51, MW-56, MW-57, MW-62, MW-66, PZ-3, and PZ-9. These wells are in the Northwest Shoreline Area, West Former Mill Area, North Shoreline Area, Estuary Area, and East Shoreline Area (Figure 2).

Hydrographs and trends in COPC concentrations over time at individual wells are depicted on graphs included in Appendix E.

- The hydrographs depicting the recent groundwater elevation data collected during the supplemental upland investigation show a seasonal increase in groundwater elevations of approximately 1 to 2 feet between August 2010 and February 2011, corresponding to the transition from the dry summer months to the wet winter months. The hydrographs depicting both historical and recent groundwater elevation data do not show any apparent long-term trends in groundwater elevations. Groundwater elevations at a number of shoreline monitoring wells (e.g., MW-51 and MW-54) appear to be influenced by tidal fluctuations, as indicated by the larger increase in groundwater elevations observed in

these wells relative to most inland wells between November 2010 and February 2011 (groundwater levels were measured at high tide in February 2011).

- There are no clear temporal correlations between groundwater elevations and COPC concentrations, for either the historical or recent monitoring data.
- Monitoring wells with two or more detections of cPAHs in groundwater include MW-28, MW-29, MW-51, MW-54, MW-55, MW-56, MW-58, PA-19, and PZ-3. Historical cPAH concentrations have generally remained stable or decreased over time, with the exception of wells MW-29 and MW-54, which had cPAH detections in 2010-2011 that were slightly elevated relative to historical concentrations. However, the cPAH concentrations detected in wells MW-29 and MW-54 decreased between the August 2010 and February 2011 monitoring events.
- Concentrations of bis(2-ethylhexyl)phthalate, detected in 2002 or earlier in wells MW-51, MW-52, MW-55, MW-59, PZ-2, PZ-9, PZ-11, and PZ-12, decreased to non-detectable levels in 2010-2011. The concentration of bis(2-ethylhexyl)phthalate detected in well PZ-7 in November 2010 is similar to the concentration detected in this well in February 1997. Bis(2-ethylhexyl)phthalate concentrations detected above the screening level in wells MW-29 and PZ-3 in August 2010 decreased to non-detectable levels in November 2010 and February 2011.
- PCP was detected in 2003 or earlier in wells MW-23, MW-29, MW-54, MW-56, MW-58, MW-59, PZ-11, and PZ-12. The 2010-2011 monitoring results indicate that PCP concentrations have decreased in these wells, typically to non-detectable levels.
- Monitoring wells MW-58 and MW-59 are the only wells that have had more than one positive detection of PCBs historically. In 2010-2011, PCBs were detected twice in monitoring well MW-58, whereas PCBs were not detected in this well in 2003 (the only previous sampling of this well). Well MW-59 exhibited the opposite trend: PCBs were not detected in this well in 2010-2011, but were detected twice in 2002-2003. PCB detections in other monitoring wells have been sporadic.
- Historical arsenic concentrations detected in groundwater have generally remained stable over time.
- Copper concentrations detected in groundwater in 2010-2011 generally exhibited a stable or decreasing trend in the majority of the monitoring wells sampled, including wells MW-29, MW-51, MW-54, MW-55, MW-57, PZ-7, PZ-11, and PA-19. However, varying trends in copper concentrations are evident in the recent data, including: higher concentrations detected in November 2010 relative to August 2010 and February 2011 in wells MW-28, MW-59, and PZ-9; lower concentrations detected in November 2010 relative to August 2010 and February 2011 in wells MW-56 and PZ-4; and higher concentrations detected in February 2011 relative to August 2010 and November 2010 in wells MW-58, PZ-3, and PZ-6.
- In general, the 2010-2011 groundwater monitoring detected variable concentrations of metals, with no consistent spatial or temporal trends. Monitoring wells PZ-7 and PZ-11, and wells located proximal to the shoreline (wells MW-54, MW-55, MW-56, MW-59, and PZ-9), generally exhibited the greatest variability in detected metals concentrations. The

variable metals concentrations in these wells do not appear to correlate with seasonal changes in groundwater elevations or the apparent degree of tidal influence in the wells. Historical metals concentrations in groundwater also show no consistent, long-term trends over time.

- Historical concentrations of ammonia (un-ionized) in the majority of monitoring wells sampled in 2010-2011 and earlier have remained relatively stable or decreased over time. Higher ammonia concentrations were detected in November 2010 than in August 2010 and February 2011 in wells MW-51, PZ-3, and PZ-9, all of which are located proximal to the shoreline. However, the same trend is not observed in well MW-56, which is also located proximal to the shoreline. The detected concentrations of ammonia in well MW-56 and several other wells decreased between August 2010 and February 2011.

3.4.4. Summary of Groundwater Monitoring and Sampling

The significant findings of the groundwater monitoring and sampling activities completed to address Data Gaps 9 and 10 identified in the Agreed Order are summarized below.

- The soil and groundwater sampling conducted in the vicinity of former monitoring well MW-13 found no evidence of chlorinated DNAPL. Although low concentrations of chlorinated VOCs were detected in groundwater samples collected from well MW-63, the detected concentrations were more than 1,000 times less than the concentrations widely considered to be indicative of potential DNAPL presence.
- The inferred groundwater flow direction beneath the Upland Study Area is generally to the north, towards Port Angeles Harbor. Tidal fluctuations in Port Angeles Harbor appear to have a relatively minor influence on groundwater elevations in monitoring wells near the shoreline, and do not appear to affect the overall northerly groundwater flow direction. The groundwater gradients are locally variable, and include lateral components towards Ennis Creek in the vicinity of the creek.
- The following constituents either were not detected in groundwater or were detected at concentrations below screening levels: TPH, pesticides, VOCs, and SVOCs (not including bis[2-ethylhexyl]phthalate and cPAHs).
- Bis(2-ethylhexyl)phthalate was detected slightly above the screening level in three wells in the West Former Mill Area and Prefab Area.
- cPAHs were detected above the screening level in seven wells in the Northwest Shoreline Area, West Former Mill Area, North Shoreline Area, and Main Former Mill Area.
- PCBs were detected above the screening level in five wells in the Northwest Shoreline Area, Main Former Mill Area, and City Purchase Area.
- One or more of the following dissolved metals were detected above screening levels in filtered groundwater samples obtained from all of the wells except upgradient well MW-64: arsenic, copper, manganese, mercury, nickel, and zinc. Dissolved manganese exceeded screening levels in 18 wells; dissolved arsenic, copper, mercury, nickel, and zinc exceeded screening levels in 7 or fewer wells. For the majority of the wells and metals, the dissolved metals concentrations in filtered groundwater samples were less than the total metals

concentrations in unfiltered samples. An exception was manganese, which had similar dissolved and total concentrations in the majority of the wells.

- Dioxins/furans were detected above the screening level at least once in all of the wells except MW-61, PA-17, and upgradient well MW-64. The concentrations of dioxins/furans in groundwater appear to be attributable to suspended solids in the samples or to background dissolved concentrations.
- Ammonia was detected above the screening level in nine wells in the Northwest Shoreline Area, West Former Mill Area, North Shoreline Area, Estuary Area, and East Shoreline Area.

3.5. Geotechnical Data Summary

Select soil samples collected during the supplemental upland field investigation were submitted for analysis of bulk density, total organic carbon, and grain size distribution (sieve analysis) to support the future evaluation of remedial alternatives. The results are presented in Appendix D and summarized below.

The bulk density of the submitted soil samples ranged from approximately 60 to 120 pounds per cubic foot. Total organic carbon results ranged from 0.13 to 31.4 percent, with an average of 1.7 percent. The results of the grain size analyses indicate that Upland Study Area soils predominantly consist of gravel with sand and/or silt, silty sand/sandy silt, and sand with silt and gravel. These results will be utilized and evaluated in greater detail during future remedial design activities.

4.0 CONCLUSIONS

The major conclusions of the supplemental upland data collection field investigation are summarized below. Further evaluation and discussion of these conclusions will be presented in the Interim Action Report Volume I: Upland Data Summary Report for the Study Area.

- The nature and extent of contamination within the Upland Study Area has been defined to the extent necessary to conduct a Feasibility Study of cleanup action alternatives for the Upland Study Area. The findings of the supplemental upland data collection investigation indicate that some of the COPCs (e.g., metals and dioxin/furans) are nearly ubiquitous in shallow soil within the various functional use areas of the mill property and are not attributable to a distinct source. Soil impacts from other COPCs (e.g., TPH, cPAHs, and PCBs) are not contiguous in the subsurface; these COPCs have limited extent and are attributed to distinct source areas (e.g., Fuel Oil Tank Nos. 1 and 2, Wood Mill, Machine Shop, and other former operations areas). The noncontiguous distribution of these COPCs reflects the heterogeneous nature of the subsurface, which includes structures such as concrete footings, foundations, wood pilings, and cribbing in many areas. Although the existing data are sufficient for conducting a Feasibility Study, additional data may be collected during the development of cleanup action alternatives or the remedial design phase to help define potential cleanup remedies.
- Groundwater seeps were not observed in the intertidal zone along the shoreline of the Upland Study Area during field reconnaissance surveys. Consequently, groundwater monitoring wells along the upland shoreline were used to evaluate the groundwater to marine surface water pathway.

- Metals (arsenic, copper, manganese, and nickel), dioxins/furans, and ammonia were detected in the surface water samples collected from Ennis Creek and White Creek; other COPCs were not detected in surface water. Of the COPCs detected, only dioxins/furans exceeded the associated screening level (0.0051 pg/l); the detected concentrations of dioxins/furans were only slightly above the laboratory MRLs for these constituents. The concentrations of metals, dioxins/furans, and ammonia detected in surface water upstream and downstream of the former mill operations areas were similar, indicating that the present-day surface water quality in Ennis Creek and White Creek is not impaired by historical mill operations. Consequently, the concentrations of metals, dioxins/furans, and ammonia detected in the surface water samples appear to be representative of background concentrations.
- The results of discrete-depth soil sampling to evaluate potential ongoing sources of COPCs to groundwater are consistent with the results of previous investigations, which indicate that concentrations of COPCs are generally highest in shallow soil and decrease with depth. The detected concentrations of PCBs and select metals in soil in some areas may represent an ongoing source of groundwater contamination. However, in general, the concentrations of PCBs and metals are relatively low and the areas of potential PCB and metals contamination to groundwater are not very large or widespread. No significant source areas of other COPCs, including pesticides, TPH, VOCs, SVOCs, and dioxin/furans, were identified in soil.
- An evaluation of the wastewater drain piping as a potential source of COPCs to groundwater identified the presence of ammonia that may be associated with historical releases from the piping. Ammonia was detected in groundwater in the same general areas during previous site investigations. Concentrations of other COPCs detected in soil and groundwater in the vicinity of the wastewater drain piping are generally consistent with, or less than, concentrations that have been detected in other former mill operations areas, and are thus not likely related to releases from the wastewater piping.
- Residual contamination remaining in prior interim action areas was assessed as part of the supplemental upland data collection field investigation. The results indicate that prior interim actions were largely successful in removing a significant mass of contaminated soil from the upland portion of the property. Residual contamination remaining in interim action areas is summarized below:
    - Wood Mill interim action area: Residual contamination consisting of TPH, cPAHs, and PCBs is present in soil at concentrations exceeding the respective screening levels to the east of the Wood Mill interim action area. Based on the results of groundwater monitoring conducted downgradient of the Wood Mill interim action area, the residual soil contamination in this area does not appear to be a significant source of COPCs to groundwater. Select metals also are present in soil in the Wood Mill area at concentrations exceeding screening levels. However, because metals are nearly ubiquitous within the former mill operations areas, the metals detected in the Wood Mill interim action area are not necessarily associated with the former Wood Mill. With the possible exception of copper, the metals detected in the Wood Mill area soil do not appear to be a significant source of metals to groundwater.

- Machine Shop interim action area: Residual contamination consisting of TPH and PCBs is present in soil at concentrations exceeding the respective screening levels to the southeast and west of the Machine Shop interim action area. Based on the results of groundwater monitoring conducted downgradient of the Machine Shop interim action area, the residual soil contamination in this area does not appear to be a significant source of COPCs to groundwater. Select metals also are present in soil in the Machine Shop area at concentrations exceeding screening levels. However, because metals are nearly ubiquitous within the former mill operations areas, the metals detected in the Machine Shop interim action area are not necessarily associated with the former Machine Shop. The metals detected in the Machine Shop area soil do not appear to be a significant source of metals to groundwater.

- Fuel Oil Tank No. 2 and Hog Fuel Pile interim action areas: Residual contamination consisting of TPH, cPAHs, PCP, and PCBs is present in soil at concentrations exceeding the respective screening levels in the vicinity of the Fuel Oil Tank No. 2 and Hog Fuel Pile interim action areas. Based on the results of groundwater monitoring conducted downgradient of the Fuel Oil Tank No. 2 and Hog Fuel Pile interim action areas, the residual soil contamination in these areas does not appear to be a significant source of TPH, PCP, or PCBs to groundwater. The residual soil contamination may be a source of cPAHs to groundwater at some locations. Select metals also are present in soil in the Fuel Oil Tank No. 2 and Hog Fuel Pile areas at concentrations exceeding screening levels. However, because metals are nearly ubiquitous within the former mill operations areas, the metals detected in the Fuel Oil Tank No. 2 and Hog Fuel Pile interim action areas are not necessarily associated with the former Fuel Oil Tank No. 2 and Hog Fuel Pile. The metals detected in the Fuel Oil Tank No. 2 and Hog Fuel Pile area soil (manganese, copper, lead, mercury, and nickel) may be a source of metals to groundwater at some locations.

- Finishing Room interim action area: Residual contamination consisting of PCBs is present in soil at concentrations exceeding the associated screening level to the north of the Finishing Room interim action area (location MW-62). Based on the results of groundwater monitoring conducted at well MW-62, this residual soil contamination does not appear to be a significant source of PCBs to groundwater.

- Fuel Oil Tank No. 1 interim action area: Residual contamination consisting of TPH, cPAHs, PCP, and PCBs is present in soil at concentrations exceeding the respective screening levels in the vicinity of the Fuel Oil Tank No. 1 interim action area. Based on the results of groundwater monitoring conducted downgradient of the Fuel Oil Tank No. 1 interim action area, the residual soil contamination in this area does not appear to be a significant source of COPCs to groundwater. Lead also is present in soil in the Fuel Oil Tank No. 1 area at concentrations exceeding screening levels. However, because lead and other metals are nearly ubiquitous within the former mill operations areas, the lead

detected in the Fuel Oil Tank No. 1 interim action area is not necessarily associated with the former Fuel Oil Tank No. 1. The lead detected in the Fuel Oil Tank No. 1 area soil does not appear to be a significant source of lead to groundwater.

- The soil and groundwater sampling conducted to evaluate the potential presence of chlorinated DNAPL in the vicinity of former monitoring well MW-13 found no evidence of chlorinated DNAPL.
- The results of groundwater monitoring conducted from August 2010 through March 2011 indicate that TPH, VOCs, pesticides, and SVOCs (except cPAHs and isolated detections of bis[2-ethylhexyl]phthalate) are not present in groundwater at concentrations exceeding screening levels. The groundwater monitoring data collected from pre-existing and recently installed monitoring wells indicate that groundwater impacts are limited in both spatial extent and the number of COPCs exceeding screening levels.
- Select metals, cPAHs, PCBs, and ammonia were detected in groundwater at concentrations exceeding screening levels in five or more monitoring wells within the Upland Study Area. Monitoring data from the network of shoreline monitoring wells indicate that a complete migration pathway from groundwater to marine surface water appears to exist for select metals, cPAHs, and ammonia in some locations. This issue will be further evaluated and discussed in the Upland Data Summary Report for the Study Area.
- Dioxins/furans were detected in groundwater at concentrations exceeding the screening level protective of surface water (0.0051 pg/l) in most of the monitoring wells within the Upland Study Area. The detected concentrations of dioxins/furans are likely attributable to the presence of suspended solids in the groundwater samples or to background dissolved concentrations.
- There is no evidence that COPCs are migrating under the mill property in groundwater from off-property sources.

5.0 REFERENCES

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Washington State Department of Ecology (Ecology), 2010a. "Agreed Order No. DE 6815 with Rayonier Properties LLC." March 25, 2010.

Washington State Department of Ecology (Ecology), 2010b. "Approval of Draft Final Supplemental Upland Data Collection Work Plan for the Upland Portion of the Study Area, Port Angeles Rayonier Mill Site." Letter from Marian L. Abbett, P.E., Project Coordinator, Toxics Cleanup Program, Southwest Regional Office, to Warren Snyder, Manager, Environmental Engineering, Rayonier Inc. August 10, 2010.

Table 1

Sampling and Analytical Testing Summary – Soil

Port Angeles Rayonier Mill Study Area
Port Angeles, Washington

Supplemental Upland Investigation Phase	Sample Location	Sample ID	Sample Depth (feet bgs)	Sample Date	Dioxins/ Furans	SVOCs (not including PAHs & Chlorophenols)	VOCs	PAHs	Chlorophenols	Total Petroleum Hydrocarbons - Diesel Extended	Select Metals	Select Metals	Mercury	Selenium	Select Toxicity Characteristic Leaching Procedure Metals	Organo-chlorinated Pesticides	PCB Aroclors	Grain Size (Sieve Analysis)	Bulk Density	Hydraulic Conductivity	Percent Solids	Total Organic Carbon
					EPA 1613	SW8270	SW8260	SW8270DSIM	SW8041	NWTPH-DX	EPA 200.4	SW6010B	SW7471A	AA, Furnace Technique	6010B-TCLP	SW8081	SW8082	ASTM D422	ASTM C39	ASTM D-5084/D-2434	EPA 160.3	SW9060M
Phase 2 (October-November 2010)	GWG-1	GWG-1-2-3.5	2 to 3.5	11/03/10	X			X			X	X	X				X				X	X
		GWG-1-5-6.5	5 to 6.5	11/03/10	X			X			X	X	X				X				X	X
		GWG-1-7.5-9	7.5 to 9	11/03/10	X			X			X	X	X				X				X	X
		GWG-1-10-11.5	10 to 11.5	11/04/10	X			X			X	X	X				X					
		GWG-1-15-16.5	15 to 16.5	11/04/10	X			X			X	X	X				X					
		GWG-1-20-21.5	20 to 21.5	11/04/10	X			X			X	X	X				X					
		GWG-1-20.75-21	20.75 to 21	11/04/10																X		
	GWG-4	GWG-4-8-9.5	8 to 9.5	11/01/10						X						X	X				X	X
		GWG-4-10-11.5	10 to 11.5	11/02/10						X						X	X	X				
		GWG-4-15-16.5	15 to 16.5	11/02/10						X						X	X					
		GWG-4-20-21.5	20 to 21.5	11/02/10						X						X	X					
		GWG-4-26-27.5	26 to 27.5	11/02/10						X						X	X					
		GWG-4-30-31.5	30 to 31.5	11/02/10						X						X	X					
		GWG-4-31-31.25	31 to 31.25	11/02/10																X		
	GWG-5	GWG-5-2-3.5	2 to 3.5	11/03/10		X		X	X		X	X	X	X		X	X				X	X
		GWG-5-5-6.5	5 to 6.5	11/03/10		X		X	X		X	X	X	X		X	X				X	X
	GWG-5A	GWG-5A-5-6.5	5 to 6.5	11/04/10		X		X	X		X	X	X	X		X	X				X	X
		GWG-5A-10-11.5	10 to 11.5	11/04/10		X		X	X		X	X	X	X		X	X				X	X
		GWG-5A-15-16.5	15 to 16.5	11/05/10		X		X	X		X	X	X	X		X	X					
		GWG-5A-20-21.5	20 to 21.5	11/05/10		X		X	X		X	X	X	X		X	X					
		GWG-5A-24-25.5	24 to 25.5	11/05/10		X		X	X		X	X	X	X		X	X					
	GWG-6	GWG-6-2-3.5	2 to 3.5	11/02/10		X		X	X	X	X	X	X	X			X				X	X
		GWG-6-5-6.5	5 to 6.5	11/02/10		X		X	X	X	X	X	X	X			X				X	X
		GWG-6-10-11.5	10 to 11.5	11/02/10		X		X	X	X	X	X	X	X			X				X	X
	GWG-7	GWG-7-2-3.5	2 to 3.5	11/02/10		X		X	X	X	X	X	X	X			X				X	X
		GWG-7-5-6.5	5 to 6.5	11/02/10		X		X	X	X	X	X	X	X			X				X	X
		GWG-7-7-8.5	7 to 8.5	11/02/10		X		X	X	X	X	X	X	X			X				X	X
	GWG-8	GWG-8-2-3.5	2 to 3.5	10/28/10		X		X	X	X	X	X	X	X			X				X	X
		DUPE3-102810	2 to 3.5	10/28/10		X		X	X	X	X	X	X	X			X					
		GWG-8-10-11.5	10 to 11.5	10/28/10		X		X	X	X	X	X	X	X			X	X			X	X
		GWG-8-15-16.5	15 to 16.5	10/28/10		X		X	X	X	X	X	X	X			X	X			X	X
	MW-60	MW-60-2-3.5	2 to 3.5	10/19/10		X		X	X	X	X						X					
		MW-60-10-11.5	10 to 11.5	10/19/10		X		X	X	X	X						X					
		MW-60-15-16.5	15 to 16.5	10/19/10		X		X	X	X	X						X					
		MW-60-20-20.75	20 to 20.75	10/19/10		X		X	X	X	X						X					
		MW-60-23-24.4	23 to 24.4	10/19/10		X		X	X	X	X					X	X					
		MW-60-24-24.25	24 to 24.25	10/19/10																X		
	MW-61	MW-61-5-6.5	5 to 6.5	10/19/10		X		X	X	X	X						X					
		MW-61-10-11.5	10 to 11.5	10/19/10		X		X	X	X	X						X					
		MW-61-15-16.5	15 to 16.5	10/19/10		X		X	X	X	X						X					
		MW-61-20.21.25	20 to 21.25	10/19/10		X		X	X	X	X						X					
	MW-62	MW-62-2-3.5	2 to 3.5	10/20/10		X		X	X	X							X	X			X	X
		MW-62-5-6.5	5 to 6.5	10/20/10		X		X	X	X							X				X	X
		MW-62-10-11.5	10 to 11.5	10/20/10		X		X	X	X							X				X	X
		MW-62-15-16.5	15 to 16.5	10/20/10		X		X	X	X							X	X				
		MW-62-20-21.5	20 to 21.25	10/20/10		X		X	X	X							X					
		MW-62-25-26.5	25 to 26.5	10/20/10		X		X	X	X							X					
		MW-62-30-31.5	30 to 31.5	10/20/10													X					
		MW-62-35-36.5	35 to 36.5	10/20/10													X					
	MW-63	MW-63-23-24.5	23 to 24.5	10/21/10			X															
		MW-63-26-27.5	26 to 27.5	10/21/10			X															
		MW-63-27.25-28	27.25 to 28	10/21/10																X		
	MW-64	MW-64-2-3.5	2 to 3.5	10/18/10	X						X	X	X	X		X						
		MW-64-10-11.5	10 to 11.5	10/18/10	X						X	X	X	X		X						
		MW-64-20-20.66	20 to 20.66	10/18/10							X	X	X	X								
		MW-64-21.25-21.5	21.25 to 21.5	10/18/10																X		

Supplemental Upland Investigation Phase	Sample Location	Sample ID	Sample Depth (feet bgs)	Sample Date	Dioxins/ Furans	SVOCs (not including PAHs & Chlorophenols)	VOCs	PAHs	Chlorophenols	Total Petroleum Hydrocarbons - Diesel Extended	Select Metals	Select Metals	Mercury	Selenium	Select Toxicity Characteristic Leaching Procedure Metals	Organo-chlorinated Pesticides	PCB Aroclors	Grain Size (Sieve Analysis)	Bulk Density	Hydraulic Conductivity	Percent Solids	Total Organic Carbon
					EPA 1613	SW8270	SW8260	SW8270DSIM	SW8041	NWTPH-DX	EPA 200.8	SW6010B	SW7471A	AA, Furnace Technique	6010B-TCLP	SW8081	SW8082	ASTM D422	ASTM C39	ASTM D-5084/D-2434	EPA 160.3	SW9060M
Phase 2 (October-November 2010) (continued)	SSB-1	SSB-1-7-8.5	7 to 8.5	10/25/10	X	X		X	X		X	X	X	X		X	X					
		SSB-1-10-11.5	10 to 11.5	10/25/10	X	X		X	X	X	X	X	X	X		X	X					
		DUPE2-102510	10 to 11.5	10/25/10		X		X	X	X	X	X	X	X		X	X					
		SSB-1-15-16.5	15 to 16.5	10/25/10	X	X		X	X	X	X	X	X	X		X	X					
		SSB-1-20-21.5	20 to 21.5	10/25/10	X											X						
		SSB-1-25-26.5	25 to 26.5	10/25/10	X	X		X	X	X	X	X	X	X		X	X					
		SSB-1-26.25-26.5	26.25 to 26.5	10/25/10																X		
	SSB-2	SSB-2-2-3.5	2 to 3.5	10/21/10		X		X	X	X	X	X	X	X		X	X					
		SSB-2-5-6.5	5 to 6.5	10/21/10		X		X	X	X	X	X	X	X		X	X					
		DUPE1-102110	5 to 6.5	10/21/10		X		X	X	X	X	X	X	X		X	X					
		SSB-2-10-11.5	10 to 11.5	10/21/10		X		X	X	X	X	X	X	X		X	X					
		SSB-2-15-16.5	15 to 16.5	10/21/10		X		X	X	X	X	X	X	X		X	X					
		SSB-2-20-20.5	20 to 20.5	10/21/10		X		X	X	X	X	X	X	X		X	X					
	SSB-3	SSB-3-2-3.5	2 to 3.5	10/22/10		X		X	X													
		SSB-3-10-11.5	10 to 11.5	10/22/10		X		X	X													
		SSB-3-15-16.5	15 to 16.5	10/22/10		X		X	X													
		SSB-3-20-21.5	20 to 21.5	10/22/10		X		X	X													
		SSB-3-25-26.5	25 to 26.5	10/22/10		X		X	X													
		SSB-3-27-28.5	27 to 28.5	10/22/10		X		X	X													
		SSB-3-30.5-30.75	30.5 to 30.75	10/22/10																X		
	SSB-4	SSB-4-5-6.5	5 to 6.5	10/22/10							X	X	X	X			X					
		SSB-4-10-11.5	10 to 11.5	10/22/10							X	X	X	X			X					
		SSB-4-15-16.5	15 to 16.5	10/22/10							X	X	X	X			X					
		SSB-4-21-22.33	21 to 22.33	10/22/10							X	X	X	X			X					
		SSB-4-22-22.25	22 to 22.25	10/22/10																X		
	SSB-5	SSB-5-2-3.5	2 to 3.5	10/26/10													X				X	X
		SSB-5-5-6.5	5 to 6.5	10/26/10													X	X			X	X
		SSB-5-10-11.5	10 to 11.5	10/26/10													X	X				
		SSB-5-15-16.5	15 to 16.5	10/26/10													X					
		SSB-5-20-21.5	20 to 21.5	10/26/10													X				X	X
		SSB-5-30-31.5	30 to 31.5	10/26/10														X				
	SSB-6	SSB-6-5-6.5	5 to 6.5	10/26/10												X	X				X	X
		SSB-6-10-11.5	10 to 11.5	10/26/10												X	X				X	X
		SSB-6-15-16.5	15 to 16.5	11/01/10												X	X				X	X
		SSB-6-20-21.5	20 to 21.5	11/01/10												X	X	X				
		SSB-6-25-26.5	25 to 26.5	11/01/10												X	X					
		SSB-6-28-28.75	28 to 28.75	11/01/10												X	X					
		SSB-6-28-29	28 to 29	11/01/10												X	X	X				
		SSB-6-28.5-28.75	28.5 to 28.75	11/01/10																X		
	SSB-7	SSB-7-2-3.5	2 to 3.5	10/26/10	X	X		X	X	X	X	X	X	X		X	X					
		SSB-7-10-11.5	10 to 11.5	10/26/10	X	X		X	X	X	X	X	X	X		X	X					
		SSB-7-20-21.5	20 to 21.5	10/26/10	X	X		X	X	X	X	X	X	X		X	X					
		SSB-7-25-26.5	25 to 26.5	10/26/10	X	X		X	X	X	X	X	X	X		X	X					
		SSB-7-30-30.75	30 to 31.75	10/26/10	X	X		X	X	X	X	X	X	X		X	X					
		SSB-7-30.5-30.75	30.5 to 30.75	10/26/10																X		
	SSB-8	SSB-8-2-3.5	2 to 3.5	10/25/10							X	X	X	X				X			X	X
		SSB-8-5-6.5	5 to 6.5	10/25/10							X	X	X	X							X	X
		SSB-8-10-11.5	10 to 11.5	10/25/10							X	X	X	X				X				
		SSB-8-15-16.5	15 to 16.5	10/25/10							X	X	X	X							X	X
		SSB-8-20-21.5	20 to 21.25	10/25/10							X	X	X	X								
		SSB-8-25-26.33	25 to 26.33	10/25/10							X	X	X	X								
		SSB-8-30.5-30.75	30.5 to 30.75	10/25/10																X		
		SSB-8-30-31	30 to 31	10/25/10														X				
	SSB-9	SSB-9-2-3.5	2 to 3.5	10/27/10							X	X	X	X							X	X
		SSB-9-5-6.5	5 to 6.5	10/27/10							X	X	X	X				X			X	X
		SSB-9-10-11.5	10 to 11.5	10/27/10							X	X	X	X								
		SSB-9-15-16.5	15 to 16.5	10/27/10							X	X	X	X								
		SSB-9-20-21.5	20 to 21.25	10/27/10							X	X	X	X				X			X	X
		SSB-9-25-26	25 to 26	10/27/10							X	X										
		SSB-9-30-31.5	30 to 31.5	10/27/10							X	X						X				

Supplemental Upland Investigation Phase	Sample Location	Sample ID	Sample Depth (feet bgs)	Sample Date	Dioxins/ Furans	SVOCs (not including PAHs & Chlorophenols)	VOCs	PAHs	Chlorophenols	Total Petroleum Hydrocarbons - Diesel Extended	Select Metals	Select Metals	Mercury	Selenium	Select Toxicity Characteristic Leaching Procedure Metals	Organo-chlorinated Pesticides	PCB Aroclors	Grain Size (Sieve Analysis)	Bulk Density	Hydraulic Conductivity	Percent Solids	Total Organic Carbon
					EPA 1613	SW8270	SW8260	SW8270DSIM	SW8041	NWTPH-DX	EPA 200.2	SW6010B	SW7471A	AA, Furnace Technique	6010B-TCLP	SW8081	SW8082	ASTM D422	ASTM C39	ASTM D-5084/D-2434	EPA 160.3	SW9060M
Phase 2 (October-November 2010) (continued)	SSB-10	SSB-10-2-3.5	2 to 3.5	10/28/10	X	X		X	X		X	X	X	X		X	X				X	X
		SSB-10-5-6.5	5 to 6.5	10/28/10	X	X		X	X		X	X	X	X		X	X	X			X	X
		SSB-10-10-11.5	10 to 11.5	10/28/10	X	X		X	X		X	X	X	X		X	X					
		SSB-10-15-16.5	15 to 16.5	10/28/10	X	X		X	X		X	X	X	X		X	X	X			X	X
		SSB-10-20-21.5	20 to 21.5	10/28/10	X	X		X	X		X	X	X	X		X	X					
		SSB-10-25-26.5	25 to 26.5	10/28/10														X				
		SSB-10-26.25-26.5	26.25 to 26.5	10/28/10																X		
Phase 3 (January 2011)	TP-01	TP-01-2'	2	1/04/11		X		X	X	X	X						X				X	X
		TP-01-8'	8	1/04/11		X		X	X	X	X						X	X			X	X
		TP-01-10'	10	1/04/11														X			X	X
	TP-02	TP-02-2'	2	1/04/11		X		X	X	X	X	X	X	X			X				X	X
		TP-02-8'	8	1/04/11		X		X	X	X	X	X	X	X			X	X	X		X	X
		TP-DUPE-1	8	1/04/11		X		X	X	X	X	X	X	X			X					
		TP-02-9'	9	1/04/11														X	X		X	X
	TP-03	TP-03-2'	2	1/04/11		X		X	X	X	X						X					
		TP-03-4'	4	1/04/11		X		X	X	X	X						X					
		TP-03-7'	7	1/04/11		X		X	X	X	X						X					
	TP-04	TP-04-2'	2	1/05/11		X		X	X	X	X						X					
		TP-04-7'	7	1/05/11		X		X	X	X	X						X					
	TP-05	TP-05-2'	2	1/05/11		X		X	X	X	X	X	X	X			X				X	X
		TP-05-6'	6	1/05/11		X		X	X	X	X	X	X	X	X		X	X			X	X
		TP-05-8'	8	1/05/11														X			X	X
	TP-06	TP-06-3'	3	1/05/11		X		X	X	X	X						X					
		TP-06-7'	7	1/05/11		X		X	X	X	X						X					
	TP-07	TP-07-2'	2	1/05/11		X		X	X	X	X	X	X	X			X				X	X
		TP-DUPE-2	2	1/05/11		X		X	X	X	X	X	X	X			X					
		TP-07-6'	6	1/05/11		X		X	X	X	X	X	X	X	X		X	X	X		X	X
		TP-07-8'	8	1/05/11														X	X		X	X
	TP-08	TP-08-2'	2	1/05/11		X		X	X	X	X				X		X					
		TP-08-5'	5	1/05/11		X		X	X	X	X						X					
	TP-09	TP-09-2'	2	1/06/11		X		X	X	X											X	X
		TP-09-3'	3	1/06/11		X		X	X	X								X			X	X
		TP-09-5'	5	1/06/11														X			X	X
	TP-10	TP-10-2'	2	1/06/11		X		X	X	X	X				X		X					
		TP-10-3'	3	1/06/11		X		X	X	X	X						X					
	TP-11	TP-11-2'	2	1/07/11		X		X	X	X	X						X				X	X
		TP-11-5'	5	1/07/11		X		X	X	X	X				X		X	X	X		X	X
		TP-DUPE-3	5	1/07/11		X		X	X	X	X				X		X					
		TP-11-7'	7	1/07/11														X	X		X	X
	TP-12	TP-12-2'	2	1/04/11		X		X	X	X	X				X		X					
		TP-12-4'	4	1/04/11		X		X	X	X	X						X					
	TP-14	TP-14-2'	2	1/06/11		X		X	X	X	X				X		X					
		TP-14-3'	3	1/06/11		X		X	X	X	X				X		X					
		TP-14-5'	5	1/06/11		X		X	X	X	X						X					
	TP-15	TP-15-2'	2	1/06/11		X		X	X	X	X				X		X				X	X
		TP-15-4'	4	1/06/11		X		X	X	X	X				X		X	X			X	X
		TP-15-5'	5	1/06/11														X			X	X
	TP-16	TP-16-2'	2	1/06/11		X		X	X	X	X						X					
		TP-16-5'	5	1/06/11		X		X	X	X	X						X					
	TP-21	TP-21-3'	3	1/07/11		X		X	X	X	X						X					
Phase 4 (March 2011)	MW-65	MW-65-5-6.5	5 to 6.5	3/10/11	X			X	X	X	X	X	X	X			X					
		MW-65-15-16.5	15 to 16.5	3/10/11	X			X	X	X	X	X	X	X			X					
	MW-66	MW-66-2.5-4	2.5 to 4	3/09/11	X			X	X		X	X	X	X			X					
		MW-66-15-16.5	15 to 16.5	3/09/11	X			X	X		X	X	X	X			X					
		MW-66-30-30.5	30 to 30.5	3/09/11							X	X	X	X								
	MW-67	MW-67-2-3.5	2 to 3.5	3/09/11	X			X	X	X	X	X	X	X								
		MW-67-15-16.5	15 to 16.5	3/09/11	X			X	X	X	X	X	X	X								
		MW-67-25-25.5	25 to 25.5	3/09/11							X	X	X	X								

Notes:
SVOCs = Semivolatile organic compounds
PAHs = Polycyclic aromatic hydrocarbons
VOCs = Volatile organic compounds
PCB = Polychlorinated biphenyl

Table 2

Sampling and Analytical Testing Summary – Groundwater

Port Angeles Rayonier Mill Study Area
Port Angeles, Washington

Supplemental Upland Investigation Phase	Sample Location	Sample ID	Sample Depth (feet bgs)	Sample Date	Ammonia	Dioxins/Furans	SVOCs (not including PAHs & Chlorophenols)	VOCs	PAHs	Chlorophenols	Total Petroleum Hydrocarbons - Gasoline Extended	Total Petroleum Hydrocarbons - Diesel Extended	Select Metals	Hexavalent Chromium	Mercury	Organo-chlorinated Pesticides	PCB Aroclors
					EPA 350.1/350.3	EPA 1613	SW8270	SW8260	SW8270D SIM	SW8041	NWTPH-Gx	NWTPH-Dx	EPA 200.8	EPA A3500	SW7470A	SW8081	SW8082
Phase 1 Baseline Groundwater Sampling - August 2010	MW-23	MW-23_100825	--	8/25/10	X	X	X	X	X	X	X	X	X		X	X	X
	MW-28	MW-28_100825	--	8/25/10	X	X	X	X	X	X	X	X	X		X	X	X
	MW-29	MW-29_100825	--	8/25/10	X	X	X	X	X	X	X	X	X		X	X	X
	MW-51	MW-51_100826	--	8/26/10	X	X	X	X	X	X	X	X	X		X	X	X
	MW-52	MW-52_100825	--	8/25/10	X	X	X	X	X	X	X	X	X		X	X	X
	MW-53	MW-53_100826	--	8/26/10	X	X	X	X	X	X	X	X	X		X	X	X
	MW-54	MW-54_100826	--	8/26/10	X	X	X	X	X	X	X	X	X		X	X	X
	MW-55	MW-55_100826	--	8/26/10	X	X	X	X	X	X	X	X	X		X	X	X
	MW-56	MW-56_100826	--	8/26/10	X	X	X	X	X	X	X	X	X		X	X	X
	MW-57	MW-57_100826	--	8/26/10	X	X	X	X	X	X	X	X	X		X	X	X
	MW-58	MW-58_100827	--	8/27/10	X	X	X	X	X	X	X	X	X		X	X	X
	MW-59	MW-59_100827	--	8/27/10	X	X	X	X	X	X	X	X	X		X	X	X
	PZ-2	PZ-2_100825	--	8/25/10	X	X	X	X	X	X	X	X	X		X	X	X
	PZ-3	PZ-3_100826	--	8/26/10	X	X	X	X	X	X	X	X	X		X	X	X
	PZ-4	PZ-4_100825	--	8/25/10	X	X	X	X	X	X	X	X	X		X	X	X
	PZ-5	PZ-5_100827	--	8/27/10	X	X	X	X	X	X	X	X	X		X	X	X
	PZ-6	PZ-6_100827	--	8/27/10	X	X	X	X	X	X	X	X	X		X	X	X
	PZ-7	PZ-7_100827	--	8/27/10	X	X	X	X	X	X	X	X	X		X	X	X
	PZ-9	PZ-9_100826	--	8/26/10	X	X	X	X	X	X	X	X	X		X	X	X
	PZ-9	DUP-082610	--	8/26/10	X	X	X	X	X	X	X	X	X		X	X	X
	PZ-10	PZ-10_100826	--	8/26/10	X	X	X	X	X	X	X	X	X		X	X	X
	PZ-11	PZ-11_100827	--	8/27/10	X	X	X	X	X	X	X	X	X		X	X	X
	PZ-12	PZ-12_100827	--	8/27/10	X	X	X	X	X	X	X	X	X		X	X	X
	PA-19	PA-19_100826	--	8/26/10	X	X	X	X	X	X	X	X	X		X	X	X
Phase 2 (October-November 2010)	GWG-1	GWG-1-W	4 to 7.5	11/04/10	X	X	X	X	X	X		X	X		X	X	X
	GWG-2	GWG-2-W	7.5 to 10	11/01/10	X	X							X		X		X
	GWG-3	GWG-3-W	8.5 to 12	11/01/10	X	X							X		X		X
	GWG-4	GWG-4-W	8.5 to 11	11/02/10	X	X							X		X		X
	GWG-5	GWG-5-W	3.5 to 7	11/03/10	X	X							X		X		X
	GWG-6	GWG-6-W	10 to 13	11/02/10			X		X			X	X		X		X
	GWG-7	GWG-7-W	6 to 8.5	11/03/10			X		X			X	X		X		X
	GWG-8	GWG-8-W	13 to 16.5	10/28/10			X		X	X		X	X		X		X
	GWG-9	GWG-9-W	21.5 to 25	11/05/10				X									
Phase 3 (January 2011)	PIPE-1-SR23	PIPE-1-SR23	--	1/07/11	X	X	X	X	X	X		X	X		X		X
Phase 4 (March 2011)	MW-65	MW-65-110311-W	--	3/11/11	X				X	X		X	X		X		X
	MW-66	MW-66-110311-W	--	3/11/11	X				X	X			X		X		X
	MW-67	MW-67-110311-W	--	3/11/11	X				X	X		X	X		X		
Phase 5 Quarterly Groundwater Monitoring - November 2010	MW-23	MW-23_101110	--	11/10/10	X					X			X		X	X	X
	MW-28	MW-28_101110	--	11/10/10	X		X	X	X	X		X	X		X		X
	MW-29	MW-29_101111	--	11/11/10	X	X	X	X	X			X	X		X		X
	MW-51	MW-51_101110	--	11/10/10	X		X		X				X	X	X		
	MW-52	MW-52_101108	--	11/08/10			X						X		X		
	MW-54	MW-54_101111	--	11/11/10		X			X				X		X	X	
	MW-55	MW-55_101108	--	11/08/10			X						X		X		
	MW-56	MW-56_101109	--	11/09/10	X					X			X		X	X	X
	MW-57	MW-57_101108	--	11/08/10	X								X		X	X	
	MW-58	MW-58_101111	--	11/11/10									X		X	X	X
	MW-59	MW-59_101110	--	11/10/10			X						X	X	X	X	X
	MW-60	MW-60_101111	--	11/11/10	X	X	X	X	X	X	X	X	X		X		X
	MW-61	MW-61_101111	--	11/11/10	X	X	X	X	X	X	X		X		X		X
	MW-62	MW-62_101109	--	11/09/10	X	X	X		X	X	X	X	X		X		X
	MW-63	MW-63_101110	--	11/10/10				X									

Supplemental Upland Investigation Phase	Sample Location	Sample ID	Sample Depth (feet bgs)	Sample Date	Ammonia EPA 350.1/350.3	Dioxins/Furans EPA 1613	SVOCs (not including PAHs & Chlorophenols) SW8270	VOCs SW8260	PAHs SW8270D SIM	Chlorophenols SW8041	Total Petroleum Hydrocarbons - Gasoline Extended NWTPH-Gx	Total Petroleum Hydrocarbons - Diesel Extended NWTPH-Dx	Select Metals EPA 200.8	Hexavalent Chromium EPA A3500	Mercury SW7470A	Organo-chlorinated Pesticides SW8081	PCB Aroclors SW8082
Phase 5 Quarterly Groundwater Monitoring - November 2010 (continued)	MW-64	MW-64_101108	--	11/08/10		X							X		X	X	
	PZ-2	PZ-2_101111	--	11/11/10	X	X	X						X		X		X
	PZ-3	PZ-3_101109	--	11/09/10	X		X						X		X	X	
	PZ-4	PZ-4_101109	--	11/09/10									X		X	X	
	PZ-6	PZ-6_101109	--	11/09/10									X		X	X	
	PZ-7	PZ-7_101110	--	11/10/10			X						X	X	X		
	PZ-9	PZ-9_101110	--	11/10/10	X		X	X					X	X	X		
	PZ-11	PZ-11_101109	--	11/09/10			X						X		X	X	
	PZ-12	PZ-12_101109	--	11/09/10			X						X		X	X	
	PA-15	PA-15_101109	--	11/09/10	X	X	X		X	X		X	X		X		X
	PA-19	PA-19_101111	--	11/11/10	X	X	X		X	X		X	X		X		X
	PA-23	PA-23_101108	--	11/08/10	X	X							X		X	X	
	PA-24	PA-24_101109	--	11/09/10	X	X	X		X	X		X	X		X		X
Phase 5 Quarterly Groundwater Monitoring - February 2011	MW-23	MW-23_110209	--	2/09/11	X					X			X		X	X	X
	MW-23	MW-23_110209D	--	2/09/11	X								X		X		
	MW-28	MW-28_110208	--	2/08/11	X	X	X	X	X	X		X	X		X		X
	MW-29	MW-29_110208	--	2/08/11	X	X	X	X	X	X		X	X		X	X	X
	MW-51	MW-51_110211	--	2/11/11	X	X	X		X	X			X		X		X
	MW-52	MW-52_110209	--	2/09/11			X		X	X			X		X	X	
	MW-53	MW-53_110211	--	2/11/11		X	X		X	X			X		X	X	X
	MW-54	MW-54_110210	--	2/10/11		X	X		X	X			X		X	X	X
	MW-55	MW-55_110210	--	2/10/11		X	X		X	X			X		X		X
	MW-56	MW-56_110211	--	2/11/11	X		X		X	X			X		X	X	X
	MW-57	MW-57_110211	--	2/11/11	X								X		X	X	
	MW-58	MW-58_110211	--	2/11/11	X	X	X		X	X			X		X	X	X
	MW-59	MW-59_110210	--	2/10/11	X		X		X	X			X		X	X	X
	MW-60	MW-60_110209	--	2/09/11		X	X		X	X		X	X		X		X
	MW-61	MW-61_110211	--	2/11/11	X	X	X		X	X		X	X		X		X
	MW-62	MW-62_110210	--	2/10/11	X	X	X		X	X		X	X		X		X
	MW-63	MW-63_110208	--	2/08/11				X					X		X		
	MW-63	MW-63_110208D	--	2/08/11				X									
	MW-64	MW-64_110207	--	2/07/11		X							X		X	X	
	PZ-2	PZ-2_110207	--	2/07/11	X	X	X		X	X							X
	PZ-3	PZ-3_110210	--	2/10/11	X		X		X	X			X		X	X	X
	PZ-4	PZ-4_110208	--	2/08/11									X		X	X	X
	PZ-5	PZ-5_110208	--	2/08/11		X											
	PZ-6	PZ-6_110208	--	2/08/11									X		X	X	
	PZ-7	PZ-7_110208	--	2/08/11		X	X						X		X		
	PZ-9	PZ-9_110208	--	2/08/11	X		X	X	X	X			X		X		
	PZ-11	PZ-11_110208	--	2/08/11									X		X	X	X
	PZ-12	PZ-12_110207	--	2/07/11									X		X	X	
	PA-15	PA-15_110208	--	2/08/11									X		X	X	
	PA-17	PA-17_110211	--	2/11/11		X	X		X	X		X	X		X	X	X
	PA-19	PA-19_110209	--	2/09/11		X	X		X	X		X	X		X	X	X
	PA-19	PA-19_110209D	--	2/09/11		X	X		X	X		X				X	X
	PA-23	PA-23_110207	--	2/07/11									X		X	X	
	PA-24	PA-24_110210	--	2/10/11	X	X	X		X	X			X		X	X	X

Notes:
SVOCs = Semivolatile organic compounds
PAHs = Polycyclic aromatic hydrocarbons
VOCs = Volatile organic compounds
PCB = Polychlorinated biphenyl

Table 3

Sampling and Analytical Testing Summary – Surface Water

Port Angeles Rayonier Mill Study Area
Port Angeles, Washington

Supplemental Upland Investigation Phase	Sample Location	Sample ID	Sample Date	Dioxins/ Furans	Ammonia	SVOCs (not including PAHs & Chlorophenols)	PAHs	Chlorophenols	Total Petroleum Hydrocarbons - Gasoline Extended	Total Petroleum Hydrocarbons - Diesel Extended	Select Metals	Mercury	Organo-chlorinated Pesticides	PCB Aroclors
				EPA 1613	EPA 350.1	SW8270	SW8270D SIM	SW8041	NWTPH-Gx	NWTPH-Dx	EPA 200.8	SW7470A	SW8081	SW8082
Phase 1 Surface Water Sampling (August 2010)	SW-1	SW-1_100826	8/26/10	X	X	X	X	X	X	X	X	X	X	X
	SW-2	SW-2_100826	8/26/10	X	X	X	X	X	X	X	X	X	X	X
	SW-3	SW-3_100826	8/26/10	X	X	X	X	X	X	X	X	X	X	X
	SW-4	SW-4_100827	8/27/10	X	X	X	X	X	X	X	X	X	X	X
	SW-5	SW-5_100827	8/27/10	X	X	X	X	X	X	X	X	X	X	X

Notes:
SVOCs = Semivolatile organic compounds
PAHs = Polycyclic aromatic hydrocarbons
PCB = Polychlorinated biphenyl

Table 4

Groundwater Elevation Data

Port Angeles Rayonier Mill Study Area
Port Angeles, Washington

Well ID	8/16/1993		8/16/1993		2/25/1997		2/25/1997		8/27/1997		2/21/2001		8/20/2001		12/11/2002		6/17/2003		8/28/2010		11/12/2010		2/11/2011		3/11/2011		5/17/2011	
	high tide		low tide		low tide		high tide		high tide		high tide		low tide		low tide		low tide		ebb to low tide		ebb tide		high tide		low tide		low tide	
	DTW	Elevation	DTW	Elevation	DTW	Elevation	DTW	Elevation	DTW	Elevation	DTW	Elevation	DTW	Elevation	DTW	Elevation	DTW	Elevation	DTW	Elevation	DTW	Elevation	DTW	Elevation	DTW	Elevation	DTW	Elevation
MW-23	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	6.95	4.15	8.52	2.58	7.71	3.39	8.13	2.97	8.45	2.65	7.40	3.70	6.47	4.63	NM	NM	6.65	4.45
MW-28	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	6.62	3.17	7.90	1.89	6.64	3.15	NM	NM	7.86	1.93	6.80	2.99	6.32	3.47	NM	NM	NM	NM
MW-29	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	7.20	3.68	8.86	2.02	7.27	3.61	8.47	2.41	9.02	1.86	7.90	2.98	7.43	3.45	NM	NM	6.60	4.28
MW-51	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	10.78	2.58	14.53	-1.17	11.51	1.85	14.69	-1.33	13.20	0.16	11.76	1.60	11.11	2.25	NM	NM	14.23	-0.87
MW-52	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	10.80	3.30	11.64	2.46	10.87	3.23	11.42	2.68	11.68	2.42	10.93	3.17	10.51	3.59	NM	NM	10.31	3.79
MW-53	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	9.87	2.04	10.80	1.11	9.47	2.44	10.77	1.14	11.06	0.85	10.16	1.75	10.18	1.73	NM	NM	10.06	1.85
MW-54	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	11.43	2.16	12.39	1.20	10.90	2.69	12.12	1.47	12.65	0.94	11.58	2.01	9.18	4.41	NM	NM	12.21	1.38
MW-55	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	11.91	1.93	13.29	0.55	11.60	2.24	13.74	0.10	13.62	0.22	12.36	1.48	12.07	1.77	NM	NM	13.36	0.48
MW-56	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	8.22	2.64	10.02	0.84	8.08	2.78	9.72	1.14	9.64	1.22	8.77	2.09	8.37	2.49	NM	NM	9.12	1.74
MW-57	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	10.87	3.19	13.22	0.84	12.50	1.56	11.49	2.57	10.77	3.29	NM	NM	12.36	1.70
MW-58	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	8.36	3.69	9.24	2.81	9.71	2.34	8.87	3.18	8.35	3.70	NM	NM	8.41	3.64
MW-59	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	11.01	3.01	12.90	1.12	12.68	1.34	11.82	2.20	11.91	2.11	NM	NM	12.06	1.96
MW-60	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	5.96	4.15	4.94	5.17	NM	NM	4.95	5.16
MW-61	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	6.52	2.98	6.22	3.28	NM	NM	6.27	3.23
MW-62	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	8.44	2.46	8.58	2.32	NM	NM	8.00	2.90
MW-63	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	7.94	3.60	7.01	4.53	NM	NM	7.33	4.21
MW-64	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	6.78	46.18	6.57	46.39	NM	NM	5.80	47.16
MW-65	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	4.71	3.23	4.98	2.96
MW-66	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	6.80	3.10	7.53	2.37
MW-67	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	5.16	2.83	5.55	2.44
MW-68	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NM	NM
MW-69	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	2.79	5.37
MW-70	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	7.43	7.61
PZ-2	7.07	3.70	7.36	3.41	NM	NM	7.90	2.87	7.84	2.93	8.23	2.54	9.12	1.65	8.14	2.63	NM	NM	9.30	1.47	8.32	2.45	7.93	2.84	NM	NM	7.96	2.81
PZ-3	8.39	2.21	9.91	0.69	9.46	1.14	8.66	1.94	8.95	1.65	8.30	2.30	9.61	0.99	8.21	2.39	9.72	0.88	9.68	0.92	8.73	1.87	8.59	2.01	NM	NM	9.28	1.32
PZ-4	3.35	5.46	3.39	5.42	3.22	5.59	3.21	5.60	4.13	4.68	4.08	4.73	5.97	2.84	5.13	3.68	NM	NM	6.02	2.79	4.90	3.91	3.83	4.98	NM	NM	3.91	4.90
PZ-5	4.00	5.91	4.01	5.90	3.69	6.22	3.72	6.19	3.93	5.98	3.86	6.05	4.56	5.35	4.25	5.66	4.21	5.70	4.01	5.90	3.37	6.54	3.29	6.62	NM	NM	2.68	7.23
PZ-6	5.08	10.18	5.08	10.18	4.71	10.55	4.78	10.48	5.30	9.96	5.18	10.08	5.88	9.38	5.63	9.63	8.43	6.83	5.71	9.55	5.26	10.00	4.63	10.63	NM	NM	3.87	11.39
PZ-7	9.42	11.07	9.45	11.04	9.69	10.80	9.76	10.73	8.91	11.58	8.53	11.96	11.89	8.60	9.05	11.44	11.17	9.32	11.52	8.97	9.06	11.43	7.58	12.91	NM	NM	7.45	13.04
PZ-9	7.12	2.14	7.11	2.15	6.39	2.87	6.33	2.93	6.87	2.39	6.12	3.14	7.14	2.12	5.60	3.66	6.74	2.52	7.50	1.76	6.46	2.80	6.25	3.01	NM	NM	5.91	3.35
PZ-10	7.28	3.05	7.28	3.05	5.65	4.68	5.82	4.51	6.77	3.56	6.24	4.09	7.49	2.84	6.79	3.54	7.28	3.05	7.68	2.65	6.79	3.54	5.94	4.39	NM	NM	6.13	4.20
PZ-11	7.67	20.24	7.67	20.24	6.39	21.52	5.54	22.37	6.61	21.30	6.02	21.89	7.15	20.76	6.61	21.30	8.04	19.87	8.39	19.52	5.38	22.53	4.38	23.53	NM	NM	4.03	23.88
PZ-12	14.92	15.29	14.92	15.29	13.55	16.66	13.70	16.51	14.01	16.20	13.40	16.81	15.89	14.32	14.99	15.22	15.05	15.16	15.18	15.03	13.88	16.33	12.91	17.30	NM	NM	12.53	17.68
PZ-13	10.47	1.13	NM	NM	Dry	Dry	10.01	1.59	10.39	1.21	8.92	2.68	Dry	Dry	8.94	2.66	Dry	Dry	Dry - AD	Dry - AD	NM	NM	NM	NM	NM	NM	NM	NM
PA-1	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NM	NM	NM	NM	NM	NM	NM	NM	7.47	5.07
PA-2	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NM	NM	NM	NM	NM	NM	NM	NM	8.80	8.11
PA-15	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NM	NM	6.63	5.09	5.28	6.44	NM	NM	4.93	6.79
PA-17	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NM	NM	NM	NM	4.11	4.10	NM	NM	3.90	4.31
PA-19	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	6.34	5.30	3.71	7.93	1.85	9.79	NM	NM	1.63	10.01
PA-21	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NM	NM	NM	NM	5.21	24.55	NM	NM	4.88	24.88
PA-23	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NM	NM	7.67	31.61	7.30	31.98	NM	NM	6.93	32.35
PA-24	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NM	NM	5.82	2.57	6.02	2.37	NM	NM	4.84	3.55

Notes:

DTW = Depth to groundwater (in feet below top of well casing).

Elevation = Groundwater elevation (in feet) relative to National Geodetic Vertical Datum of 1929 (NGVD 29), based on surveyed well casing elevation and measured depth to groundwater.

-- = Information not available.

NP = Well was not present on the date of the monitoring event (not yet installed).

NM = Water level not measured.

Dry = Groundwater not present in well.

AD = Apparent damage to well (casing appeared to be approximately half full of filter pack sand).

Table 5

Construction Details for Monitoring Wells

Port Angeles Rayonier Mill Study Area

Port Angeles, Washington

Well ID	Northing (a)	Easting (a)	Date Installed	Ground Elevation (feet NGVD 29)	Casing Elevation (feet NGVD 29)	Casing Diameter (inches)	Screened Interval (feet bgs)		Well Installed By (Consultant)
							Top of Screen	Bottom of Screen	
MW-23	417783	1011276	2/21/1991	12.9	11.10 (b)	2	4.0	13.0	Landau Associates
MW-28	417745	1011088	6/12/1991	10.40	9.79	2	5.0	15.3	Landau Associates
MW-29	417791	1011174	6/12/1991	11.38	10.88 (b)	2	5.1	15.5	Landau Associates
MW-51	418288	1011799	2/26/1998	–	13.36	4	13.0	23.0	Landau Associates
MW-52	417610	1010635	2/25/1998	–	14.10	4	13.0	23.0	Landau Associates
MW-53	417990	1011135	2/14/2001	9.4	11.91	2	8.0	14.0	Landau Associates
MW-54	418173	1011250	2/14/2001	10.9	13.59	2	7.0	23.0	Landau Associates
MW-55	418282	1011322	2/13/2001	10.0	13.84	2	9.5	27.5	Landau Associates
MW-56	418194	1012044	2/14/2001	10.6	10.86	2	12.0	32.0	Landau Associates
MW-57	418069	1011468	11/21/2002	12.06	14.06	2	5.0	30.0	Landau Associates
MW-58	417926	1011911	11/21/2002	10.05	12.05	2	5.0	20.0	Landau Associates
MW-59	417190	1013376	11/22/2002	12.02	14.02	2	4.0	19.0	Landau Associates
MW-60	417636	1011053	10/19/2010	10.57	10.11	2	6.0	21.0	GeoEngineers
MW-61	417720	1010873	10/19/2010	9.75	9.50	2	6.0	21.0	GeoEngineers
MW-62	418060	1012203	10/20/2010	11.36	10.90	2	6.0	20.0	GeoEngineers
MW-63	417728	1011165	10/21/2010	11.91	11.54	2	5.0	25.0	GeoEngineers
MW-64	415231	1012869	10/18/2010	53.75	52.96	2	5.0	20.0	GeoEngineers
MW-65	417791	1012154	3/10/2011	8.40	7.94	2	4.0	26.0	GeoEngineers
MW-66	418101	1011805	3/9/2011	10.24	9.90	2	7.0	27.4	GeoEngineers
MW-67	417834	1011067	3/9/2011	8.26	7.99	2	4.4	24.4	GeoEngineers
MW-68	417714	1011128	5/18/2011	11.52	14.31	2	53.2	58.2	GeoEngineers
MW-69	417454	1012063	5/7/2011	8.44	8.16	2	4.0	24.0	GeoEngineers
MW-70	417324	1012249	5/6/2011	12.67	15.04	2	4.0	24.0	GeoEngineers
PZ-2	417932	1011234	8/5/1993	11.13	10.77 (b)	2	4.0	19.0	Harding Lawson Associates
PZ-3	418244	1011484	8/4/1993	10.77	10.60 (b)	2	4.0	19.0	Harding Lawson Associates
PZ-4	417726	1011547	8/9/1993	9.07	8.81 (b)	2	4.0	19.0	Harding Lawson Associates
PZ-5	417284	1012067	8/10/1993	10.13	9.91 (b)	2	4.0	14.0	Harding Lawson Associates
PZ-6	416878	1011841	8/2/1993	15.43	15.26 (b)	2	4.0	14.0	Harding Lawson Associates
PZ-7	417068	1012258	8/3/1993	20.73	20.49 (b)	2	4.5	19.5	Harding Lawson Associates
PZ-9	417397	1012941	8/5/1993	9.58	9.26 (b)	2	3.5	21.5	Harding Lawson Associates
PZ-10	417164	1012938	8/10/1993	10.60	10.33 (b)	2	4.0	19.0	Harding Lawson Associates
PZ-11	416754	1012559	8/3/1993	28.20	27.91 (b)	2	6.0	15.0	Harding Lawson Associates

Well ID	Northing (a)	Easting (a)	Date Installed	Ground Elevation (feet NGVD 29)	Casing Elevation (feet NGVD 29)	Casing Diameter (inches)	Screened Interval (feet bgs)		Well Installed By (Consultant)
							Top of Screen	Bottom of Screen	
PZ-12	416547	1012281	8/10/1993	30.51	30.21 (b)	2	7.0	22.0	Harding Lawson Associates
PZ-13	416876	1013854	8/6/1993	10.68	11.60 (b)	2	4.0	19.0	Harding Lawson Associates
PA-1	417533	1010686	8/17/2006	12.62	12.54	2	20.0	30.0	Shannon & Wilson
PA-2	416756	1011871	8/18/2006	17.20	16.91	2	70.0	80.0	Shannon & Wilson
PA-15	417517	1011503	8/19/2009	12.10	11.72	2	10.0	15.0	Shannon & Wilson
PA-17	417455	1012067	8/19/2009	8.31	8.21	2	40.0	50.0	Shannon & Wilson
PA-19	417221	1012402	8/21/2009	12.22	11.64	2	10.0	15.0	Shannon & Wilson
PA-21	416717	1012637	8/21/2009	29.99	29.76	2	10.0	15.0	Shannon & Wilson
PA-23	416115	1012515	8/24/2009	39.67	39.28	2	20.0	30.0	Shannon & Wilson
PA-24	417573	1012615	8/24/2009	8.58	8.39	2	10.0	15.0	Shannon & Wilson

Notes:

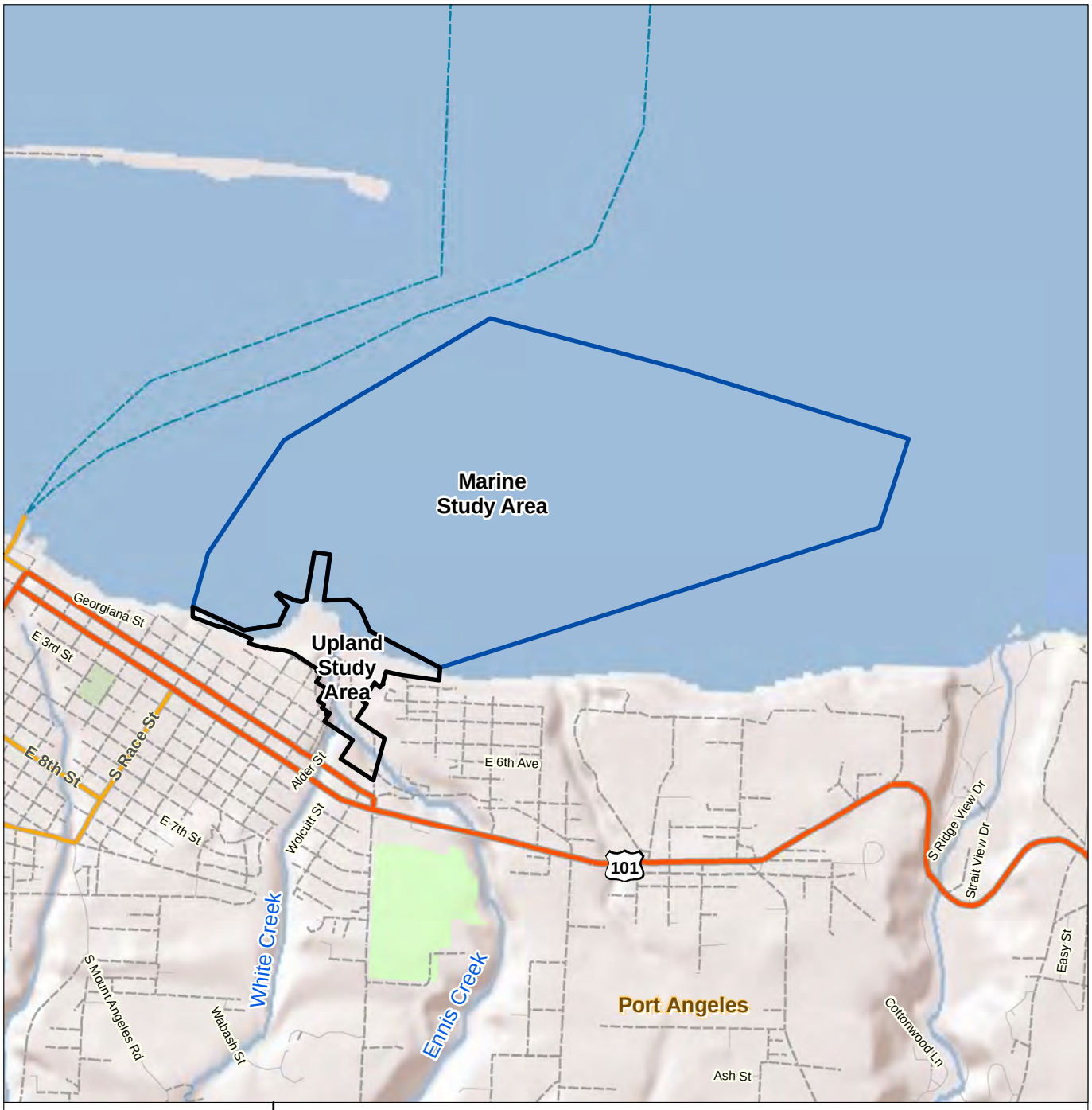
(a) Coordinates listed are relative to the Washington State Plane Coordinate System of 1983, North Zone [NAD 83(91)]. Surveys conducted by Northwestern Territories, Inc.

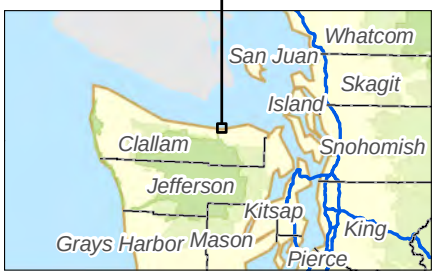
(b) Casing elevation based on 2001 survey data, not data on original boring/well logs.

bgs = Below ground surface.

feet NGVD 29 = Feet above National Geodetic Vertical Datum of 1929.

-- = Information not available.





N
W E
S

3,000 0 3,000
Feet

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. can not guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Sources: ESRI Data & Maps, Street Maps 2005

Projection: NAD 1983 Washington North (feet)

Vicinity Map

Port Angeles Rayonier Mill Study Area
Port Angeles, Washington

GeoEngineers

Figure 1

Office: SEA Path: \\Sea\projects\00137015\GIS\0137015_F1_VicinityMap.mxd Map Revised: March 4, 2010 KKS

Phase 1, 2, 3 and 4 Exploration Locations

- Phase 2 Groundwater Grab Sample
- Phase 2 Soil Boring
- Phase 2 or 4 Monitoring Well
- Monitoring Well/Piezometer Installed Prior to 2010
- Phase 3 Test Pit
- Phase 3 Pipe Contents Sample
- Phase 1 Surface Water Sample
- Former Monitoring Well

Interim Action Areas & Material Quantities Removed

- Finishing Room - 10,150 tons soil (hydraulic oil/PCBs; 1993, 1998, 2002)
- Fuel Tank No. 2 - 5,400 tons soil (Bunker C; 1993, 2002)
- Hog Fuel Pile - 2,700 cy wood residue (diesel & heavy oil; 2001)
- Machine Shop - 970 tons soil (diesel & heavy oil; 2002)
- SSL Lagoon - 4,800 tons soil (arsenic; 2001)
- Wood Mill & Fuel Tank No.1 - 7,980 tons soil (hydraulic oil & Bunker C; 2006)

- Functional Use Areas

Rayonier Property and Parcel Boundaries

- Rayonier Property Boundary
- Parcel Boundary

Easements

- New
- Existing
- Existing, To Be Abandoned
- New, Preferred but Not Required

Utilities

- CSO Project Phase I
- Exist. City Sewer

Proposed Purchases

- Abandoned Rayonier Pipe
- Storage Tank

N, W, E, S

150 0 150
Feet

Notes:
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Office: Seattle Path: \\Sea\projects\0\0137015\GIS\0137015_SupplementalUplandDataCollectionSampleLocations.mxd Modified: June 14, 2011 CRC

Supplemental Upland Data Collection Sample Locations

Port Angeles Rayonier Mill Study Area
Port Angeles, Washington

GeoEngineers

Figure 2

PORT ANGELES HARBOR

MW-55 0.22
PZ-3 0.92
MW-51 0.16
MW-54 0.94
MW-56 1.22
MW-57 1.56
MW-53 0.85
PZ-2 1.47
MW-58 2.34
MW-29 1.86
MW-23 2.65
MW-28 1.93
PZ-4 2.79
MW-52 2.42
PA-1 NM
PA-15 NM
PA-17 NM
PA-24 NM
PZ-9 1.76
PZ-5 5.90
PA-19 5.30
PZ-10 2.65
MW-59 1.34
PZ-7 8.97
PZ-6 9.55
PA-2 NM
PZ-11 19.52
PA-21 NM
PZ-12 15.03
PZ-13 NM
PA-23 NM

1.0
2.0
3.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0

Log Yard
Main Process Area
BLUFF
Ennis Creek
Pre-Fab Area
Chlorine Dioxide Generator
Primary Clarifier
Secondary Treatment
Drainage Ditch
Bone Yard

Monitoring Well Locations

Groundwater Elevation Contours (August 2010)

Groundwater Elevation Contours (August 2010) - Estimated

Upland Study Area

MW-52 2.42 = Monitoring Well Name, Groundwater Elevation (feet NGVD 29)

NM = Not Measured

N W E S

250 0 250
Feet

August 2010 Potentiometric Map

Port Angeles Rayonier Mill Study Area
Port Angeles, Washington

GeoEngineers

Figure 3

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

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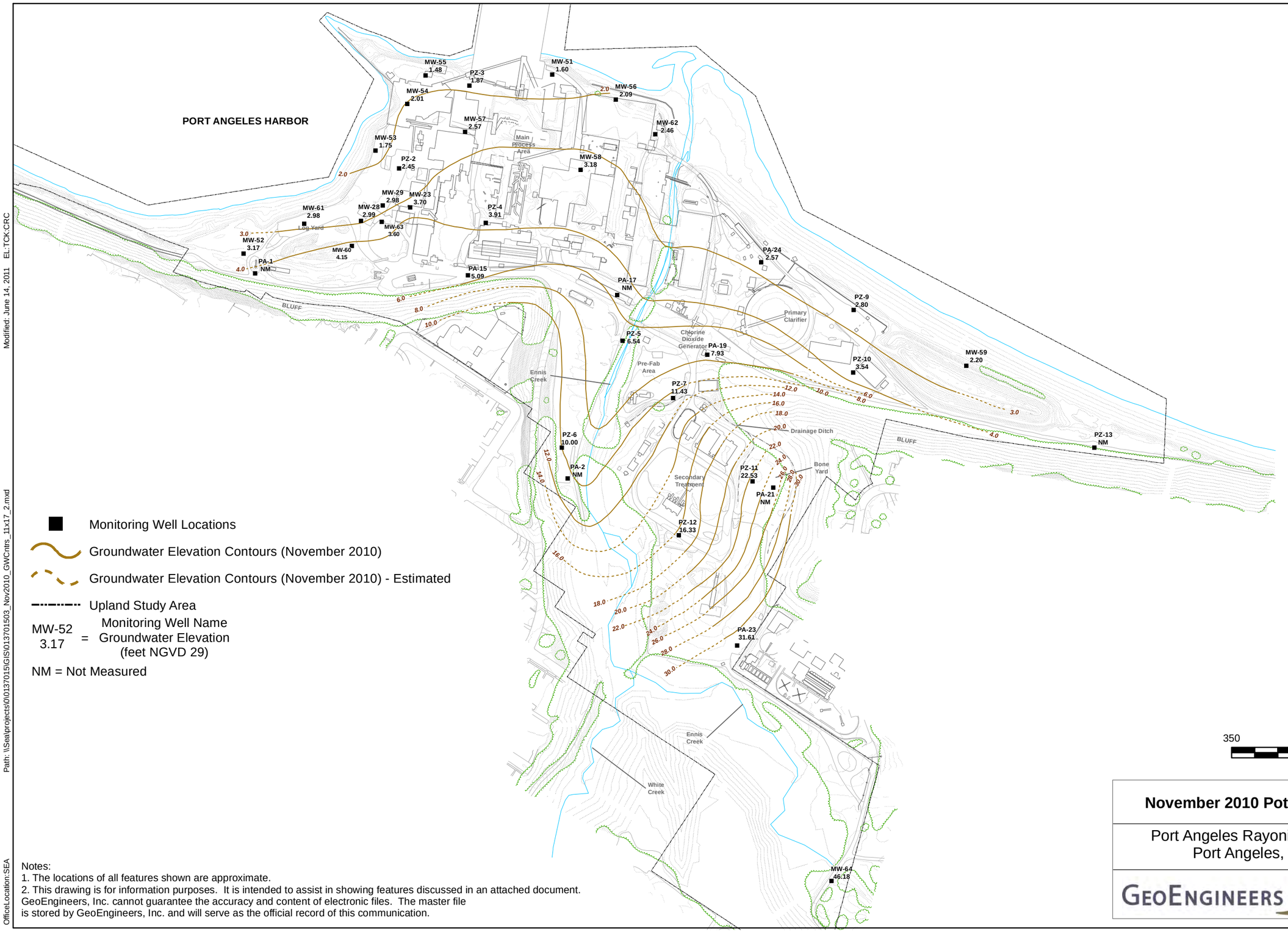

Monitoring Well Locations

Groundwater Elevation Contours (November 2010)

Groundwater Elevation Contours (November 2010) - Estimated

Upland Study Area

MW-52 / 3.17 = Monitoring Well Name / Groundwater Elevation (feet NGVD 29)

NM = Not Measured

N

W E

S

350 0 350

Feet

November 2010 Potentiometric Map

Port Angeles Rayonier Mill Study Area
Port Angeles, Washington

GeoEngineers

Figure 4

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

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OfficeLocation:SEA

Modified: June 14, 2011 EL:TCK:CRC
Path: \\Seaprojects\0\013701S\GIS\013701503_FIG5_Feb2011_GWCntrs_11x17.mxd
OfficeLocation:SEA

PORT ANGELES HARBOR

MW-55 1.77
PZ-3 2.01
MW-51 2.25
MW-56 2.49
MW-54 4.41
MW-57 3.29
MW-62 2.32
MW-53 1.73
PZ-2 2.84
MW-58 3.70
MW-29 3.45
MW-23 4.63
MW-28 3.47
MW-61 3.28
MW-63 4.53
PZ-4 4.98
MW-52 3.59
MW-60 5.17
PA-1 NM
PA-15 6.44
PA-17 4.10*
PA-24 2.37
PZ-9 3.01
PZ-5 6.62
PA-19 9.79
PZ-10 4.39
MW-59 2.11
PZ-7 12.91
PZ-6 10.63
PZ-13 NM
PA-2 NM
PZ-11 23.53
PA-21 24.55
PZ-12 17.30
PA-23 31.98
MW-64 46.39

Main Process Area
Log Yard
Ennis Creek
Primary Clarifier
Chlorine Dioxide Generator
Pre-Fab Area
Drainage Ditch
Bone Yard
Secondary Treatment
BLUFF
White Creek

Monitoring Well Locations

Groundwater Elevation Contours (February 2011)

Groundwater Elevation Contours (February 2011) - Estimated

Upland Study Area

MW-52 3.59 = Monitoring Well Name Groundwater Elevation (feet NGVD 29)

NM = Not Measured

*Groundwater elevation not used for contouring because well is screened deeper than the majority of the wells.

N W E S

350 0 350
Feet

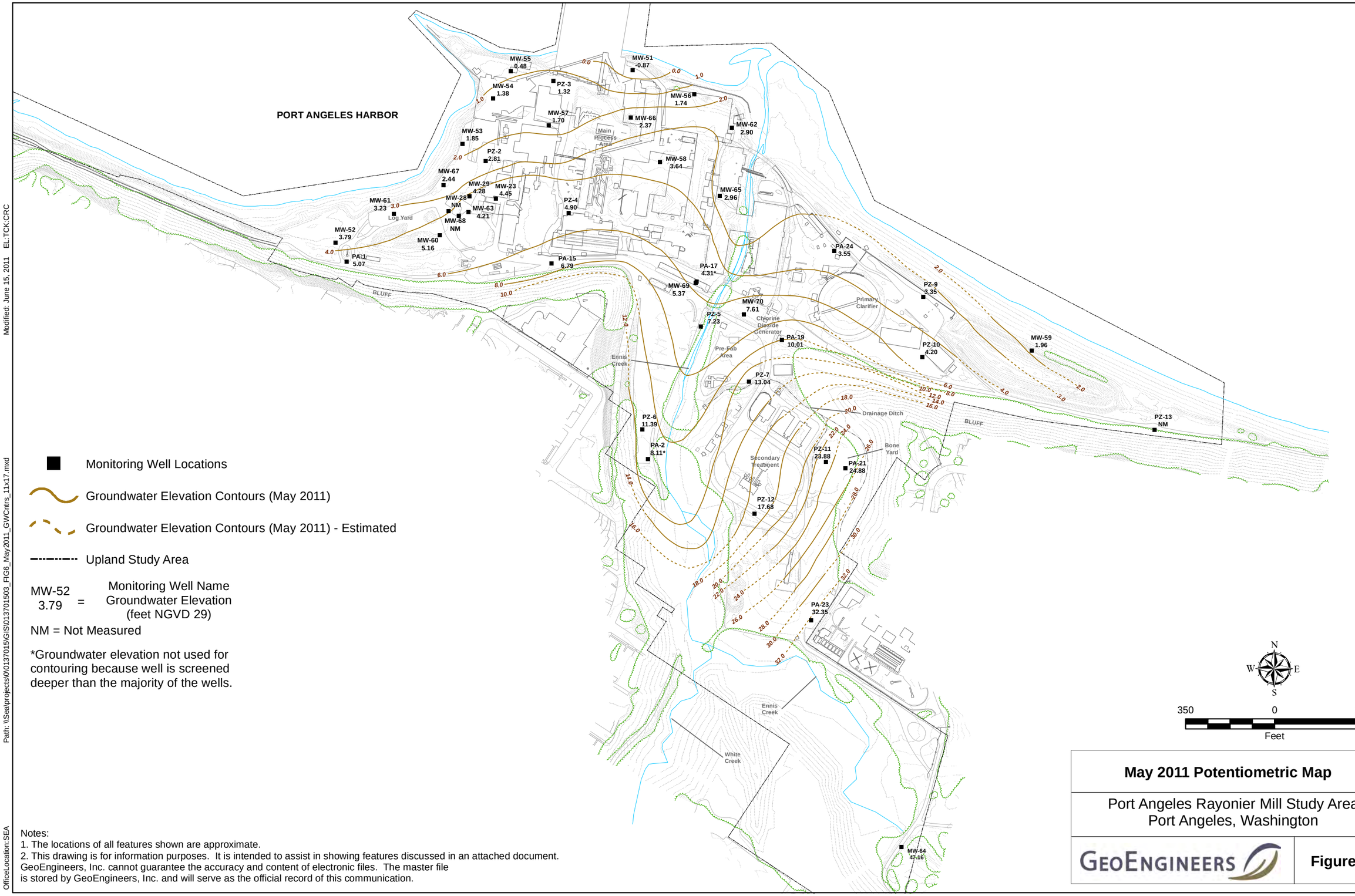
February 2011 Potentiometric Map

Port Angeles Rayonier Mill Study Area
Port Angeles, Washington

GeoEngineers

Figure 5

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.



Notes:
1. The locations of all features shown are approximate.
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May 2011 Potentiometric Map

Port Angeles Rayonier Mill Study Area
Port Angeles, Washington

GeoEngineers

Figure 6

Modified: June 15, 2011 EL:TCK:CRC

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OfficeLocation:SEA

APPENDIX A
Seep Survey Technical Memorandum

GeoEngineers

Memorandum

Plaza 600 Building, 600 Stewart Street, Suite 1700, Seattle, WA 98101, Telephone: 206.728.2674, Fax: 206.728.2732 www.geoengineers.com

To:	Warren Snyder
From:	Rob Leet
Date:	October 1, 2010
File:	0137-015-03
Subject:	Groundwater Seep Survey Results – Port Angeles Rayonier Mill Study Area

INTRODUCTION

Field reconnaissance was conducted along the beach and intertidal zone adjacent to the Former Rayonier Mill property on May 11, 2010 and August 27, 2010. The purpose of the field reconnaissance was to conduct a visual survey for groundwater seeps that may be discharging to the marine environment along the shoreline. An additional objective of the May 11, 2010 reconnaissance was to obtain information about shoreline substrate and vegetation conditions needed to prepare a Joint Aquatic Resources Permit Application (JARPA) for the seep monitoring stations described in the Supplemental Upland Data Collection Work Plan (Work Plan; GeoEngineers, July 20, 2010). The seep survey was performed in compliance with Agreed Order No. DE 6815, and was conducted in accordance with the Work Plan. This memorandum summarizes the results of the groundwater seep survey.

TIDAL ELEVATIONS DURING FIELD RECONNAISSANCE

According to the National Oceanic and Atmospheric Administration (NOAA), low tide on the morning of May 11, 2010 occurred at approximately 8:15 AM (local time); the measured tidal elevation at 8:15 AM was approximately -0.2 feet (relative to mean lower low water [MLLW])[1]. The May 11, 2010 field reconnaissance was conducted between approximately 10:00 AM and 11:50 AM; measured tidal elevations during this period ranged from approximately +1.0 feet to +2.8 feet MLLW. High tide occurred at approximately 3:00 PM, with a measured elevation of approximately +4.8 feet MLLW.

Low tide on the morning of August 27, 2010 occurred at approximately 11:00 AM; the measured tidal elevation at 11:00 AM was approximately +1.8 feet MLLW. The August 27, 2010 field reconnaissance was conducted between approximately 11:00 AM and 12:00 PM; measured tidal elevations during this period ranged from approximately +1.8 to +2.2 feet MLLW. High tide occurred at approximately 5:15 PM, with a measured elevation of approximately +6.4 feet MLLW.

SUMMARY OF OBSERVATIONS

Field reconnaissance was conducted along the entire shoreline of the mill property, and all seven Seep Survey Zones identified on Figure 28 of the Work Plan were inspected for visual evidence of groundwater

[1] source: http://tidesandcurrents.noaa.gov/cgi-bin-mp/data_plot.cgi?mins=&datum=6&unit=1&stn=9444090&bdate=20100511&edate=20100511&data_type=wl&relative=&type=Historic Tide Data&shift=d&plot_size=large&relative=&wl_sensor_hist=W1&plot_backup=

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seeps. General shoreline conditions were noted, and the exposed portions of the beach and intertidal zone were visually surveyed for indications of seeps and/or runoff. In general, the shoreline of the mill property is protected by rip-rap armoring. In some locations this armoring extends below MLLW, particularly within Seep Survey Zones 4, 5, and 6. **No discharge of water at the surface was observed during either field reconnaissance event, except for flow of Ennis Creek into Port Angeles Harbor.** Tidal pools were present locally in the intertidal zone of Seep Survey Zone 4; however, no flow was observed in the tidal pools. The table below summarizes conditions observed within each Seep Survey Zone. Photographs taken during the seep survey are attached to this memorandum.

Seep Survey Zone	Shoreline Condition	Substrate	Seeps	Vegetation	Comments
1	Beach	Sand and gravel	None	Dunegrass above OHWM	Rip-rap above OHWM
2	Beach	Sand and gravel	None	Dunegrass above OHWM	Rip-rap above OHWM
3	Beach and stream alluvium	Sand and gravel	None	Dunegrass above OHWM	Ennis Creek
4	Armoring and piles near pier, cobble near creek	Sand, gravel, cobble, rip-rap	None	Kelp	Top of dilapidated wood stave pipe visible extending from piles at MHLW – majority of pipe buried in beach sand and gravel
5	Heavily armored	Rip-rap, cobble near pier	None	Kelp	Steel pipe extending from rip-rap at mean tide, appears plugged – no liquids observed discharging from pipe; small crabs observed
6	Beach and armoring	Rip-rap, sand and gravel	None	Kelp and eelgrass; upland forbs above armoring	Rip-rap above MLHW
7	Beach	Sand and gravel	None	Kelp and eelgrass. upland forbs above armoring	Rip-rap above MLHW; concrete pipe extending from rip-rap at OHWM – no liquids observed discharging from pipe

Notes: OHWM = Ordinary high water mark
MHLW = Mean higher low water
MLHW = Mean lower high water

CONCLUSION

Groundwater seeps were not observed during the field reconnaissance. Consequently, in accordance with the Work Plan, seep monitoring stations will not be installed. The spacing of groundwater monitoring wells along

the shoreline, as well as soil and groundwater data collected during Phases 1, 2, and 3 of the supplemental upland investigation, will be reviewed. If necessary, additional monitoring wells will be installed during Phase 4 of the investigation to further evaluate the groundwater to surface water pathway.

Photograph 1
Seep Survey Zones 1 and 2, looking northwest.

Photograph 2
Seep Survey Zone 2, looking southeast.

Photograph 3
Seep Survey Zone 3, looking south-southeast.

Photograph 4
Seep Survey Zone 3.

GeoEngineers
Earth Science + Technology

May 11, 2010 Field Reconnaissance Photographs

Port Angeles Rayonier Mill Study Area

Photograph 5
Ennis Creek Bridge, looking south-southwest.

Photograph 6
Ennis Creek Bridge, looking southeast.

Photograph 7
Ennis Creek Bridge, looking south-southeast.

Photograph 8
Ennis Creek intertidal zone.

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Earth Science + Technology

May 11, 2010 Field Reconnaissance Photographs

Port Angeles Rayonier Mill Study Area

Photograph 9
Seep Survey Zone 4 intertidal alluvium, looking east.

Photograph 10
Seep Survey Zone 5 cobble beach, looking east.

Photograph 11
Seep Survey Zone 5 cobbles.

Photograph 12
Seep Survey Zone 5 crabs.

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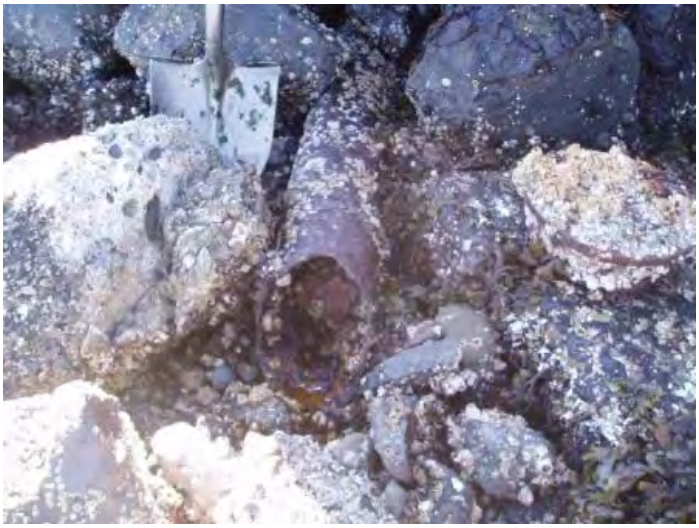
May 11, 2010 Field Reconnaissance Photographs

Port Angeles Rayonier Mill Study Area

Photograph 13
Seep Survey Zone 5, looking east.



Photograph 14
Steel pipe in Seep Survey Zone 5 rip-rap.

Photograph 15
Seep Survey Zone 5, looking west-northwest.

Photograph 16
Jetty from Seep Survey Zone 5, looking northwest.

GeoEngineers
Earth Science + Technology

May 11, 2010 Field Reconnaissance Photographs

Port Angeles Rayonier Mill Study Area

Photograph 17
Jetty, looking northwest.

Photograph 18
Jetty from Seep Survey Zone 6, looking northwest.

Photograph 19
Seep Survey Zone 6, looking north-northeast.

Photograph 20
Seep Survey Zone 6 from jetty, looking south.

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Earth Science + Technology

May 11, 2010 Field Reconnaissance Photographs

Port Angeles Rayonier Mill Study Area

Photograph 21
Seep Survey Zone 6 rip-rap, looking north.

Photograph 22
Seep Survey Zone 6, looking north-northeast.

Photograph 23
Seep Survey Zone 6 beach.

Photograph 24
Seep Survey Zone 6.

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May 11, 2010 Field Reconnaissance Photographs

Port Angeles Rayonier Mill Study Area

Photograph 25
Seep Survey Zone 7, looking west-southwest.

Photograph 26
Seep Survey Zone 7 beach.

Photograph 27
Seep Survey Zone 7.

Photograph 28
Concrete pipe in Seep Survey Zone 7 rip-rap.

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May 11, 2010 Field Reconnaissance Photographs

Port Angeles Rayonier Mill Study Area

Photograph 1
Seep Survey Zone 4, looking northwest.

Photograph 2
Seep Survey Zone 4 tidal pool, looking northwest.

Photograph 3
Seep Survey Zone 4, looking west-northwest.

Photograph 4
Wood stave pipe in Seep Survey Zone 4, looking east-southeast.

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August 27, 2010 Field Reconnaissance Photographs

Port Angeles Rayonier Mill Study Area

Photograph 5
Seep Survey Zone 5, looking east.

Photograph 6
Seep Survey Zone 5, looking west.

Photograph 7
Seep Survey Zone 6 from jetty, looking southeast.

Photograph 8
Seep Survey Zone 6, looking south-southwest.

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August 27, 2010 Field Reconnaissance Photographs

Port Angeles Rayonier Mill Study Area

Photograph 9
Seep Survey Zones 6 and 7, looking southwest.

Photograph 10
Seep Survey Zone 7, looking east-northeast.

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August 27, 2010 Field Reconnaissance Photographs

Port Angeles Rayonier Mill Study Area

APPENDIX B
Boring/Well Logs

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% RETAINED ON NO. 200 SIEVE	SAND AND SANDY SOILS	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS
				SP	POORLY-GRADED SANDS, GRAVELLY SAND
	MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS, ROCK FLOUR, CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% PASSING NO. 200 SIEVE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS AND SILTS OF MEDIUM TO HIGH PLASTICITY
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: Multiple symbols are used to indicate borderline or dual soil classifications

ADDITIONAL MATERIAL SYMBOLS

SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
	CC	Cement Concrete
	AC	Asphalt Concrete
	CR	Crushed Rock/ Quarry Spalls
	TS	Topsoil/ Forest Duff/Sod

Measured groundwater level in exploration, well, or piezometer

Groundwater observed at time of exploration

Perched water observed at time of exploration

Measured free product in well or piezometer

Graphic Log Contact

Distinct contact between soil strata or geologic units

Approximate location of soil strata change within a geologic soil unit

Material Description Contact

Distinct contact between soil strata or geologic units

Approximate location of soil strata change within a geologic soil unit

Sampler Symbol Descriptions

2.4-inch I.D. split barrel

Standard Penetration Test (SPT)

Shelby tube

Piston

Direct-Push

Bulk or grab

Blowcount is recorded for driven samplers as the number of blows required to advance sampler 12 inches (or distance noted). See exploration log for hammer weight and drop.

A "P" indicates sampler pushed using the weight of the drill rig.

Laboratory / Field Tests

%F	Percent fines
AL	Atterberg limits
CA	Chemical analysis
CP	Laboratory compaction test
CS	Consolidation test
DS	Direct shear
HA	Hydrometer analysis
MC	Moisture content
MD	Moisture content and dry density
OC	Organic content
PM	Permeability or hydraulic conductivity
PP	Pocket penetrometer
SA	Sieve analysis
TX	Triaxial compression
UC	Unconfined compression
VS	Vane shear

Sheen Classification

NS	No Visible Sheen
SS	Slight Sheen
MS	Moderate Sheen
HS	Heavy Sheen
NT	Not Tested

NOTE: The reader must refer to the discussion in the report text and the logs of explorations for a proper understanding of subsurface conditions. Descriptions on the logs apply only at the specific exploration locations and at the time the explorations were made; they are not warranted to be representative of subsurface conditions at other locations or times.

KEY TO EXPLORATION LOGS

GeoEngineers

FIGURE B-1

Start / End	Total Depth (ft)	Logged By / Checked By	Driller	Drilling Method
Drilled 10/19/2010 / 10/19/2010	24.4	AMW / RCL	Boart Longyear	Hollow Stem Auger

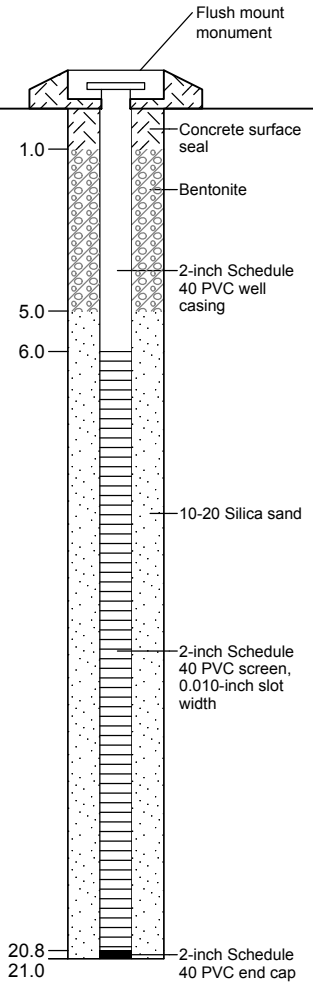
Hammer Data	Wireline 300 (lbs) / 30 (in) Drop	Drilling Equipment	Mobile B59
Surface Elevation (ft) Vertical Datum	10.6 NGVD29	Top of Casing Elevation (ft)	10.11
Easting (X) Northing (Y)	1011053 417636	System Datum	NAD83

Licencing agency well number: **BAM 433**
A 2 (in) well was installed on 10/19/2020 to a depth of 21 (ft).

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
11/12/2010	5.96	4.15

Notes: Auger Data: 4¼-inch I.D.

Elevation (feet)	Depth (feet)	Interval Recovered (in)	Blows/foot	Collected Sample	Sample No.	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor
10	0	14	28		1			GW	Cobbles and boulders with abundant void spaces (based on cuttings)		
									Brown fine to coarse gravel with fine to coarse sand and trace silt (medium dense, moist)		<1
5	5	6	11		2	▼			5-foot sample consists of large pulverized rock (medium dense, moist)		<1
0								SW	Dark gray to black fine to coarse sand with fine to coarse gravel, trace silt and wood debris in matrix (loose, wet)		
-5	10	12	3		3					MS	10.3
									Grades to dark brown-gray fine to coarse sand with occasional fine gravel and trace silt (very loose, wet)		
-10	15	17	2		4					SS	4.3
								GW	Gray fine to coarse gravel with sand, trace silt (medium dense, wet)		
	20	6	50/3"		5						<1
		0	31		6			ML	Gray sandy silt with occasional fine gravel (hard, wet)	NS	<1
		10	50/5"		7				Grades to gray fine sandy silt to silt with fine sand (hard, moist)	NS	<1



Note: Please see Figure B-1 for explanation of symbols

Log of Monitoring Well MW-60

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-2
Sheet 1 of 1

Seattle: Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015030137015O3 (2).GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

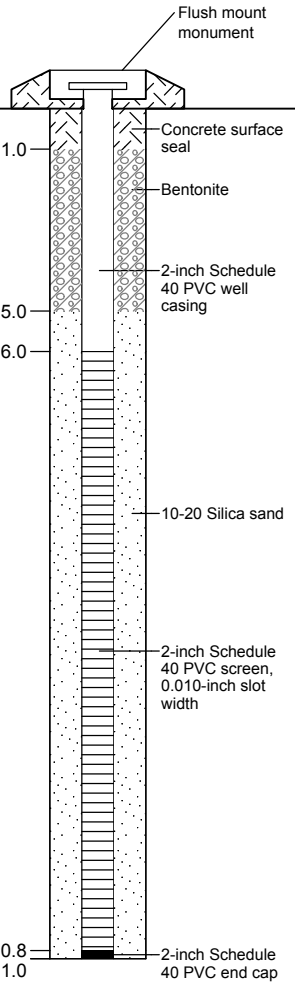
Start / End	Total Depth (ft)	Logged By / Checked By	Driller	Drilling Method
Drilled 10/19/2010 / 10/19/2010	21.3	AMW / RCL	Boart Longyear	Hollow Stem Auger

Hammer Data	Wireline 300 (lbs) / 30 (in) Drop	Drilling Equipment	Mobile B59	Licencing agency well number: **BAM 432** A 2 (in) well was installed on 10/19/2020 to a depth of 21 (ft).
Surface Elevation (ft) Vertical Datum	9.7 NGVD29	Top of Casing Elevation (ft)	9.50	Groundwater: Date Measured 11/12/2010; Depth to Water (ft) 6.52; Elevation (ft) 2.98
Easting (X) Northing (Y)	1010873 417720	System Datum	NAD83	

Notes: Auger Data: 4¼-inch I.D.

Elevation (feet)	Depth (feet)	Interval Recovered (in)	Blows/foot	Collected Sample	Sample No.	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor
	0	0	50/3"		1			AC	Asphalt concrete		
								GW	Brown fine to coarse gravel (encountered logs)		
	5	14	17		2				Grades to gray fine to coarse gravel (angular) with fine to coarse sand and trace silt (medium dense, moist)	NS	<1
	10	7	8		3				Becomes loose, wet	NS	<1
	15	14	5		4					NS	<1
	20	13	50/3"		5					NS	<1
								ML	Gray silt with fine gravel and fine to coarse sand (very dense, moist)		

WELL LOG



Note: Please see Figure B-1 for explanation of symbols

Log of Monitoring Well MW-61

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-3
Sheet 1 of 1

Seattle: Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015030137015O3 (2).GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

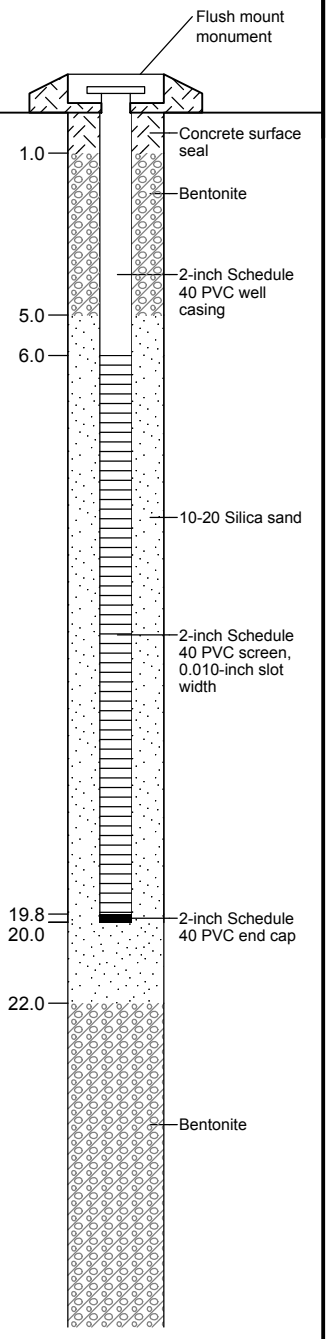
Start / End	Total Depth (ft)	Logged By / Checked By	Driller	Drilling Method
Drilled 10/20/2010 / 10/20/2010	51	AMW / RCL	Boart Longyear	Hollow Stem Auger

Hammer Data	Wireline 300 (lbs) / 30 (in) Drop	Drilling Equipment	Mobile B59	Licencing agency well number: **BAM 434** A 2 (in) well was installed on 10/20/2010 to a depth of 20 (ft).
Surface Elevation (ft) Vertical Datum	11.4 NGVD29	Top of Casing Elevation (ft)	10.90	Groundwater: Date Measured 11/12/2010; Depth to Water (ft) 8.44; Elevation (ft) 2.46
Easting (X) Northing (Y)	1012203 418060	System Datum	NAD83	

Notes: Auger Data: 4¼-inch I.D.

Elevation (feet)	Depth (feet)	Interval Recovered (in)	Blows/foot	Collected Sample	Sample No.	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor
10	0							TS	Topsoil, sod with grass and other vegetation		
								SW	Brown fine to coarse sand with fine to coarse gravel and trace silt (loose, moist)		
		17	8		1					NS	<1
5	5	10	8		2				Grades to gray fine to coarse sand with occasional fine gravel and trace silt (loose, moist)	NS	<1
0	10	11	1		3	▼			Becomes very loose, wet	NS	<1
-5	15	18	41		4				Grades to gray fine to coarse sand with fine to coarse gravel and trace silt with occasional shell fragments (dense, wet)	NS	<1
-10	20	18	8		5				Becomes loose, wet	NS	<1
-15	25	9	6		6				Grades to gray fine to coarse sand with occasional fine gravel and trace silt, occasional shell fragments (loose, wet)	NS	<1
	30										

WELL LOG



Note: Please see Figure B-1 for explanation of symbols

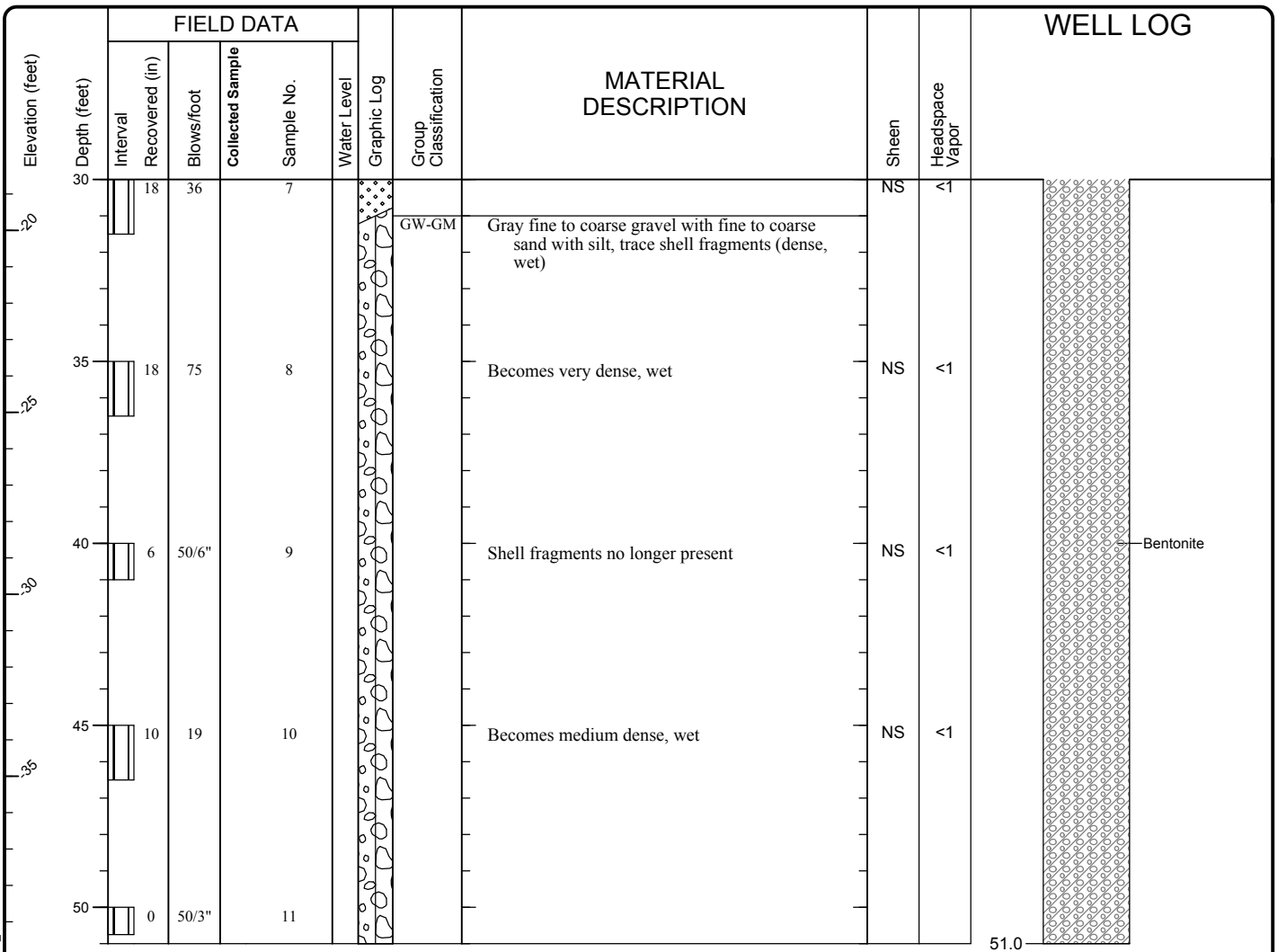
Log of Monitoring Well MW-62

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-4
Sheet 1 of 2

Seattle: Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015030137015O3 (2).GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL



Note: Please see Figure B-1 for explanation of symbols

Log of Monitoring Well MW-62 (continued)

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-4
Sheet 2 of 2

Seattle: Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015030137015O3 (2).GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

Drilled Start 10/21/2010 End 10/21/2010	Total Depth (ft) 28	Logged By AMW Checked By RCL	Driller Boart Longyear	Drilling Method Hollow Stem Auger

Hammer Data: Wireline 300 (lbs) / 30 (in) Drop	Drilling Equipment: Mobile B59	Licencing agency well number: **BAM 435** A 2 (in) well was installed on 10/21/2010 to a depth of 25 (ft).
Surface Elevation (ft) 11.9 Vertical Datum NGVD29	Top of Casing Elevation (ft) 11.54	
Easting (X) 1011165 Northing (Y) 417728	System Datum NAD83	

Groundwater

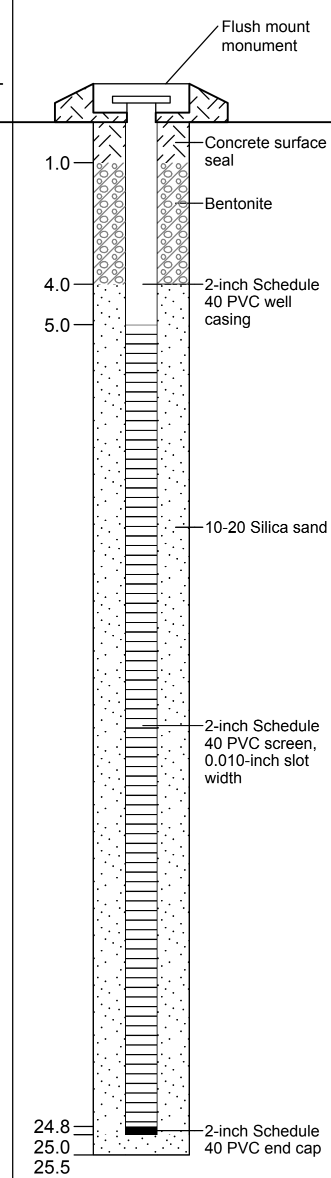
Date Measured	Depth to Water (ft)	Elevation (ft)
11/12/2010	7.94	3.60

Notes: Auger Data: 4¼-inch I.D.

FIELD DATA

Elevation (feet)	Depth (feet)	Recovered (in)	Blows/foot	Sample No.	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor
	0				SW-SM	Brown fine to coarse sand with fine to coarse gravel with silt (rootlets) (dense, moist)		
10		16	37	1			NS	<1
	5	18	23	2	SM	Brown sandy silt with fine gravel (very stiff, moist)	NS	<1
5								
	10	18	24	3		Becomes very stiff, moist	NS	<1
0								
	15	8	50/3"	4	SP-SM	Gray fine to medium sand with silt (very dense, moist) (wood shavings in slough)	NS	<1
-5								
	20	10	3	5		Grades to gray-brown fine to medium sand with silt and occasional fine to coarse gravel (very loose, moist)	NS	<1
-10		18	13	6	SP	Gray fine to medium sand with trace silt (medium dense, wet)	NS	<1
	25				ML	Gray sandy silt with fine to coarse gravel (hard, moist)		
-15		4	50/5"	7				<1
		5	50/5"	8				<1

WELL LOG



Note: Please see Figure B-1 for explanation of symbols

Log of Monitoring Well MW-63

GEOENGINEERS

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-5
Sheet 1 of 1

Seattle: Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\013701503\013701503 (2).GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

Start / End	Total Depth (ft)	Logged By / Checked By	Driller	Drilling Method
Drilled 10/18/2010 / 10/18/2010	21.75	AMW / RCL	Boart Longyear	Hollow Stem Auger

Hammer Data	Wireline 300 (lbs) / 30 (in) Drop	Drilling Equipment	Mobile B59
Surface Elevation (ft) Vertical Datum	53.7 NGVD29	Top of Casing Elevation (ft)	52.96
Easting (X) Northing (Y)	1012869 415231	System Datum	NAD83

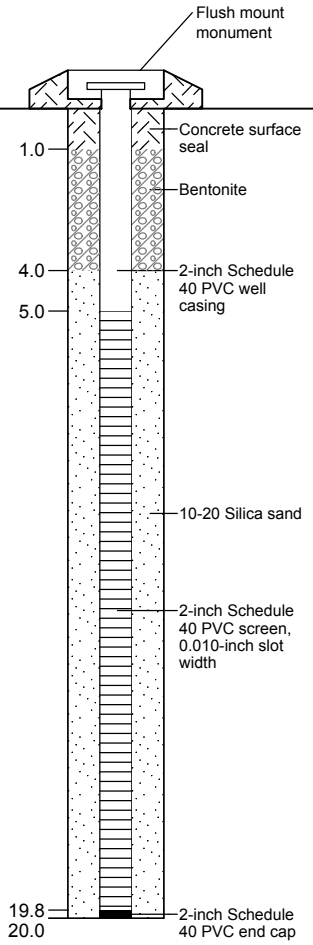
Licencing agency well number: **BAM 431**
A 2 (in) well was installed on 10/18/2010 to a depth of 20 (ft).

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
11/12/2010	6.78	46.18

Notes: Auger Data: 4¼-inch I.D.

Depth (feet)	Elevation (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample No.	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor
0	50								GW-GM	Brown fine to coarse gravel with fine to coarse sand and silt (moist)		
			13	13		1					NS	<1
5	45		6	17		2				Becomes medium dense, moist	NS	<1
10	40		18	43		3				Becomes dense, wet	NS	<1
15	35		11	61		4				Grades to orange-brown to gray-brown (very dense, wet)	NS	<1
20			8	50/2"		5			ML	Gray silt with fine to coarse sand and fine to coarse gravel (hard, moist)	NS	<1
			6	50/3"		6					NS	<1

WELL LOG



Note: Please see Figure B-1 for explanation of symbols

Log of Monitoring Well MW-64

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-6
Sheet 1 of 1

Seattle: Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015030137015O3 (2).GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

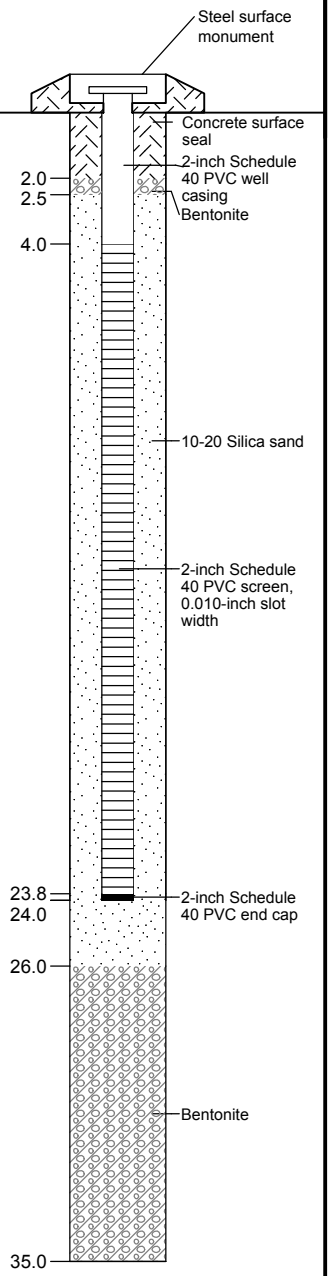
Drilled	Start	End	Total Depth (ft)	Logged By / Checked By	Driller	Drilling Method
	3/10/2011	3/10/2011	36.5	AMW / RCL	Cascade Drilling	Hollow Stem Auger

Hammer Data	Wireline 300 (lbs) / 30 (in) Drop	Drilling Equipment	CME 75	Licencing agency well number: **BHB 103** A 2 (in) well was installed on 3/10/2011 to a depth of 24 (ft).
Surface Elevation (ft) Vertical Datum	8.4 NGVD29	Top of Casing Elevation (ft)	7.94	Groundwater: Date Measured 3/11/2011; Depth to Water (ft) 4.71; Elevation (ft) 3.23
Easting (X) Northing (Y)	1012154 417791	System Datum	NAD83	

Notes:

Elevation (feet)	Depth (feet)	Interval Recovered (in)	Blows/foot	Collected Sample	Sample No.	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor
	0							RBL	Concrete rubble (fill)		
								GW	Gray-brown fine to coarse gravel with fine to coarse sand, trace silt (medium dense, moist)		
	5	14	16		1	▼				NS	<1
	10	18	21		2			GW-GM	Dark gray-brown fine to coarse gravel with fine to coarse sand with silt (medium dense, wet)	NS	<1
	15	18	52		3			SW	Gray fine to coarse sand, occasional fine gravel, trace silt (very dense, wet)	NS	<1
	20	6	50/6"		4			SM	Dark gray-brown silty fine to coarse sand with fine gravel, (very dense, wet)	NS	<1
	25	12	16		5			ML	Dark gray fine sandy silt, occasional fine gravel (stiff, wet)	NS	<1
	30	6	50/6"		6			SW	Gray fine to coarse sand, occasional fine gravel, trace silt (very dense, wet)	NS	<1
	35	6	20		7					NS	<1

WELL LOG



Note: Please see Figure B-1 for explanation of symbols

Log of Monitoring Well MW-65

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-7
Sheet 1 of 1

Seattle: Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015030137015O3 (2).GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

Drilled	Start	End	Total Depth (ft)	Logged By / Checked By	Driller	Drilling Method
	3/9/2011	3/9/2011	30.5	AMW / RCL	Cascade Drilling	Hollow Stem Auger

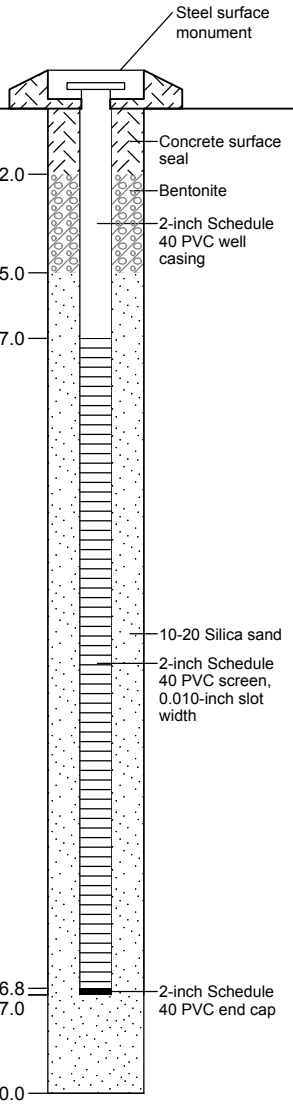
Hammer Data	Wireline 300 (lbs) / 30 (in) Drop	Drilling Equipment	CME 75
Surface Elevation (ft) Vertical Datum	10.2 NGVD29	Top of Casing Elevation (ft)	9.90
Easting (X) Northing (Y)	1011805 418101	System Datum	NAD83

Licencing agency well number: **BHB 102**
A 2 (in) well was installed on 3/9/2011 to a depth of 27 (ft).

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
3/11/2011	6.80	3.10

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample No.	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor
10	0								RBL	Concrete rubble with sand and gravel, trace silt		
			18	10		1			SW	Gray-brown fine to coarse sand with fine to coarse gravel, occasional fine concrete rubble, apparent sawdust (medium dense, moist)	NS	<1
5	5		18	16		2	▼				NS	<1
0	10		18	6		3				Grades to black fine to coarse sand with occasional fine gravel, trace silt (loose, wet)	NS	<1
-5	15		18	8		4					NS	<1
-10	20		6	50/6"		5				Becomes very dense	NS	<1
									GW-GM	Gray fine to coarse gravel with sand and silt (very dense, wet) (possible weathered till)		
-15	25		18	27		6					NS	<1
									GM	Gray silty fine to coarse gravel with fine to coarse sand (very dense, moist)		
-20	30		6	50/6"		7					NS	<1



Note: Please see Figure B-1 for explanation of symbols

Log of Monitoring Well MW-66

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-8
Sheet 1 of 1

Seattle: Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015030137015O3 (2).GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

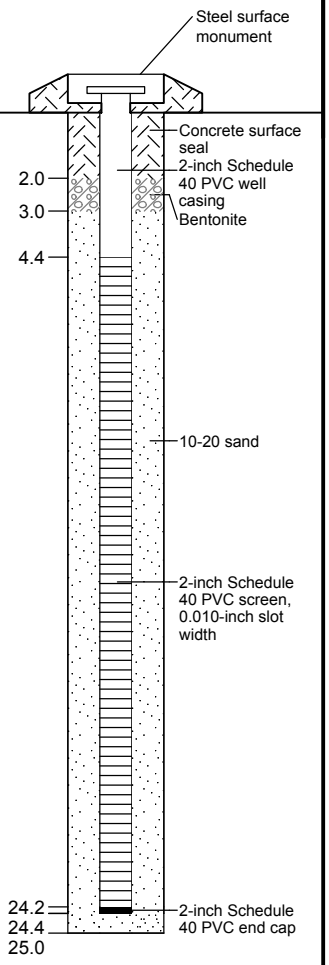
Drilled	Start	End	Total Depth (ft)	Logged By / Checked By	Driller	Drilling Method
	3/9/2011	3/9/2011	25.5	AMW / RCL	Cascade Drilling	Hollow Stem Auger

Hammer Data	Wireline 300 (lbs) / 30 (in) Drop	Drilling Equipment	CME 75	Licencing agency well number: **BHB 101** A 2 (in) well was installed on 3/9/2011 to a depth of 24.4 (ft).
Surface Elevation (ft) Vertical Datum	8.3 NGVD29	Top of Casing Elevation (ft)	7.99	Groundwater: Date Measured 3/11/2011; Depth to Water (ft) 5.16; Elevation (ft) 2.83
Easting (X) Northing (Y)	1011067 417834	System Datum	NAD83	

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample No.	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor
	0								AS	0-8" asphalt		
									SW	Brown fine to coarse sand with fine to coarse gravel, trace silt (medium dense, moist)		
			16	29		1					NS	<1
	5		18	25		2	▼				SS	<1
										Grades to gray fine to coarse sand, occasional fine gravel (very dense, wet)		
	10		6	50/6"		3					NS	<1
	15		12	16		4				Becomes medium dense	NS	<1
	20		16	51		5					NS	<1
									GM	Gray silty fine to coarse gravel with fine to coarse sand (very dense, moist)		
	25		6	50/6"		6					NS	<1

WELL LOG



Note: Please see Figure B-1 for explanation of symbols

Log of Monitoring Well MW-67

GeoEngineers

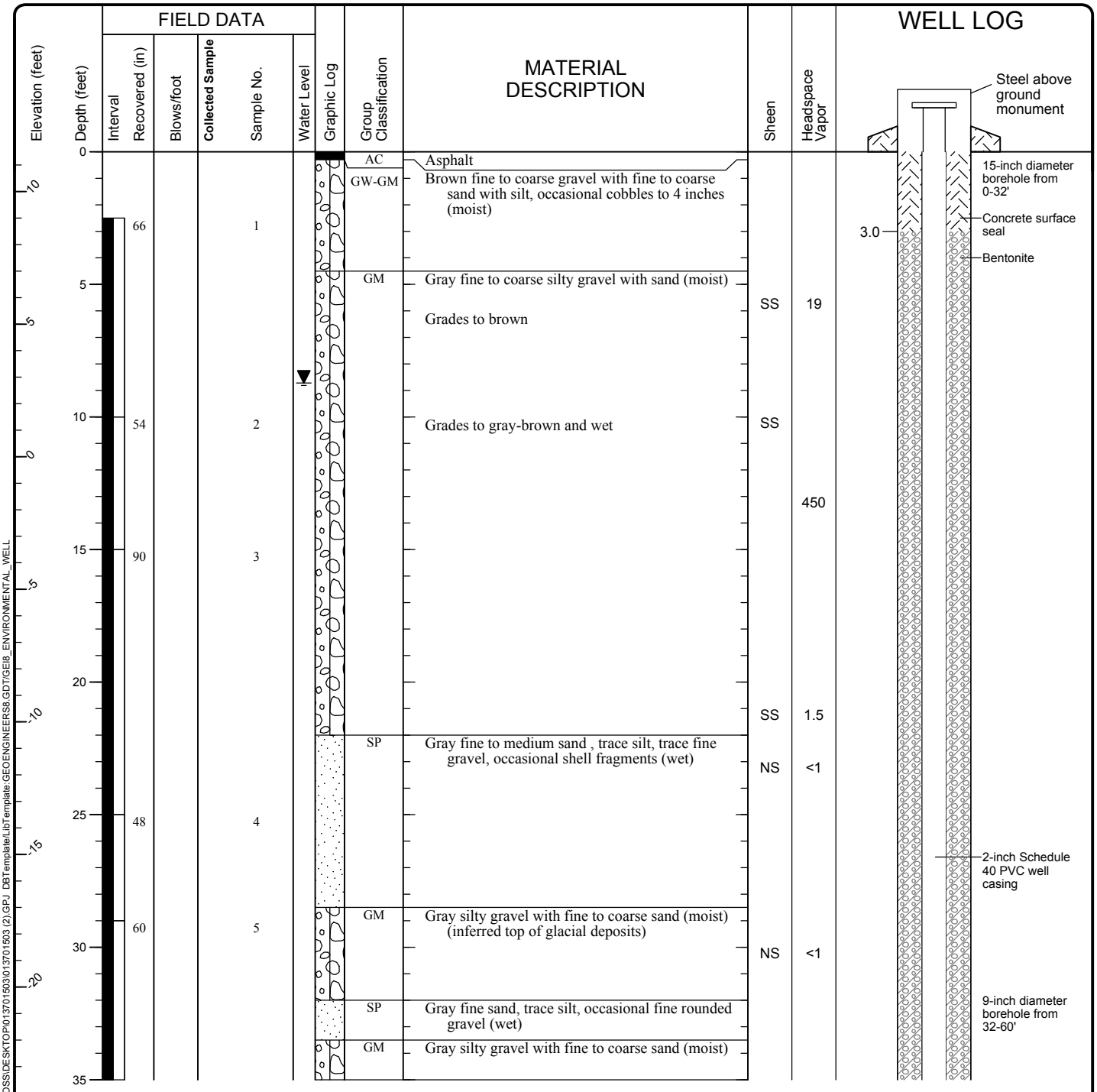
Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-9
Sheet 1 of 1

Seattle: Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015030137015O3 (2).GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

Drilled Start 5/17/2011 End 5/18/2011	Total Depth (ft) 60.5	Logged By AMW Checked By RCL	Driller Cascade Drilling	Drilling Method Rotosonic Hollow Stem Auger
Hammer Data Wireline 300 (lbs) / 30 (in) Drop		Drilling Equipment Sonic Drill Corp/CME 75		Licencing agency well number: **BHB 011** A 2 (in) well was installed on 5/18/2011 to a depth of 58.5 (ft).
Surface Elevation (ft) Vertical Datum 11.5 NGVD29		Top of Casing Elevation (ft) 14.31		Groundwater: Date Measured 5/18/2011; Depth to Water (ft) 11.61; Elevation (ft) 2.70
Easting (X) 1011128 Northing (Y) 417714		System Datum NAD83		

Notes: Soil samples obtained from 0 to 55 feet bgs are from abandoned boring MW-68a, completed 7.5 feet northeast of well MW-68 on 5/4/11 and 5/5/11.



Note: Please see Figure B-1 for explanation of symbols

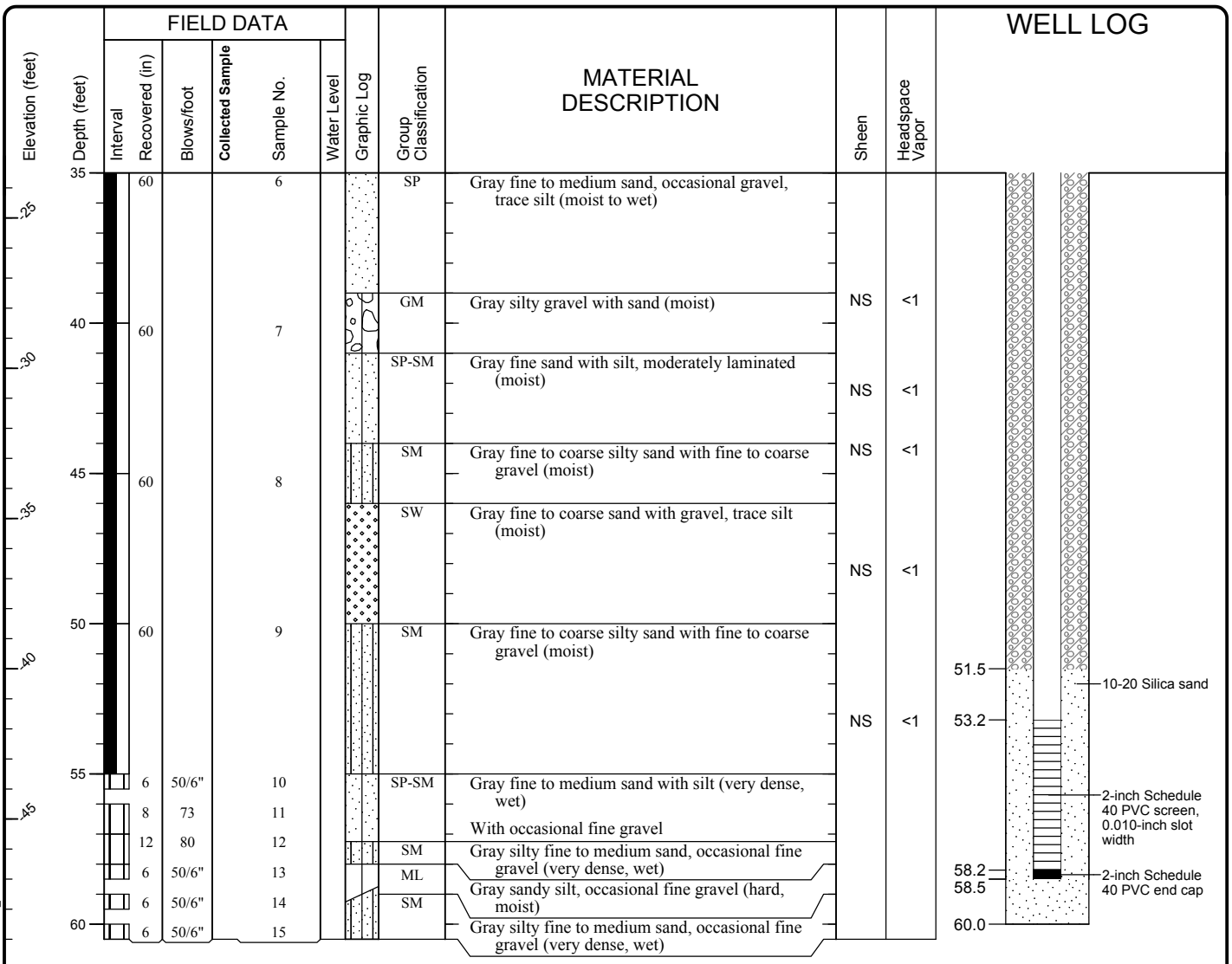
Log of Monitoring Well MW-68

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-10
Sheet 1 of 2

Seattle: Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015030\0137015030 (2).GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL



Note: Please see Figure B-1 for explanation of symbols

Log of Monitoring Well MW-68 (continued)

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-10
Sheet 2 of 2

Seattle: Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015030137015O3 (2).GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

Drilled Start	End	Total Depth (ft)	Logged By / Checked By	Driller	Drilling Method
11/3/2010	11/4/2010	21.5	AMW / RCL	Boart Longyear	Hollow Stem Auger

Surface Elevation (ft) / Vertical Datum	Hammer Data	Drilling Equipment
7.9 NGVD29	Wireline 300 (lbs) / 30 (in) Drop	Mobile B59

Easting (X) / Northing (Y)	System Datum	Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
1011712 / 417715	NAD83	11/3/2010	4.0	3.9

Notes: Auger Data: 4¼-inch I.D.

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample: Sample No. Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0						AC	Asphalt			
							SP	Gray fine to medium sand with trace silt (loose, moist)			
		12	5	1					NS	1.6	Sweet odor
	5	14	6	2				Becomes loose, wet	NS	1.1	Sweet odor
		15	4	3			GW	Dark gray fine gravel with fine to coarse sand and trace silt (wet, loose)	NS	<1	
	10	12	21	4				Grades to fine to coarse gravel (medium dense, wet)	NS	<1	
	15	14	17	5				Becomes medium dense, wet	NS	<1	
	20	10	50/3"	6			SW-SM	Gray fine to coarse silty sand with fine to coarse gravel (very dense, moist)	NS	<1	

Set temporary screen from 4 to 7.5 feet below ground surface

Note: Please see Figure B-1 for explanation of symbols

Log of Boring GWG-1

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-11
Sheet 1 of 1

Seattle Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015\03\0137015\03 (2).GPJ DBTemplate\LibTemplate\GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_STANDARD

Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	11/1/2010	11/2/2010	31.5	AMW	RCL	Boart Longyear	Hollow Stem Auger

Surface Elevation (ft) Vertical Datum	9.1 NGVD29	Hammer Data	Wireline 300 (lbs) / 30 (in) Drop	Drilling Equipment	Mobile B59
Easting (X) Northing (Y)	1012143 417992	System Datum	NAD83	Groundwater	

Groundwater		
Date Measured	Depth to Water (ft)	Elevation (ft)
11/1/2010	7.0	2.1

Notes: Auger Data: 4¼-inch I.D.

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample: Sample No. Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0						Rubble	Concrete rubble			
	5						GP	Gray fine gravel with coarse sand, trace silt (wet)			
		12	1	1			SP	Gray fine sand with trace silt and occasional fine gravel (very loose, wet)	NS	<1	
	10	16	15	2			ML	Gray fine sandy silt (very soft, wet)	NS	<1	
							SW	Gray fine to coarse sand with trace silt (medium dense, wet)			
							ML	Gray fine sandy silt (very soft, wet)			
	15	6	10	3			GW-GM	Gray fine gravel with fine to coarse sand with occasional silt (medium dense, wet)	NS	<1	
	20	12	6	4			SW	Gray fine to coarse sand with fine to coarse gravel and trace silt (loose, wet)	NS	<1	
	25	6	51	5			GW	Gray fine to coarse gravel with fine to coarse sand with silt (very dense, wet)	NS	<1	
		0	22	6				Becomes medium dense	NS	<1	
	30	12	112	7			ML	Gray fine to coarse gravelly silt with fine to coarse sand (very hard, moist)	NS	<1	
								Set temporary screen from 8.5 to 11 feet below ground surface			

Note: Please see Figure B-1 for explanation of symbols

Log of Boring GWG-4

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-12
Sheet 1 of 1

Seattle Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015\03\0137015\03 (2).GPJ DBTemplate\LibTemplate\GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_STANDARD

Drilled Start	End	Total Depth (ft)	Logged By / Checked By	Driller	Drilling Method
11/3/2010	11/3/2010	10.25	AMW / RCL	Boart Longyear	Hollow Stem Auger

Surface Elevation (ft) / Vertical Datum	Hammer Data	Drilling Equipment
7.9 NGVD29	Wireline 300 (lbs) / 30 (in) Drop	Mobile B59

Easting (X) / Northing (Y)	System Datum	Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
1012095 / 417757	NAD83	11/3/2010	4.0	3.9

Notes: Auger Data: 4¼-inch I.D.

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample: Sample No. Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0						SW	Brown fine to coarse sand with fine to coarse gravel and trace silt (loose, moist)			
		9	7	1					NS	<1	
	5						SW-SM	Red-brown fine to coarse sand with fine to coarse gravel with silt (loose, wet)			
		14	9	2					NS	<1	
	10	1	35/3"	3				Concrete slab in shoe			
								Set temporary screen from 3.5 to 7 feet below ground surface			

Note: Please see Figure B-1 for explanation of symbols

Log of Boring GWG-5

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-13
Sheet 1 of 1

Seattle Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015\03\0137015\03 (2).GPJ DBTemplate\LibTemplate\GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_STANDARD

Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	11/4/2010	11/5/2010	27.5	AMW	RCL	Boart Longyear	Hollow Stem Auger

Surface Elevation (ft) Vertical Datum	8.8 NGVD29	Hammer Data	Wireline 300 (lbs) / 30 (in) Drop	Drilling Equipment	Mobile B59
Easting (X) Northing (Y)	1012142 417823	System Datum	NAD83	Groundwater	

Groundwater		
Date Measured	Depth to Water (ft)	Elevation (ft)
11/4/2010	4.0	4.8

Notes: Auger Data: 4¼-inch I.D.

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample: Sample No. Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0						Rubble	Concrete rubble			
	5	9	9	1			SW	Brown fine to coarse sand with fine to coarse gravel and trace silt (loose, moist)	NS	<1	
							GP	Brown fine rounded gravel with coarse sand and trace silt (loose, wet)			
	10	13	10	2			GW	Gray fine to coarse gravel with fine to coarse sand and trace silt (medium dense, wet)	NS	<1	
	15	10	30	3					NS	<1	
	20	9	38	4			SW	Gray fine to coarse sand with fine to coarse gravel and trace silt (dense, wet)	NS	<1	
		12	74	5			GW-GM	Gray fine to coarse gravel with silt intermixed with fine to coarse sand (very dense, wet)	NS	<1	
	25	2	82	6					NS	<1	

Note: Please see Figure B-1 for explanation of symbols

Log of Boring GWG-5A

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-14
Sheet 1 of 1

Seattle Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015\03\0137015\03 (2).GPJ DBTemplate\LibTemplate\GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_STANDARD

Drilled	Start	End	Total Depth (ft)	Logged By / Checked By	Driller	Drilling Method
	11/2/2010	11/2/2010	11.5	AMW / RCL	Boart Longyear	Hollow Stem Auger

Surface Elevation (ft) / Vertical Datum	14.4 NGVD29	Hammer Data	Wireline 300 (lbs) / 30 (in) Drop	Drilling Equipment	Mobile B59
Easting (X) / Northing (Y)	1012321 417284	System Datum	NAD83	Groundwater	

Groundwater		
Date Measured	Depth to Water (ft)	Elevation (ft)
11/2/2010	10.0	4.4

Notes: Auger Data: 4¼-inch I.D.

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample: Sample No. Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0						GW	Brown fine to coarse gravel with fine to coarse sand and trace silt (medium dense, moist)			
		15	21	1					SS	<1	
10							ML	Brown sandy silt with fine gravel (medium stiff, moist)			
	5	18	9	2					SS	<1	
							SP	Orange-brown fine to medium sand with trace silt (loose, moist)			
5							SW-SM	Brown fine to coarse sand with fine to coarse gravel with silt (loose)			
	10	16	7	3	▽				NS	<1	
							SP-SM	Gray fine to medium sand with silt (loose, wet)			
								Set temporary screen from 10 to 13 feet below ground surface			

Note: Please see Figure B-1 for explanation of symbols

Log of Boring GWG-6

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-15
Sheet 1 of 1

Seattle Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015\03\0137015\03 (2).GPJ DBTemplate\LibTemplate\GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_STANDARD

Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	11/2/2010	11/2/2010	8.5	AMW	RCL	Boart Longyear	Hollow Stem Auger

Surface Elevation (ft) Vertical Datum	11.7 NGVD29	Hammer Data	Wireline 300 (lbs) / 30 (in) Drop	Drilling Equipment	Mobile B59
Easting (X) Northing (Y)	1012393 417308	System Datum	NAD83	Groundwater	

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
11/2/2010	6.0	5.7

Notes: Auger Data: 4¼-inch I.D.

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample: Sample No. Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0						AC	Asphalt concrete			
							ML	Brown sandy silt with occasional gravel (stiff, moist)			
10		6	9	1					NS	<1	
	5	14	9	2					NS	<1	
					▽		SP	Brown fine to medium sand with trace silt (loose, wet)			
5		16	8	3					NS	<1	
							ML	Dark brown to dark gray sandy silt with occasional gravel (medium stiff, wet)			
								Set temporary screen from 6 to 8.5 feet below ground surface			

Note: Please see Figure B-1 for explanation of symbols

Log of Boring GWG-7

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-16
Sheet 1 of 1

Seattle Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015\03\0137015\03 (2).GPJ DBTemplate\LibTemplate\GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_STANDARD

Drilled Start	End	Total Depth (ft)	Logged By / Checked By	Driller	Drilling Method
11/1/2010	11/1/2010	10	AMW / RCL	Boart Longyear	Hollow Stem Auger

Surface Elevation (ft) Vertical Datum	Hammer Data	Drilling Equipment
Undetermined	Wireline 300 (lbs) / 30 (in) Drop	Mobile B59

Easting (X) Northing (Y)	System Datum	Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
	NA			

Notes: Auger Data: 4¼-inch I.D.

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample: Sample No. Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0						AC	Asphalt pavement			
							Wood	Wood debris (possible railroad tie)			
							SW	Brown fine to coarse sand with fine to coarse gravel with silt (dense, moist)			
		16	44	1					SS	<1	
	5						GW	Brown fine to coarse gravel with fine to coarse sand and trace silt (medium dense, moist)			
		14	20	2					SS	<1	
	10							Drilling encountered 36-inch diameter fiberglass pipe at 10 feet bgs.			

Note: Please see Figure B-1 for explanation of symbols

Log of Boring GWG-7A

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-17
Sheet 1 of 1

Seattle Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015\03\0137015\03 (2).GPJ DBTemplate\LibTemplate\GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_STANDARD

Drilled Start	End	Total Depth (ft)	Logged By / Checked By	Driller	Drilling Method
10/28/2010	10/28/2010	16.5	AMW / RCL	Boart Longyear	Hollow Stem Auger

Surface Elevation (ft) / Vertical Datum	Hammer Data	Drilling Equipment
21.5 NGVD29	Wireline 300 (lbs) / 30 (in) Drop	Mobile B59

Easting (X) / Northing (Y)	System Datum	Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
1012411 / 417147	NAD83	10/28/2010	13.0	8.5

Notes: Auger Data: 4¼-inch I.D.

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample: Sample No. Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0						AC	Asphalt concrete			
							SW	Dark gray fine to coarse sand with gravel, trace silt (dense, moist)			
20		18	45	1					SS	1.2	
	5						SM	Gray-brown silty sand with occasional fine gravel (loose, moist)			
		0	8	2							
15											
	10	18	7	3					NS	<1	
10											
	15	18	10	4			GW	Orange fine to coarse gravel with fine to coarse sand and trace silt (medium dense, wet)	NS	<1	
5											

Set temporary screen from 13 to 16.5 feet below ground surface

Note: Please see Figure B-1 for explanation of symbols

Log of Boring GWG-8

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-18
Sheet 1 of 1

Seattle: Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015\03\0137015\03 (2).GPJ DBTemplate\LibTemplate\GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_STANDARD

Drilled Start	End	Total Depth (ft)	Logged By / Checked By	Driller	Drilling Method
10/25/2010	10/25/2010	26.5	AMW / RCL	Boart Longyear	Hollow Stem Auger

Surface Elevation (ft) Vertical Datum	Hammer Data	Drilling Equipment
11.9 NGVD29	Wireline 300 (lbs) / 30 (in) Drop	Mobile B59

Easting (X) Northing (Y)	System Datum	Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
1011585 417794	NAD83	10/25/2010	10.0	1.9

Notes: Auger Data: 4¼-inch I.D.

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample: Sample No. Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
10	0						Rubble	Broken concrete rubble to 5 feet below grade surface (fill)			
5	5	8	2	1			GW	Light brown fine to coarse gravel with fine to coarse sand with trace silt (very loose, moist) (occasional concrete fragments) (fill)	SS	<1	
							SP-SM	Black fine to medium sand with trace silt (very loose, moist)			
0	10	14	2	2	▽			Grades to dark gray fine to medium sand with silt (very loose, wet)	MS	<1	
-5	15	18	7	3				Contains shell fragments	SS	<1	
							GW-GM	Dark gray fine to coarse gravel with fine to coarse sand with silt (loose, wet)			
-10	20	2	26	4			SM	Gray-brown silty sand with occasional fine gravel (medium dense, wet)	NS	<1	
	25	14	50/5.5"	5			SW-SM	Gray fine to coarse sand with fine to coarse gravel with silt (very dense, moist)		<1	

Note: Please see Figure B-1 for explanation of symbols

Log of Boring SSB-1

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-19
Sheet 1 of 1

Seattle Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015\03\0137015\03 (2).GPJ DBTemplate\LibTemplate\GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_STANDARD

Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	10/21/2010	10/21/2010	21.5	AMW	RCL	Boart Longyear	Hollow Stem Auger

Surface Elevation (ft) Vertical Datum	10.9 NGVD29	Hammer Data	Wireline 300 (lbs) / 30 (in) Drop	Drilling Equipment	Mobile B59
Easting (X) Northing (Y)	1011263 417785	System Datum	NAD83	Groundwater	

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
10/21/2010	8.0	2.9

Notes: Auger Data: 4¼-inch I.D.

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample: Sample No. Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
10	0	16	11	1			SW-SM	Brown fine to coarse sand with fine to coarse gravel and silt (medium dense, moist) (rootlets, concrete debris)	NS	<1	
5	5	18	14	2	▽		SW	Dark gray to brown fine to coarse sand with coarse gravel, trace silt, and shell fragments (medium dense, moist)	NS	<1	
0	10	17	7	3				Grades to gray fine to coarse sand with occasional fine to coarse gravel with trace silt and shell fragments (loose, wet)	NS	<1	
-5	15	17	5	4					NS	<1	
-10	20	5	50/5.5"	5				Becomes very dense	NS	<1	
		5	50/3"	6			ML	Gray sandy silt with fine to coarse gravel (hard, moist)	NS	<1	

Note: Please see Figure B-1 for explanation of symbols

Seattle Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015O3\0137015O3 (2).GPJ DBTemplate\LibTemplate\GEOENGINEERS8.GDT\GEI8_ENVIRONMENTAL_STANDARD

Log of Boring SSB-2

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-20
Sheet 1 of 1

Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	10/22/2010	10/22/2010	31	AMW	RCL	Boart Longyear	Hollow Stem Auger

Surface Elevation (ft) Vertical Datum	8.8 NGVD29	Hammer Data	Wireline 300 (lbs) / 30 (in) Drop	Drilling Equipment	Mobile B59
Easting (X) Northing (Y)	1011615 417718	System Datum	NAD83	Groundwater	

Groundwater		
Date Measured	Depth to Water (ft)	Elevation (ft)
10/22/2010	5.0	3.8

Notes: Auger Data: 4¼-inch I.D.

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample: Sample No. Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0						GW	Brown fine to coarse gravel with fine to coarse sand, trace silt and occasional rootlets (medium dense, moist)			
		10	20	1					NS	<1	
	5	0	7	2	▽			Becomes loose, wet			
							SW	Gray fine to coarse sand with fine to coarse gravel and trace silt (medium dense, wet)			
	10	12	15	3					NS	<1	
	15	6	2	4				Becomes very loose	NS	<1	
	20	6	14	5				Grades to dark gray fine to coarse sand with fine to coarse gravel (medium dense, wet)	NS	<1	
	25	18	50/5"	6				Becomes dense	NS	<1	
		2	21	7			ML	Gray fine to coarse sandy silt with fine to coarse gravel (hard, moist)	NS	<1	
	30	3	50/5"	8							

Note: Please see Figure B-1 for explanation of symbols

Log of Boring SSB-3

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-21
Sheet 1 of 1

Seattle Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015\03\0137015\03 (2).GPJ DBTemplate/LibTemplate/GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_STANDARD

Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	10/22/2010	10/22/2010	24.5	AMW	RCL	Boart Longyear	Hollow Stem Auger

Surface Elevation (ft) Vertical Datum	7.4 NGVD29	Hammer Data	Wireline 300 (lbs) / 30 (in) Drop	Drilling Equipment	Mobile B59
Easting (X) Northing (Y)	1011603 417586	System Datum	NAD83	Groundwater	

Groundwater		
Date Measured	Depth to Water (ft)	Elevation (ft)
10/22/2010	5.5	1.9

Notes: Auger Data: 4¼-inch I.D.

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample: Sample No. Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0						GW	Brown fine to coarse gravel with fine to coarse sand with trace silt (loose, moist) (concrete rubble and fill)			
5		2	5	1					NS	<1	
	5	13	8	2	▽		Wood	Wood fragments	NS	<1	
							GP	Brown fine rounded gravel and trace sand and silt (loose, wet)			
0							GW-GM	Brown fine to coarse gravel with fine to coarse sand and silt (medium dense, wet)			
	10	12	18	3					NS	<1	
5											
	15	17	50/5"	4				Becomes very dense	NS	<1	
10											
	20	1	50/6"	5			ML	Gray sandy silt with fine to coarse gravel (hard, moist)			
		5	200/4"	6			SW	Gray fine to coarse sand with fine rounded gravel and trace silt (very dense, wet)	NS	<1	
15		16	50/5"	7					NS	<1	

Note: Please see Figure B-1 for explanation of symbols

Log of Boring SSB-4

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-22
Sheet 1 of 1

Seattle Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015\03\0137015\03 (2).GPJ DBTemplate\LibTemplate\GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_STANDARD

Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	10/26/2010	10/27/2010	31.5	AMW	RCL	Boart Longyear	Hollow Stem Auger

Surface Elevation (ft) Vertical Datum	6.9 NGVD29	Hammer Data	Wireline 300 (lbs) / 30 (in) Drop	Drilling Equipment	Mobile B59
Easting (X) Northing (Y)	1012186 417770	System Datum	NAD83	Groundwater	

Groundwater		
Date Measured	Depth to Water (ft)	Elevation (ft)
10/26/2010	5.0	1.9

Notes: Auger Data: 4¼-inch I.D.

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample: Sample No. Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
5	0	6	5	1			GW	Brown fine to coarse gravel with fine to coarse sand and trace silt (loose, moist)	NS	<1	
0	5	10	15	2	▽		SW	Gray fine to coarse sand with fine to coarse gravel and trace silt (medium dense, wet)	NS	<1	
-5	10	12	42	3			GW-GM	Gray-brown fine to coarse gravel with fine to coarse sand with silt (dense, wet)	NS	<1	
-10	15	13	20	4			SW-SM	Gray-brown fine to coarse sand with gravel with silt (medium dense, wet)	NS	<1	
-15	20	9	29	5			SM	Gray silty fine sand with occasional fine gravel (medium dense, wet)	NS	<1	
-20	25	3	27	6			GW-GM	Gray fine to coarse gravel with fine to coarse sand with silt (medium dense, wet)	NS	<1	
	30	18	113	7				Becomes very dense	NS	<1	

Note: Please see Figure B-1 for explanation of symbols

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Log of Boring SSB-5

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-23
Sheet 1 of 1

Drilled Start	End	Total Depth (ft)	Logged By / Checked By	Driller	Drilling Method
10/26/2010	10/26/2010	29	AMW / RCL	Boart Longyear	Hollow Stem Auger

Surface Elevation (ft) Vertical Datum	Hammer Data	Drilling Equipment
9.8 NGVD29	Wireline 300 (lbs) / 30 (in) Drop	Mobile B59

Easting (X) Northing (Y)	System Datum	Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
1011953 417947	NAD83	10/26/2010	8.0	1.8

Notes: Auger Data: 4¼-inch I.D.

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample: Sample No. Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0						Rubble	Concrete rubble and fill			
	5	16	16	1			GW	Brown fine to coarse gravel with fine to coarse sand and trace silt (medium dense, moist)	NS	<1	
							Shells	Brown clam shells in matrix of brown fine to coarse sand and trace silt with occasional fine gravel (medium dense, moist)			
							SP	Gray fine to medium sand with shell fragments and occasional fine gravel (medium dense, wet)			
	10	16	27	2					NS	<1	
	15	2	19	3			GW	Gray fine to coarse gravel with fine to coarse sand and trace silt (medium dense, wet)	NS	<1	
	20	15	16	4					NS	<1	
	25	4	50/3"	5			SW-SM	Gray fine to coarse sand with fine gravel with silt (very dense, wet)	NS	<1	
		12	50/3"	6			ML	Gray sandy silt with fine gravel (very hard, moist)	NS	<1	

Note: Please see Figure B-1 for explanation of symbols

Log of Boring SSB-6

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-24
Sheet 1 of 1

Seattle Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015\03\0137015\03 (2).GPJ DBTemplate/LibTemplate/GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_STANDARD

Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	10/26/2010	10/26/2010	30.8	AMW	RCL	Boart Longyear	Hollow Stem Auger

Surface Elevation (ft) Vertical Datum	11.1 NGVD29	Hammer Data	Wireline 300 (lbs) / 30 (in) Drop	Drilling Equipment	Mobile B59
Easting (X) Northing (Y)	1011458 418071	System Datum	NAD83	Groundwater	

Groundwater		
Date Measured	Depth to Water (ft)	Elevation (ft)
10/26/2010	13.0	-1.9

Notes: Auger Data: 4¼-inch I.D.

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample: Sample No. Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
10	0	18	16	1			SW	Brown fine to coarse sand with fine to coarse gravel and trace silt, occasional rootlets, concrete rubble, brick fragments and fiberglass pieces (medium dense, moist)	SS	<1	
5	5	3	50/2"	2			Debris	Brick fragments and cemented debris (very dense, moist)	NS	<1	
0	10	8	23	3			GW-GM	Gray-brown fine to coarse gravel with fine to coarse sand with silt (medium dense, moist)	SS	<1	
-5	15	0	6	4			SP-SM	Gray fine to medium sand with silt and occasional shell fragments (loose, wet)	NS	<1	
-10	20	18	11	5			SW	Gray fine to coarse sand with shell fragments and trace silt (medium dense, wet)	NS	<1	
							SW-SM	Gray fine to coarse sand with fine gravel and silt (medium dense, wet)			
-15	25	18	3	6			SP	Gray fine to medium sand, occasional shell fragments and trace silt (very loose, wet)	NS	<1	
	30	10	107/4"	7			SW	Gray fine to coarse sand with fine to coarse gravel and trace silt (very dense, moist)	NS	<1	

Note: Please see Figure B-1 for explanation of symbols

Log of Boring SSB-7

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-25
Sheet 1 of 1

Seattle Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015\03\0137015\03 (2).GPJ DBTemplate\LibTemplate\GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_STANDARD

Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	10/25/2010	10/25/2010	31	AMW	RCL	Boart Longyear	Hollow Stem Auger

Surface Elevation (ft) Vertical Datum	10.9 NGVD29	Hammer Data	Wireline 300 (lbs) / 30 (in) Drop	Drilling Equipment	Mobile B59
Easting (X) Northing (Y)	1010709 417602	System Datum	NAD83	Groundwater	

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
10/25/2010	8.0	2.9

Notes: Auger Data: 4¼-inch I.D.

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample: Sample No. Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
10	0						TS	Topsoil			
		10	24	1			GW	Brown coarse gravel with fine to coarse sand with trace silt and occasional cobbles (medium dense, moist)	NS	<1	
5	5	5	10	2					NS	<1	
0	10	16	7	3			SP	Gray medium to coarse sand with occasional fine subrounded gravel and trace silt (loose, wet)	NS	<1	
								1-inch apparent sawdust layer observed at 11 feet bgs			
-5	15	18	7	4					NS	<1	
							GW-GM	Dark gray fine gravel with fine to coarse sand with silt (loose, wet)			
-10	20	15	15	5			SP	Light brown fine to medium sand, grading to very fine sand with trace silt, poorly laminated (medium dense, wet)	NS	<1	
-15	25	16	50/4"	6				Becomes very dense	NS	<1	
							SM	Gray silty fine to coarse sand with fine gravel (very dense, moist)			
-20	30	6	376/9"	7						<1	

Note: Please see Figure B-1 for explanation of symbols

Log of Boring SSB-8

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-26
Sheet 1 of 1

Seattle Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015\03\0137015\03 (2).GPJ DBTemplate\LibTemplate\GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_STANDARD

Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	10/27/2010	10/27/2010	31.5	AMW	RCL	Boart Longyear	Hollow Stem Auger

Surface Elevation (ft) Vertical Datum	20.9 NGVD29	Hammer Data	Wireline 300 (lbs) / 30 (in) Drop	Drilling Equipment	Mobile B59
Easting (X) Northing (Y)	1012169 417111	System Datum	NAD83	Groundwater	

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
10/27/2010	20.0	0.9

Notes: Auger Data: 4¼-inch I.D.

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample: Sample No. Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
20	0						GW	Dark brown fine gravel with fine to coarse sand and trace silt (moist)			
		18	7	1			ML	Brown sandy silt, occasional fine rounded gravel and trace clay (medium stiff, moist)	NS	<1	
15	5	18	5	2					NS	<1	
10	10	18	8	3					NS	<1	
							SW-SM	Orange-brown fine to coarse sand with silt and occasional fine gravel (loose, moist)			
5	15	18	3	4				Becomes very loose	NS	<1	
							SM	Gray fine sand with silt (very loose, moist)			
0	20	16	50	5	▽		GW	Gray fine to coarse gravel with fine to coarse sand and trace silt (very dense, wet)	NS	<1	
-5	25	12	53/1"	6					NS	<1	
-10	30	16	40	7			GW-GM	Gray fine to coarse gravel with fine to coarse sand with silt (dense, wet)	NS	<1	

Note: Please see Figure B-1 for explanation of symbols

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Log of Boring SSB-9

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-27
Sheet 1 of 1

Drilled Start	End	Total Depth (ft)	Logged By / Checked By	Driller	Drilling Method
10/28/2010	10/28/2010	26.5	AMW / RCL	Boart Longyear	Hollow Stem Auger

Surface Elevation (ft) Vertical Datum	Hammer Data	Drilling Equipment
29.0 NGVD29	Wireline 300 (lbs) / 30 (in) Drop	Mobile B59

Easting (X) Northing (Y)	System Datum	Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
1012622 416781	NAD83	10/28/2010	13.0	16.0

Notes: Auger Data: 4¼-inch I.D.

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample: Sample No. Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0						GP-GM	Gray coarse gravel with sand and trace silt (moist)			
		18	17	1			SW	Black fine to coarse sand with coarse gravels/rubble and trace silt (medium dense, moist) (fill)	SS	0.6	
							SP	Black coarse sand with trace silt (medium dense, moist)			
	5	18	3	2			SM	Gray to black silty sand (loose, moist)	NS	0.9	
							ML	Black sandy silt with occasional fine gravel and trace clay (soft, moist)			
	10	18	4	3	▽				NS	1.0	
							GW-GM	Brown fine to coarse gravel with fine to coarse sand with silt (medium dense, wet)			
	15	17	16	4			SW-SM	Brown-gray fine to coarse sand with fine gravel and trace silt (medium dense, wet)	NS	<1	
							GW	Gray fine gravel with fine to coarse sand and trace silt (medium dense, wet)			
	20	12	9	5				Becomes loose	NS	<1	
							ML	Gray sandy silt with fine to coarse gravel and trace clay (stiff, moist)			
	25	6	82	6				Becomes hard	NS	<1	

Note: Please see Figure B-1 for explanation of symbols

Log of Boring SSB-10

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-28
Sheet 1 of 1

Seattle: Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015\03\0137015\03 (2).GPJ DBTemplate/LibTemplate/GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_STANDARD

Date Excavated: 1/4/2011 Logged By: AMW

Equipment: CAT 321LCR Trackhoe Total Depth (ft) 10.5

Elevation (feet) / Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample No. Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
0				GW		Brown fine to coarse gravel with fine to coarse sand trace silt (moist)			
1									
2	X	1					NS		No odor
3				SW		Gray-brown fine to coarse sand with fine to coarse gravel and trace silt (moist)			
4									
5									
6							NS		No odor
7									
8	X	2					NS		No odor
9	X	3			▽			<1	
10	X	4		SP		Gray medium to coarse sand with occasional coarse gravel and trace silt (wet)			

Test pit completed at 10.5 feet bgs.
Moderate groundwater seepage observed at 9 feet bgs.
No caving observed.

Notes: Please see Figure B-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to 0.5 feet.

Log of Test Pit TP-01

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-29
Sheet 1 of 1

Seattle Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015\03\0137015\03 TEST PITS.GPJ DBTemplate/LibTemplate.GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_ENV

Date Excavated: 1/4/2011 Logged By: AMW

Equipment: CAT 321LCR Trackhoe Total Depth (ft) 10.5

ADDITIONAL NOTES

Concrete footers along west and north sidewalls.
Concrete structure at ~7 feet bgs in northeast corner of test pit.
East sidewall has apparent backfill material against the north footer down to the concrete structure at ~7 feet bgs.

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Log of Test Pit TP-01

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-29b

Date Excavated: 1/4/2011 Logged By: AMW

Equipment: CAT 321LCR Trackhoe Total Depth (ft) 9.5

Elevation (feet) / Depth (feet)	SAMPLE: Testing Sample / Sample No. Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
0			GW		Brown fine to coarse gravel with fine to coarse sand and trace silt (moist)			
1								
2	1					NS		No odor
3			SW		Gray-brown fine to coarse sand with fine gravel and trace silt (moist)			
4						NS		No odor
5								
6						NS		No odor
7								
8	2					HS	1.3	HC odor
9			SP		Dark gray medium to coarse sand with fine to coarse gravel (moist)			
	3			▽	Becomes wet	SS		

Test pit completed at 9.5 feet bgs.
Slow to moderate groundwater seepage observed at 9 feet bgs.
No caving observed.

Notes: Please see Figure B-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to 0.5 feet.

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Log of Test Pit TP-02

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-30
Sheet 1 of 1

Date Excavated: 1/4/2011 Logged By: AMW

Equipment: CAT 321LCR Trackhoe Total Depth (ft) 9.5

ADDITIONAL NOTES

Concrete structures in south and east sidewalls, wood piling in center of test pit.
Dimensional lumber (apparent beam) and iron pipe crossing excavation at approximately 2 feet bgs.
Concrete slab at approximately 9.5 feet to 10 feet bgs, north of piling.

Log of Test Pit TP-02

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-30b
Sheet 1 of 1

Seattle Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015\03\0137015\03 NOTES.GPJ DBTemplate\LibTemplate\GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_ENV_NOTES

Date Excavated: 1/4/2011 Logged By: AMW

Equipment: CAT 321LCR Trackhoe Total Depth (ft) 9.5

Elevation (feet) / Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample No. Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
0				Concrete Rubble		Concrete rubble with sand and gravel matrix			
1									
2	X	1					NS	<1	No odor
3				GM		Grayish-green to gray-brown silty gravel with sand (moist)			
4	X	2					SS	<1	Slight odor
5				Woodwaste		Dark brown to black apparent charred woodwaste with dimensional lumber (moist)			
6									
7	X	3					MS	<1	HC odor
8				SW-SM	▽	Two >12-inch boulders in south and west sidewalls Dark brown to black fine to coarse sand with fine to coarse gravel with silt (moist)			
9									

Test pit completed at 9.5 feet bgs.
Slow to moderate groundwater seepage observed at 8.5 feet bgs.
No caving observed.

Notes: Please see Figure B-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to 0.5 feet.

Log of Test Pit TP-03

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-31
Sheet 1 of 1

Seattle Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015\03\0137015\03 TEST PITS.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_ENV

Date Excavated: 1/4/2011 Logged By: AMW

Equipment: CAT 321LCR Trackhoe Total Depth (ft) 9.5

ADDITIONAL NOTES

6-inch-diameter fiberglass pipe with 90° elbow in SW corner of test pit.
Three pilings exposed at SE corner, SW corner, and north sidewall.

Log of Test Pit TP-03

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-31b
Sheet 1 of 1

Seattle Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015\03\0137015\03 NOTES.GPJ DBTemplate\LibTemplate\GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_ENV_NOTES

Date Excavated: 1/5/2011 Logged By: AMW

Equipment: CAT 321LCR Trackhoe Total Depth (ft) 7.0

Elevation (feet) / Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample No. Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
0				Concrete Rubble		Concrete rubble with sand and gravel matrix			
1				GM		Brown fine to coarse silty gravel with fine to coarse sand (moist) (includes concrete rubble, weathered lime rock, apparent clinker and iron scrap)			
2	X	1					NS	<1	No odor
3									
4									
5									
6									
7	X	2			▽	Apparent sawdust in northeast corner of test pit; becomes wet at 7 feet bgs	NS	<1	No odor

Test pit completed at 7 feet bgs.
Slow groundwater seepage observed at 7 feet bgs.
No caving observed.

Notes: Please see Figure B-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to 0.5 feet.

Log of Test Pit TP-04

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-32
Sheet 1 of 1

Seattle: Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015\03\0137015\03 TEST PITS.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_ENV

Date Excavated: 1/5/2011 Logged By: AMW

Equipment: CAT 321LCR Trackhoe Total Depth (ft) 8.0

Elevation (feet) / Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample No. Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
0				GW		Brown fine to coarse gravel with fine to coarse sand, occasional cobbles (up to 6") and trace silt (moist)			
1									
2		1					NS	<1	No odor
3							NS	<1	No odor
4				SW-SM		Dark brown fine to coarse sand with fine to coarse gravel with silt, bricks, concrete clinker, and minor amounts of wood debris (moist)			
5									
6		2			▽		NS	<1	No odor
7				SW		Gray fine to coarse sand with fine to coarse gravel, trace silt, and abundant shell fragments (wet)			
8		3					NS	<1	No odor

Test pit completed at 8 feet bgs.
Fast groundwater seepage observed at 6 feet bgs.
No caving observed.

Notes: Please see Figure B-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to 0.5 feet.

Log of Test Pit TP-05

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-33
Sheet 1 of 1

Seattle Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015\03\0137015\03 TEST PITS.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_ENV

Date Excavated: 1/5/2011
Equipment: CAT 321LCR Trackhoe

Logged By: AMW
Total Depth (ft) 8.0

ADDITIONAL NOTES

Plastic 4-inch-diameter pipe observed in south sidewall at approximately 1.5 feet bgs.

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Log of Test Pit TP-05

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-33b

Date Excavated: 1/5/2011 Logged By: AMW

Equipment: CAT 321LCR Trackhoe Total Depth (ft) 8.0

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample No. Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
	0				Concrete Rubble		Concrete rubble in sand and gravel matrix			
	1				Concrete Slab		Concrete slab with brick and stone base			
	2									
	3	X	1		SW-SM		Brown fine to coarse sand with fine to coarse gravel with silt, bricks, concrete, and wood debris	NS	<1	No odor
	4							NS	<1	No odor
	5									
	6									
	7	X	2		SW		Gray fine to coarse sand with fine to coarse gravel and trace silt (moist)	NS	<1	No odor
	8					▽	Becomes wet at 8 feet bgs.			

Test pit completed at 8 feet bgs.
Slow groundwater seepage observed at 8 feet bgs.
No caving observed.

Notes: Please see Figure B-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to 0.5 feet.

Log of Test Pit TP-06

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-34
Sheet 1 of 1

Seattle Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015\03\0137015\03 TEST PITS.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_ENV

Date Excavated: 1/5/2011 Logged By: AMW

Equipment: CAT 321LCR Trackhoe Total Depth (ft) 8.0

ADDITIONAL NOTES

Wood pilings in center of test pit at approximately 1-foot bgs and in NW corner of test pit.
Wire wrapped 12-inch-diameter wood pipe at approximately 45° angle along south sidewall, angled from east down to the west.
2-inch-diameter gray PVC pipe encased in red concrete running along south side of test pit.

Log of Test Pit TP-06

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-34b
Sheet 1 of 1

Seattle Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015\03\0137015\03 NOTES.GPJ DBTemplate\LibTemplate\GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_ENV_NOTES

Date Excavated: 1/5/2011 Logged By: AMW

Equipment: CAT 321LCR Trackhoe Total Depth (ft) 8.0

Elevation (feet) / Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample No. Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
0				GW-GM		Brown fine to coarse gravel with fine to coarse sand with silt, bricks, concrete, and apparent clinker (moist)			
1									
1	X	1					NS	<1	No odor
2						2-inch-diameter polyethylene pipe coming out of east sidewall extending to the west at 2 feet bgs			
3									
4						12-inch-diameter x 2 feet long iron pipe in southeast corner of test pit			
5				Sawdust		12-inch-thick dark brown to black apparent sawdust layer (moist)			
2	X	2			▽		NS	<1	No odor
6				SW		Orange-brown fine to coarse sand with fine to coarse gravel, bricks and concrete rubble intermixed (moist to wet)			
7				SP		Gray-brown medium to coarse sand with fine to coarse gravel and trace silt (wet)			
3	X	3					NS	<1	HC odor
8									

Test pit completed at 8 feet bgs.
Fast groundwater seepage observed at 6 feet bgs.
No caving observed.

Notes: Please see Figure B-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to 0.5 feet.

Log of Test Pit TP-07

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-35
Sheet 1 of 1

Seattle Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015\03\0137015\03 TEST PITS.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_ENV

Date Excavated: 1/5/2011 Logged By: AMW

Equipment: CAT 321LCR Trackhoe Total Depth (ft) 8.0

ADDITIONAL NOTES

Concrete rubble observed from surface to 6 feet bgs.

Log of Test Pit TP-07

GeoEngineers

Project: Rayonier Mill

Project Location: Port Angeles, Washington

Project Number: 0137-015-03

Figure B-35b

Sheet 1 of 1

Seattle: Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015\03\0137015\03 NOTES.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_ENV_NOTES

Date Excavated: 1/5/2011 Logged By: AMW

Equipment: CAT 321LCR Trackhoe Total Depth (ft) 7.5

Elevation (feet) / Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample No. Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
0				GM		Brown fine to coarse silty gravel with fine to coarse sand (moist)			
1									
2	X	1		GW-GM		Dark brown fine to coarse gravel with fine to coarse sand with silt, occasional cobbles, steel and iron debris	NS	<1	No odor
3									
4									
5	X	2					NS	<1	No odor
				GW		Black stained gravel with sand			
				SM		Gray-brown silty fine to coarse sand with fine to coarse gravel (moist)	HS	5.7	HC odor
6					▽		NS	<1	No odor
7				SP		Gray medium to coarse sand with occasional gravel and trace silt (moist)	NS	<1	No odor

Test pit completed at 7.5 feet bgs.
Slow to moderate groundwater seepage observed at 6 feet bgs.
No caving observed.

Notes: Please see Figure B-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to 0.5 feet.

Log of Test Pit TP-08

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-36
Sheet 1 of 1

Seattle Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015\03\0137015\03 TEST PITS.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_ENV

Date Excavated: 1/5/2011
Equipment: CAT 321LCR Trackhoe

Logged By: AMW
Total Depth (ft) 7.5

ADDITIONAL NOTES

Removed Bunker C oil located near base of utility pole at southeast corner of the tank #1 excavation.

Seattle Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015O3\0137015O3 NOTES.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_ENV_NOTES

Log of Test Pit TP-08

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-36b
Sheet 1 of 1

Date Excavated: 1/6/2011 Logged By: AMW

Equipment: CAT 321LCR Trackhoe Total Depth (ft) 5.0

Elevation (feet) / Depth (feet)	SAMPLE: Testing Sample / Sample No. Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
0			SW		Light brown fine to coarse sand with fine to coarse gravel and trace silt (moist)	NS	<1	No odor
1	1		GW-GM		Gray-brown fine to coarse gravel with fine to coarse sand with silt, bricks and concrete rubble (moist)	NS	<1	No odor
2	2		Charred Wood	▽	Dark brown to black apparent charred wood with scrap iron, bricks, glass, and one railroad tie (moist)	NS	<1	No odor
3			SW		Gray fine to coarse sand with fine to coarse gravel and trace silt (wet)			
4	3					NS	<1	No odor
5								

Test pit completed at 5 feet bgs.
Slow groundwater seepage observed at 3 feet bgs.
No caving observed.

Notes: Please see Figure B-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to 0.5 feet.

Log of Test Pit TP-09

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-37
Sheet 1 of 1

Seattle Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015\03\0137015\03 TEST PITS.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_ENV

Date Excavated: 1/6/2011 Logged By: AMW

Equipment: CAT 321LCR Trackhoe Total Depth (ft) 5.0

ADDITIONAL NOTES

4-foot long railroad iron running across south end of test pit; possible scrap iron pile.

Log of Test Pit TP-09

GeoEngineers

Project: Rayonier Mill

Project Location: Port Angeles, Washington

Project Number: 0137-015-03

Figure B-37b

Sheet 1 of 1

Seattle Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015\03\0137015\03 NOTES.GPJ DBTemplate\LibTemplate\GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_ENV_NOTES

Date Excavated: 1/6/2011 Logged By: AMW

Equipment: CAT 321LCR Trackhoe Total Depth (ft) 4.0

Elevation (feet) / Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample No. Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
0				SW		Gray-brown fine to coarse sand with fine to coarse gravel and trace silt (moist)	NS	<1	No odor
1				GM		Brown fine to coarse silty gravel with fine to coarse sand, bricks and clay tile (moist)	NS	<1	No odor
2		1							
		2		Waste Material		Apparent charred wood, trash, broken glass, and steel and iron scrap	NS	<1	No odor
3					▽				
4				SP		Gray medium to coarse sand with fine to coarse gravel and trace silt (wet)	NS	<1	No odor

Test pit completed at 4 feet bgs.
Moderate groundwater seepage observed at 3.5 feet bgs.
No caving observed.

Notes: Please see Figure B-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to 0.5 feet.

Log of Test Pit TP-10

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-38
Sheet 1 of 1

Seattle Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015\03\0137015\03 TEST PITS.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_ENV

Date Excavated: 1/6/2011 Logged By: AMW

Equipment: CAT 321LCR Trackhoe Total Depth (ft) 4.0

ADDITIONAL NOTES

2-foot-wide concrete structure along north sidewall.
Clay tile pipe immediately south of concrete structure at 1-foot bgs.

Log of Test Pit TP-10

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-38b
Sheet 1 of 1

Seattle Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015\03\0137015\03 NOTES.GPJ DBTemplate\LibTemplate\GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_ENV_NOTES

Date Excavated: 1/7/2011 Logged By: AMW

Equipment: CAT 321LCR Trackhoe Total Depth (ft) 7.0

Elevation (feet) / Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample No. Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
0				Concrete Rubble		Concrete rubble with bricks and rebar (moist)			
1	X	1					NS	<1	No odor
2				SW-SM		Brown fine to coarse sand with fine to coarse gravel with silt, bricks, wood debris, and steel wire (moist)			
3									
4									
4	X	2					HS	18	Moderate HC odor
5				GM/SM		Dark gray silty fine to coarse gravel with fine to coarse sand with bricks, concrete with reinforcing wire, and wood debris (moist)			
6					▽				
7	X	3					HS	2.3	Moderate HC odor

Test pit completed at 7 feet bgs.
Fast groundwater seepage observed at 6 feet bgs.
No caving observed.

Notes: Please see Figure B-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to 0.5 feet.

Log of Test Pit TP-11

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-39
Sheet 1 of 1

Seattle Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015\03\0137015\03 TEST PITS.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_ENV

Date Excavated: 1/7/2011 Logged By: AMW

Equipment: CAT 321LCR Trackhoe Total Depth (ft) 7.0

ADDITIONAL NOTES

Very compacted subsurface. Dug with difficulty without subsurface structures or pilings.
Diesel-like odor with sheen in silty gravel horizon.

Log of Test Pit TP-11

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-39b
Sheet 1 of 1

Seattle Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015\03\0137015\03 NOTES.GPJ DBTemplate\LibTemplate\GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_ENV_NOTES

Date Excavated: 1/4/2011 Logged By: AMW

Equipment: CAT 321LCR Trackhoe Total Depth (ft) 5.0

Elevation (feet) / Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample No. Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
0				Concrete Rubble		Concrete rubble in sand and gravel matrix			
1									
1.5		1		GW		Brown fine to coarse gravel with fine to coarse sand and trace silt (moist)	NS	<1	No odor
2									
3									
3.5		2					NS	<1	No odor
4									
4.5					▽				
5									

Test pit completed at 5 feet bgs.
Fast groundwater seepage observed at 4.5 feet bgs.
No caving observed.

Notes: Please see Figure B-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to 0.5 feet.

Log of Test Pit TP-12

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-40
Sheet 1 of 1

Seattle Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015\03\0137015\03 TEST PITS.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_ENV

Date Excavated: 1/7/2011 Logged By: AMW

Equipment: CAT 321LCR Trackhoe Total Depth (ft) 4.5

Elevation (feet) / Depth (feet)	SAMPLE: Testing Sample / Sample No. Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
0			Concrete Rubble		Concrete rubble to below water table with rebar, PVC pipe and stainless steel pipe pieces, bricks, and sections of broken electrical conduit and wire			
1						NS		No odor
2								
3								
4				▽				

Test pit completed at 4.5 feet bgs.
Fast groundwater seepage observed at 4 feet bgs.
No caving observed.

Notes: Please see Figure B-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to 0.5 feet.

Log of Test Pit TP-13

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-41
Sheet 1 of 1

Seattle Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015\03\0137015\03 TEST PITS.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_ENV

Date Excavated: 1/6/2011 Logged By: AMW

Equipment: CAT 321LCR Trackhoe Total Depth (ft) 5.5

Elevation (feet) / Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample No. Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
0				GW		Brown-gray fine to coarse gravel with fine to coarse sand and trace silt with bricks, concrete and scrap iron	NS	<1	No odor
1									
		1					HS	3.2	H_2S odor, HC odor
2				Woodwaste		Black to dark brown wood chips			
		2					NS	<1	No odor
3									
				SP-SM		Gray-brown fine to medium sand with silt and occasional fine gravel (moist)			
4									
		3					NS	<1	No odor
5				SW	▽	Gray fine to coarse sand with fine to coarse gravel and trace silt (wet)			

Test pit completed at 5.5 feet bgs.
Slow groundwater seepage observed at 5 to 5.5 feet bgs.
No caving observed.

Notes: Please see Figure B-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to 0.5 feet.

Log of Test Pit TP-14

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-42
Sheet 1 of 1

Seattle Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015\03\0137015\03 TEST PITS.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_ENV

Date Excavated: 1/6/2011 Logged By: AMW

Equipment: CAT 321LCR Trackhoe Total Depth (ft) 5.5

ADDITIONAL NOTES

Apparent woodwaste layer with hydrocarbon staining and odor (2 to 3.5 feet bgs).

Log of Test Pit TP-14

GeoEngineers

Project: Rayonier Mill

Project Location: Port Angeles, Washington

Project Number: 0137-015-03

Figure B-42b

Sheet 1 of 1

Seattle Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015\03\0137015\03 NOTES.GPJ DBTemplate\LibTemplate\GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_ENV_NOTES

Date Excavated: 1/6/2011 Logged By: AMW

Equipment: CAT 321LCR Trackhoe Total Depth (ft) 5.0

Elevation (feet) / Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample No. Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
0				Concrete Rubble		Concrete rubble in sand and gravel matrix (moist)			
1									
1	X	1					NS	<1	No odor
2				Woodwaste		Scraps of lumber (fill)			
2				Lime Rock Debris		Brown 4- to 12-inch cobbles (angular) with fine to coarse gravel, trace sand and trace silt			
3									
3	X	2							
4				Sawdust		Dark brown apparent sawdust			
4	X	3		SW	▽	Gray fine to coarse sand with occasional fine gravel and trace silt (moist)	SS	<1	No odor
5							NS	<1	No odor

Test pit completed at 5 feet bgs.
Slow to moderate groundwater seepage observed at 4.5 feet bgs.
No caving observed.

Notes: Please see Figure B-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to 0.5 feet.

Log of Test Pit TP-15

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-43
Sheet 1 of 1

Seattle Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015\03\0137015\03 TEST PITS.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_ENV

Date Excavated: 1/6/2011 Logged By: AMW

Equipment: CAT 321LCR Trackhoe Total Depth (ft) 5.0

Elevation (feet) / Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample No. Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
0				Concrete Rubble		Concrete rubble with bricks, pieces of rebar and pipe intermixed (moist)			
1									
	X	1					NS	<1	No odor
2				SW-SM		Gray fine to coarse sand with fine to coarse gravel with silt and occasional cobbles (up to 4-inch diameter); partially cemented at upper contact (moist)			
3							NS	<1	No odor
4					▽				
	X	2		SW		Gray fine to coarse sand with fine to coarse gravel with trace silt (wet)	NS	<1	No odor
5									

Test pit completed at 5 feet bgs.
Fast groundwater seepage observed at 4.5 feet bgs.
No caving observed.

Notes: Please see Figure B-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to 0.5 feet.

Log of Test Pit TP-16

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-44
Sheet 1 of 1

Seattle Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015\03\0137015\03 TEST PITS.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_ENV

Date Excavated: 1/6/2011 Logged By: AMW

Equipment: CAT 321LCR Trackhoe Total Depth (ft) 5.0

Elevation (feet) / Depth (feet)	SAMPLE: Testing Sample / Sample No. Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
0			Concrete Rubble		Concrete rubble with bricks and occasional scrap iron			
4				▽		NS		No odor
5					Test pit completed at 5 feet bgs. Fast groundwater seepage observed at 4 feet bgs. No caving observed.			

Notes: Please see Figure B-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to 0.5 feet.

Log of Test Pit TP-17

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-45
Sheet 1 of 1

Seattle Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015\03\0137015\03 TEST PITS.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_ENV

Date Excavated: 1/6/2011 Logged By: AMW

Equipment: CAT 321LCR Trackhoe Total Depth (ft) 5.0

ADDITIONAL NOTES

Assumed concrete rubble backfill from hog fuel interim action area excavation.

Seattle Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015O3\0137015O3 NOTES.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_ENV_NOTES

Log of Test Pit TP-17

GeoEngineers

Project: Rayonier Mill

Project Location: Port Angeles, Washington

Project Number: 0137-015-03

Figure B-45b

Date Excavated: 1/7/2011 Logged By: AMW

Equipment: CAT 321LCR Trackhoe Total Depth (ft) 5.0

Depth (feet)	Sample No. / Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
			Concrete Rubble		Concrete rubble with debris			
1			SW-SM		Brown fine to coarse sand with fine to coarse gravel with silt, occasional bricks and concrete debris (moist)	NS	<1	No odor
2								
3								
						NS	<1	No odor
4								
					Becomes dark gray; wood debris	HS	23	HC odor
5								

Test pit completed at 5 feet bgs.
No groundwater seepage observed.
No caving observed.

Notes: Please see Figure B-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to 0.5 feet.

Log of Test Pit TP-18

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-46
Sheet 1 of 1

Seattle Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015\03\0137015\03 TEST PITS.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_ENV

Date Excavated: 1/7/2011 Logged By: AMW

Equipment: CAT 321LCR Trackhoe Total Depth (ft) 5.0

ADDITIONAL NOTES

Stainless steel pipe, approximately 8-inch-diameter x 10-feet long, crossing the test pit north to south.
No samples collected.

Seattle Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015O3\0137015O3 NOTES.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_ENV_NOTES

Log of Test Pit TP-18

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-46b
Sheet 1 of 1

Date Excavated: 1/7/2011 Logged By: AMW

Equipment: CAT 321LCR Trackhoe Total Depth (ft) 7.0

Elevation (feet) / Depth (feet)	SAMPLE: Testing Sample / Sample No. Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
0			Concrete Rubble		Concrete rubble with rebar and bricks			
1			SW-SM		Brown fine to coarse sand with fine to coarse gravel with silt, occasional bricks and concrete rubble	NS	<1	No odor
2								
3						NS	<1	No odor
4								
5								
6			SP		Gray medium to coarse sand with fine gravel and trace silt with shell fragments, broken glass, and a section of chainlink fence	HS	<1	HC odor
7				▽				

Test pit completed at 7 feet bgs.
Slow groundwater seepage observed at 7 feet bgs.
No caving observed.

Notes: Please see Figure B-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to 0.5 feet.

Log of Test Pit TP-19

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-47
Sheet 1 of 1

Seattle Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015\03\0137015\03 TEST PITS.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_ENV

Date Excavated: 1/7/2011 Logged By: AMW

Equipment: CAT 321LCR Trackhoe Total Depth (ft) 7.0

ADDITIONAL NOTES

Concrete footer in northeast corner of test pit.
No samples collected.

Log of Test Pit TP-19

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-47b
Sheet 1 of 1

Seattle Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015\03\0137015\03 NOTES.GPJ DBTemplate\LibTemplate\GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_ENV_NOTES

Date Excavated: 1/7/2011 Logged By: AMW

Equipment: CAT 321LCR Trackhoe Total Depth (ft) 3.5

Elevation (feet) / Depth (feet)	SAMPLE: Testing Sample / Sample No. Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
0			Concrete Rubble		Concrete rubble with bricks and rebar	NS	<1	No odor
1						NS	<1	No odor
2			GW-GM		Brown fine to coarse gravel with fine to coarse sand with silt, wood debris (apparent sawdust, wood chips, and wood beams set vertically in subsurface)			
3						NS	<1	No odor

Test pit completed at 3.5 feet bgs.
No groundwater seepage observed.
No caving observed.

Notes: Please see Figure B-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to 0.5 feet.

Log of Test Pit TP-20

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-48
Sheet 1 of 1

Seattle Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015\03\0137015\03 TEST PITS.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_ENV

Date Excavated: 1/7/2011 Logged By: AMW

Equipment: CAT 321LCR Trackhoe Total Depth (ft) 3.5

ADDITIONAL NOTES

Step-out exploration approximately 50 feet east of TP-02.
Three attempts yielded no information below 4 feet bgs due to abundant concrete structures. First attempt was 50 feet east of TP-02, second attempt was 45 feet east of TP-02, and third attempt was 30 feet east of TP-02. Square grid pattern of concrete footer walls, approximately 4 feet square, backfilled to grade with debris.
No samples collected.

Seattle Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015O3\0137015O3 NOTES.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_ENV_NOTES

Log of Test Pit TP-20

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-48b
Sheet 1 of 1

Date Excavated: 1/7/2011 Logged By: AMW

Equipment: CAT 321LCR Trackhoe Total Depth (ft) 3.0

Elevation (feet) / Depth (feet)	SAMPLE: Testing Sample / Sample No. Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
0			Concrete Rubble		Concrete rubble	NS	<1	No odor
1			GW		Dark brown fine to coarse gravel with fine to coarse sand and trace silt, abundant bricks, lime rock, and apparent charred wood	NS	<1	No odor
2			ML		Dark brown to black sandy silt with abundant wood debris (apparent sawdust and wood chips) (moist)	NS	<1	No odor
3								

Test pit completed at 3 feet bgs.
Fast groundwater seepage observed at 1 and 3 feet bgs.
No caving observed.

Notes: Please see Figure B-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to 0.5 feet.

Log of Test Pit TP-21

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-49
Sheet 1 of 1

Seattle Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015\03\0137015\03 TEST PITS.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_ENV

Date Excavated: 1/7/2011 Logged By: AMW

Equipment: CAT 321LCR Trackhoe Total Depth (ft) 3.0

ADDITIONAL NOTES

Perched water in concrete rubble and standing water at ground surface approximately 5 feet south of test pit.

Seattle Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015O3\0137015O3 NOTES.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_ENV_NOTES

Log of Test Pit TP-21

GeoEngineers

Project: Rayonier Mill

Project Location: Port Angeles, Washington

Project Number: 0137-015-03

Figure B-49b

Date Excavated: 1/7/2011 Logged By: AMW

Equipment: CAT 321LCR Trackhoe Total Depth (ft) 8.0

Elevation (feet) / Depth (feet)	SAMPLE: Testing Sample / Sample No. Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Sheen	Headspace Vapor	Notes
0			Concrete Rubble		Concrete rubble with rebar, bricks and other debris	NS	<1	Sweet odor
1			SM		Dark gray silty fine to medium sand with gravel and fill debris (including bricks, concrete rubble, lime rock, wood debris, wire and occasional scrap iron)			
2								
3								
4				▼		NS	<1	Sweet odor
4						NS	<1	Sweet odor
5								
6								
7								
8				▽		NS	<1	Sweet odor

Test pit completed at 8 feet bgs.
Moderately slow groundwater seepage observed at 1, 4 and 8 feet bgs.
No caving observed.

Notes: Please see Figure B-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to 0.5 feet.

Log of Test Pit PIPE-1-SR23

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-50
Sheet 1 of 1

Seattle Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015\03\0137015\03 TEST PITS.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_ENV

Date Excavated: 1/7/2011 Logged By: AMW

Equipment: CAT 321LCR Trackhoe Total Depth (ft) 8.0

ADDITIONAL NOTES

Excavated at location of survey stake down to 8 feet bgs; did not encounter a green pipe (the pipe that was expected based on prior RI sampling).
Continued west at same depth and eventually exposed an iron pipe (approximately 10-inch-diameter) running parallel to excavation along the north sidewall, at approximately 6 feet bgs; pipe had belled joints.
Trench was approximately 30 feet long east to west, 7 feet wide, and approximately 8 feet deep.
Collected grab groundwater sample.

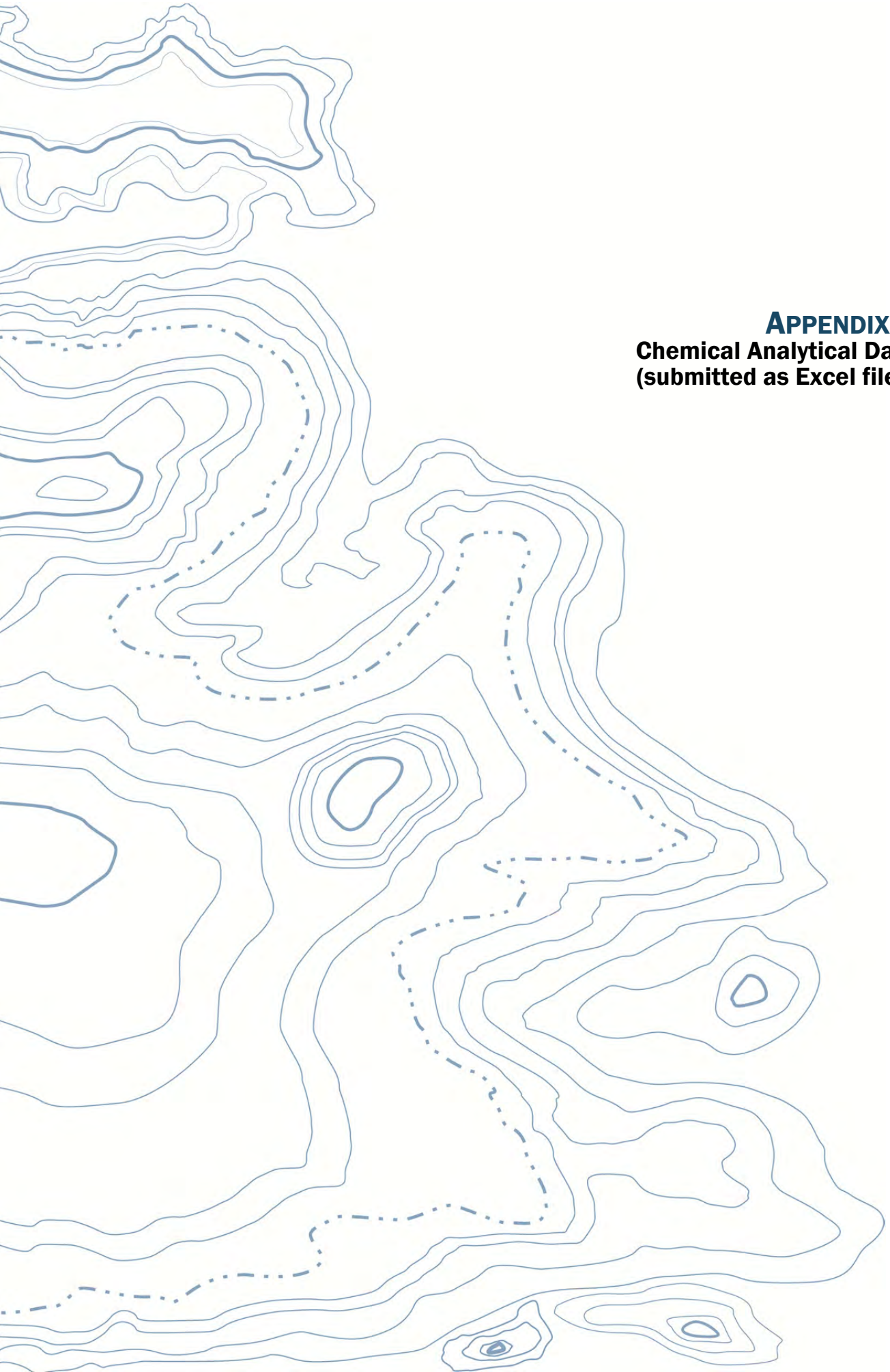
Log of Test Pit PIPE-1-SR23

GeoEngineers

Project: Rayonier Mill
Project Location: Port Angeles, Washington
Project Number: 0137-015-03

Figure B-50b
Sheet 1 of 1

Seattle Date:6/15/11 Path:C:\USERS\CVOSS\DESKTOP\0137015\03\0137015\03 NOTES.GPJ DBTemplate\LibTemplate\GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_ENV_NOTES



APPENDIX C
Chemical Analytical Data (submitted as Excel files)

APPENDIX C – TABLE NOTES AND ACRONYMNS

Notes

-- = Constituent not analyzed
Screening levels are presented in the July 20, 2010 Supplemental Data Collection Work Plan.
Detections are shown in bold typeface.
Sample depth is in feet below ground surface.

Yellow highlighted or red bordered cells indicate values that exceed the screening levels.

Green highlighted cells indicate positive detections below the screening levels.

Pink highlighted cells indicate method reporting limits that exceed the screening levels.

Blue and red data bars on Phase 2 groundwater grab and soil results tables indicate relative magnitude of COPC concentrations in groundwater grab and soil samples, respectively.

Acronyms

PAH = polycyclic aromatic hydrocarbon
cPAHs = carcinogenic polycyclic aromatic hydrocarbons
mg/kg = milligrams per kilogram
ug/kg = micrograms per kilogram
ng/kg = nanograms per kilogram
MRL = method reporting limit
PCB = polychlorinated biphenyl
TEC = total toxic equivalent concentration, calculated per WAC 173-340-708(8)(d) and (e)
TPH = total petroleum hydrocarbons
mg/l = milligrams per liter
ug/l = micrograms per liter
pg/l = picograms per liter
VOC = volatile organic compound
SVOC = semivolatile organic compound
NS = No sheen
NO = No odor
TB = Trip Blank
EB = Rinsate/Equipment Blank
TCLP = Toxicity Characteristic Leaching Procedure

Data Qualifiers

J = The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.
N = Tentatively identified analyte.
U = The analyte was analyzed for, but was not detected above the laboratory MRL reported.
V = Value calculated by GeoEngineers.

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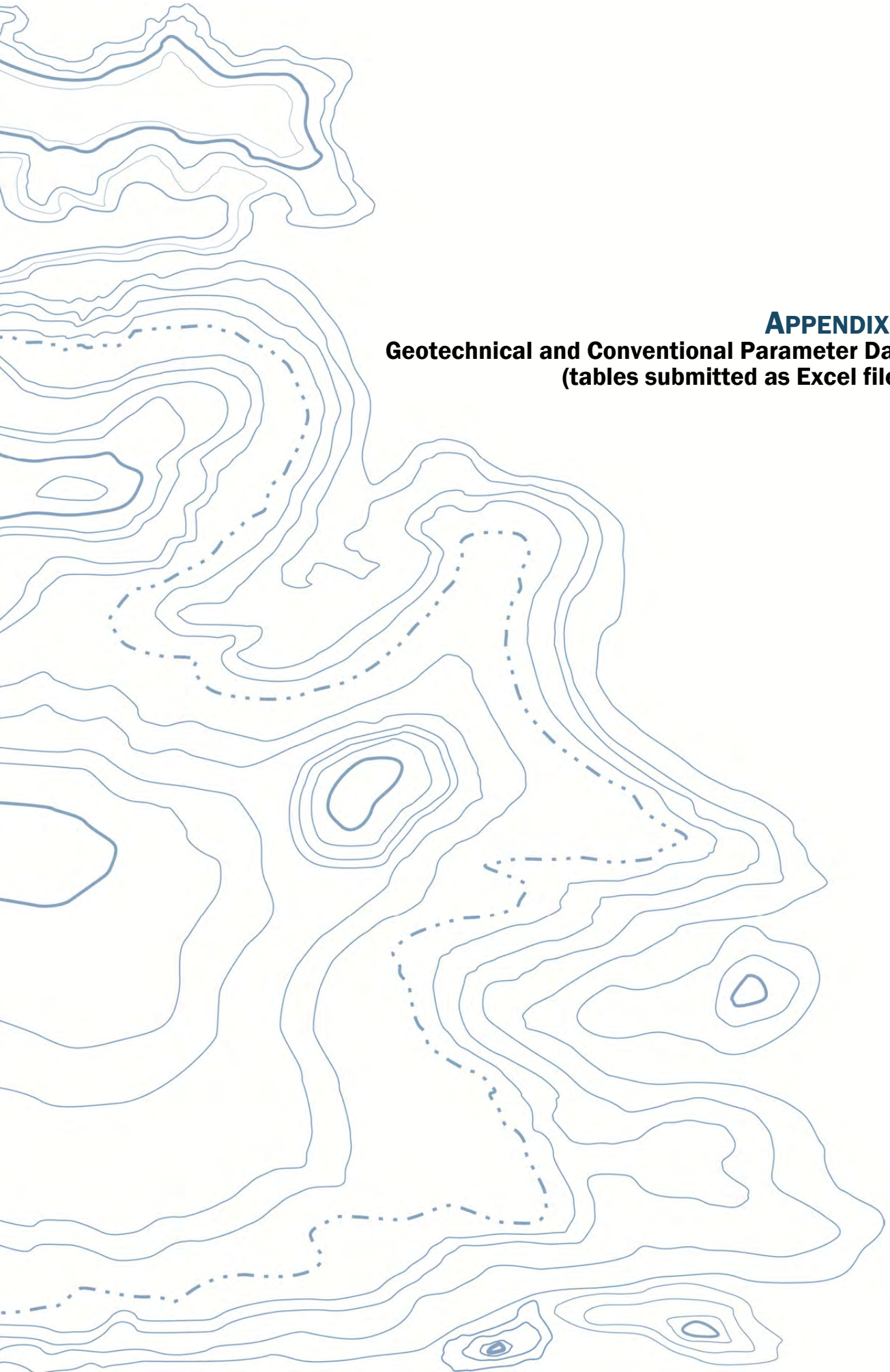

APPENDIX D

Geotechnical and Conventional Parameter Data (tables submitted as Excel files)

0371-176-00 Figure A-10.ppt

BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		COARSE	FINE	COARSE	MEDIUM	FINE	

SYMBOL	EXPLORATION NUMBER	DEPTH (ft)	MOISTURE CONTENT	SOIL CLASSIFICATION
◆	MW-62	2-3.5	6	Fine to coarse gravel with silt and sand (GP-GM)
□	MW-62	15-16.5	12	Fine to coarse sand with silt and gravel (SP-SM)

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Figure D-1

Rayonier Mill
Port Angeles, Washington

Sieve Analysis Results

BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		COARSE	FINE	COARSE	MEDIUM	FINE	

SYMBOL	EXPLORATION NUMBER	DEPTH (ft)	MOISTURE CONTENT	SOIL CLASSIFICATION
◆	GWG-8	10-11.5	20	Silty sand with gravel (SM)
□	GWG-8	15-6.5	7	Fine to course gravel (GP)

GeoEngineers

Figure D-2

Rayonier Mill
Port Angeles, Washington

Sieve Analysis Results

BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		COARSE	FINE	COARSE	MEDIUM	FINE	

SYMBOL	EXPLORATION NUMBER	DEPTH (ft)	MOISTURE CONTENT	SOIL CLASSIFICATION
◆	SSB-5	5-6.5	9	Fine to coarse gravel with silt and sand (GP-GM)
□	SSB-5	10-11.5	12	Fine to coarse gravel with silt and sand (GP-GM)
○	SSB-5	30-31.5	6	Fine to coarse gravel with sand (GP)

GeoEngineers

Figure D-3

Rayonier Mill
Port Angeles, Washington

Sieve Analysis Results

BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		COARSE	FINE	COARSE	MEDIUM	FINE	

SYMBOL	EXPLORATION NUMBER	DEPTH (ft)	MOISTURE CONTENT	SOIL CLASSIFICATION
◆	SSB-8	2-3.5	2	Fine to coarse gravel with sand (GP)
□	SSB-8	10-11.5	25	Fine to coarse sand with silt and gravel (SP-SM)
○	SSB-8	30-31	8	Silty sand with gravel (SM)

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Figure D-4

Rayonier Mill
Port Angeles, Washington

Sieve Analysis Results

BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		COARSE	FINE	COARSE	MEDIUM	FINE	

SYMBOL	EXPLORATION NUMBER	DEPTH (ft)	MOISTURE CONTENT	SOIL CLASSIFICATION
◆	SSB-9	5-6.5	25	Sandy silt (ML)
□	SSB-9	20-21.5	10	Fine to coarse gravel with silt and sand (GP-GM)
○	SSB-9	30-31.5	13	Fine to coarse gravel with silt and sand (GP-GM)

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Rayonier Mill
Port Angeles, Washington

Sieve Analysis Results

Figure D-5

BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		COARSE	FINE	COARSE	MEDIUM	FINE	

SYMBOL	EXPLORATION NUMBER	DEPTH (ft)	MOISTURE CONTENT	SOIL CLASSIFICATION
◆	SSB-10	5-6.5	35	Sandy silt (ML)
□	SSB-10	15-16.5	8	Fine to coarse gravel with sand (GP)
○	SSB-10	25-26.5	8	Fine to coarse gravel with silt and sand (GP-GM)

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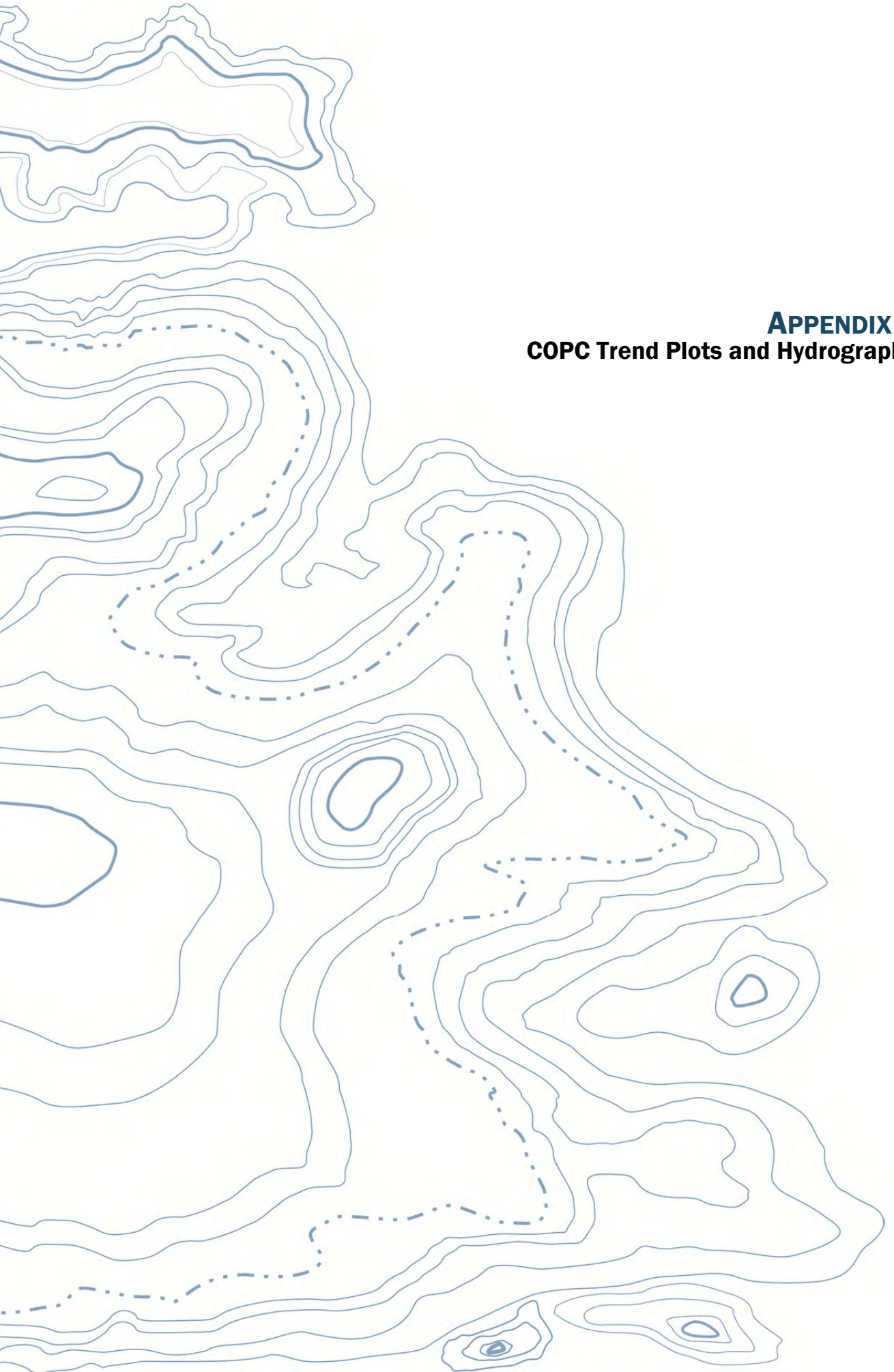
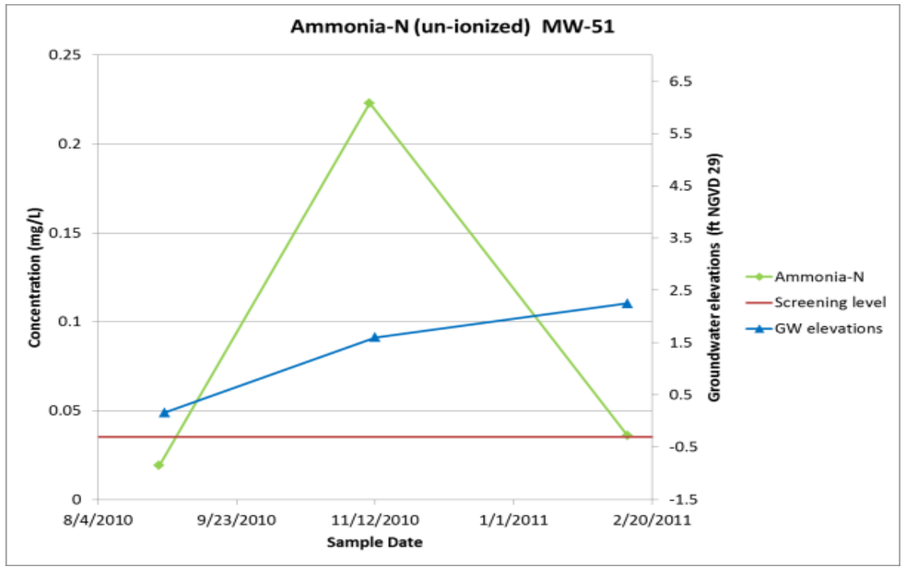
Rayonier Mill
Port Angeles, Washington

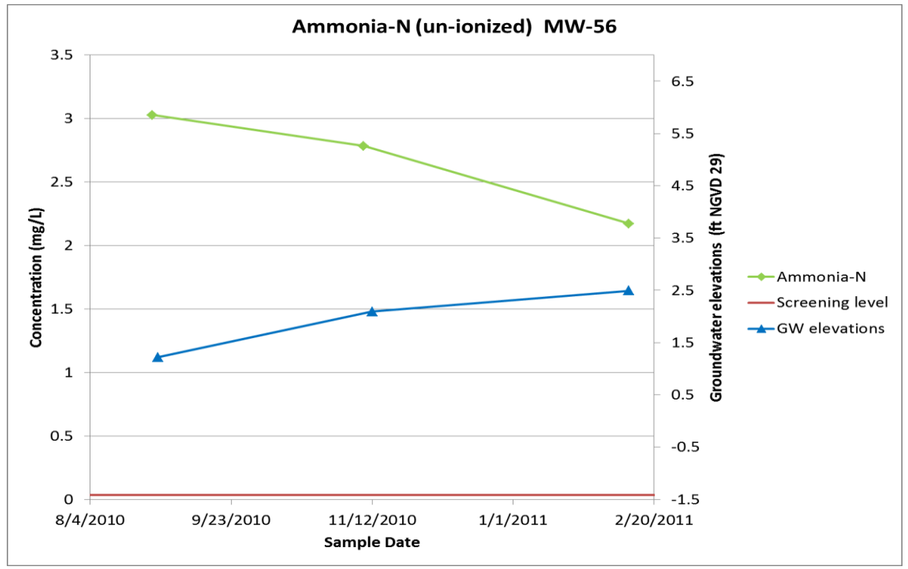
Sieve Analysis Results

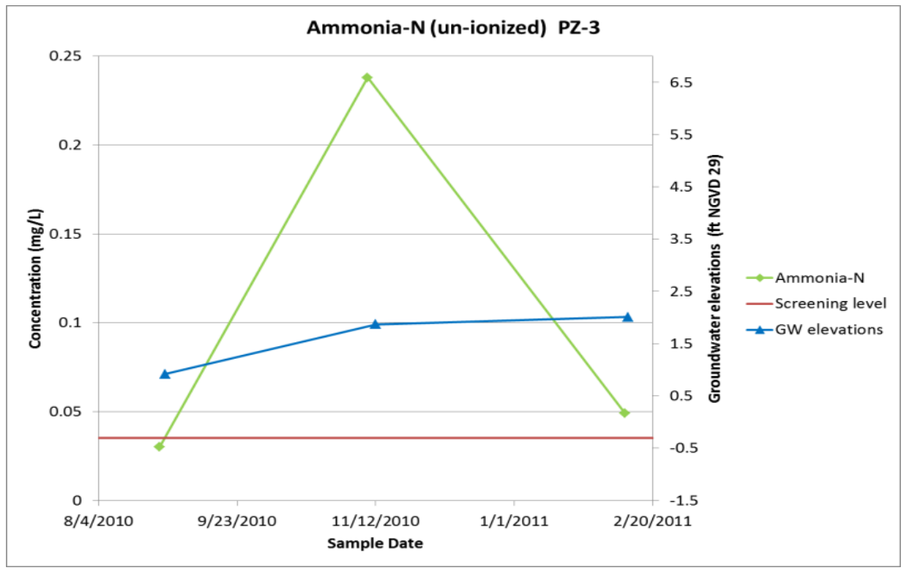
Figure D-6



APPENDIX E
COPC Trend Plots and Hydrographs







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Ammonia-N and Hydrograph – Tidally Influenced Wells, Aug 2010 to Feb 2011

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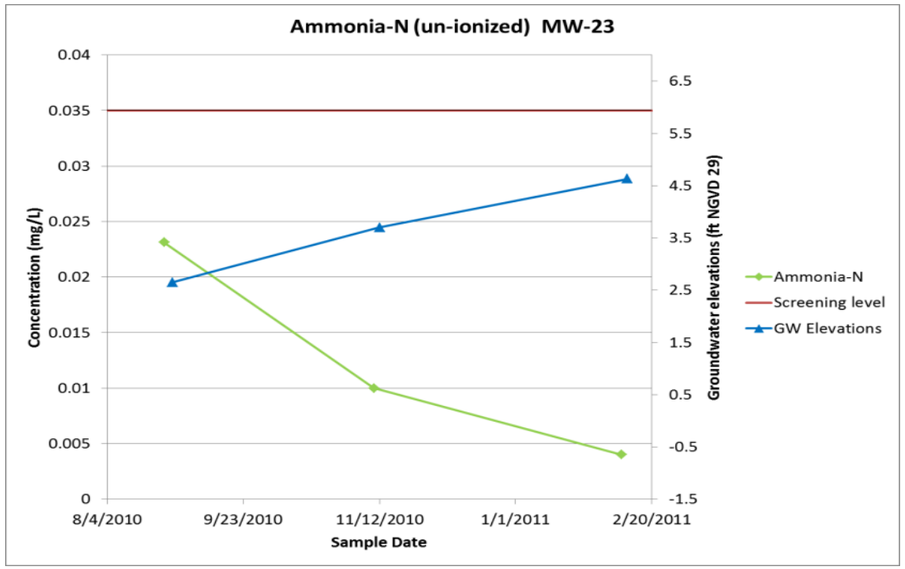
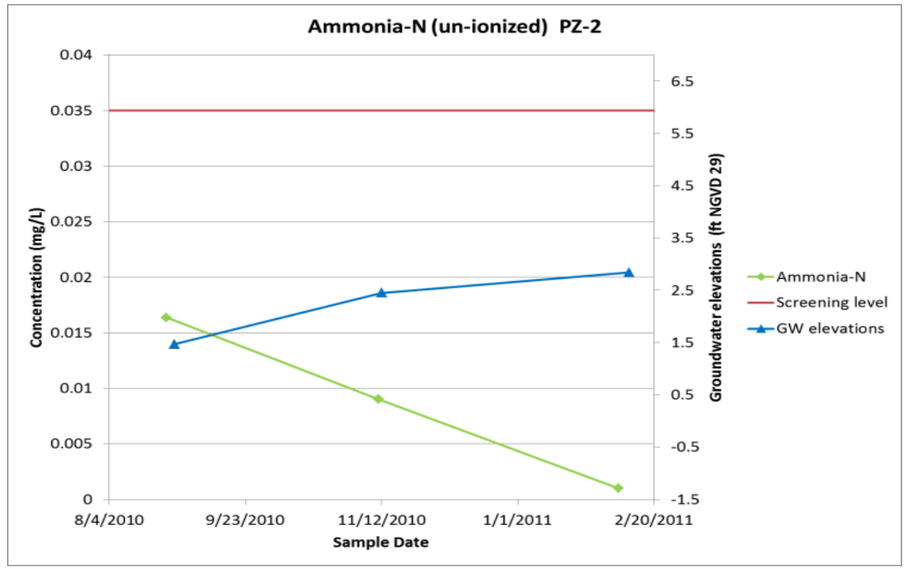
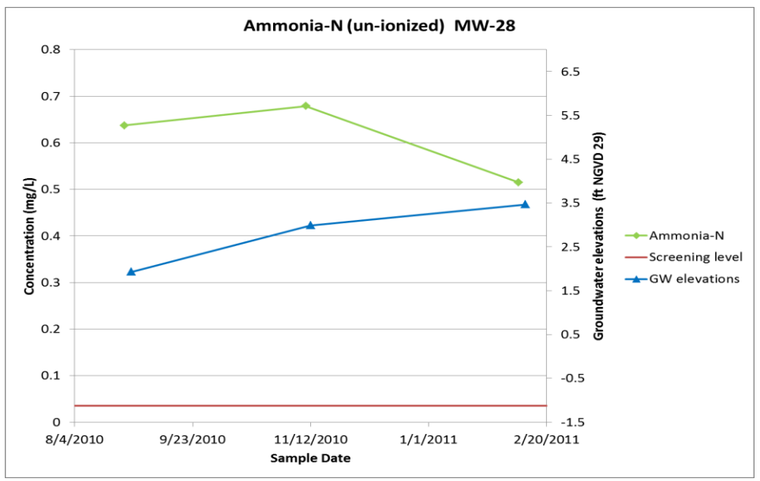
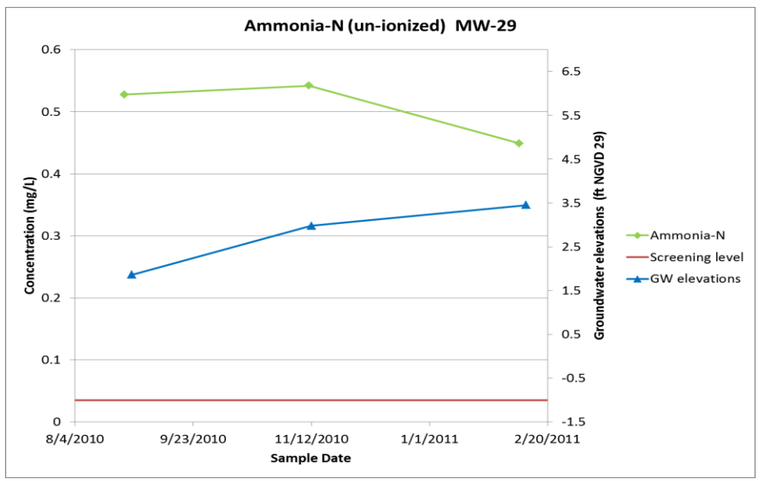
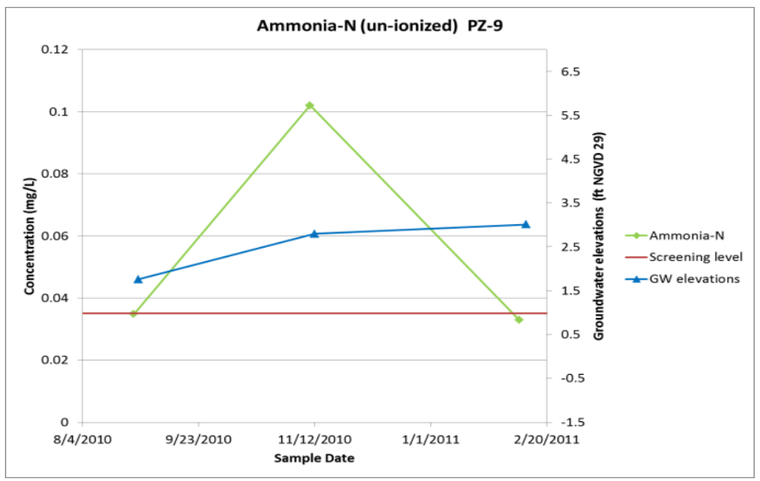
Figure E-1











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Ammonia-N and Hydrograph, Aug 2010 to Feb 2011

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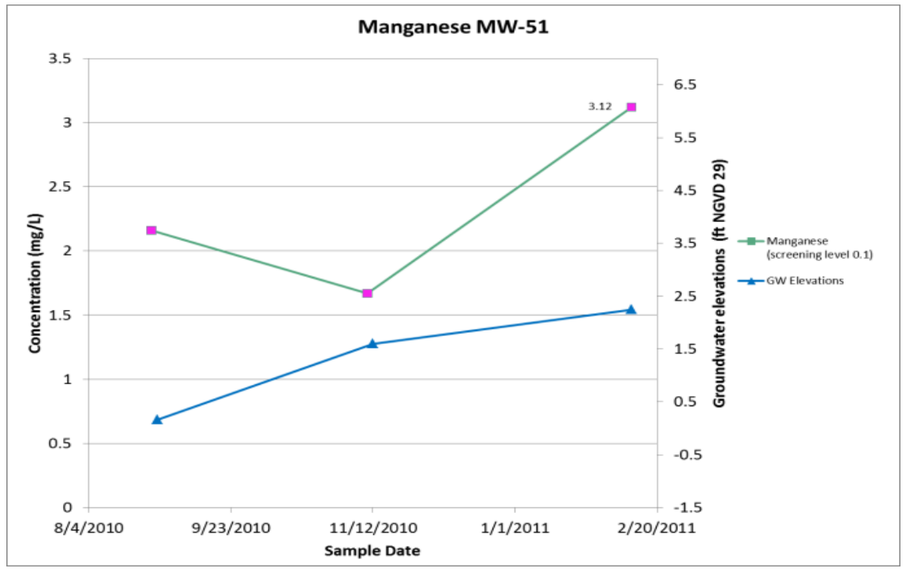
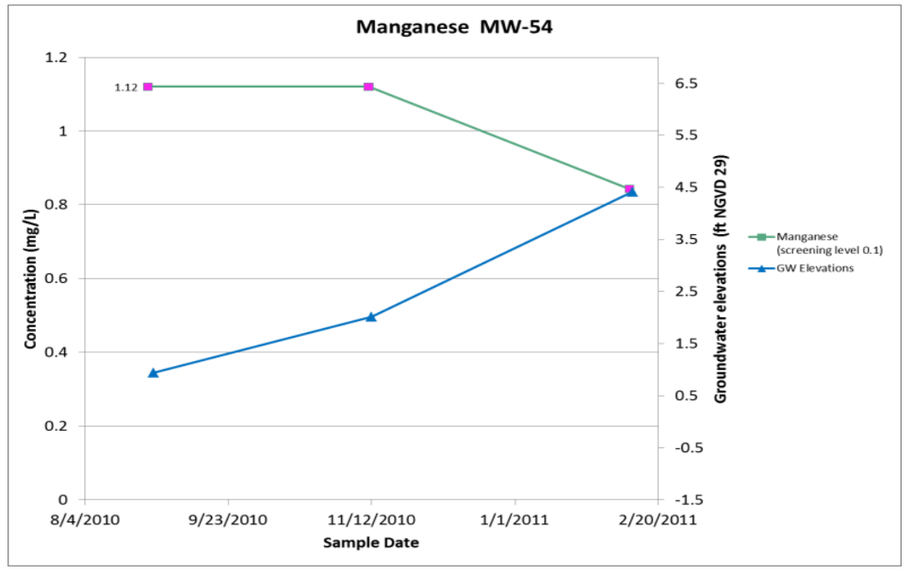
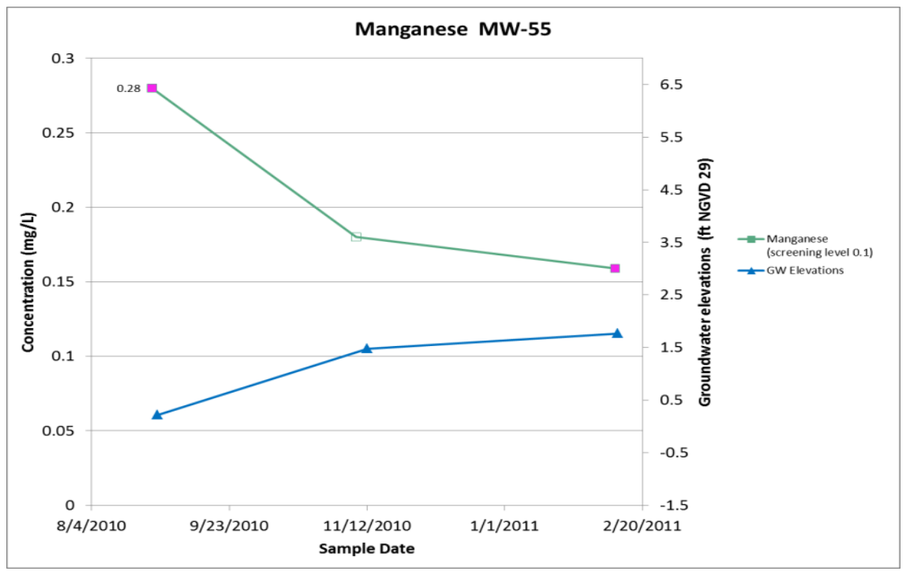
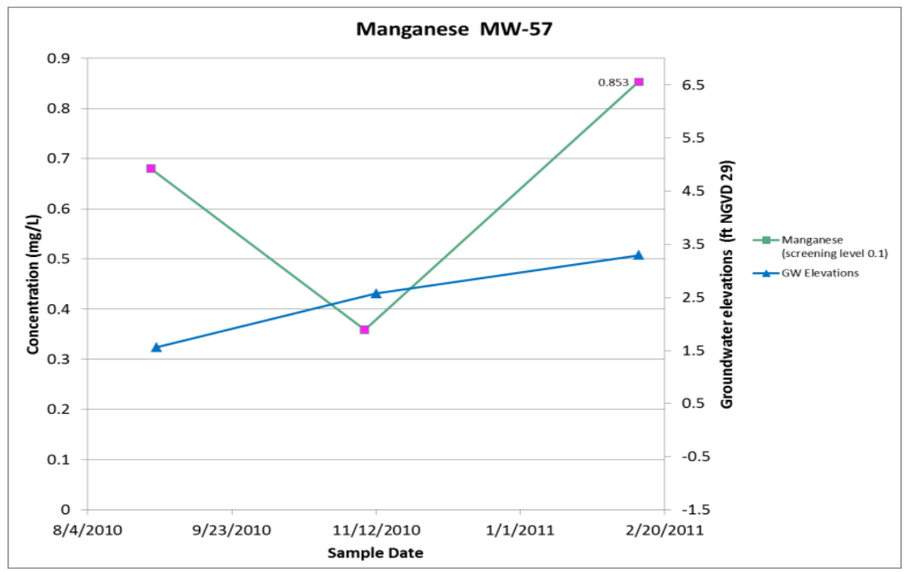
Figure E-2









Legend

Open symbol indicates non-detected result

Filled symbol indicates detected result

Pink symbol indicates detected result above screening level

Notes:

1. For metals trend plots, plotted data generally represent dissolved metals results (filtered samples); for sampling events where only total metals (unfiltered samples) were analyzed, the totals data are plotted.
2. Only metals with at least one screening level exceedance are shown in this figure.
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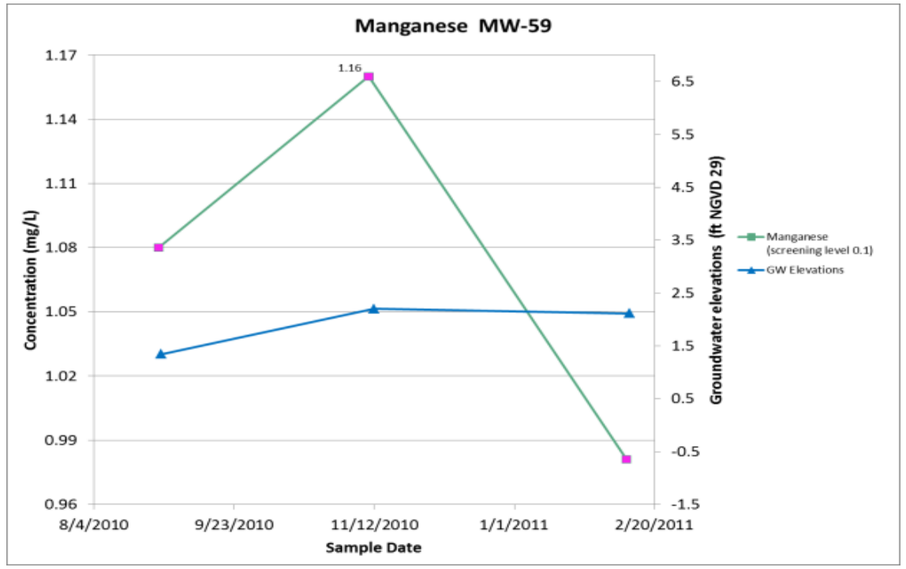
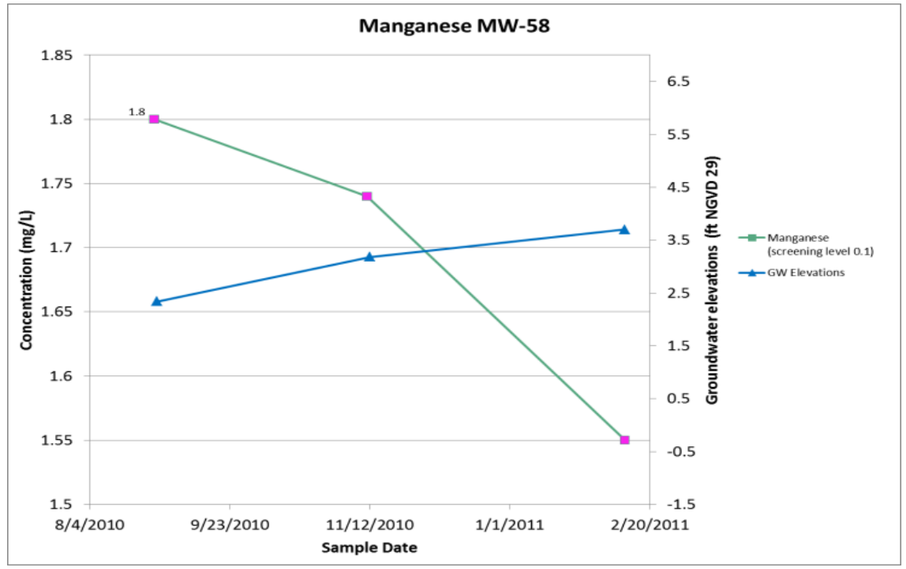
Figure E-3





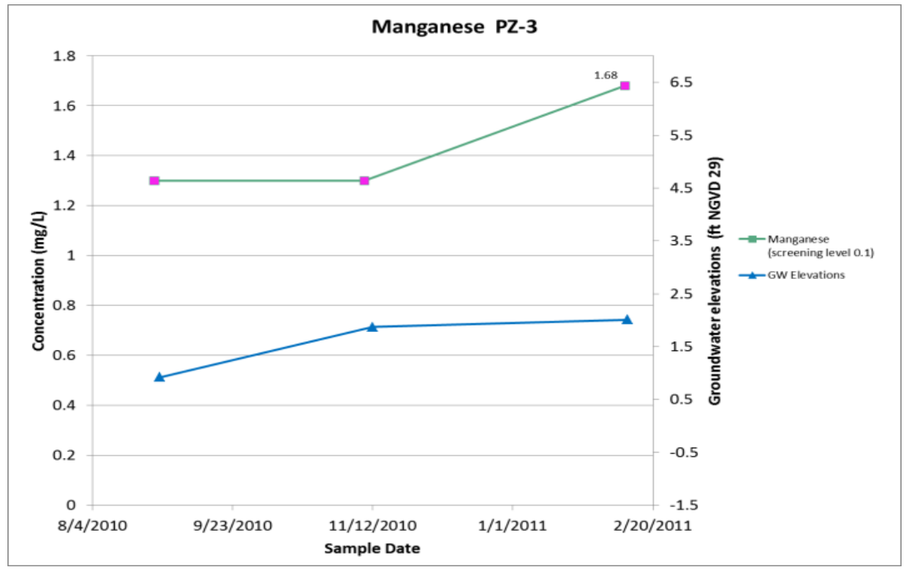


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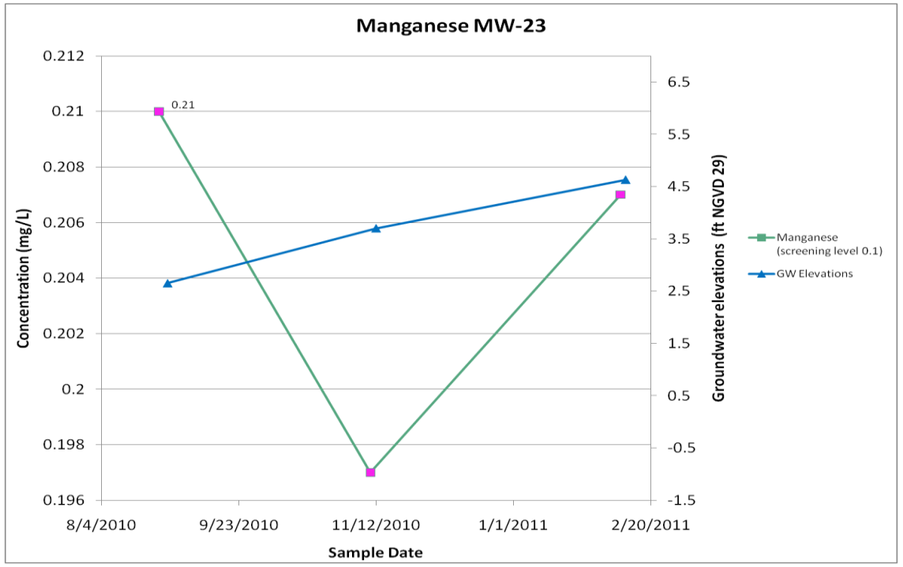
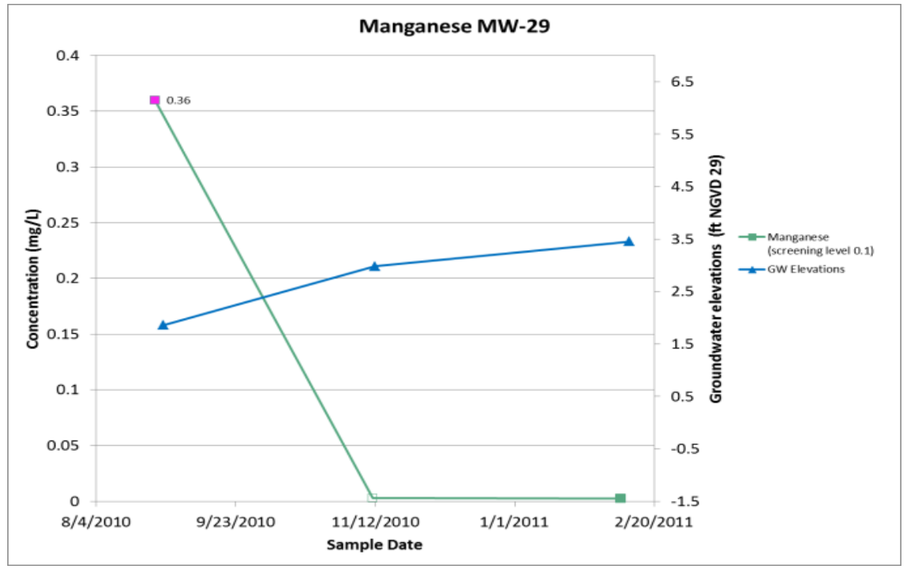
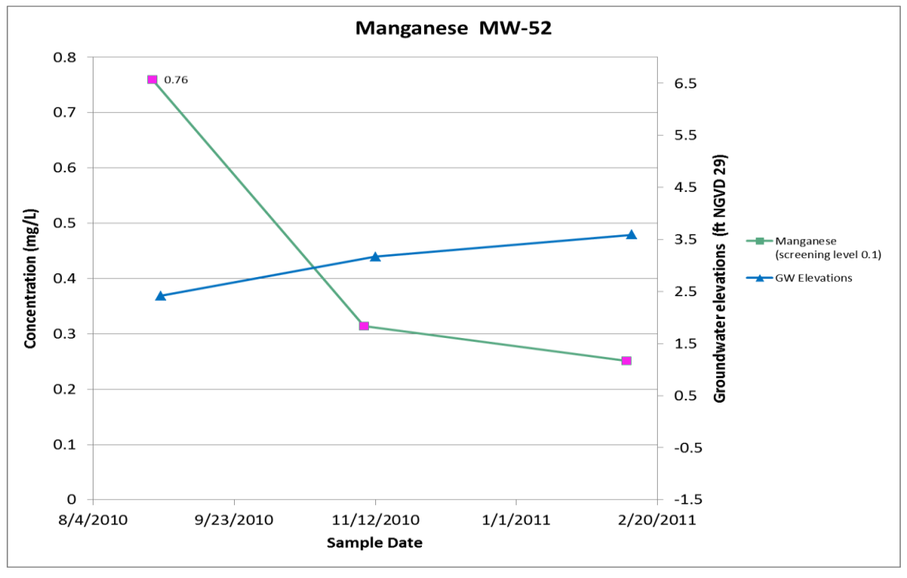
Figure E-4







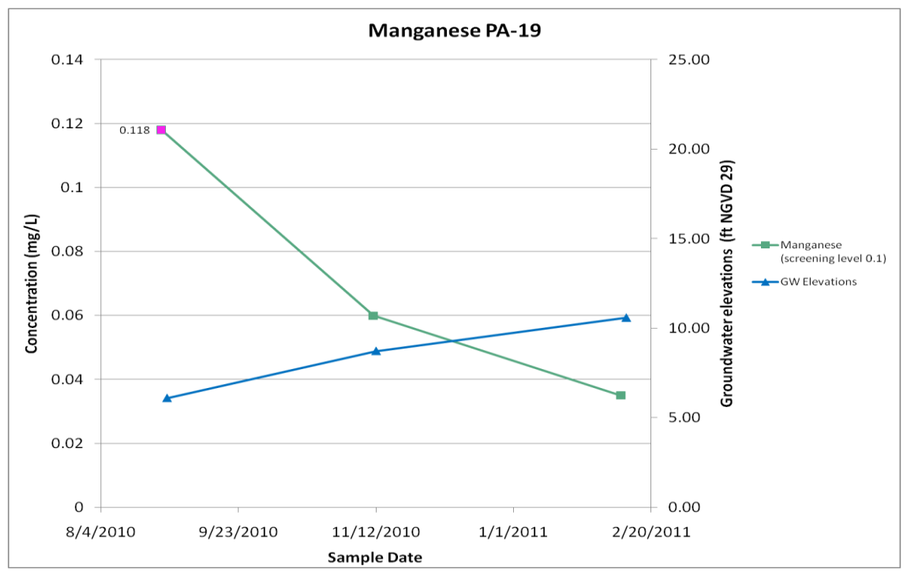


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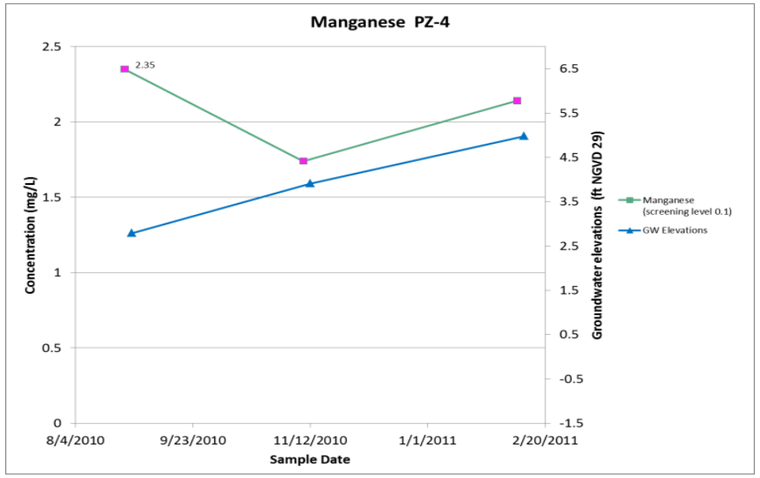
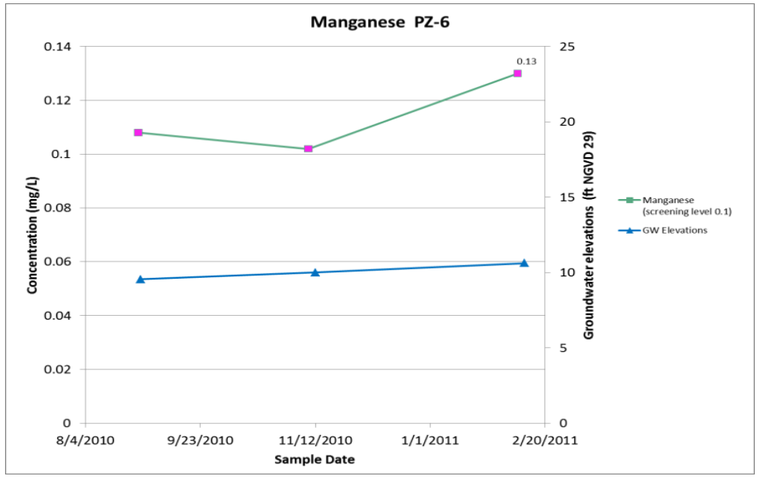
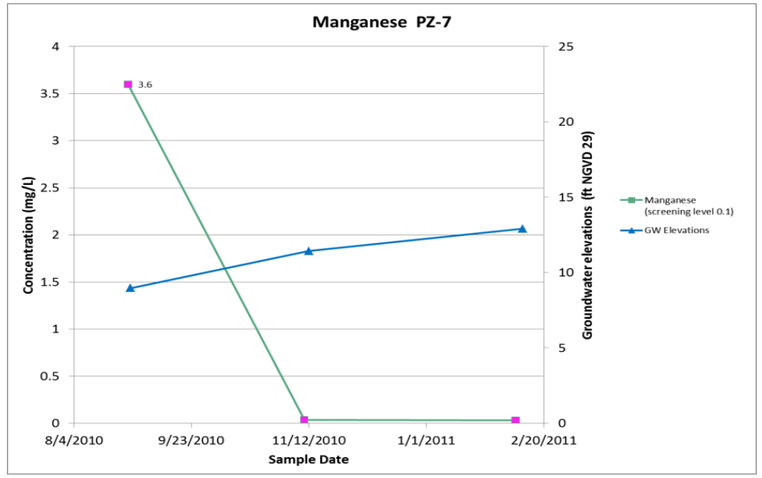
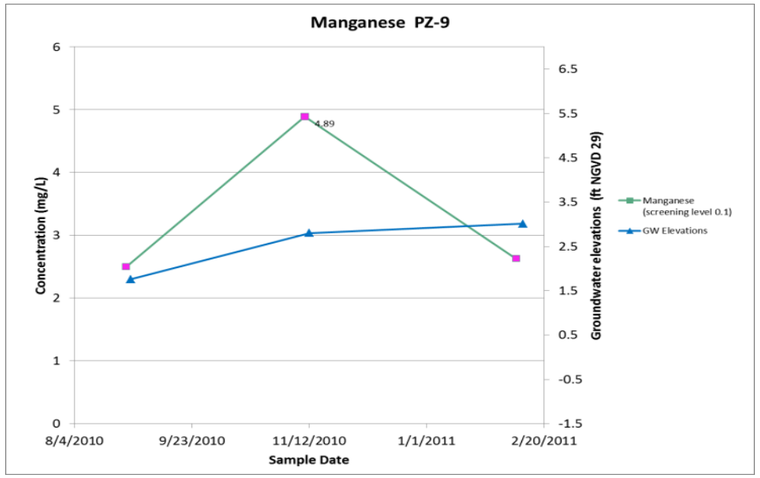
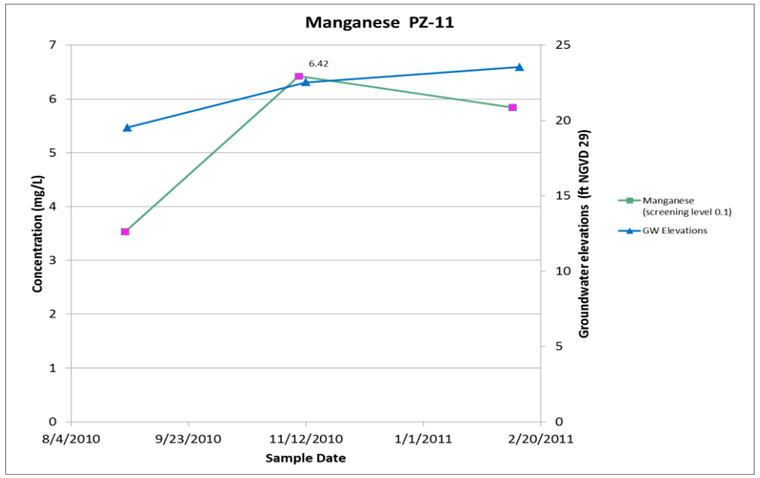
Figure E-5

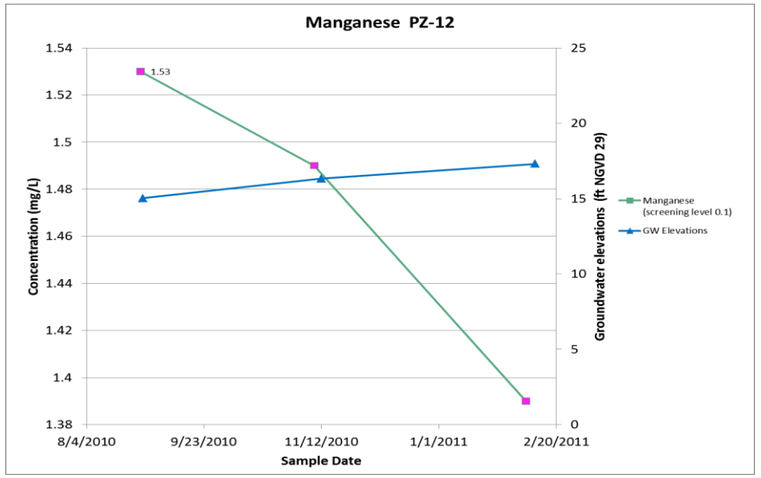












Legend

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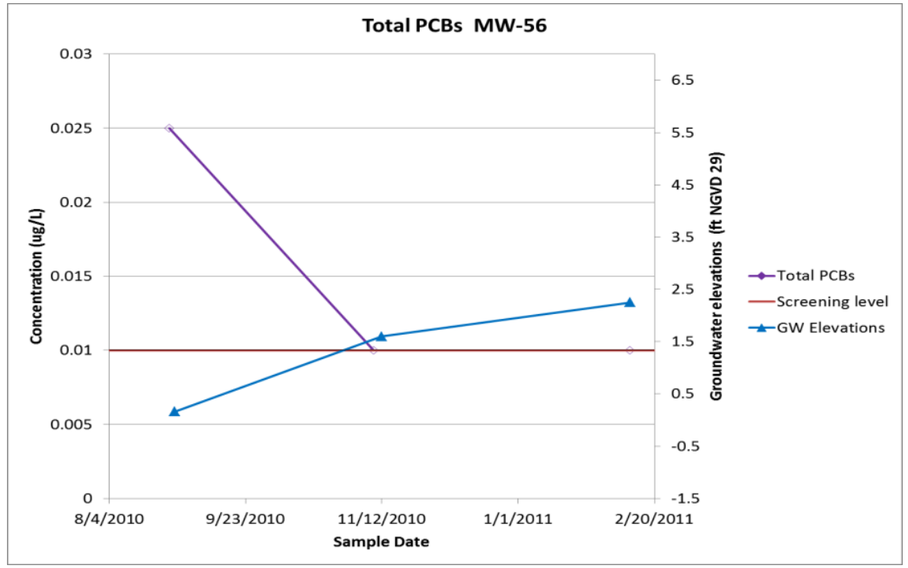
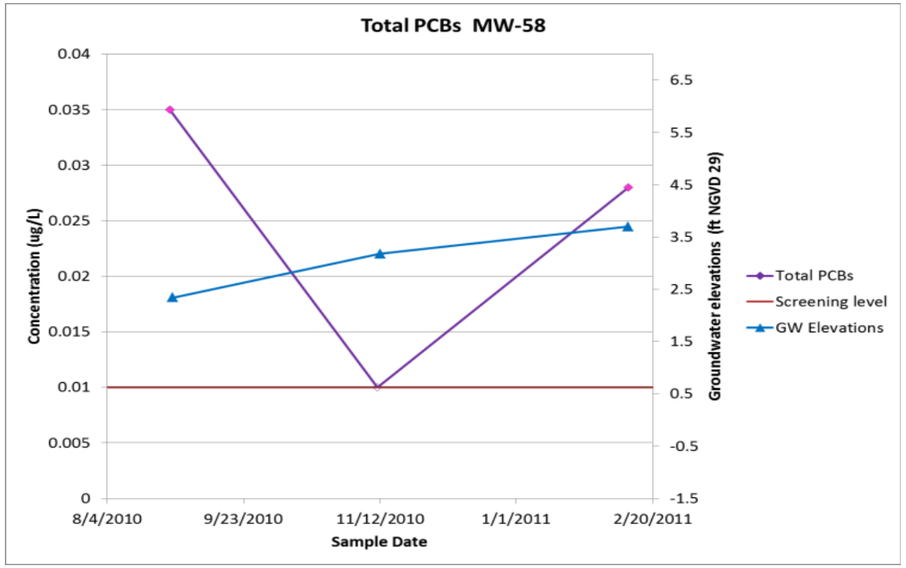
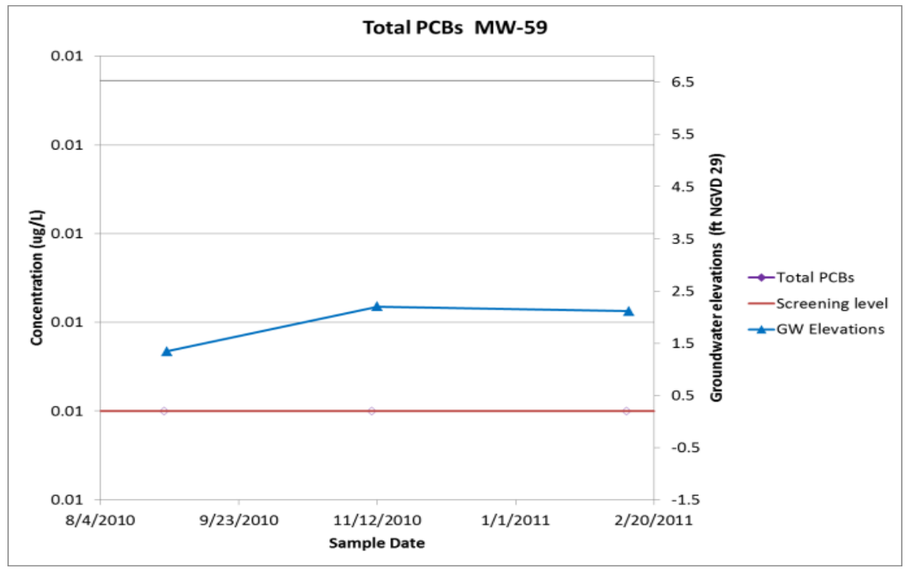
Figure E-6







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Port Angeles Rayonier Mill
Port Angeles, Washington

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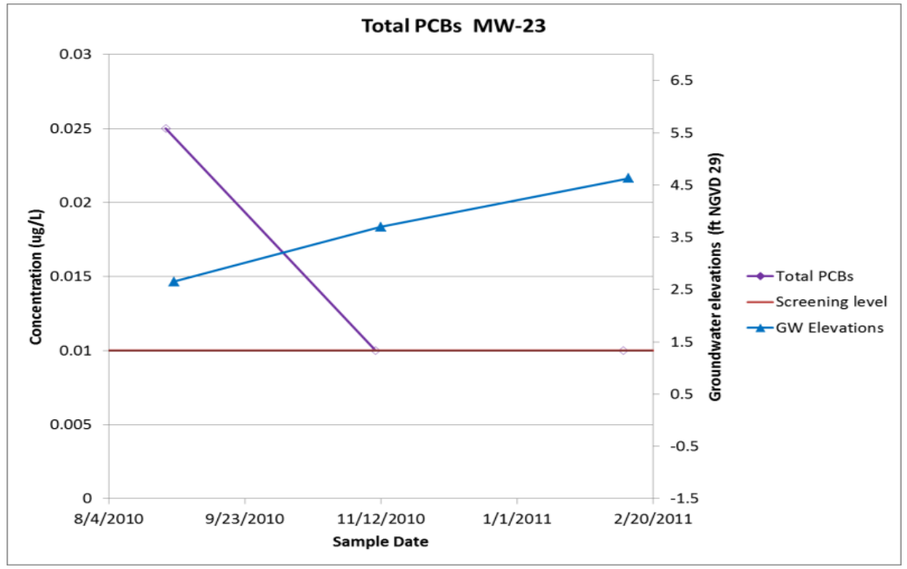
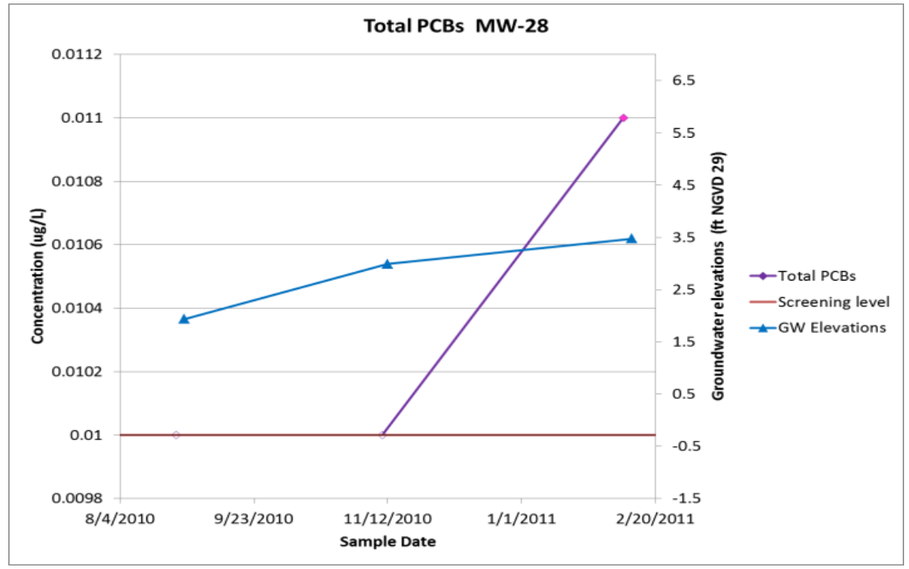
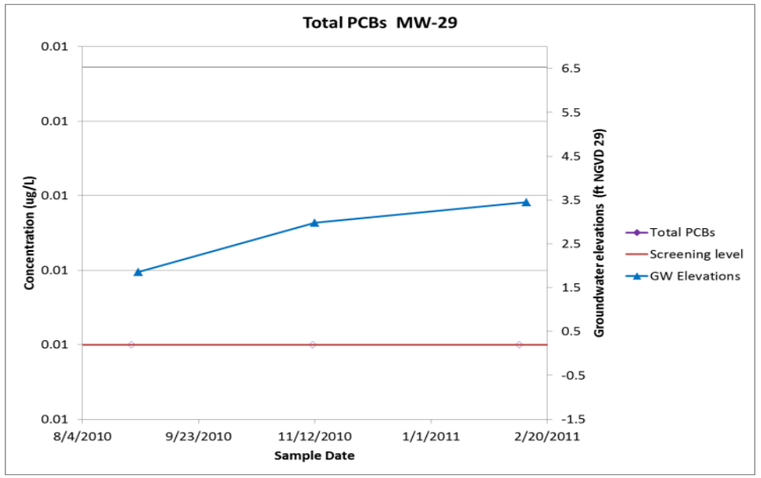
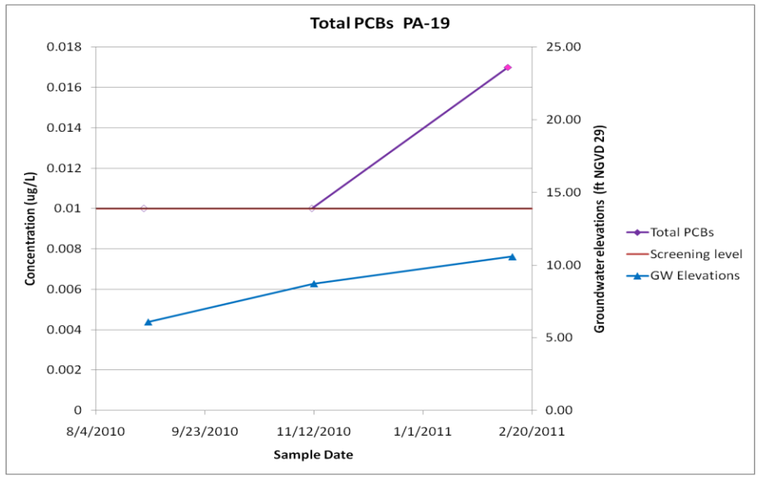
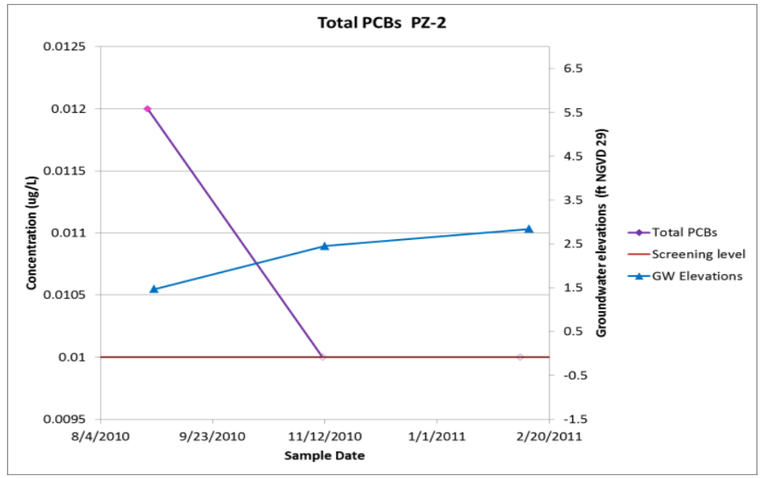
Figure E-7











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Total PCBs and Hydrograph, Aug 2010 to Feb 2011

Port Angeles Rayonier Mill
Port Angeles, Washington

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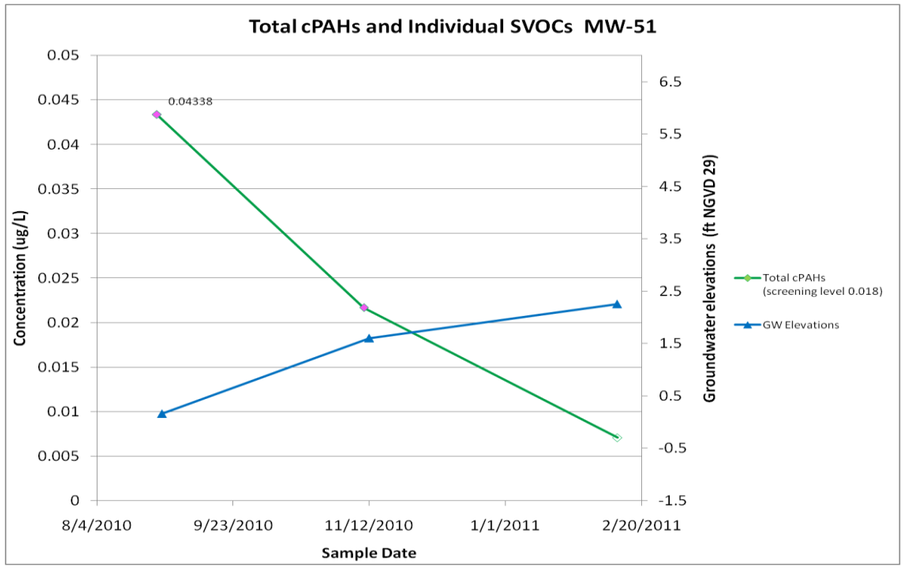
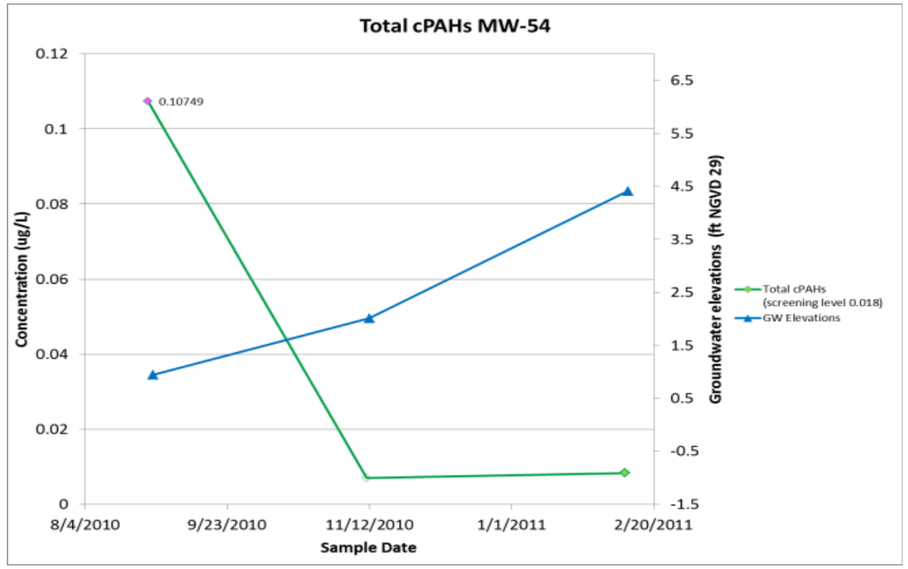
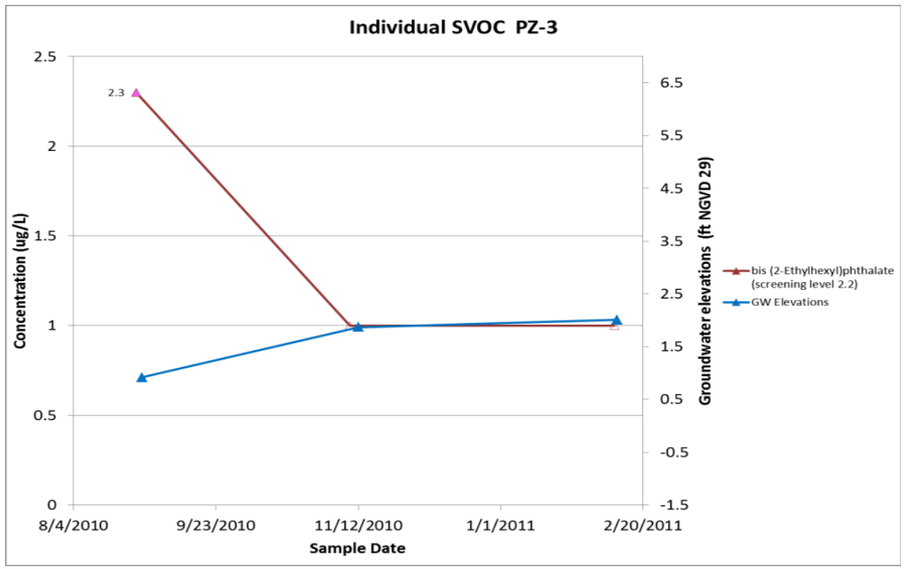
Figure E-8







Legend

Open symbol indicates non-detected result

Filled symbol indicates detected result

Pink symbol indicates detected result above screening level

Notes:

1. Only individual SVOCs with at least one screening level exceedance are shown in this figure.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

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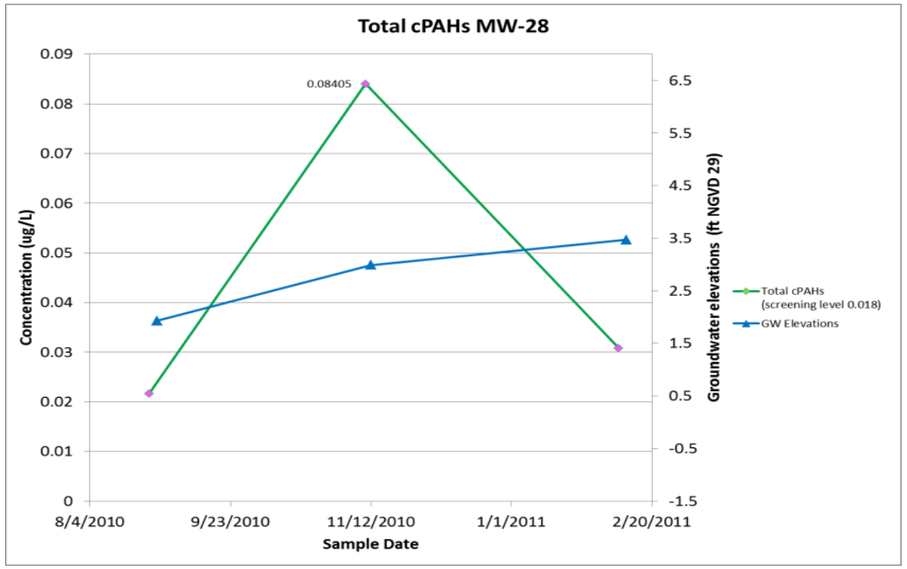
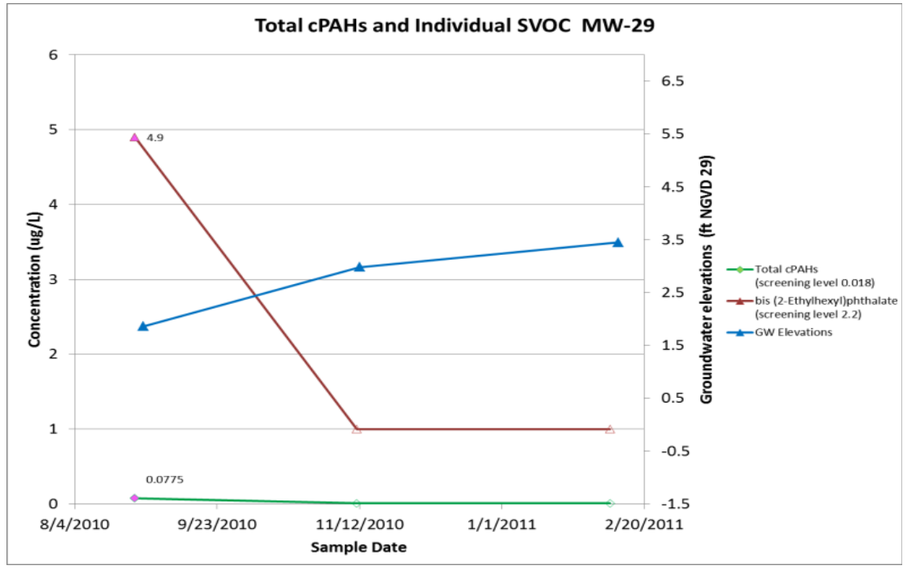
Total cPAHs and Individual SVOCs and Hydrograph – Tidally Influenced Wells, Aug 2010 to Feb 2011

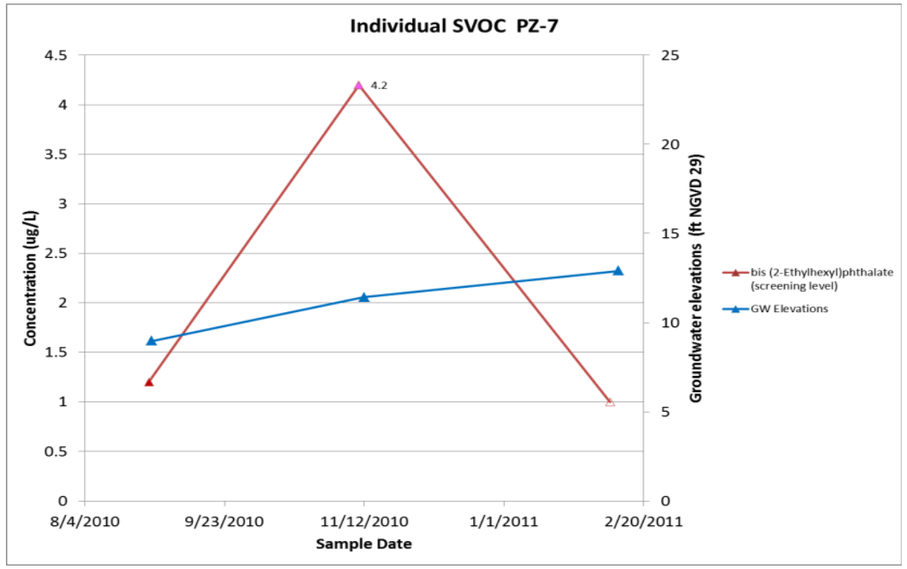
Port Angeles Rayonier Mill
Port Angeles, Washington

GeoEngineers

Figure E-9







Legend

Open symbol indicates non-detected result

Filled symbol indicates detected result

Pink symbol indicates detected result above screening level

Notes:

1. Only individual SVOCs with at least one screening level exceedance are shown in this figure.
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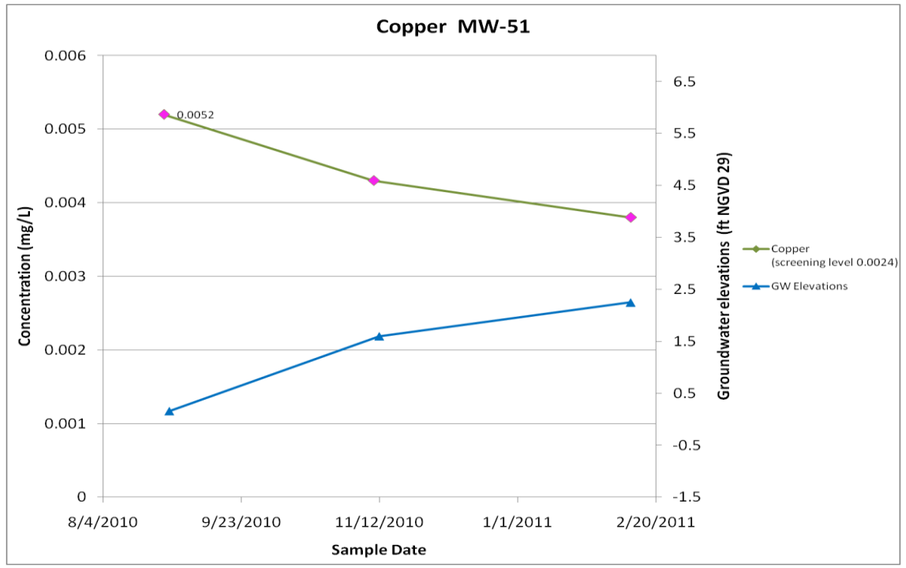
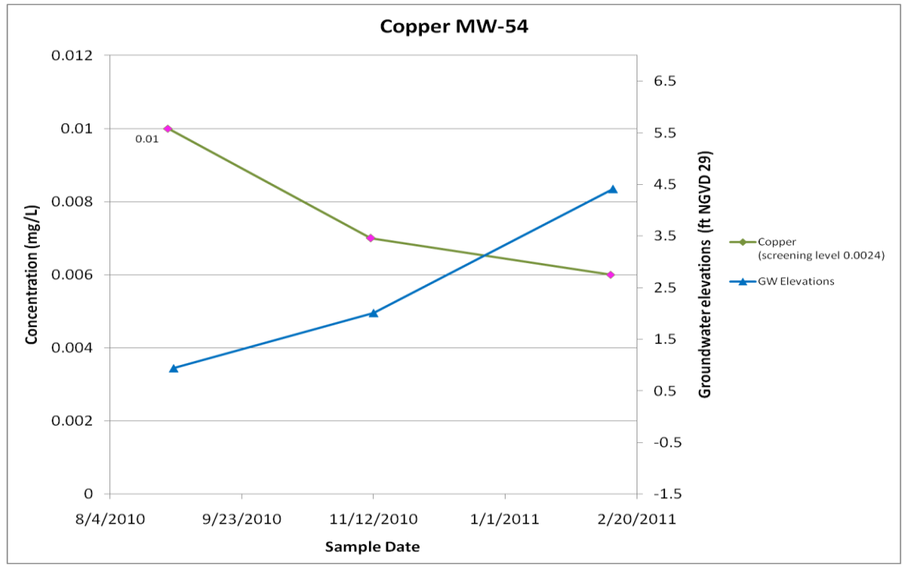
Total cPAHs and Individual SVOCs and Hydrograph, Aug 2010 to Feb 2011

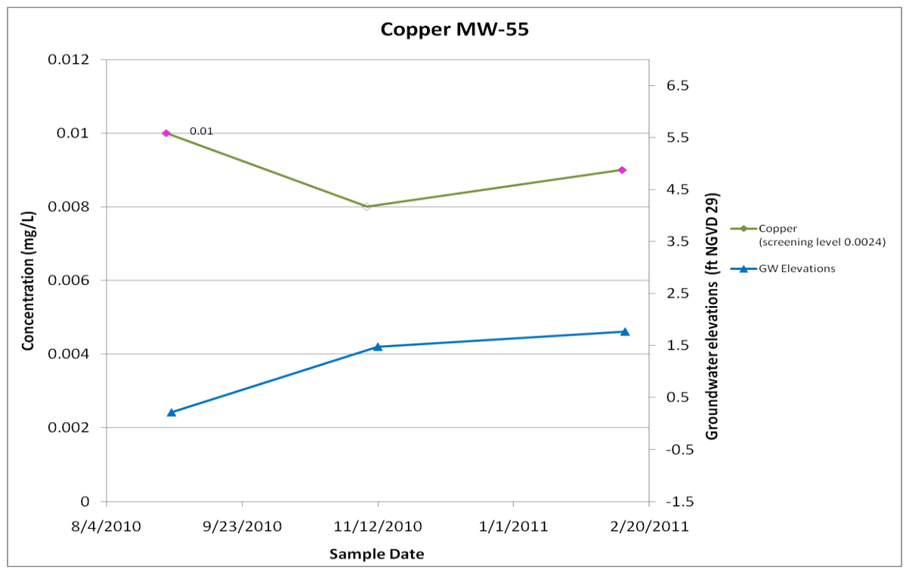
Port Angeles Rayonier Mill
Port Angeles, Washington

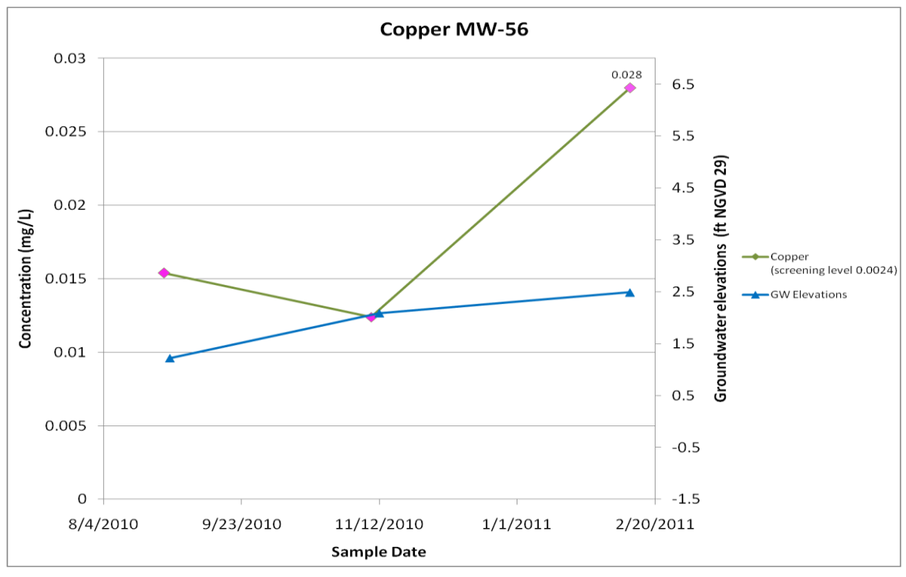
GeoEngineers

Figure E-10









Legend

Open symbol indicates non-detected result

Filled symbol indicates detected result

Pink symbol indicates detected result above screening level

Notes:

1. For metals trend plots, plotted data generally represent dissolved metals results (filtered samples); for sampling events where only total metals (unfiltered samples) were analyzed, the totals data are plotted.
2. Only metals with at least one screening level exceedance are shown in this figure.
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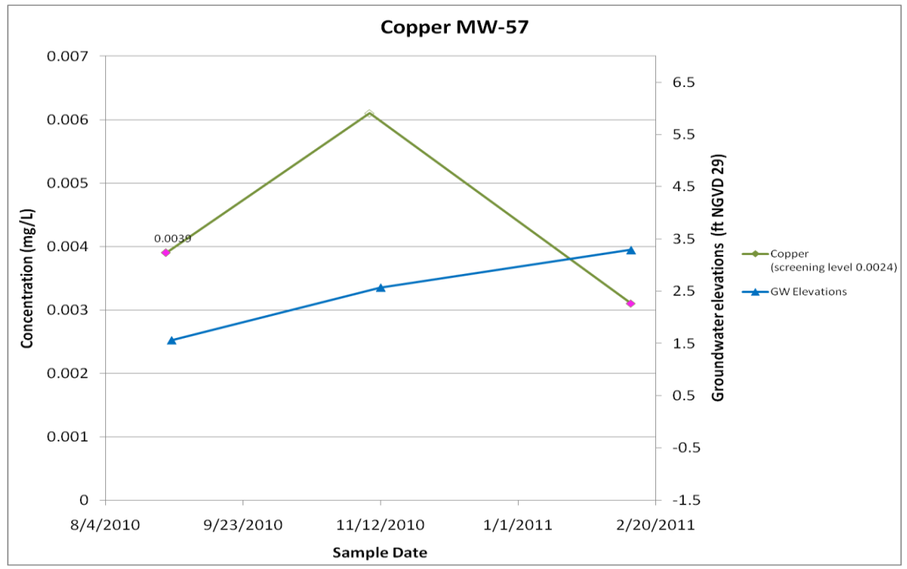
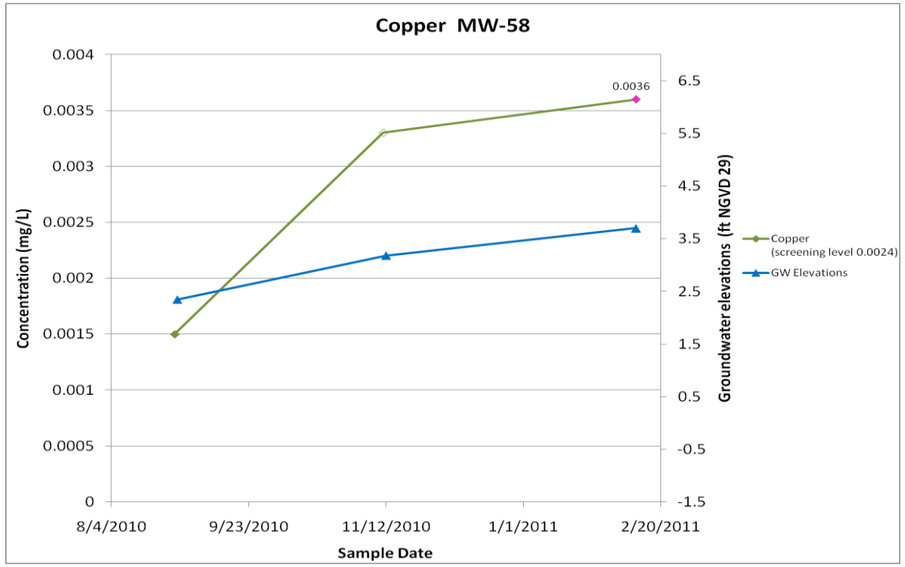
Copper and Hydrograph – Tidally Influenced Wells, Aug 2010 to Feb 2011

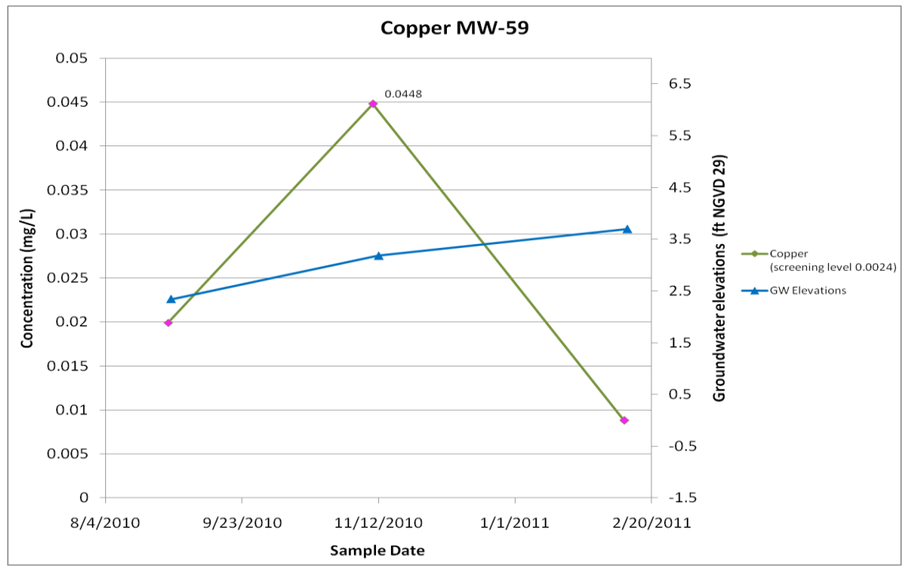
Port Angeles Rayonier Mill
Port Angeles, Washington

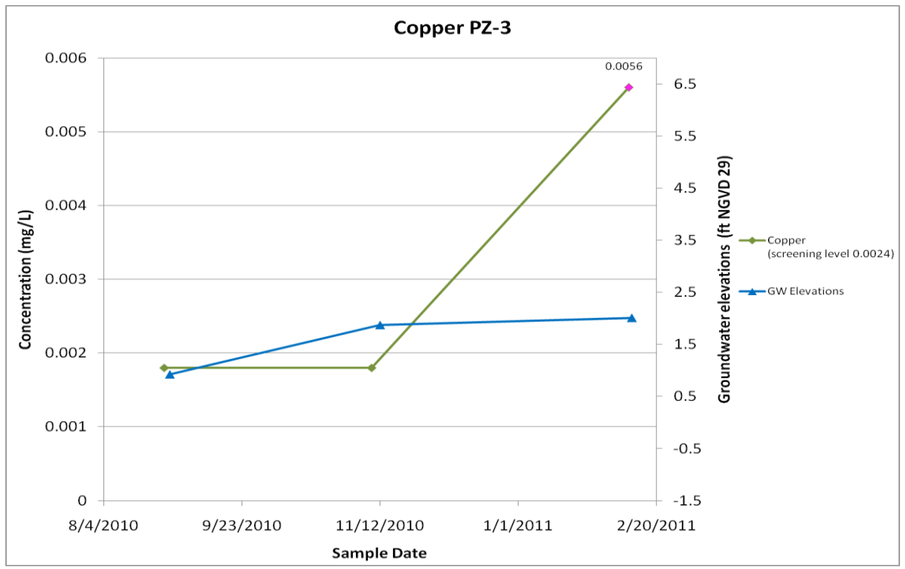
GeoEngineers

Figure E-11









Legend

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Filled symbol indicates detected result

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Notes:

1. For metals trend plots, plotted data generally represent dissolved metals results (filtered samples); for sampling events where only total metals (unfiltered samples) were analyzed, the totals data are plotted.
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Copper and Hydrograph – Tidally Influenced Wells, Aug 2010 to Feb 2011

Port Angeles Rayonier Mill
Port Angeles, Washington

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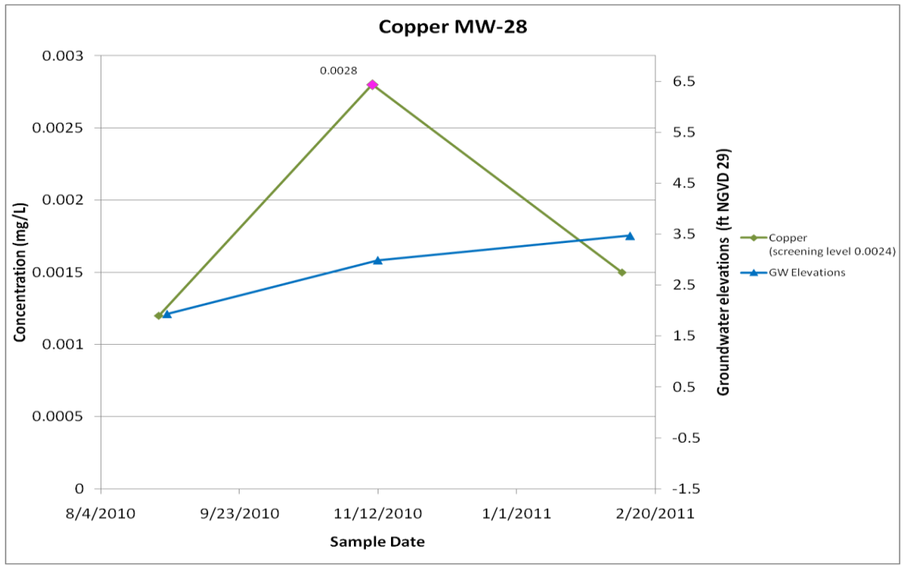
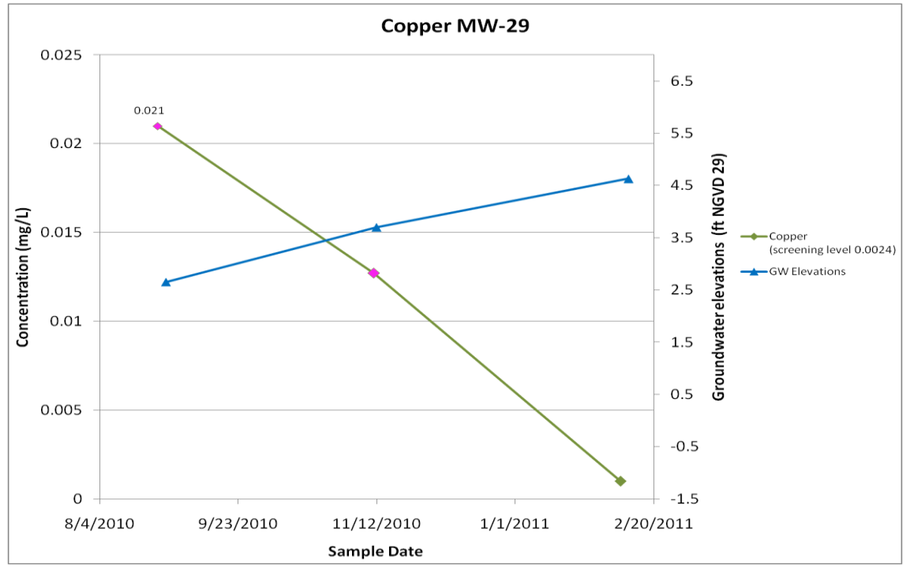
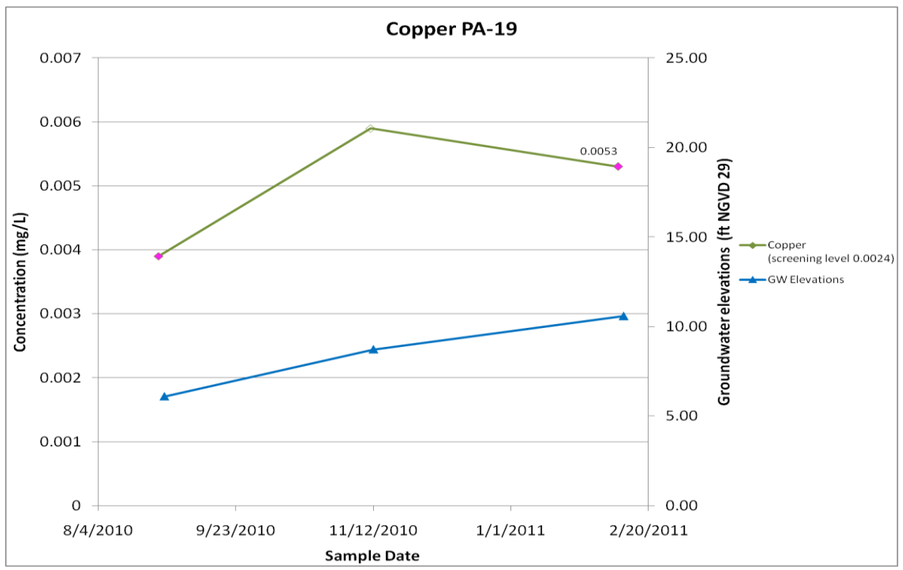
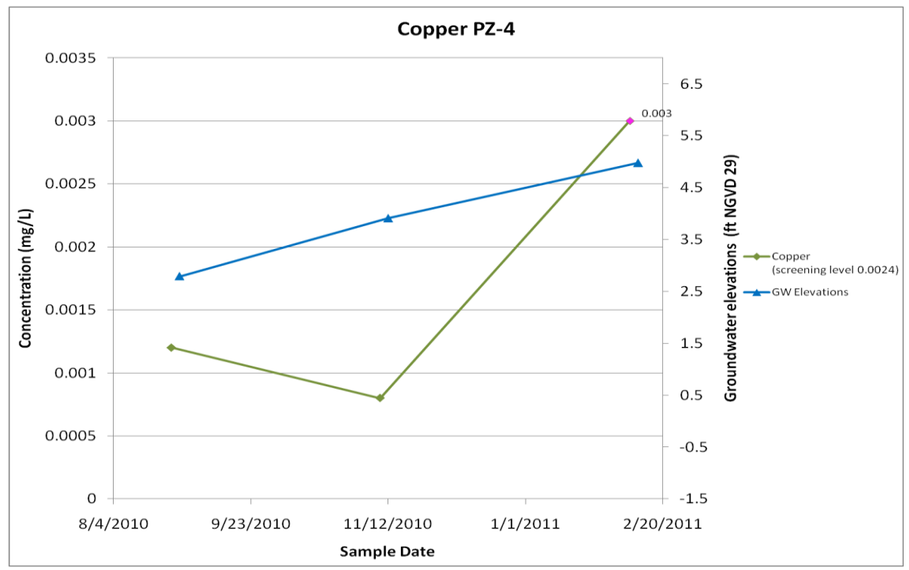
Figure E-12









Legend

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Notes:

1. For metals trend plots, plotted data generally represent dissolved metals results (filtered samples); for sampling events where only total metals (unfiltered samples) were analyzed, the totals data are plotted.
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Copper and Hydrograph, Aug 2010 to Feb 2011

Port Angeles Rayonier Mill
Port Angeles, Washington

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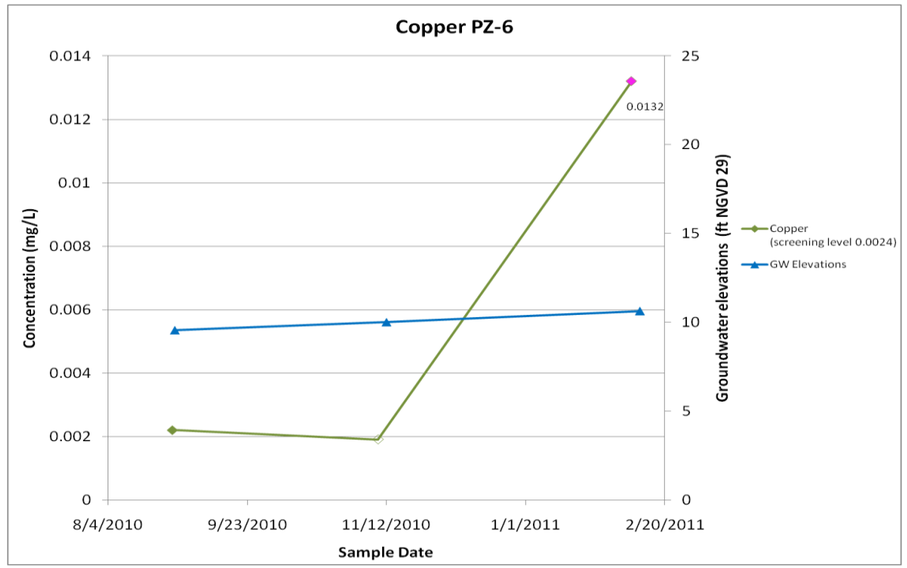
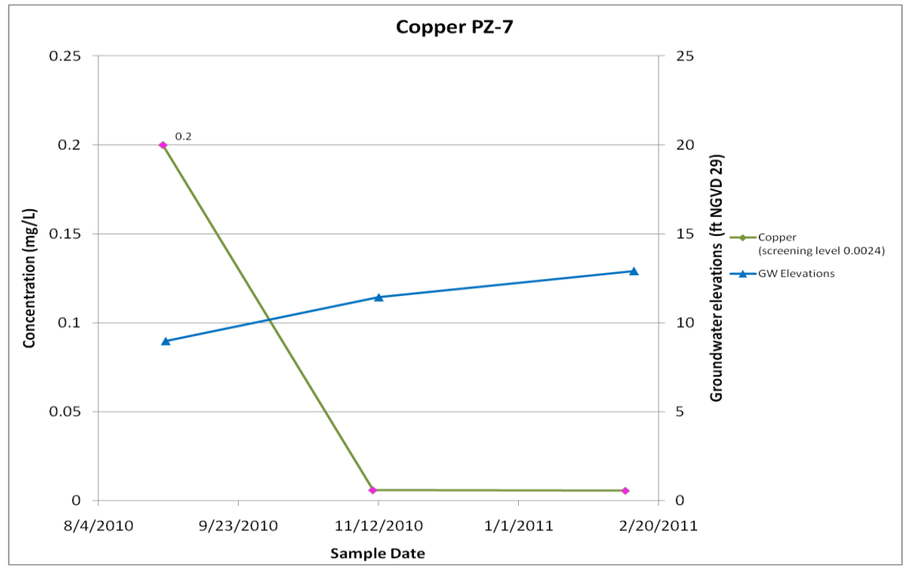
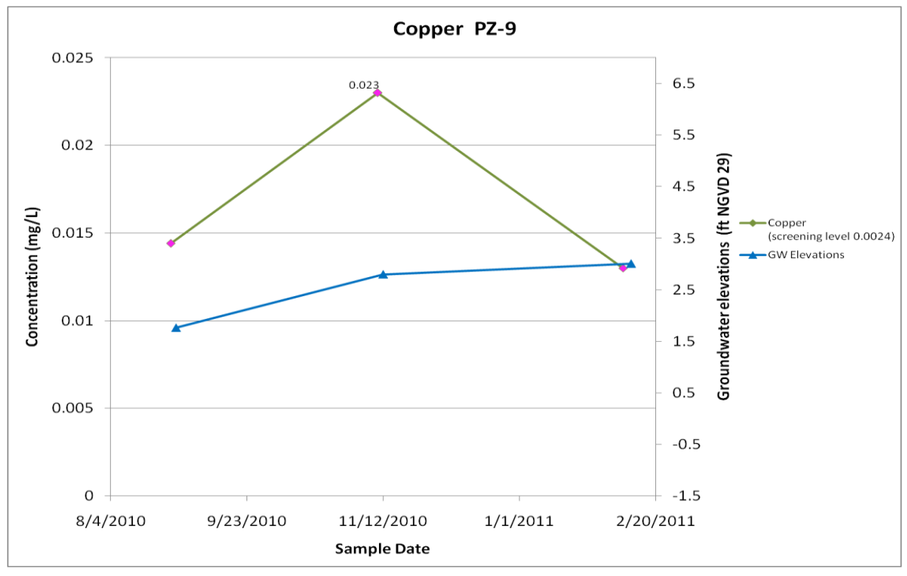
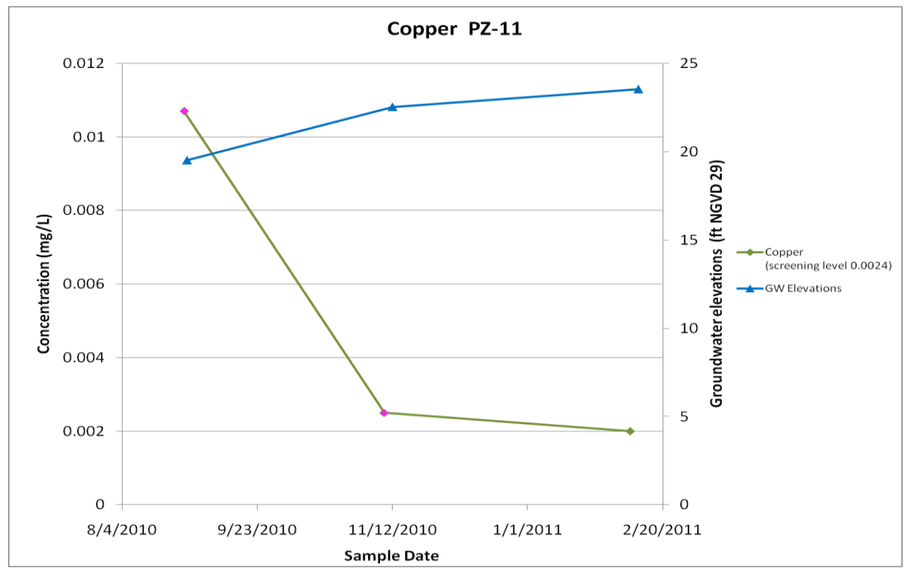
Figure E-13









Legend

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1. For metals trend plots, plotted data generally represent dissolved metals results (filtered samples); for sampling events where only total metals (unfiltered samples) were analyzed, the totals data are plotted.
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Copper and Hydrograph, Aug 2010 to Feb 2011

Port Angeles Rayonier Mill
Port Angeles, Washington

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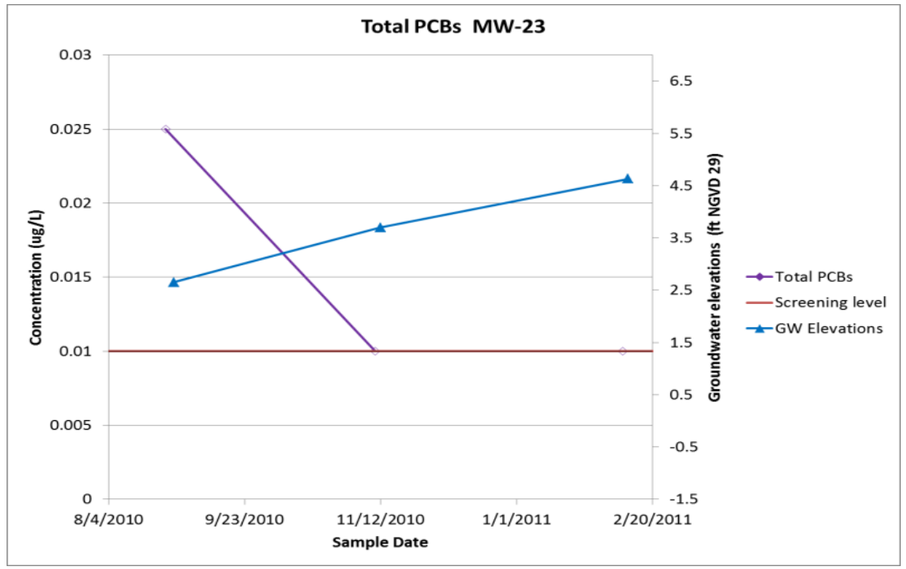
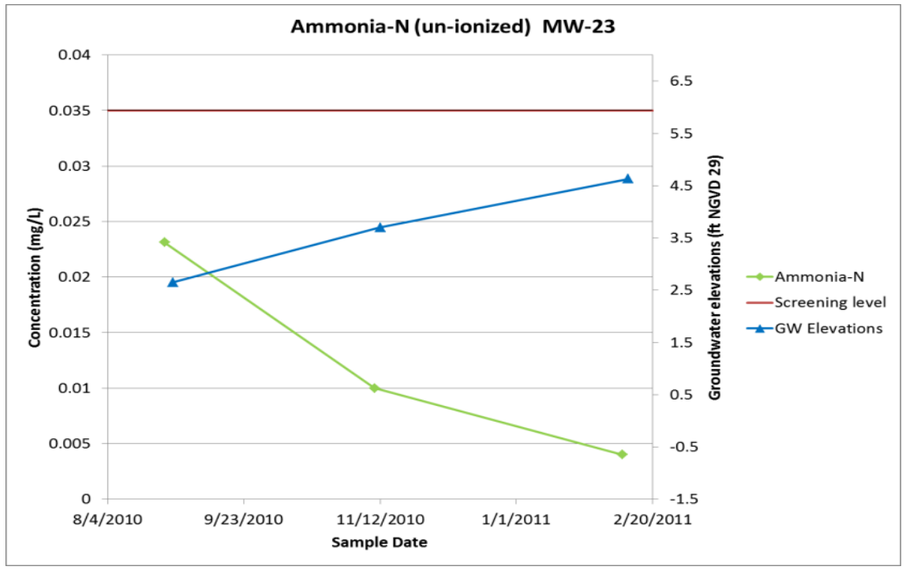
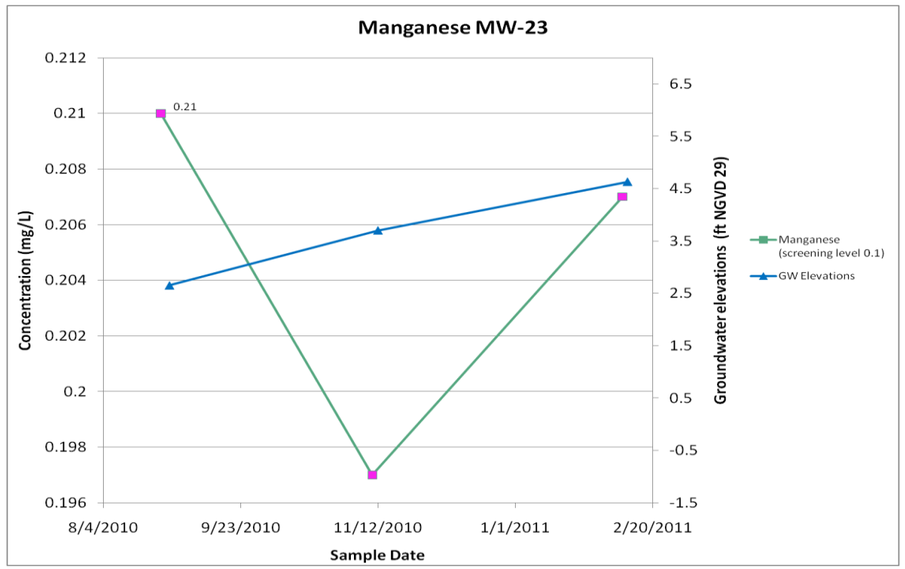
Figure E-14







Legend

Open symbol indicates non-detected result

Filled symbol indicates detected result

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Notes:

1. For metals trend plots, plotted data generally represent dissolved metals results (filtered samples); for sampling events where only total metals (unfiltered samples) were analyzed, the totals data are plotted.
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Contaminants of Concern and Hydrograph, Aug 2010 to Feb 2011 (MW 23)

Port Angeles Rayonier Mill
Port Angeles, Washington

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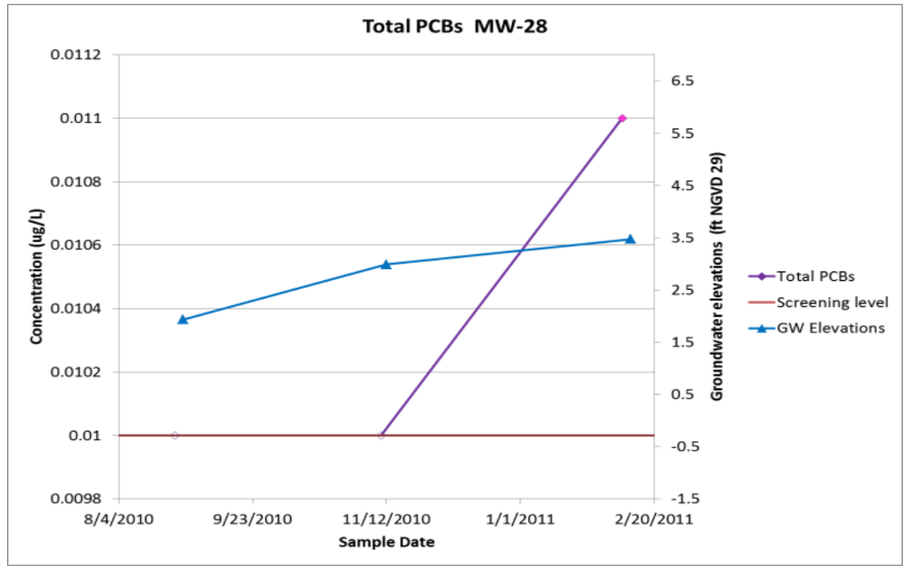
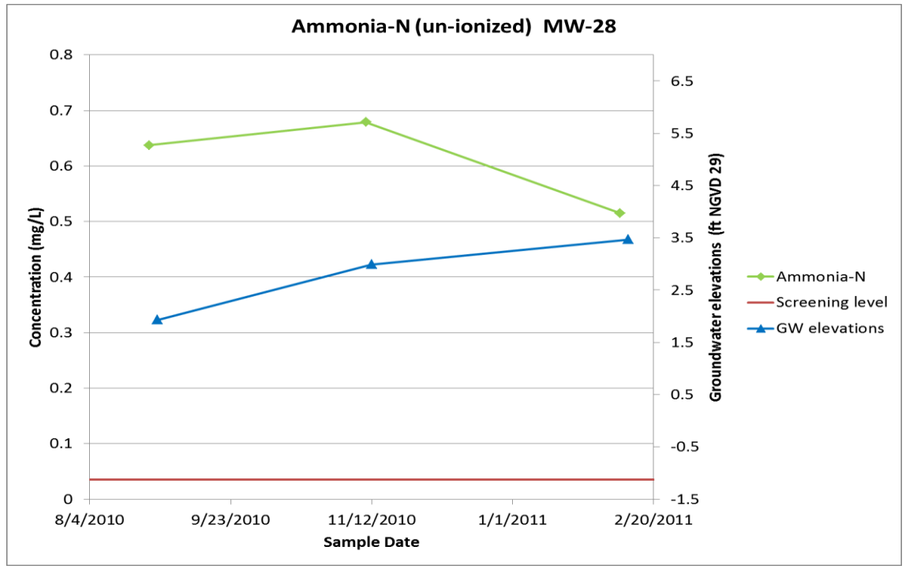
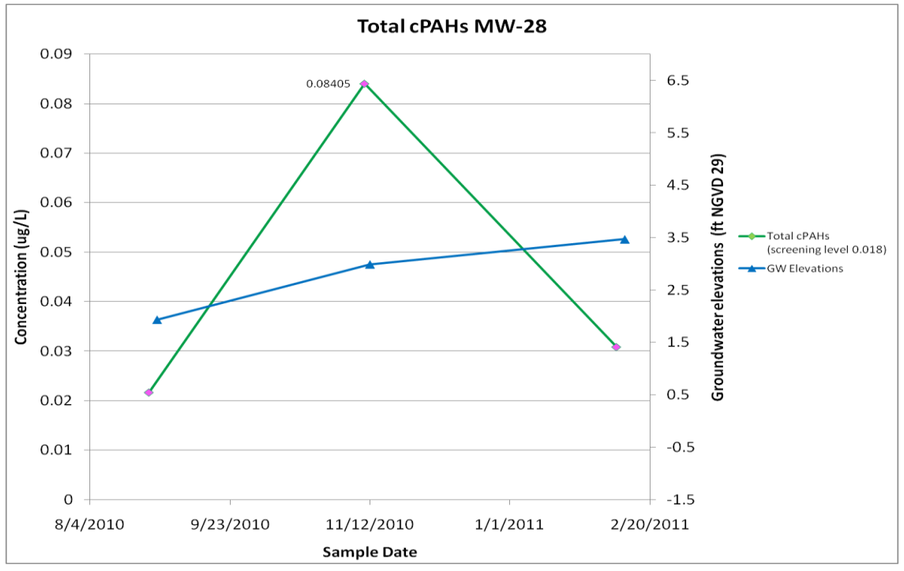
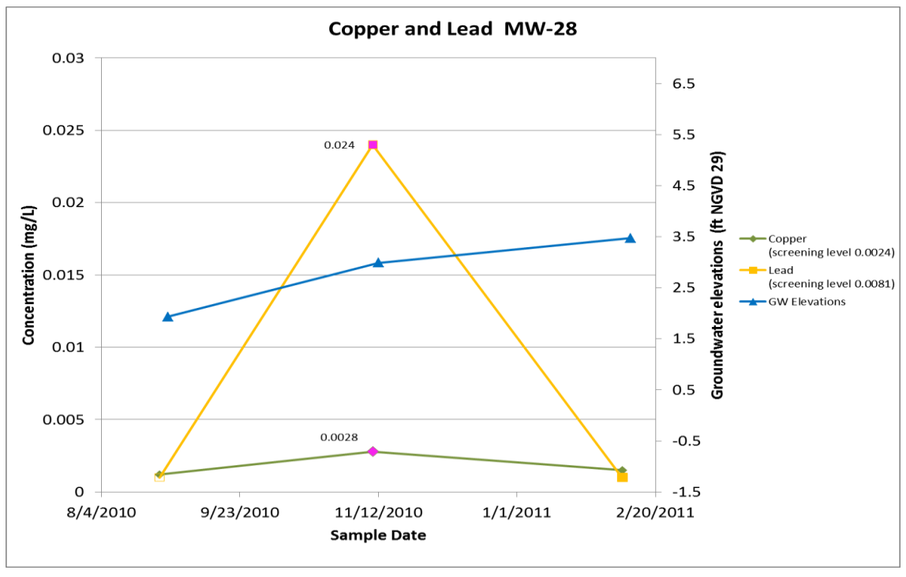
Figure E-15









Legend

Open symbol indicates non-detected result

Filled symbol indicates detected result

Pink symbol indicates detected result above screening level

Notes:

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Contaminants of Concern and Hydrograph, Aug 2010 to Feb 2011 (MW 28)

Port Angeles Rayonier Mill
Port Angeles, Washington

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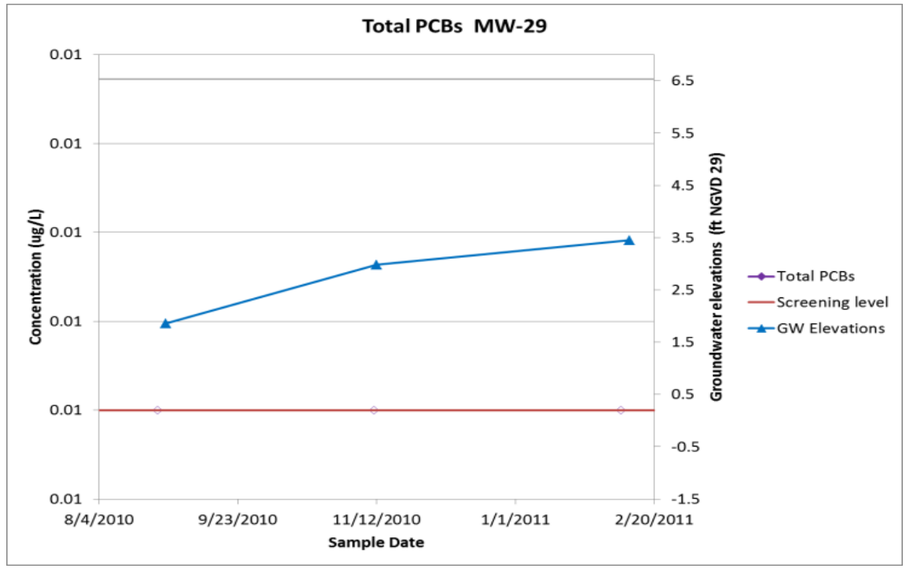
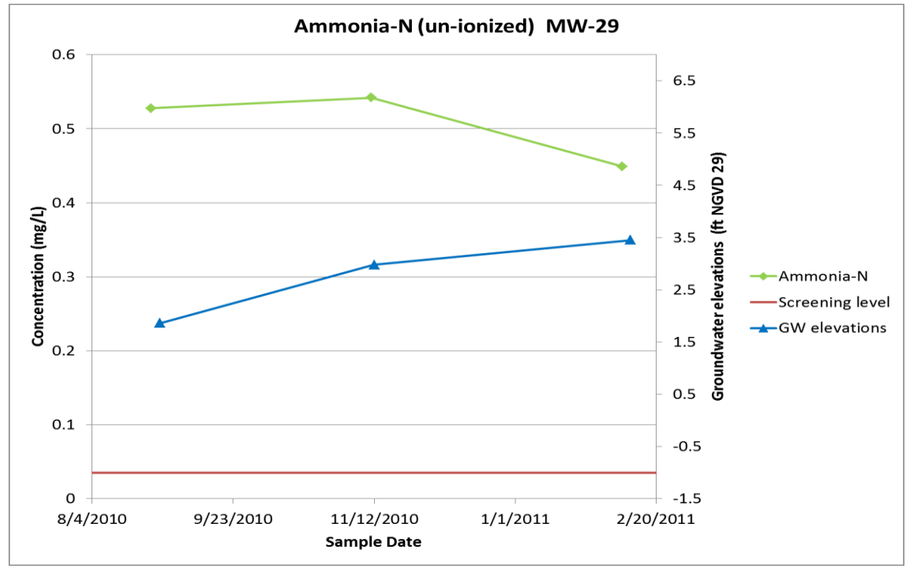
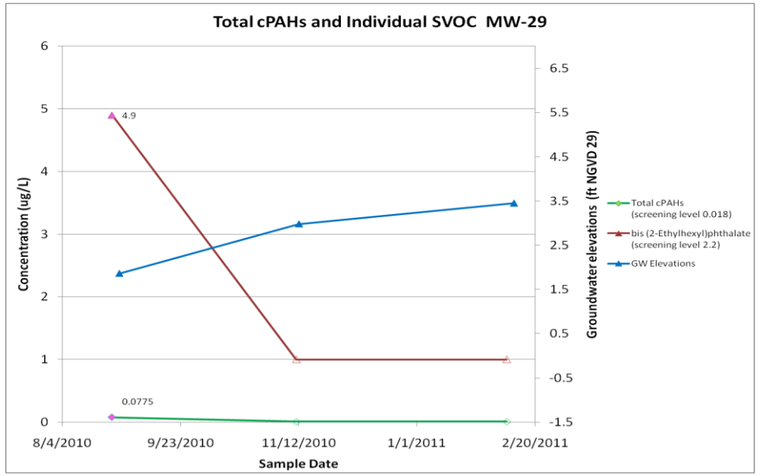
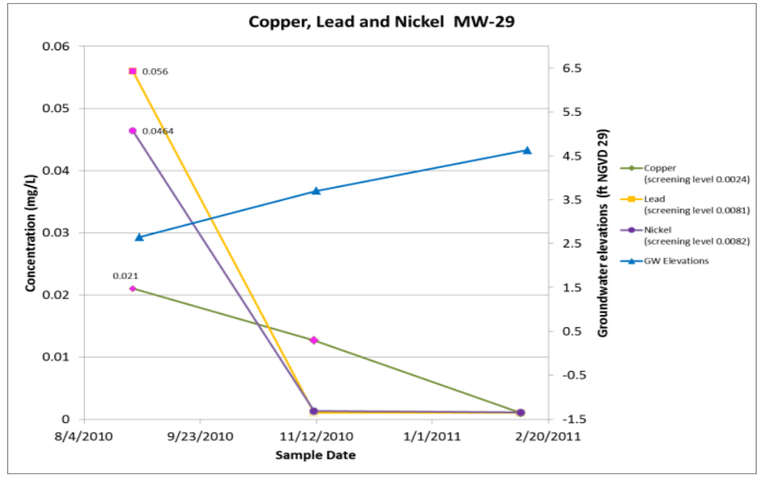
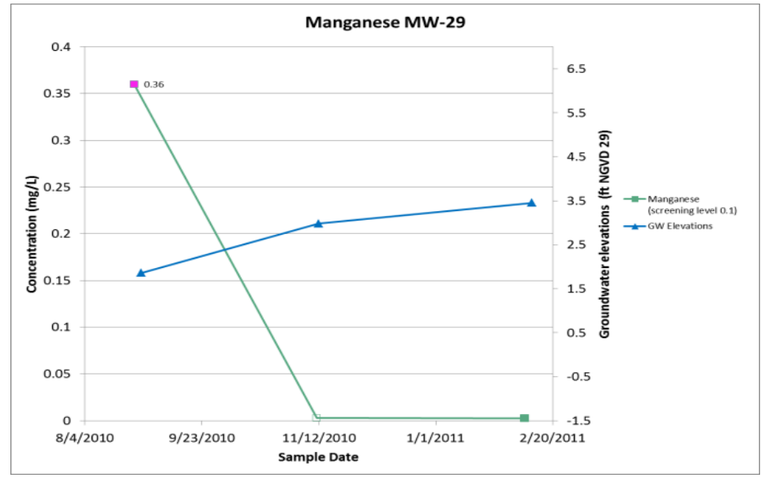
Figure E-16











Legend

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Notes:

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Contaminants of Concern and Hydrograph, Aug 2010 to Feb 2011 (MW 29)

Port Angeles Rayonier Mill
Port Angeles, Washington

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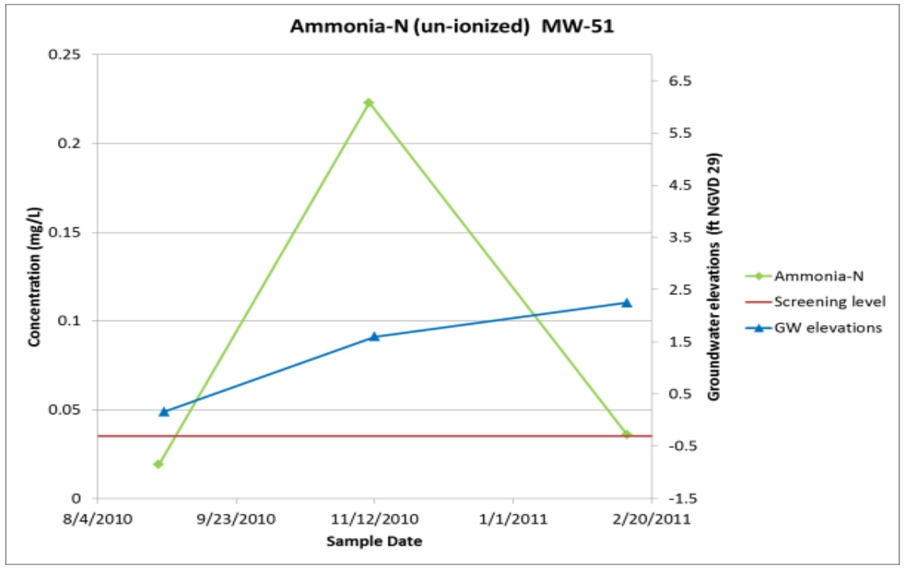
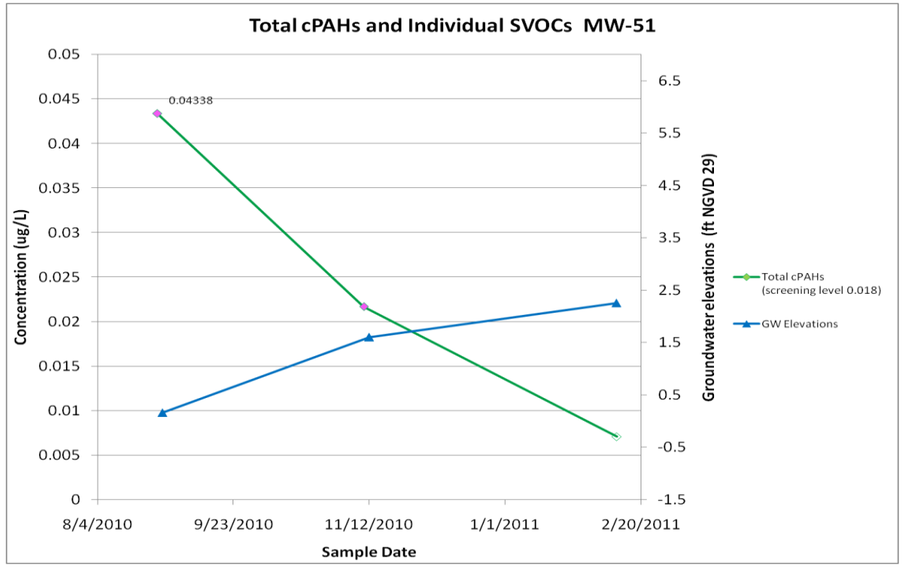
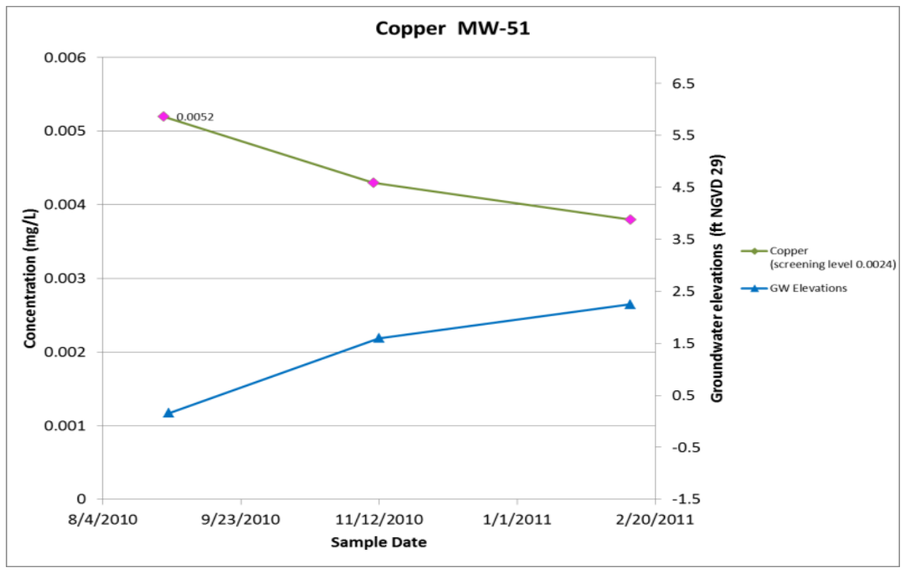
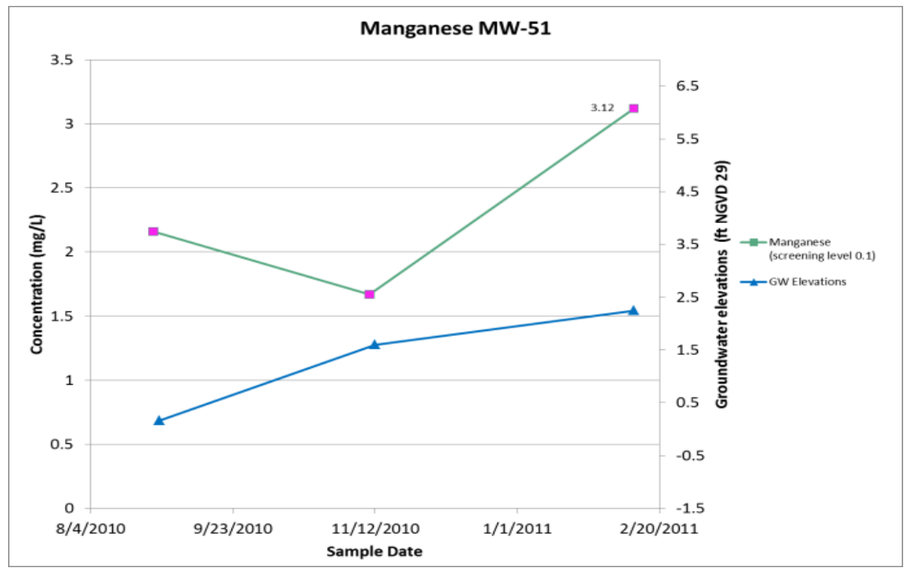
Figure E-17









Legend

Open symbol indicates non-detected result

Filled symbol indicates detected result

Pink symbol indicates detected result above screening level

Notes:

1. For metals trend plots, plotted data generally represent dissolved metals results (filtered samples); for sampling events where only total metals (unfiltered samples) were analyzed, the totals data are plotted.
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Port Angeles Rayonier Mill
Port Angeles, Washington

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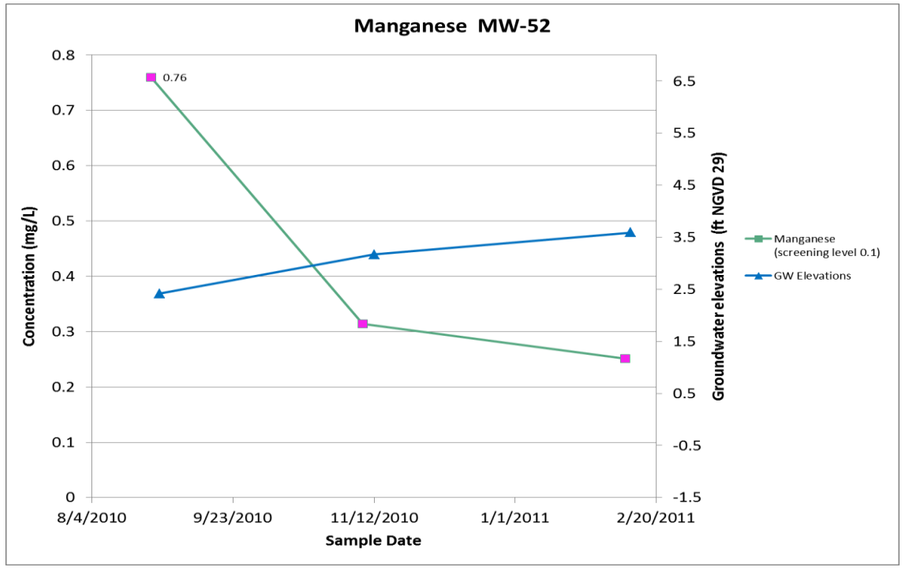
Figure E-18



Legend

Open symbol indicates non-detected result

Filled symbol indicates detected result

Pink symbol indicates detected result above screening level

Notes:

1. For metals trend plots, plotted data generally represent dissolved metals results (filtered samples); for sampling events where only total metals (unfiltered samples) were analyzed, the totals data are plotted.
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Port Angeles Rayonier Mill
Port Angeles, Washington

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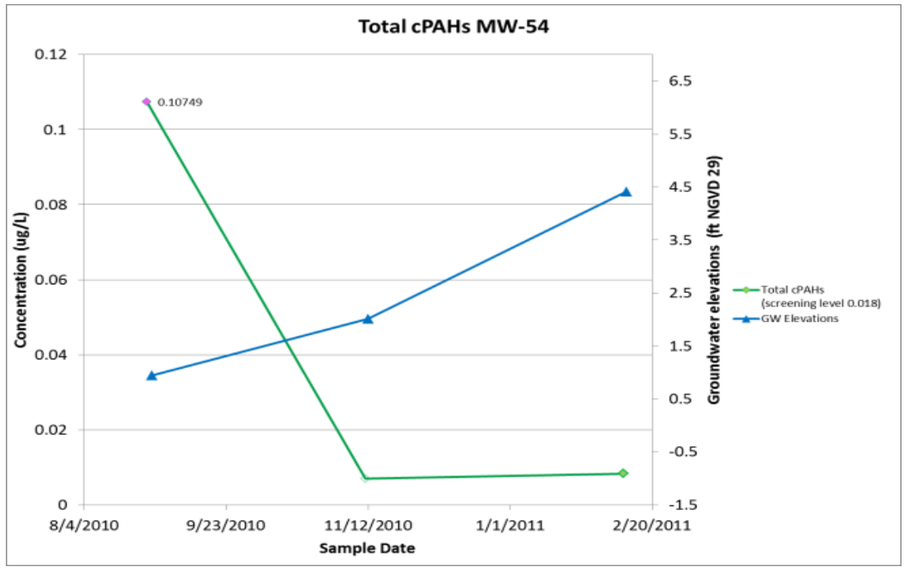
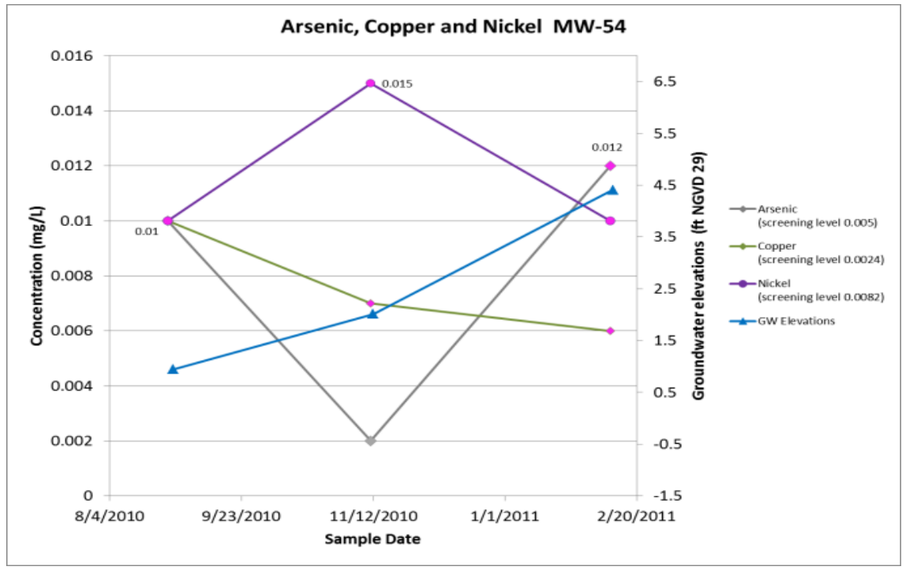
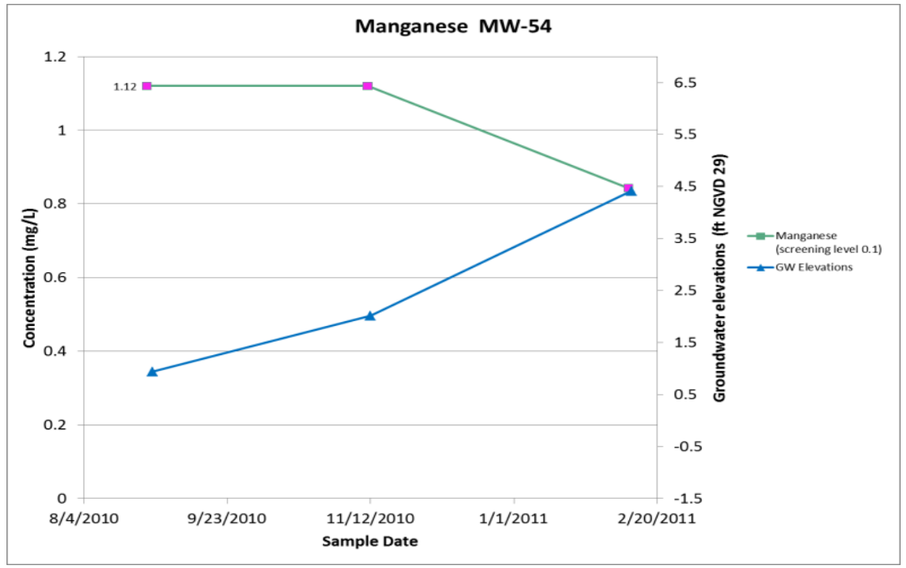
Figure E-19







Legend

Open symbol indicates non-detected result

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Notes:

1. For metals trend plots, plotted data generally represent dissolved metals results (filtered samples); for sampling events where only total metals (unfiltered samples) were analyzed, the totals data are plotted.
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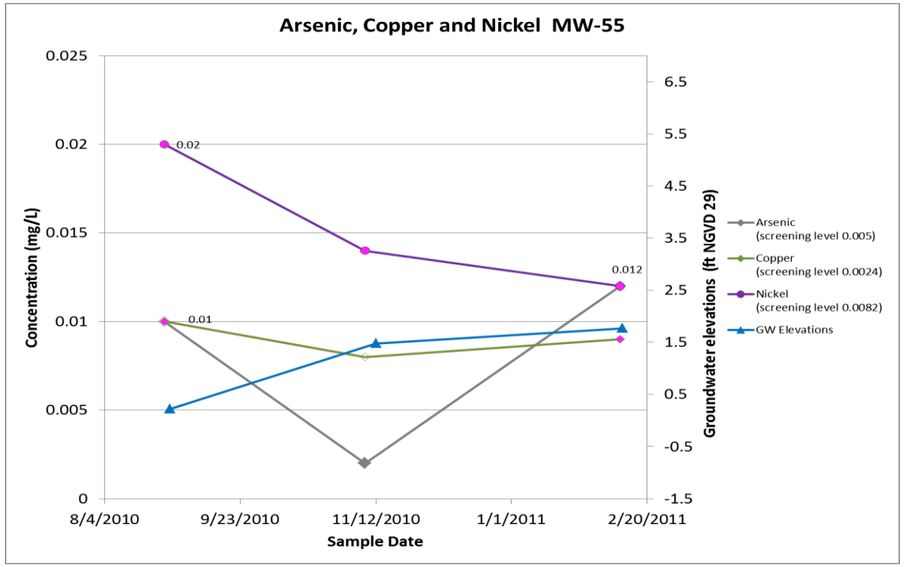
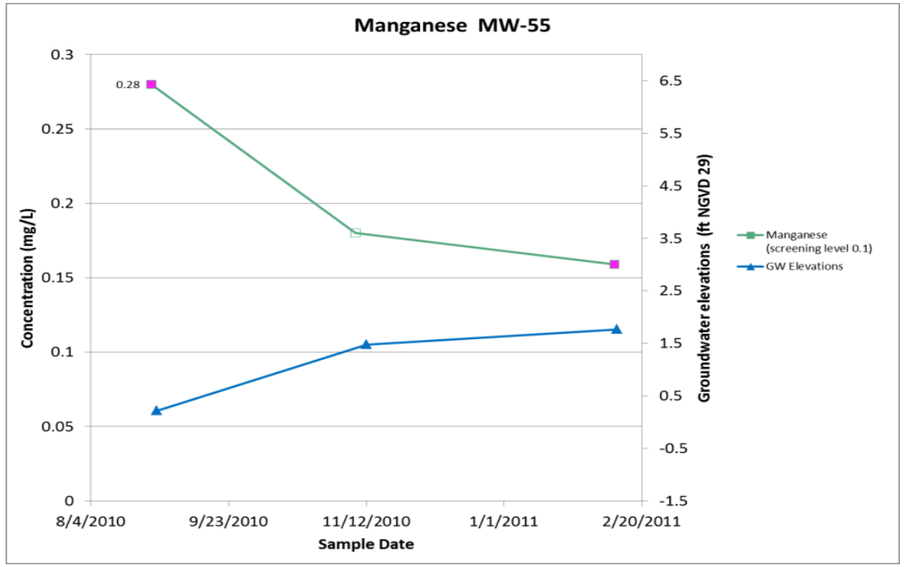
Figure E-20





Legend

Open symbol indicates non-detected result

Filled symbol indicates detected result

Pink symbol indicates detected result above screening level

Notes:

1. For metals trend plots, plotted data generally represent dissolved metals results (filtered samples); for sampling events where only total metals (unfiltered samples) were analyzed, the totals data are plotted.
2. Only metals and individual SVOCs with at least one screening level exceedance are shown in this figure.
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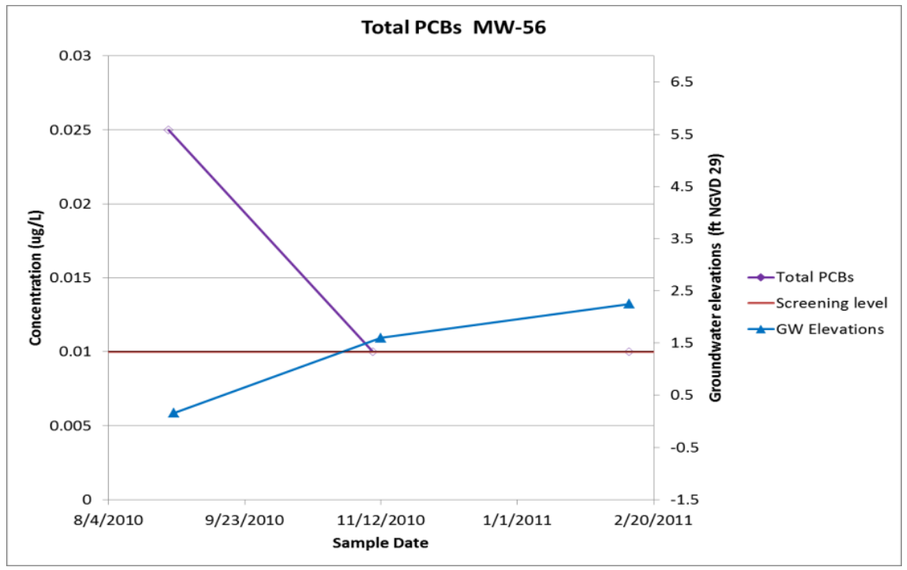
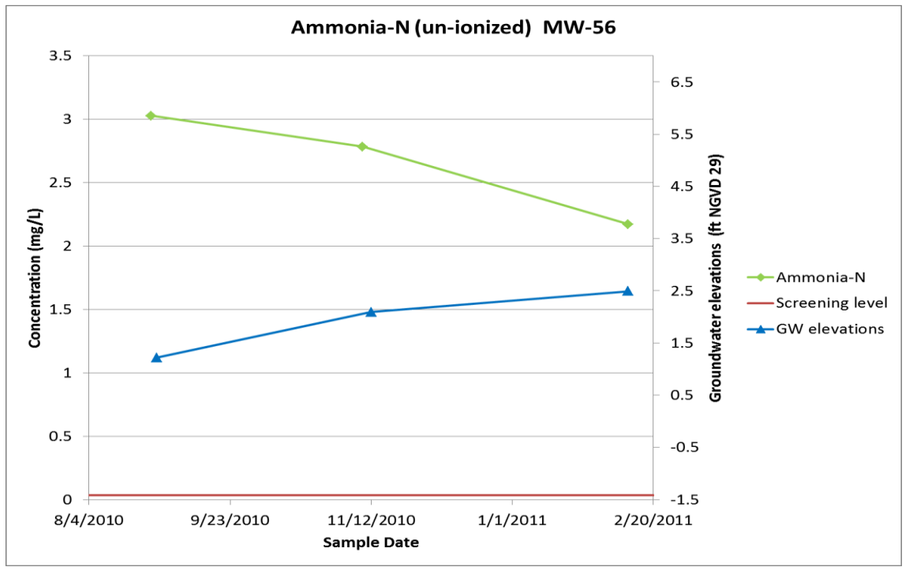
Contaminants of Concern and Hydrograph, Aug 2010 to Feb 2011 (MW 55)

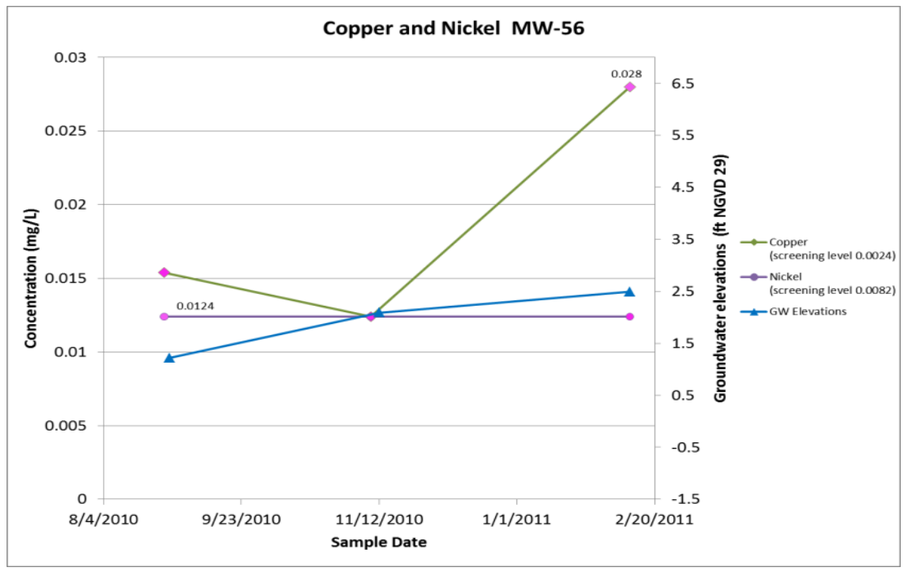
Port Angeles Rayonier Mill
Port Angeles, Washington

GeoEngineers

Figure E-21







Legend

Open symbol indicates non-detected result

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Notes:

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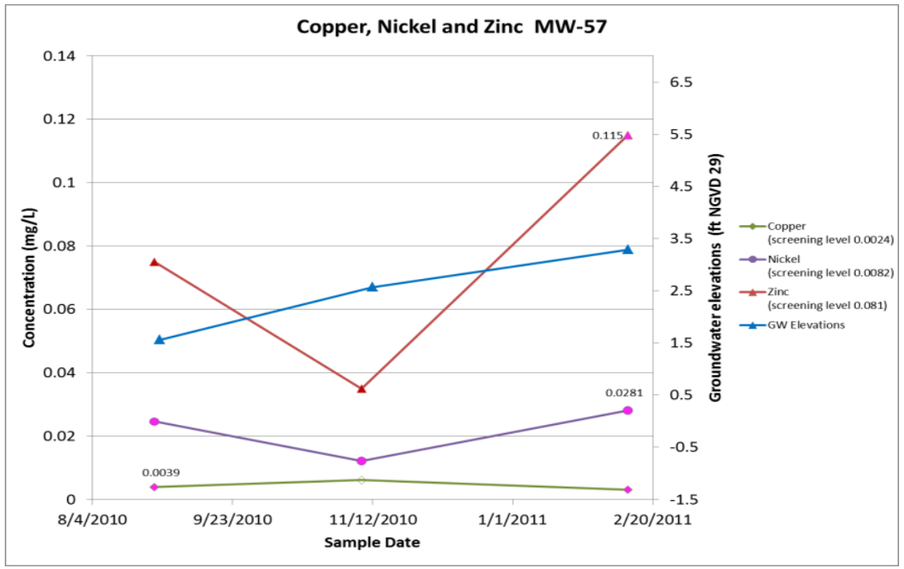
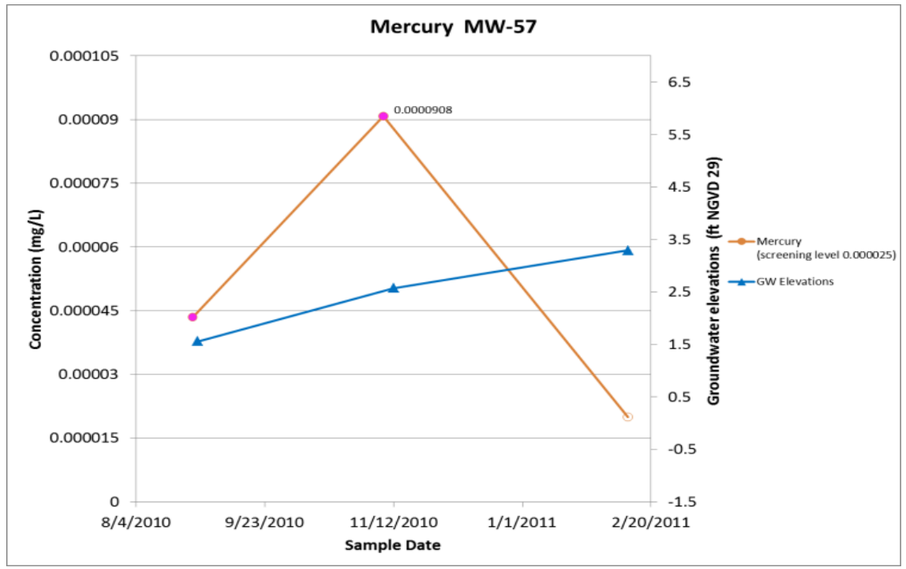
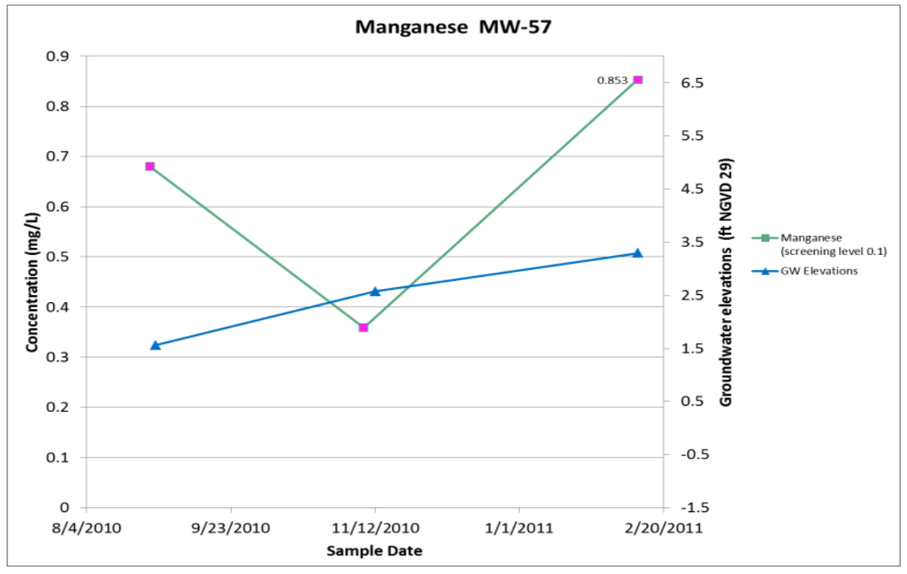
Port Angeles Rayonier Mill
Port Angeles, Washington

GeoEngineers

Figure E-22







Legend

Open symbol indicates non-detected result

Filled symbol indicates detected result

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Notes:

1. For metals trend plots, plotted data generally represent dissolved metals results (filtered samples); for sampling events where only total metals (unfiltered samples) were analyzed, the totals data are plotted.
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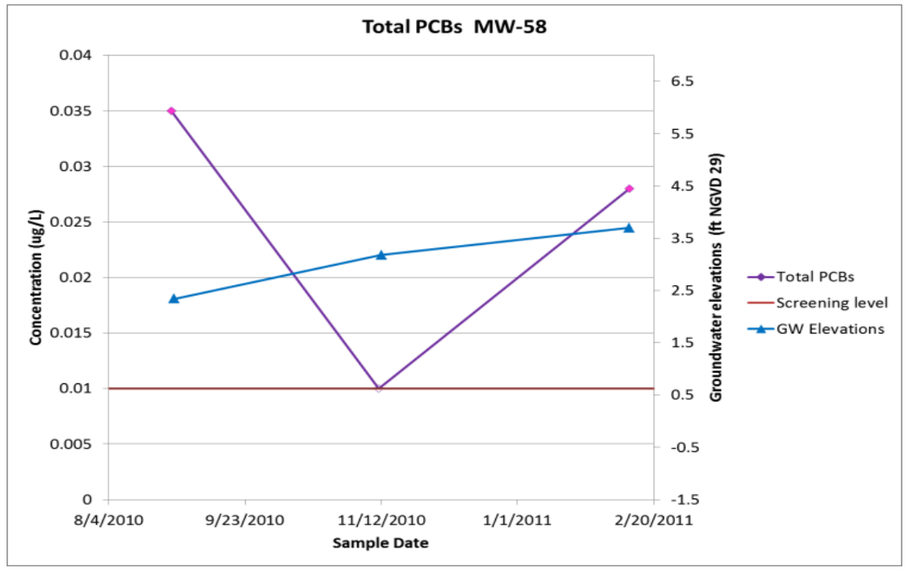
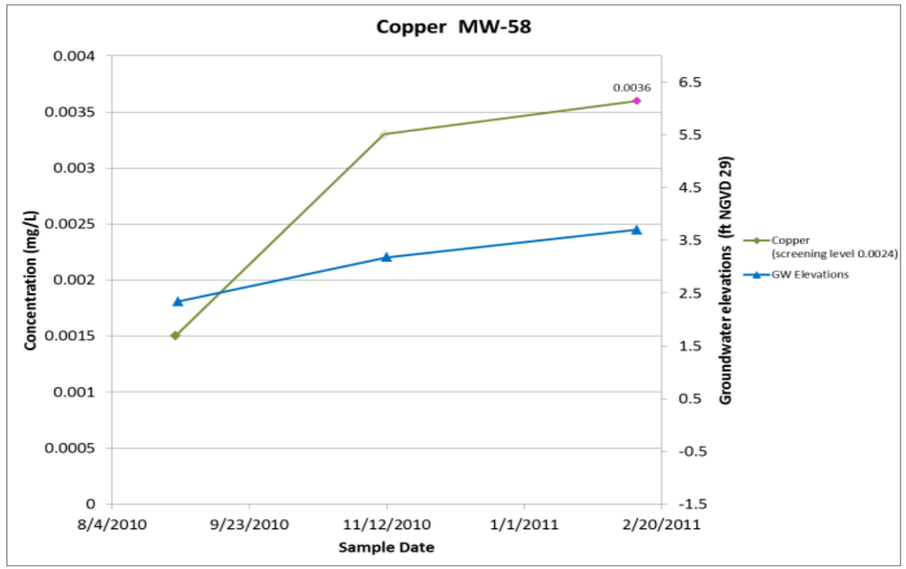
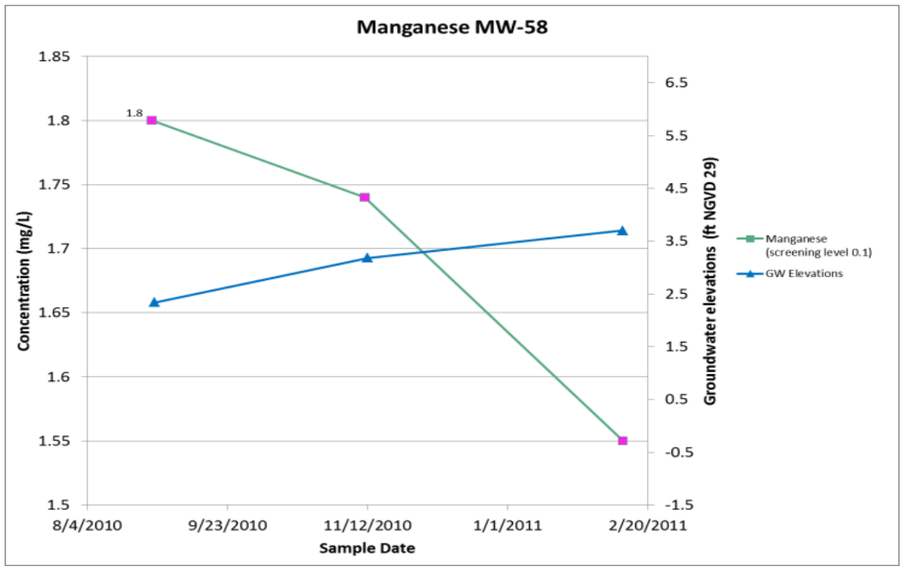
Port Angeles Rayonier Mill
Port Angeles, Washington

GeoEngineers

Figure E-23







Legend

Open symbol indicates non-detected result

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1. For metals trend plots, plotted data generally represent dissolved metals results (filtered samples); for sampling events where only total metals (unfiltered samples) were analyzed, the totals data are plotted.
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Contaminants of Concern and Hydrograph, Aug 2010 to Feb 2011 (MW 58)

Port Angeles Rayonier Mill
Port Angeles, Washington

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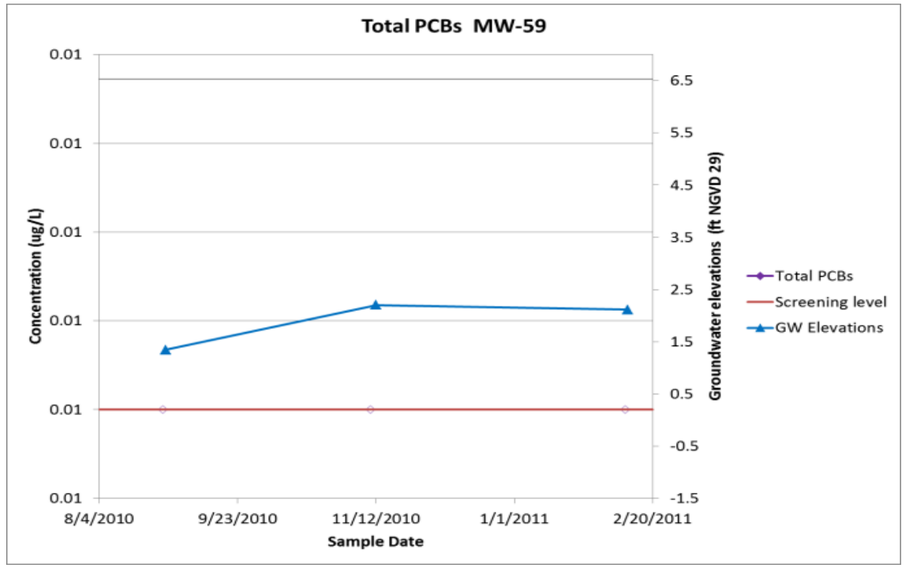
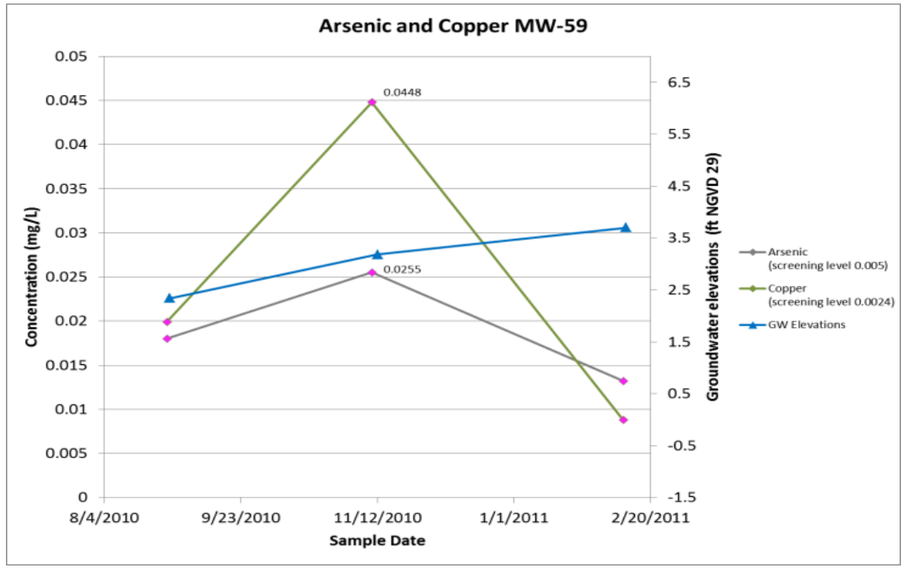
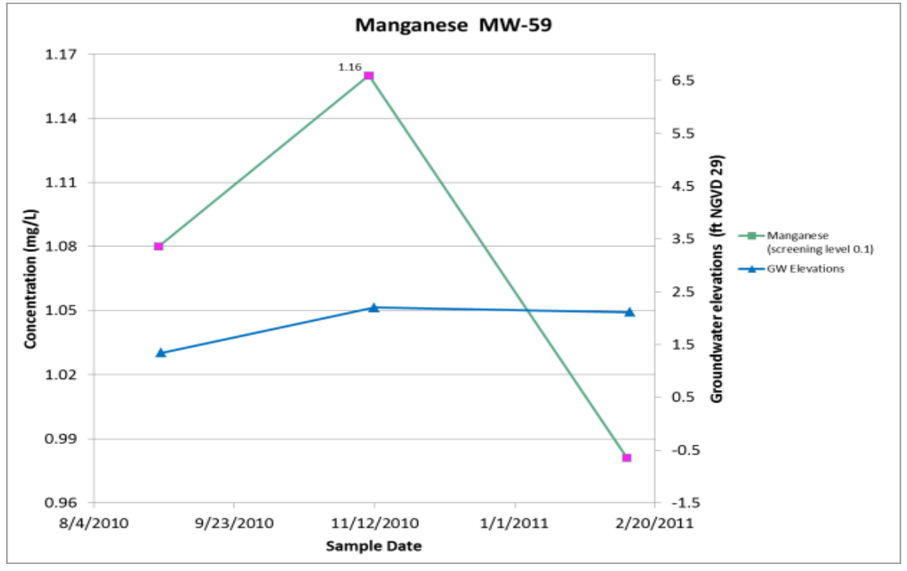
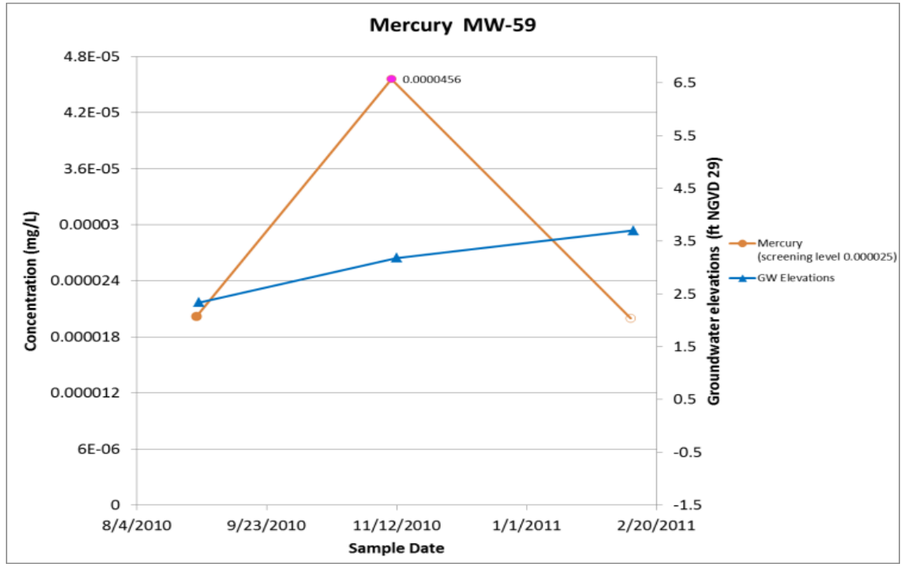
Figure E-24









Legend

Open symbol indicates non-detected result

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1. For metals trend plots, plotted data generally represent dissolved metals results (filtered samples); for sampling events where only total metals (unfiltered samples) were analyzed, the totals data are plotted.
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Port Angeles Rayonier Mill
Port Angeles, Washington

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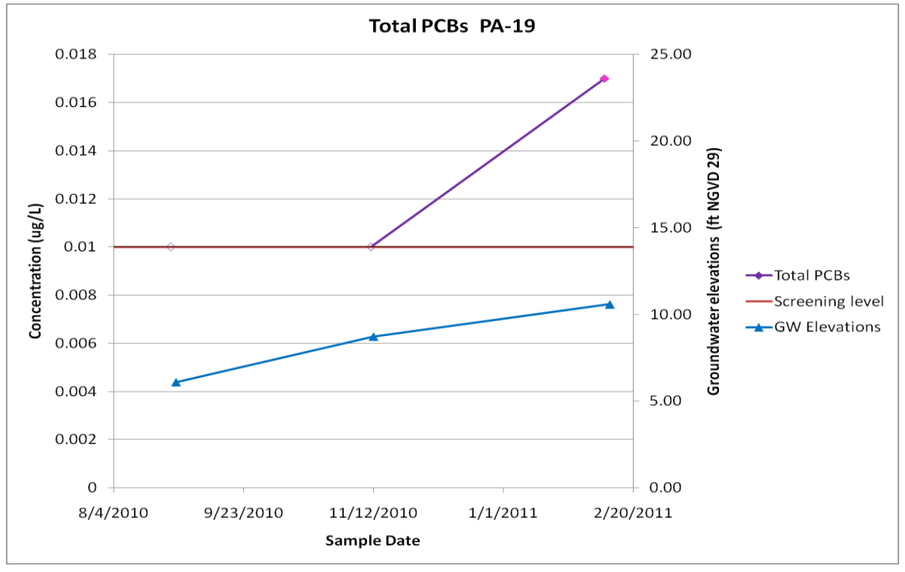
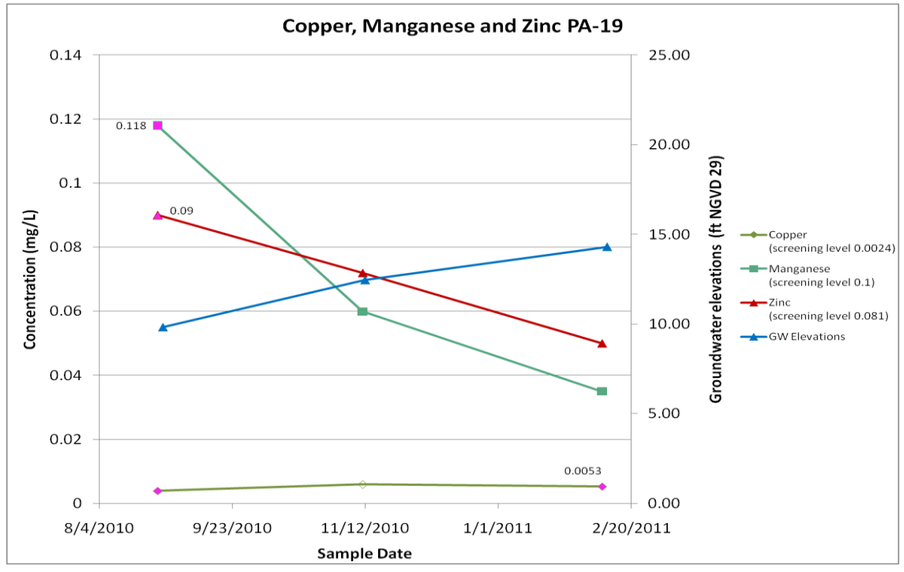
Figure E-25





Legend

Open symbol indicates non-detected result

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Port Angeles Rayonier Mill
Port Angeles, Washington

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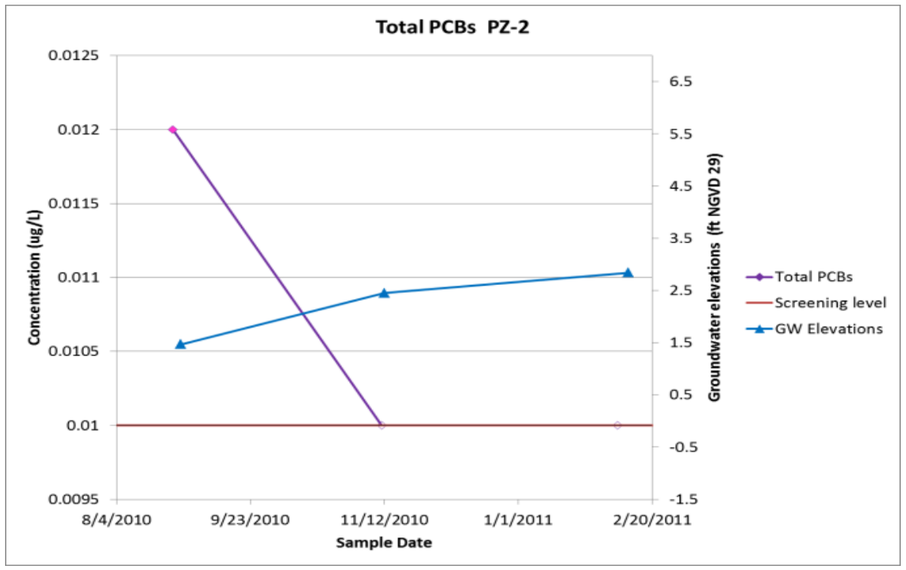
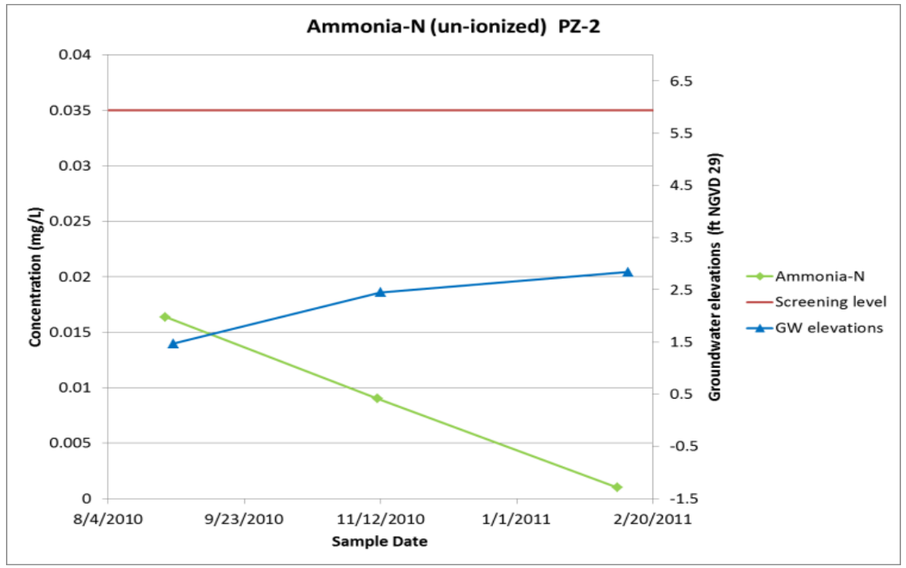
Figure E-26





Legend

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1. For metals trend plots, plotted data generally represent dissolved metals results (filtered samples); for sampling events where only total metals (unfiltered samples) were analyzed, the totals data are plotted.
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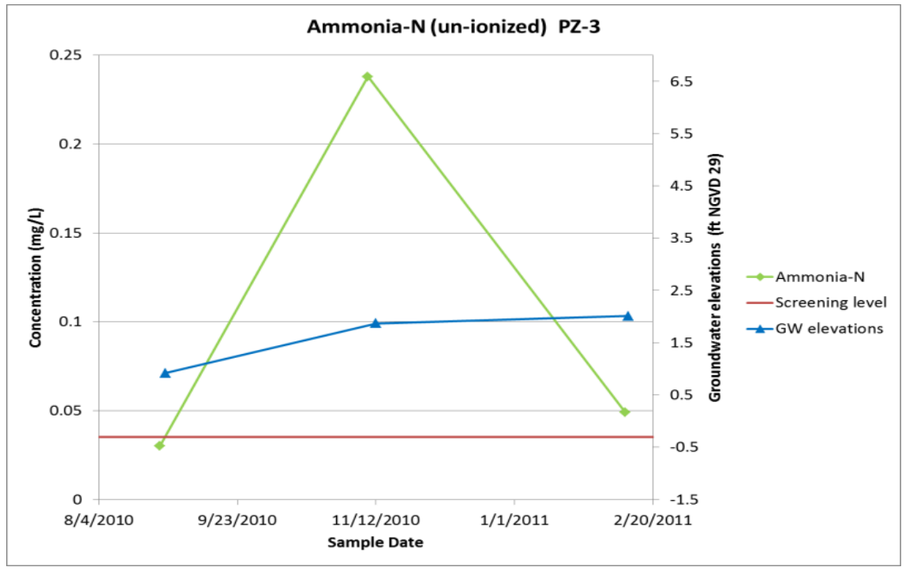
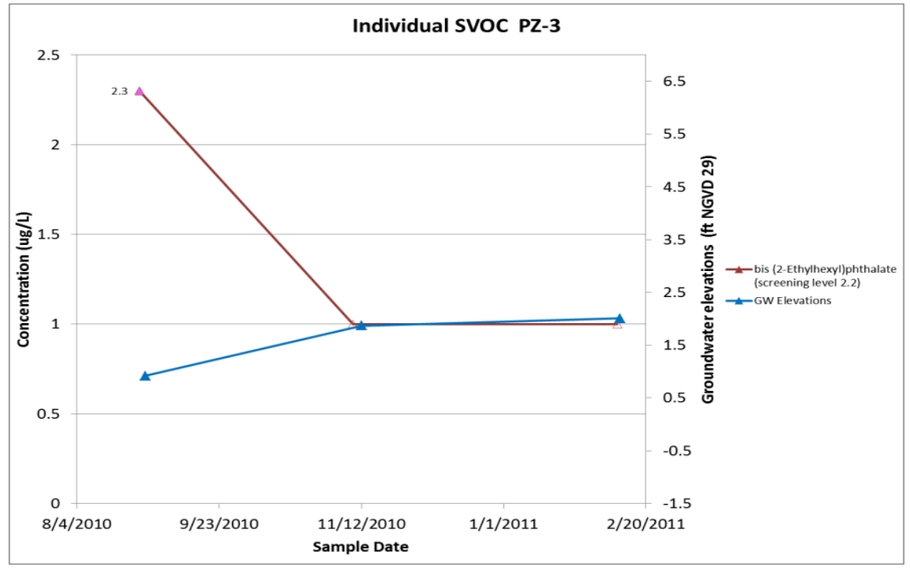
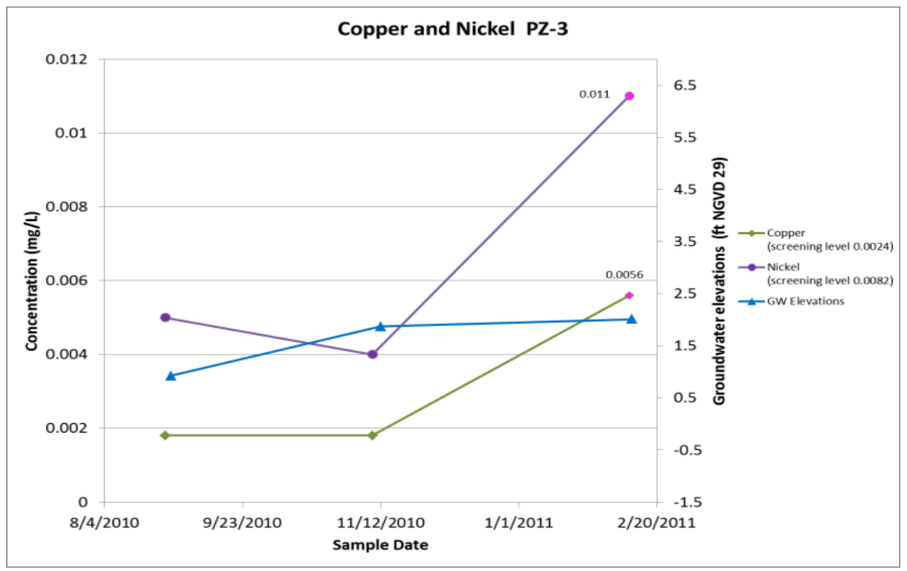
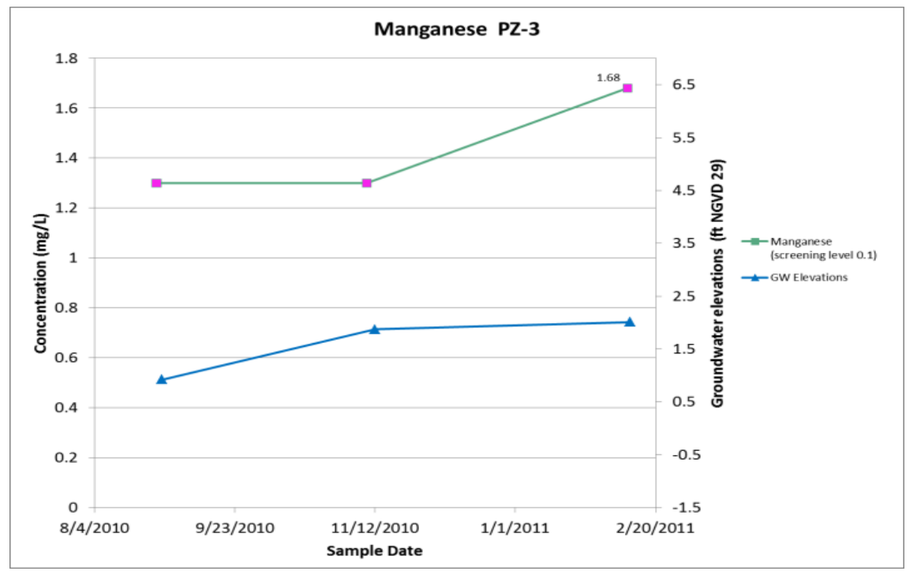
Figure E-27









Legend

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Port Angeles Rayonier Mill
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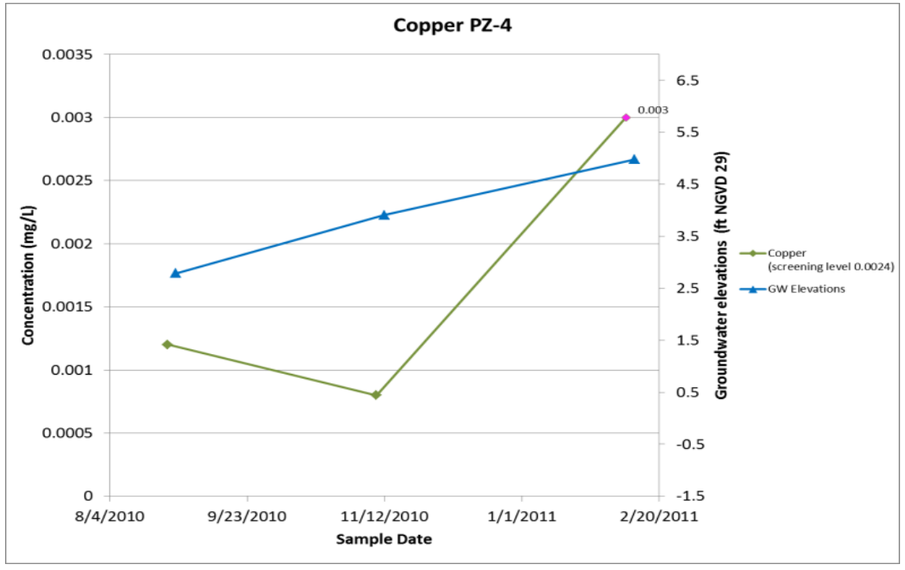
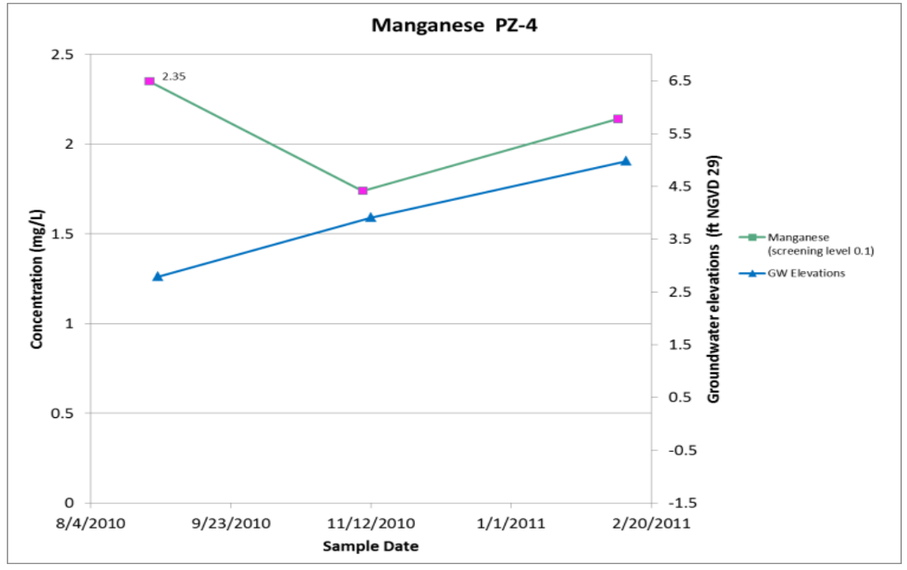
Figure E-28





Legend

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Port Angeles, Washington

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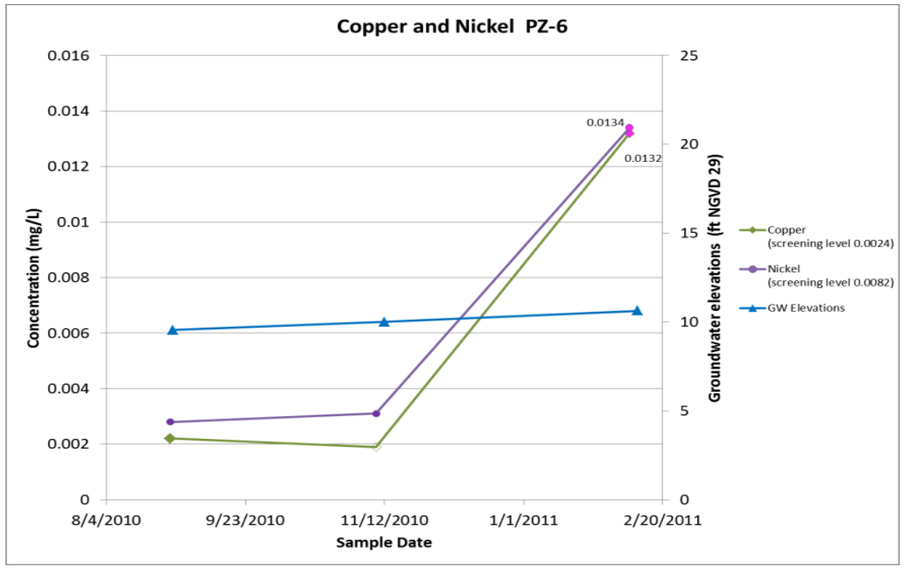
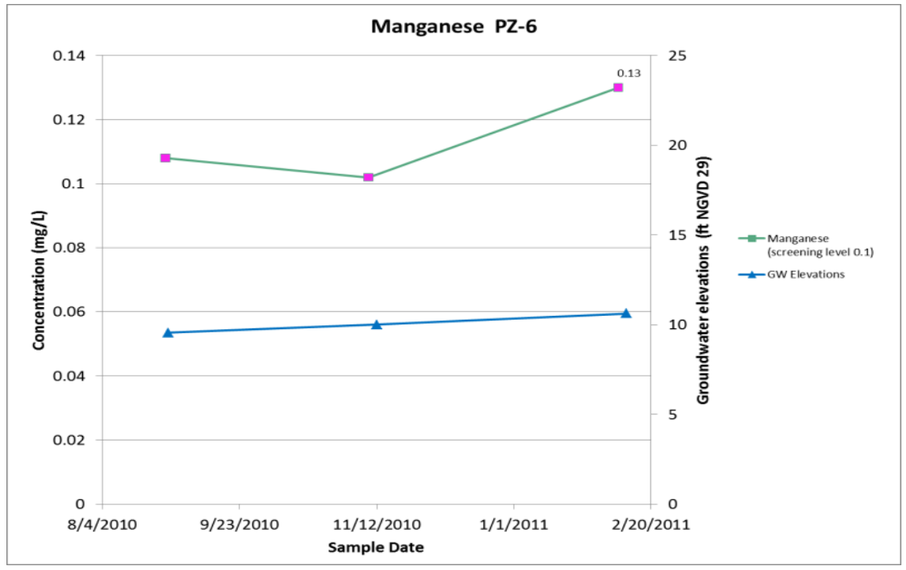
Figure E-29





Legend

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Contaminants of Concern and Hydrograph, Aug 2010 to Feb 2011 (PZ 6)

Port Angeles Rayonier Mill
Port Angeles, Washington

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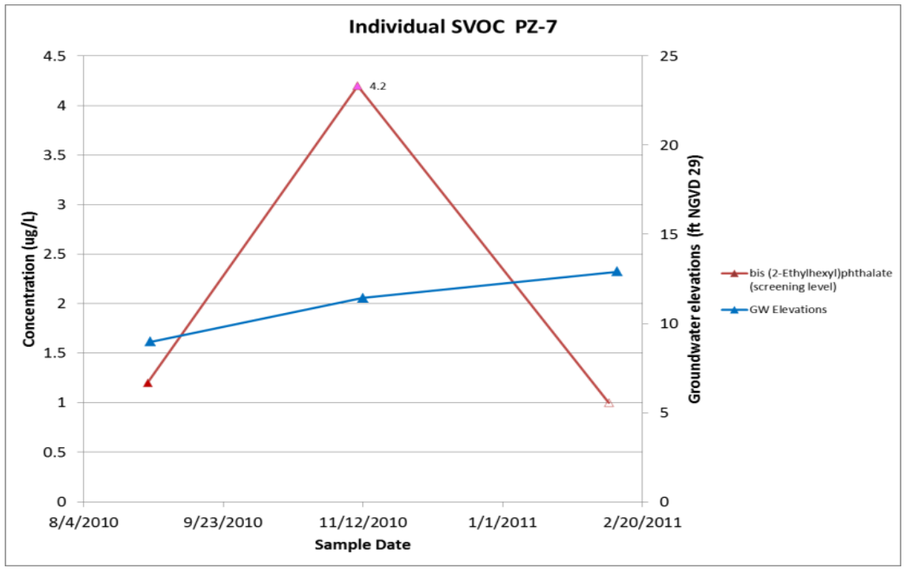
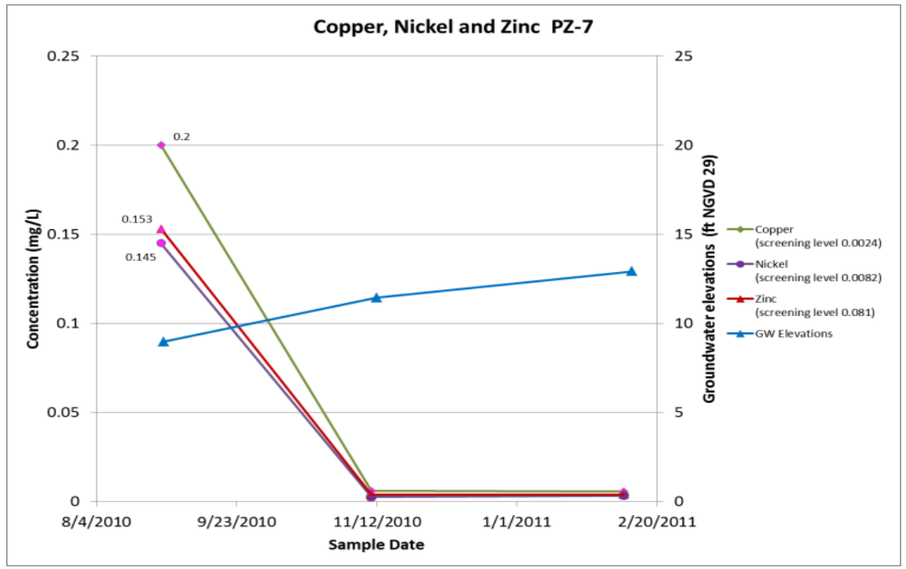
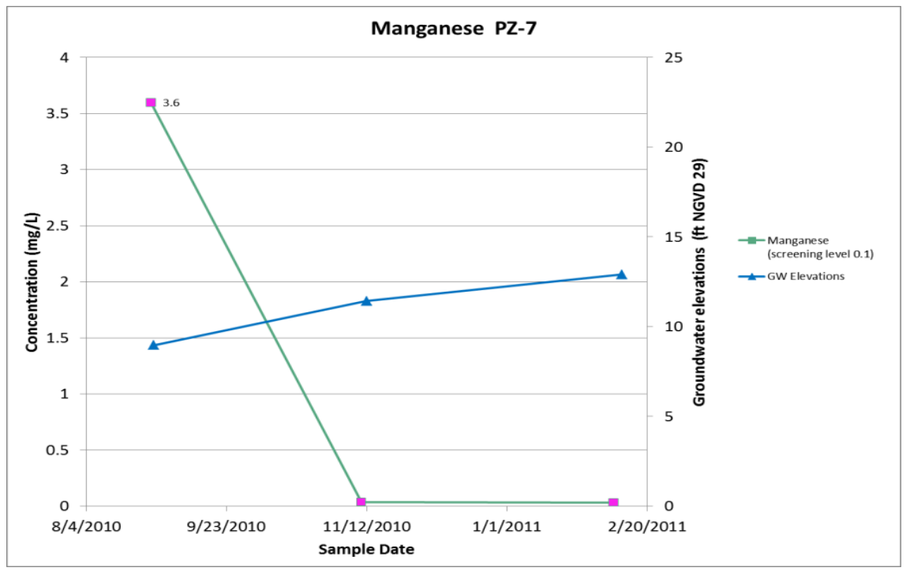
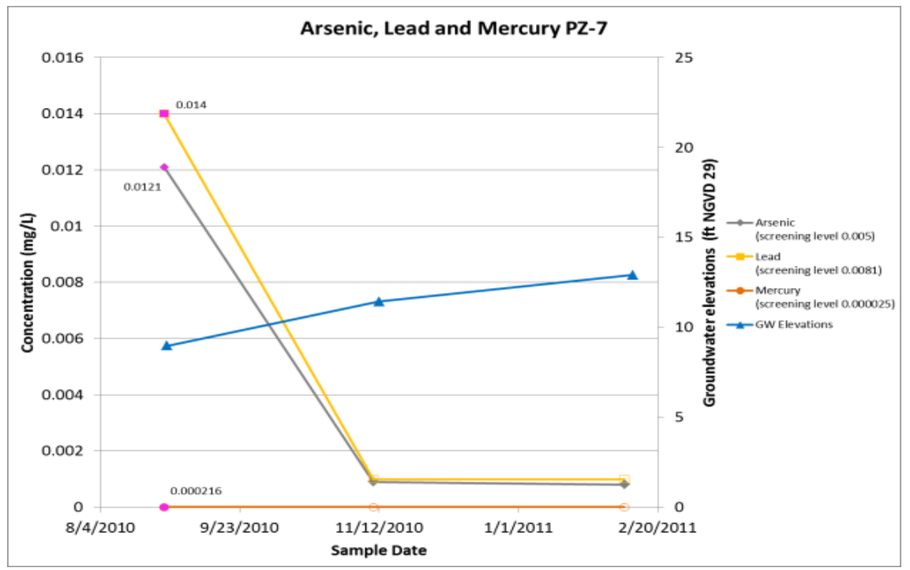
Figure E-30









Legend

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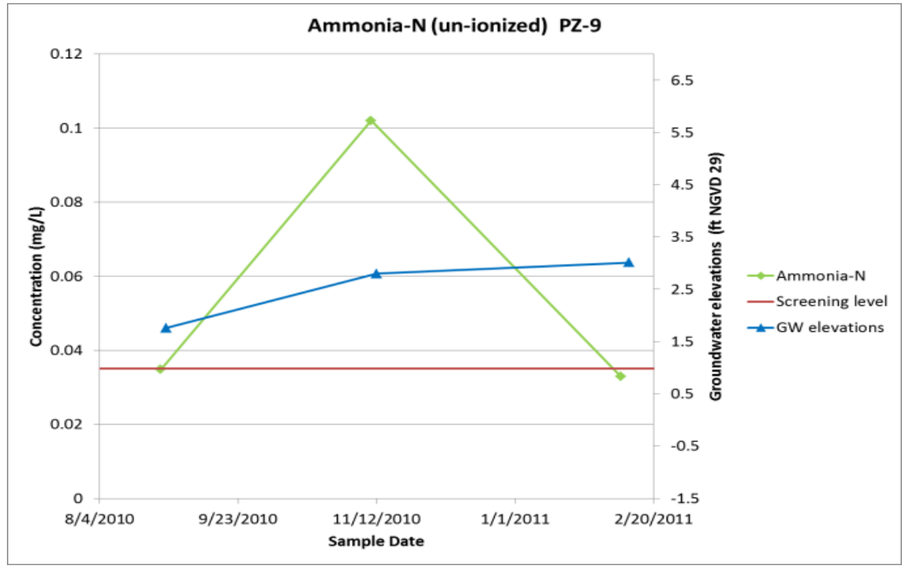
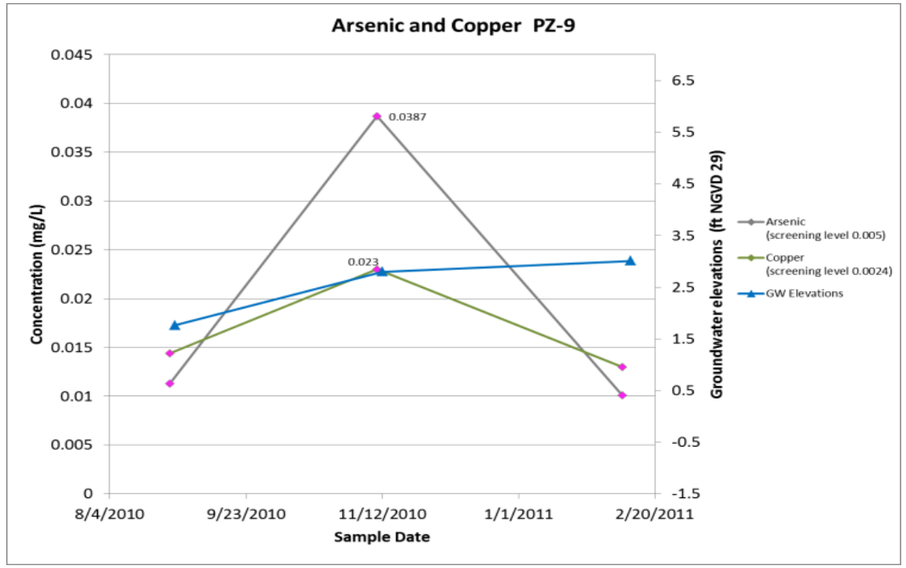
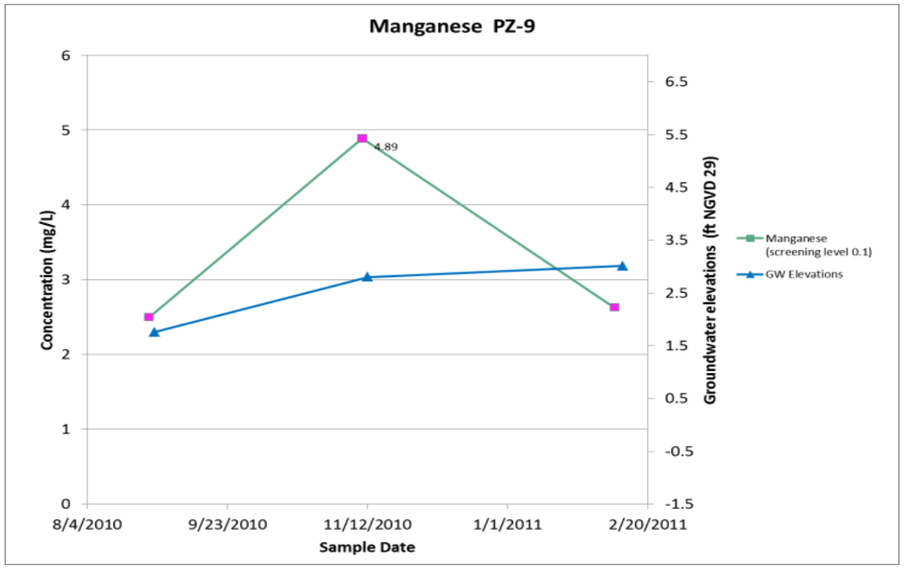
Figure E-31







Legend

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Port Angeles Rayonier Mill
Port Angeles, Washington

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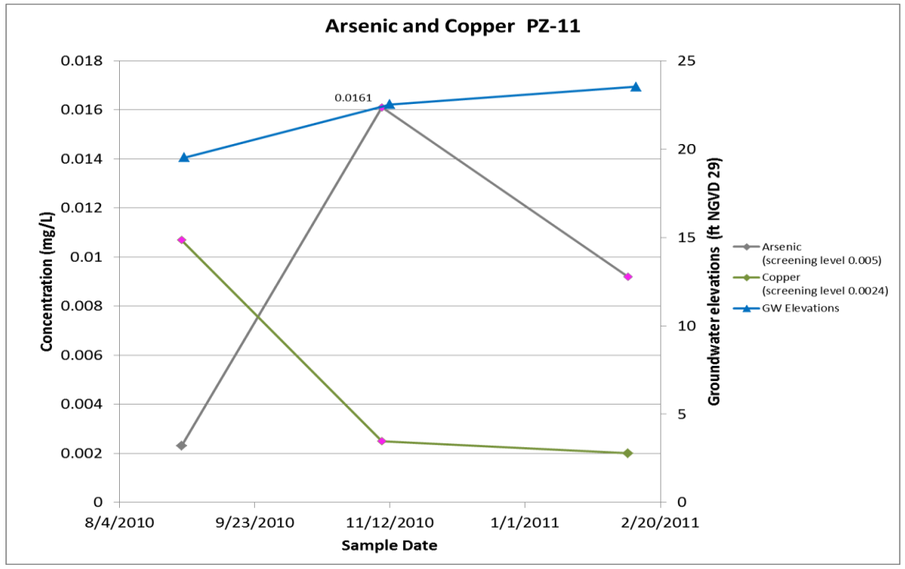
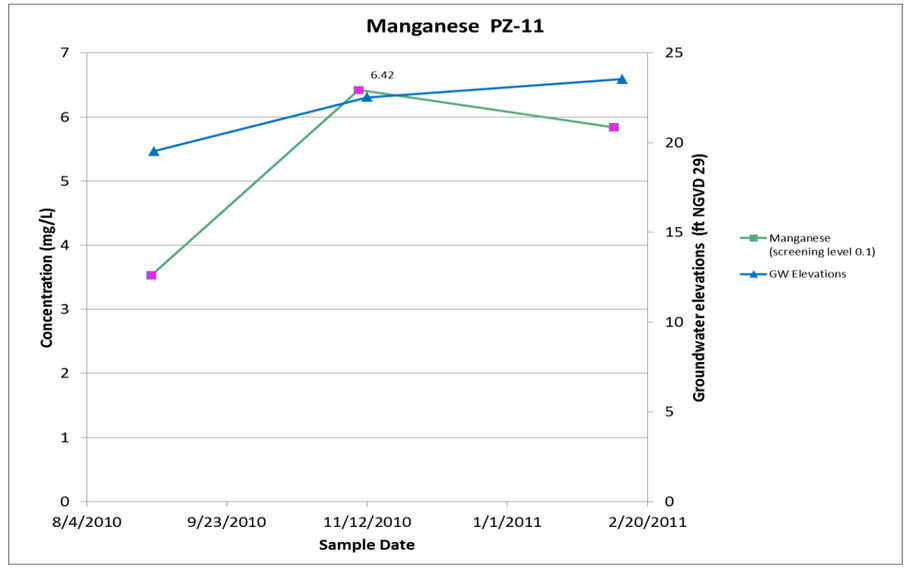
Figure E-32





Legend

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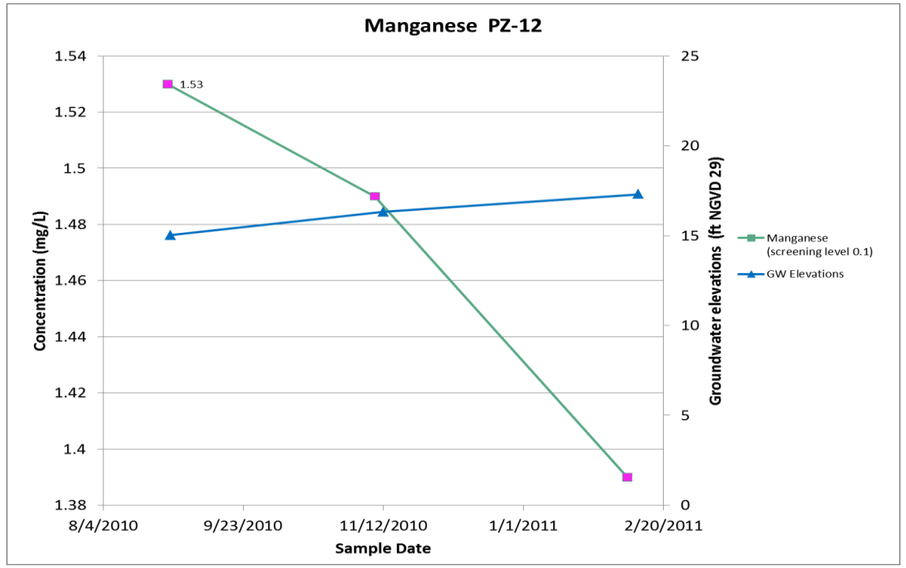
Figure E-33



Legend

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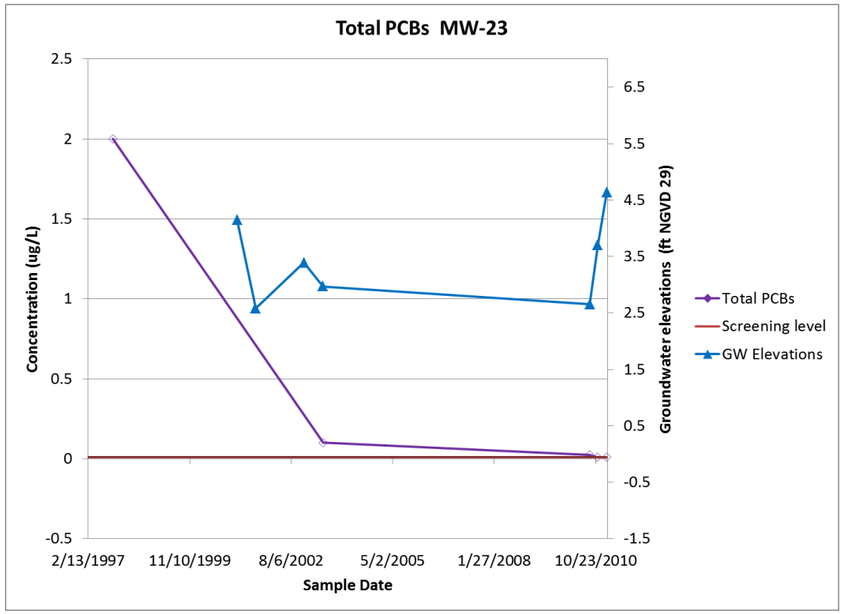
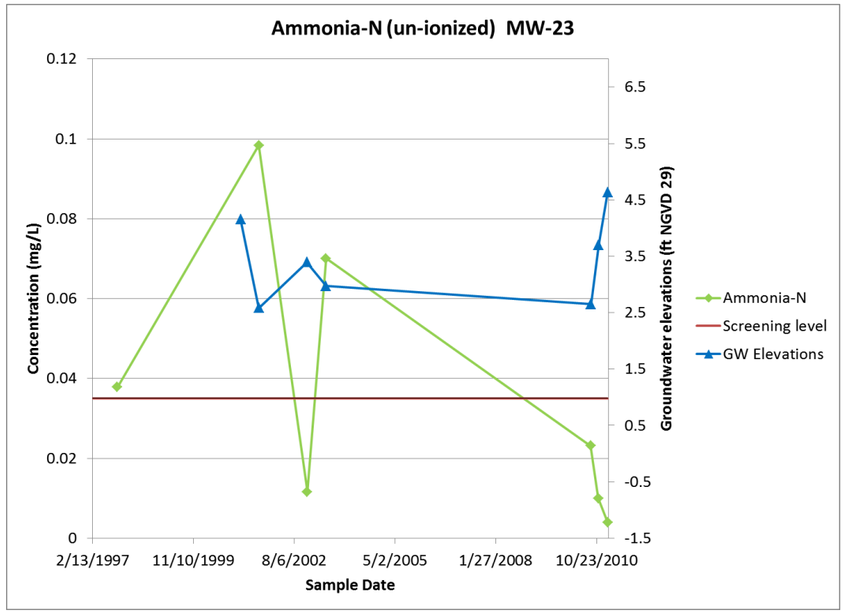
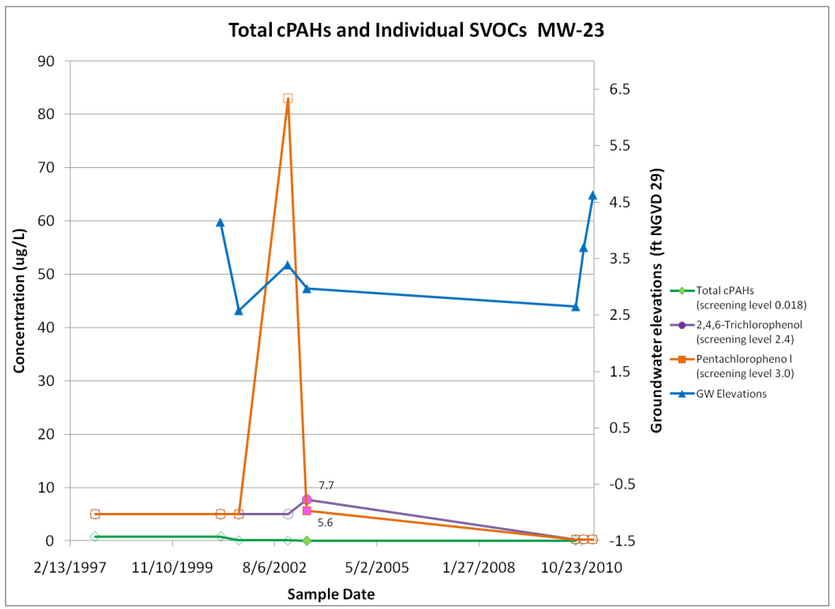
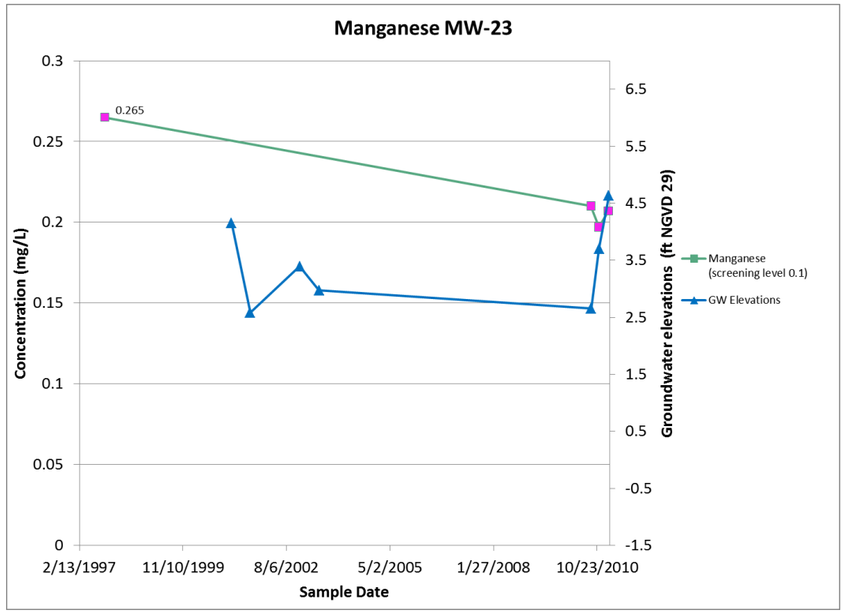
Figure E-34









Legend

Open symbol indicates non-detected result

Filled symbol indicates detected result

Pink symbol indicates detected result above screening level

Notes:

1. For metals trend plots, plotted data generally represent dissolved metals results (filtered samples); for sampling events where only total metals (unfiltered samples) were analyzed, the totals data are plotted.
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Contaminants of Concern and Hydrograph (MW 23)

Port Angeles Rayonier Mill
Port Angeles, Washington

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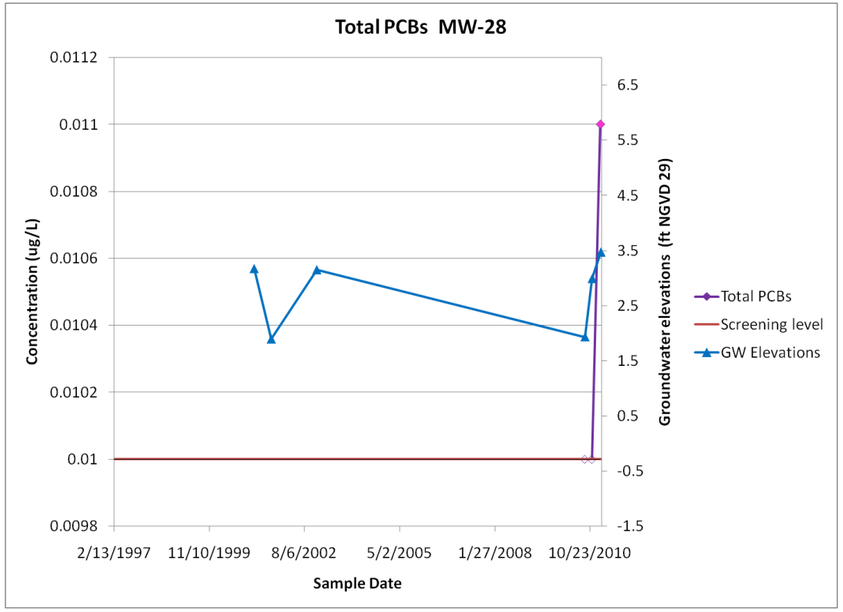
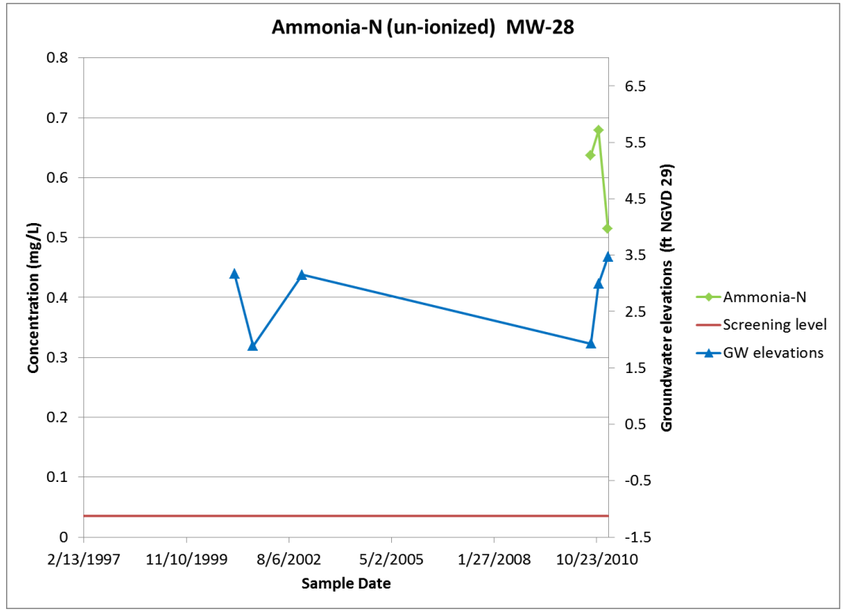
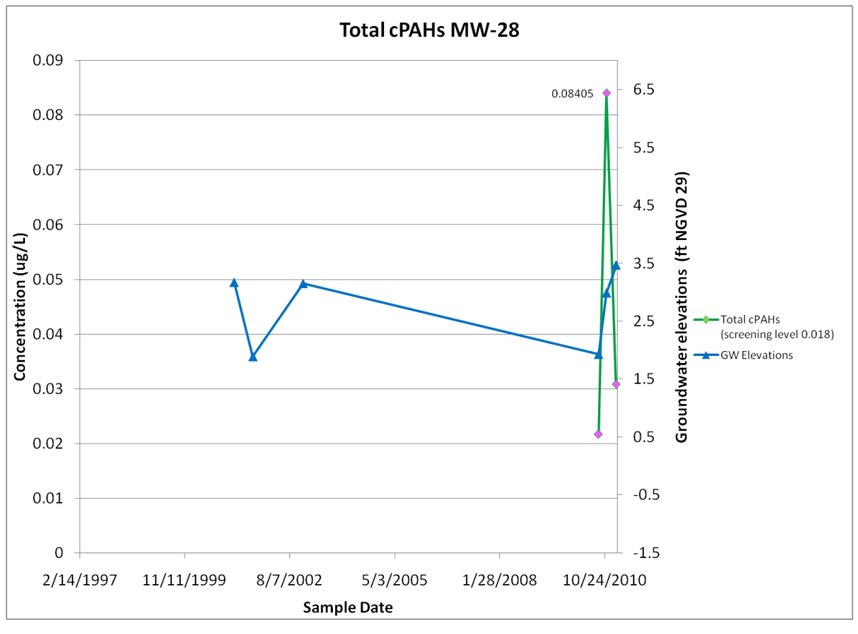
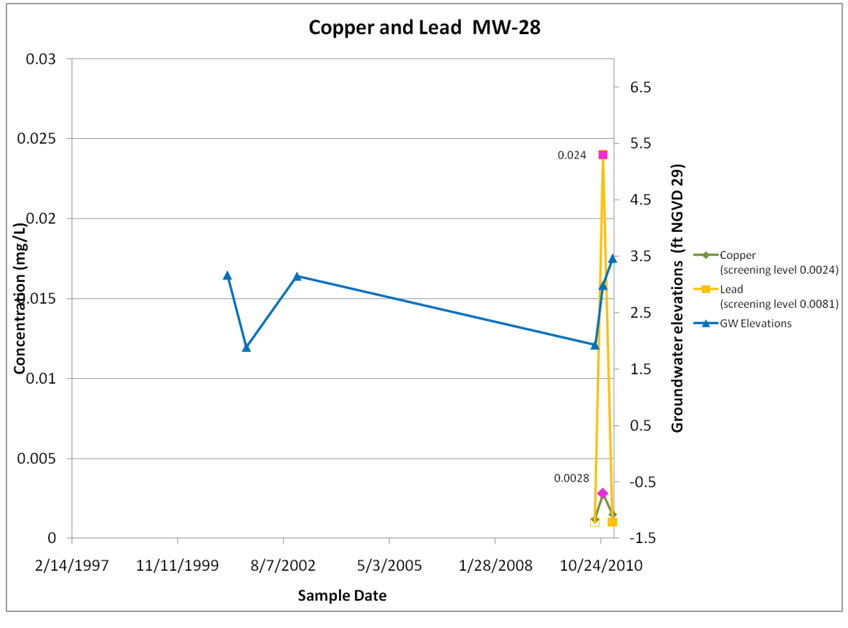
Figure E-35









Legend

Open symbol indicates non-detected result

Filled symbol indicates detected result

Pink symbol indicates detected result above screening level

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Contaminants of Concern and Hydrograph (MW 28)

Port Angeles Rayonier Mill
Port Angeles, Washington

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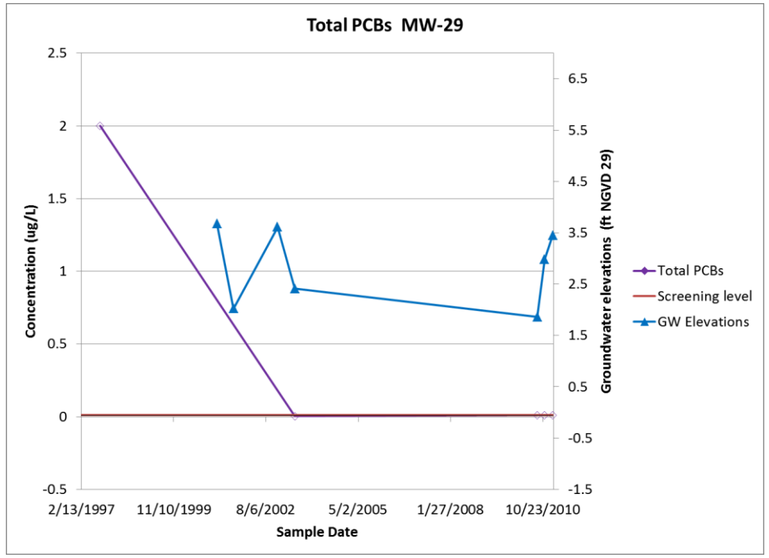
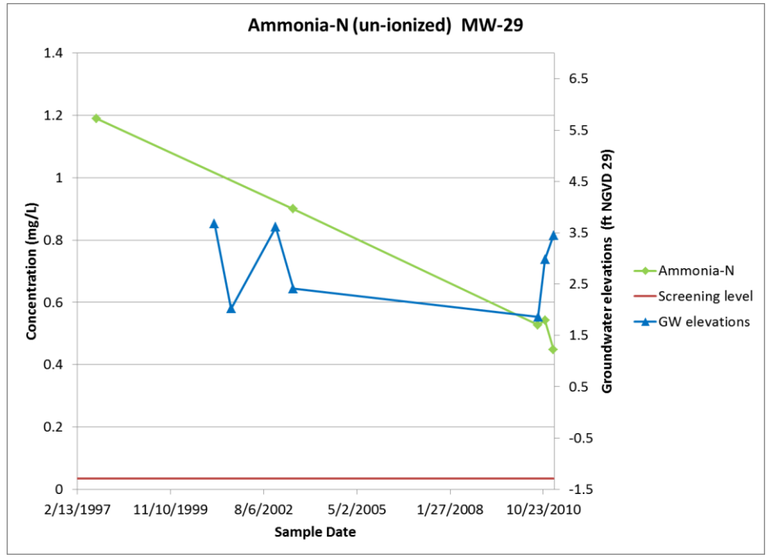
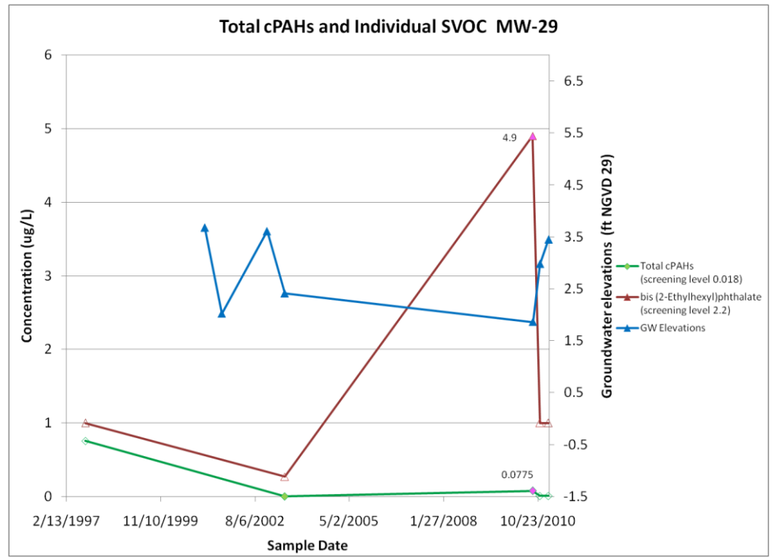
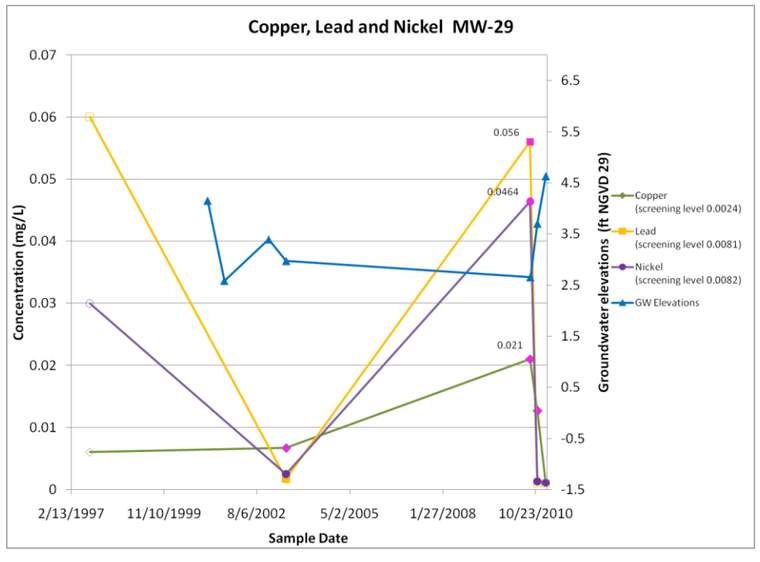
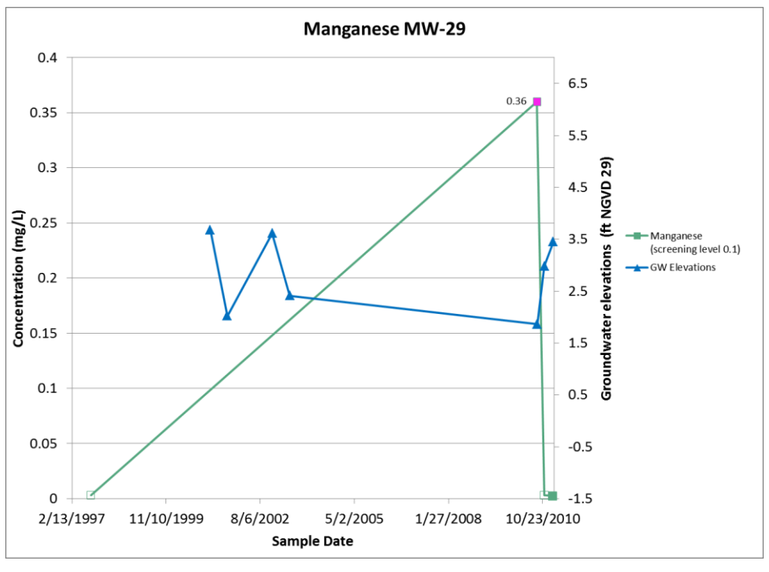
Figure E-36

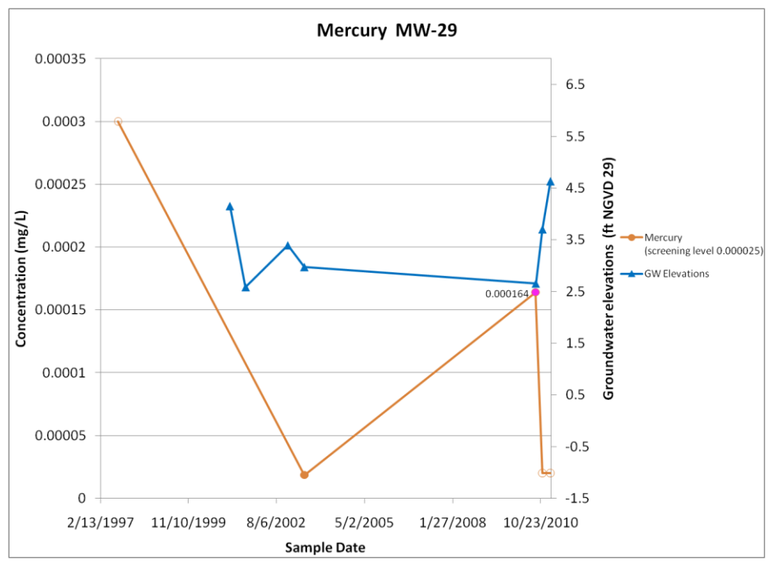












Legend

Open symbol indicates non-detected result

Filled symbol indicates detected result

Pink symbol indicates detected result above screening level

Notes:

1. For metals trend plots, plotted data generally represent dissolved metals results (filtered samples); for sampling events where only total metals (unfiltered samples) were analyzed, the totals data are plotted.
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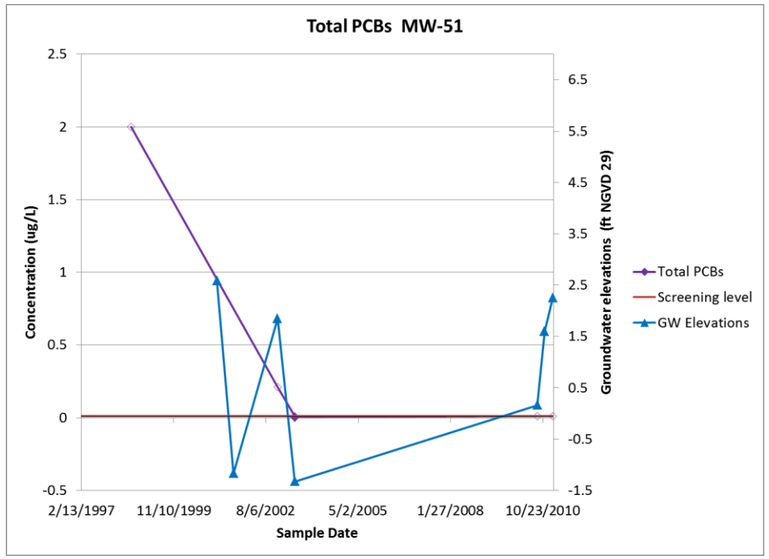
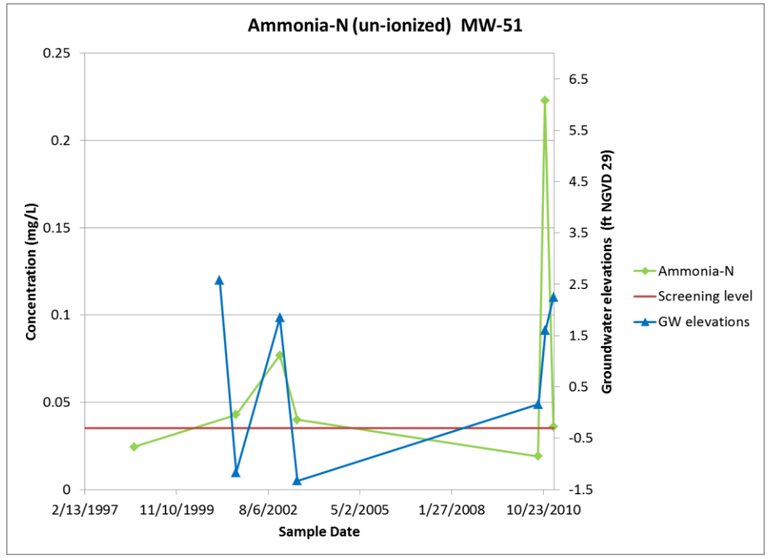
Contaminants of Concern and Hydrograph (MW 29)

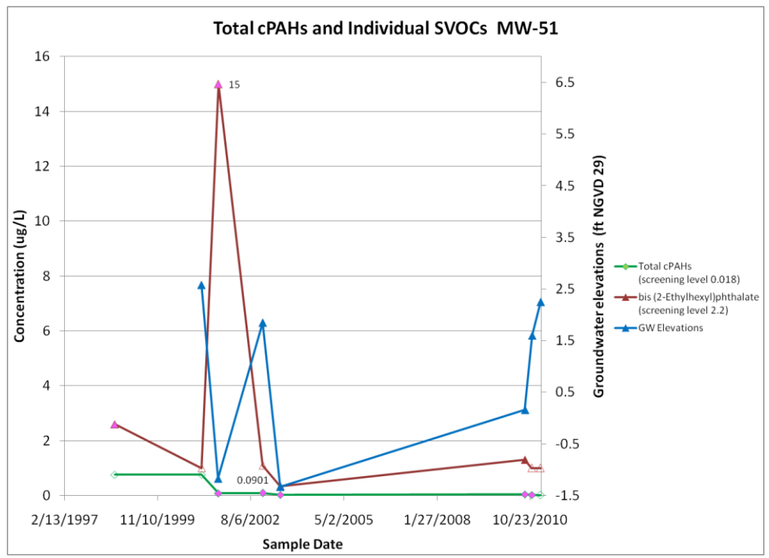
Port Angeles Rayonier Mill
Port Angeles, Washington

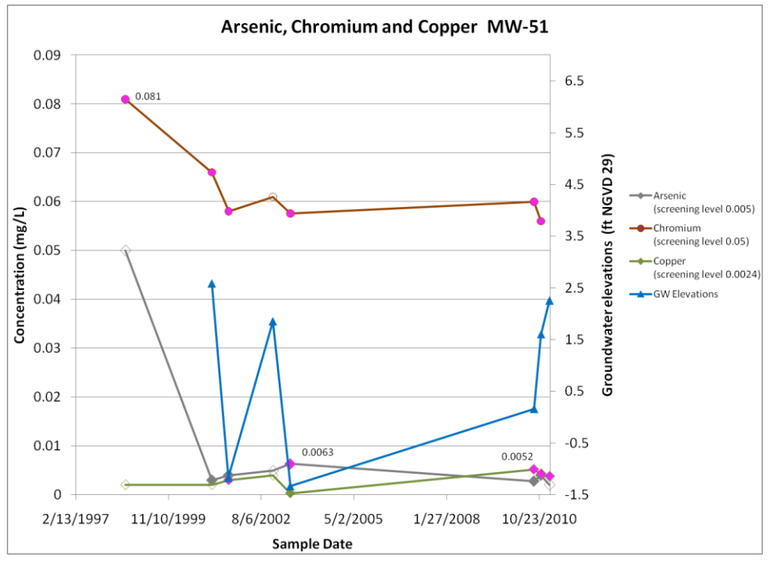
GeoEngineers

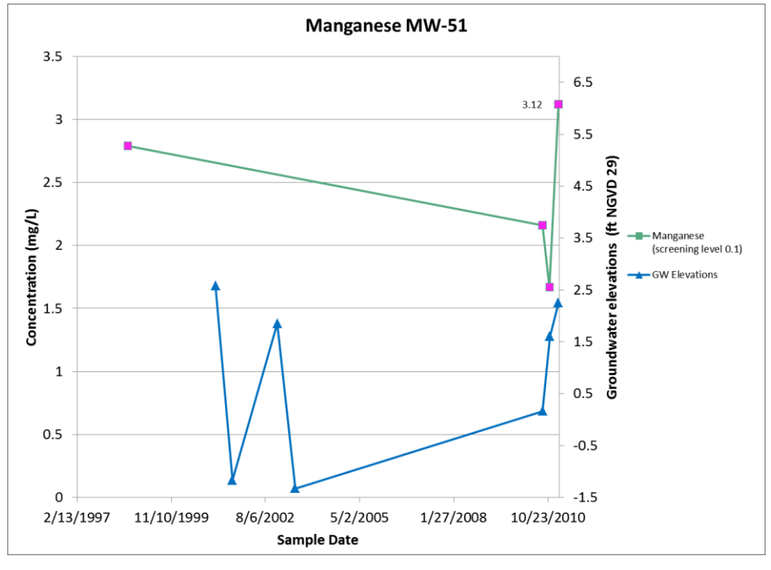
Figure E-37











Legend

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Notes:

1. For metals trend plots, plotted data generally represent dissolved metals results (filtered samples); for sampling events where only total metals (unfiltered samples) were analyzed, the totals data are plotted.
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Contaminants of Concern and Hydrograph (MW 51)

Port Angeles Rayonier Mill
Port Angeles, Washington

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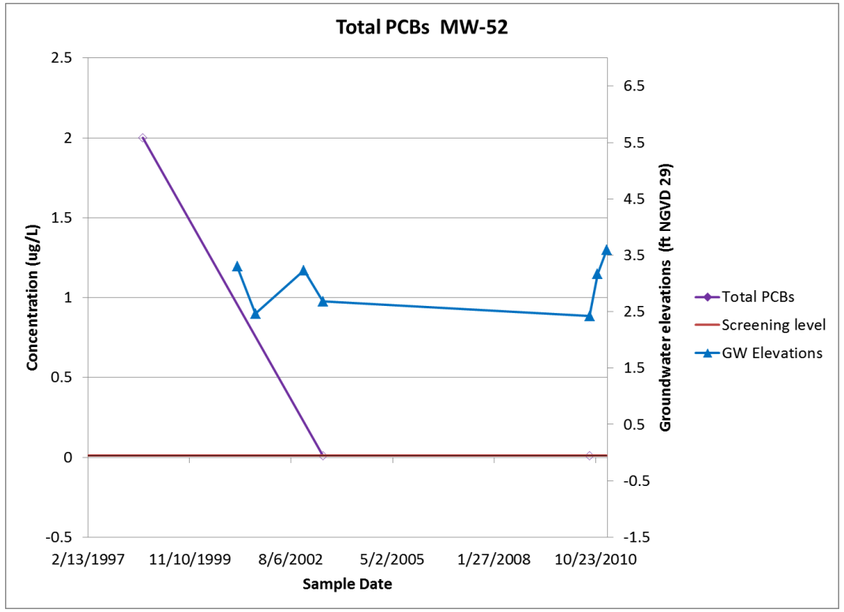
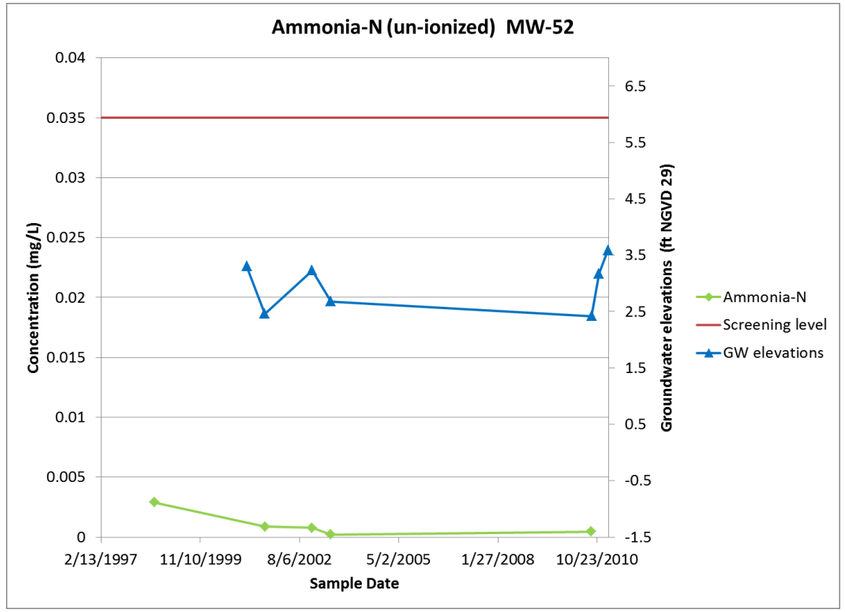
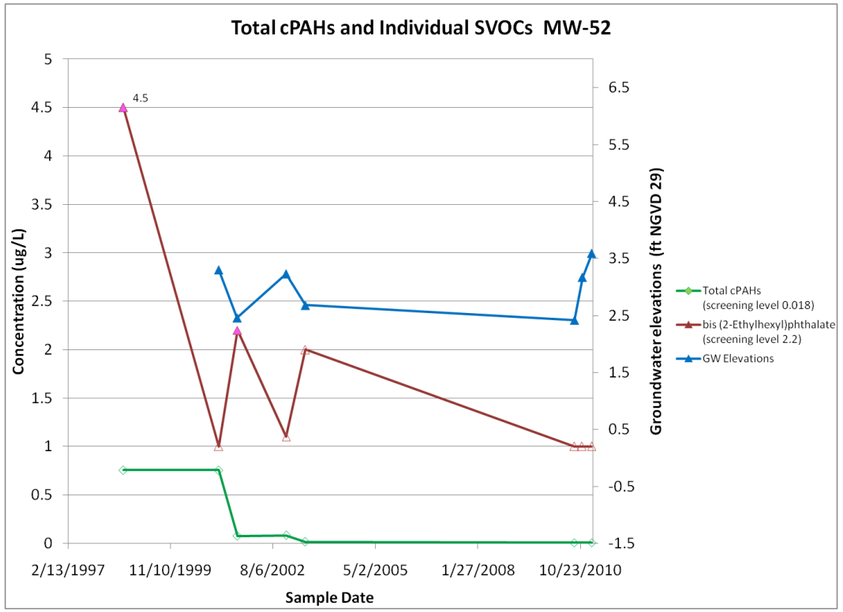
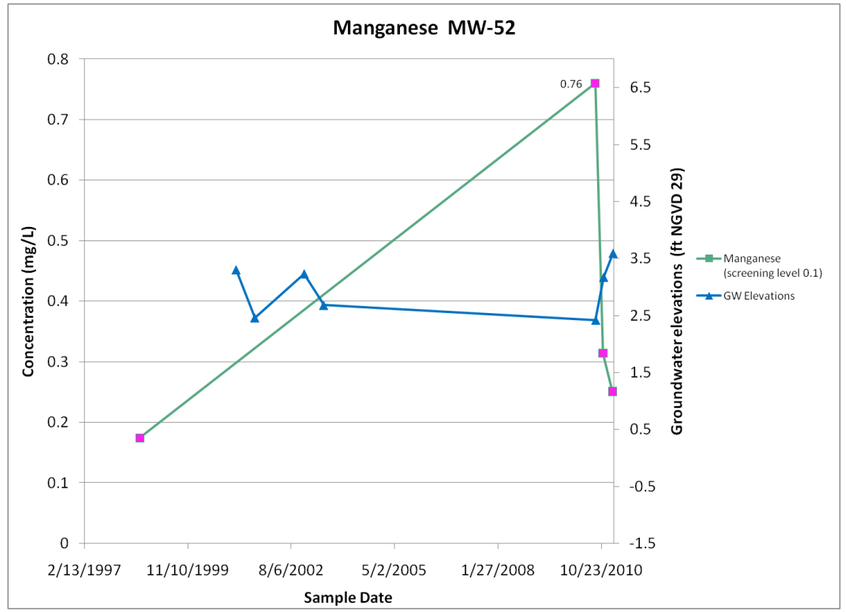
Figure E-38









Legend

Open symbol indicates non-detected result

Filled symbol indicates detected result

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Notes:

1. For metals trend plots, plotted data generally represent dissolved metals results (filtered samples); for sampling events where only total metals (unfiltered samples) were analyzed, the totals data are plotted.
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Contaminants of Concern and Hydrograph (MW 52)

Port Angeles Rayonier Mill
Port Angeles, Washington

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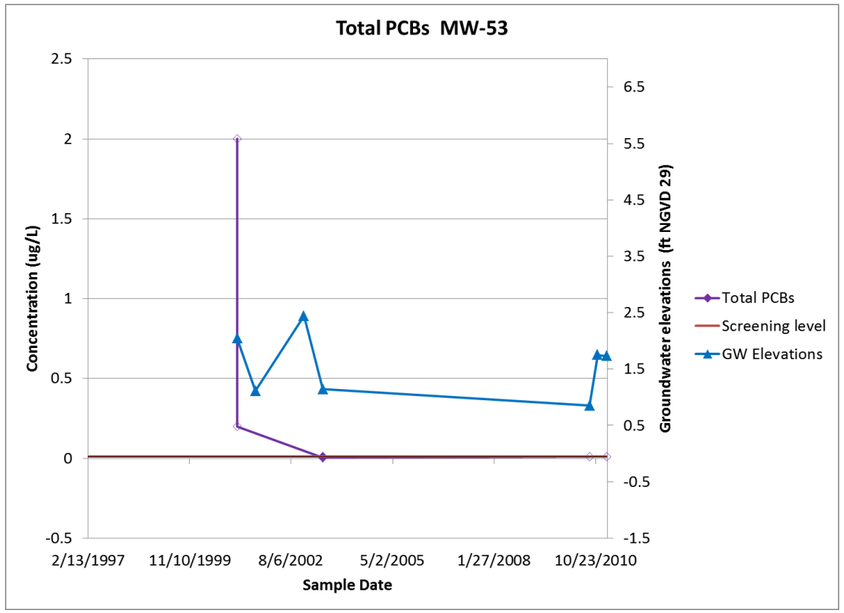
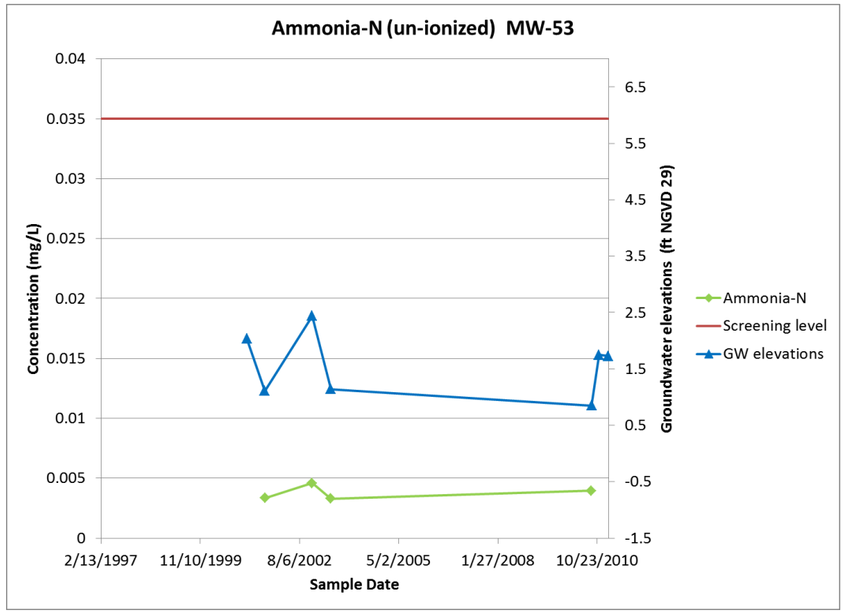
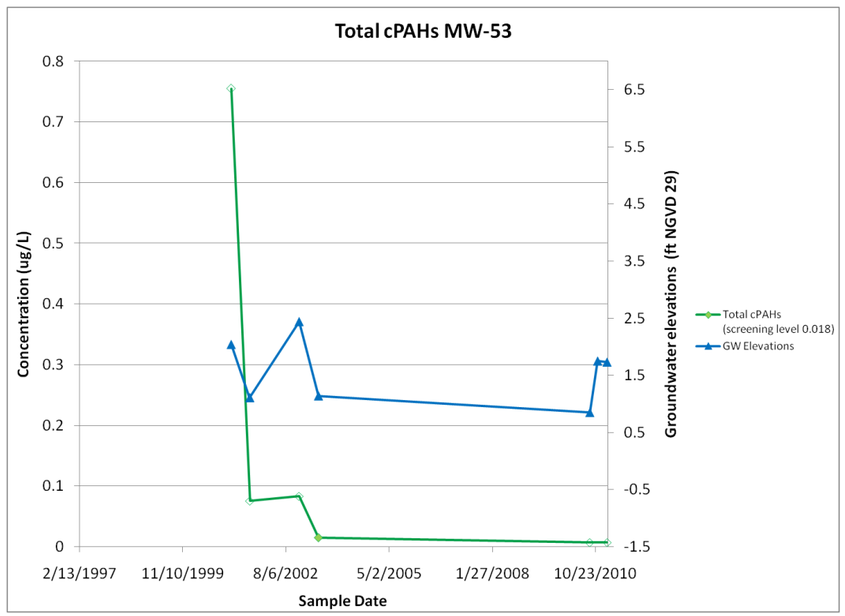
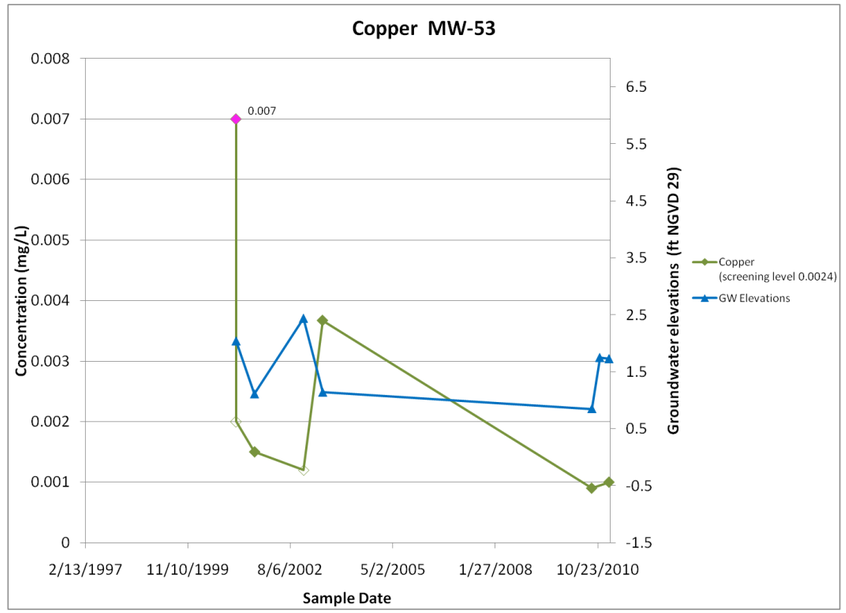
Figure E-39









Legend

Open symbol indicates non-detected result

Filled symbol indicates detected result

Pink symbol indicates detected result above screening level

Notes:

1. For metals trend plots, plotted data generally represent dissolved metals results (filtered samples); for sampling events where only total metals (unfiltered samples) were analyzed, the totals data are plotted.
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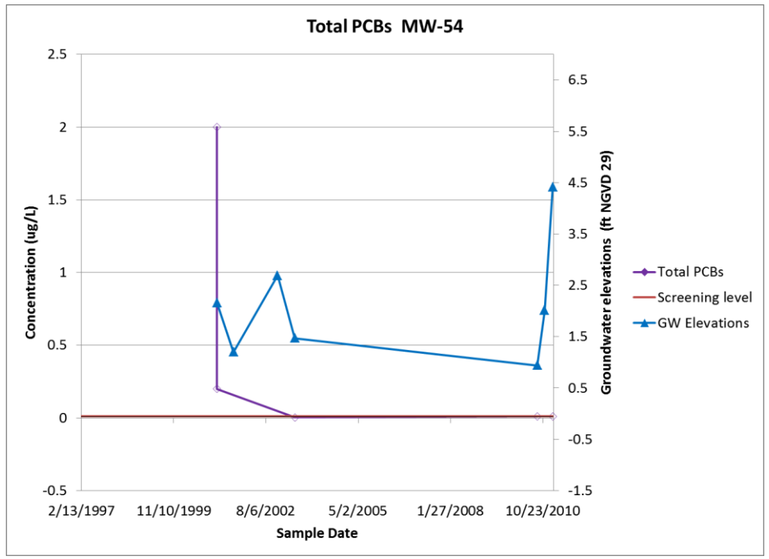
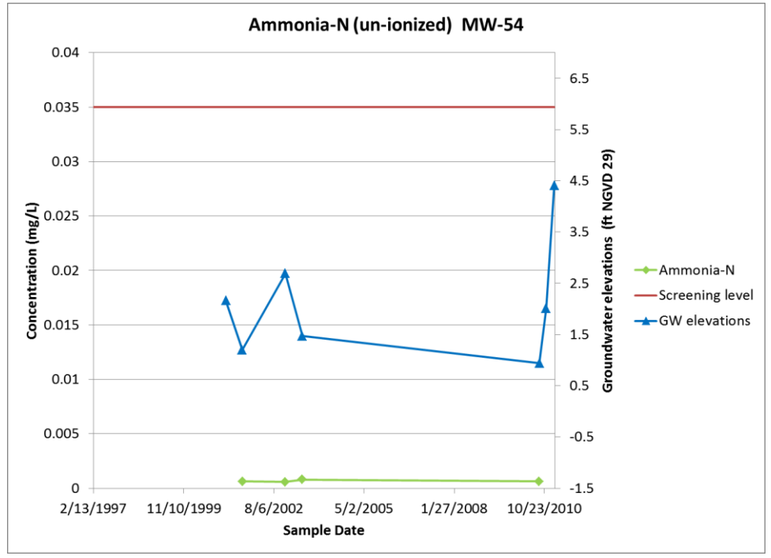
Contaminants of Concern and Hydrograph (MW 53)

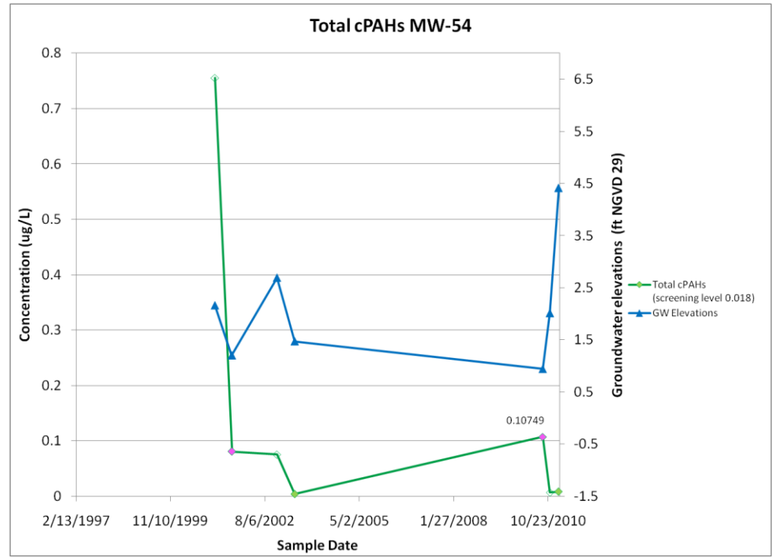
Port Angeles Rayonier Mill
Port Angeles, Washington

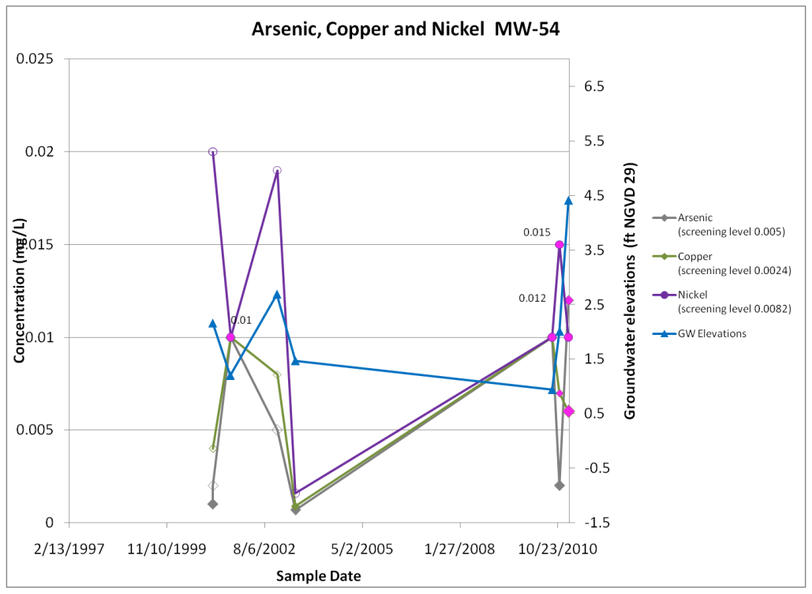
GeoEngineers

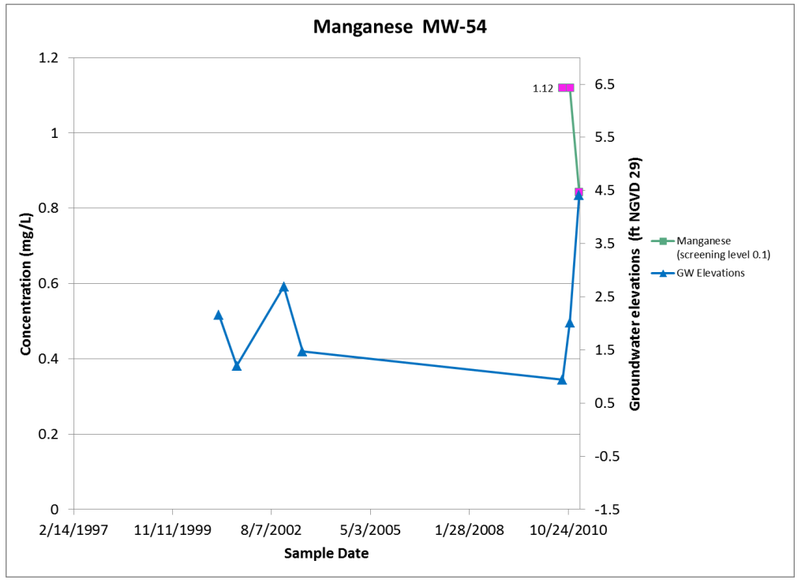
Figure E-40











Legend

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Contaminants of Concern and Hydrograph (MW 54)

Port Angeles Rayonier Mill
Port Angeles, Washington

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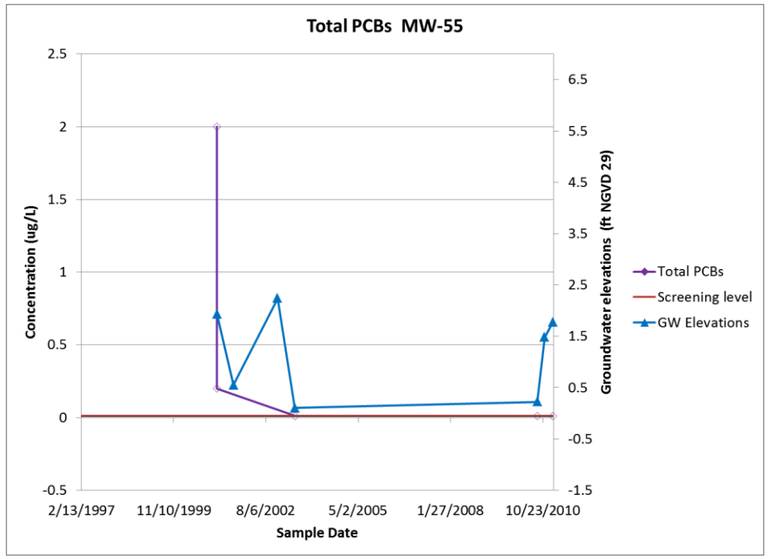
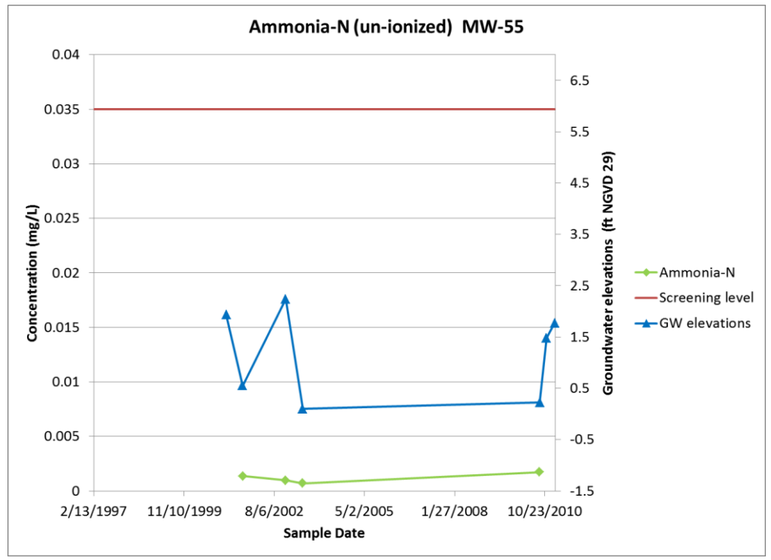
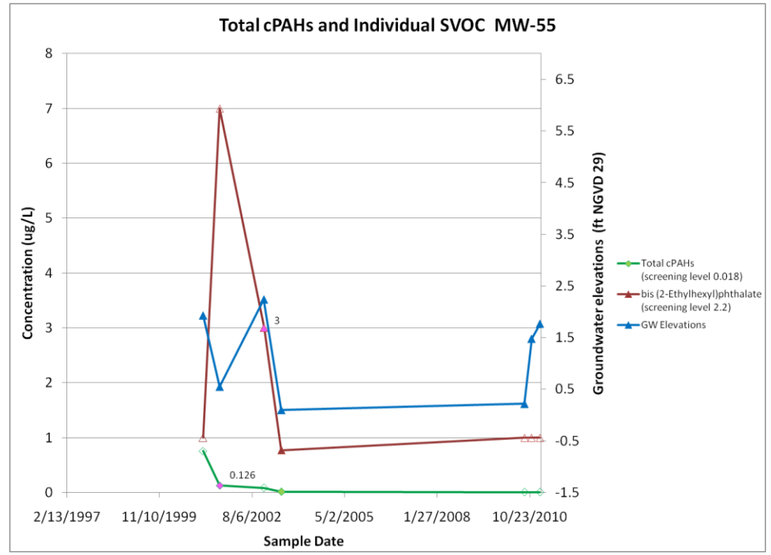
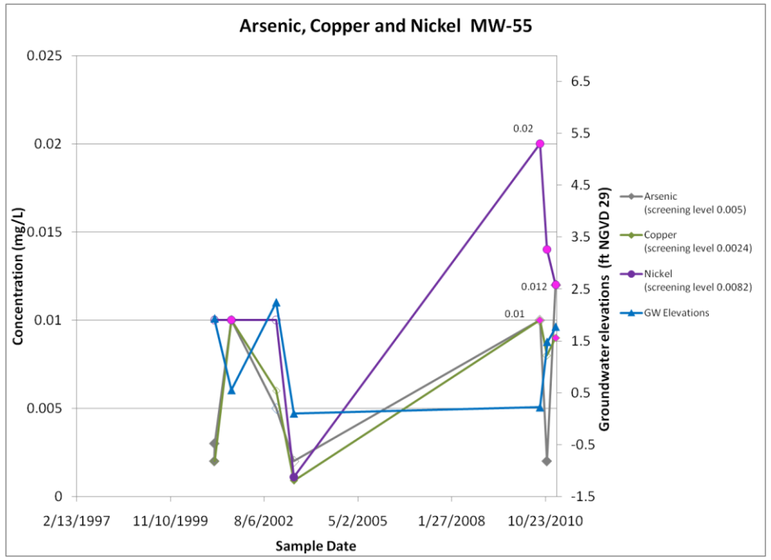
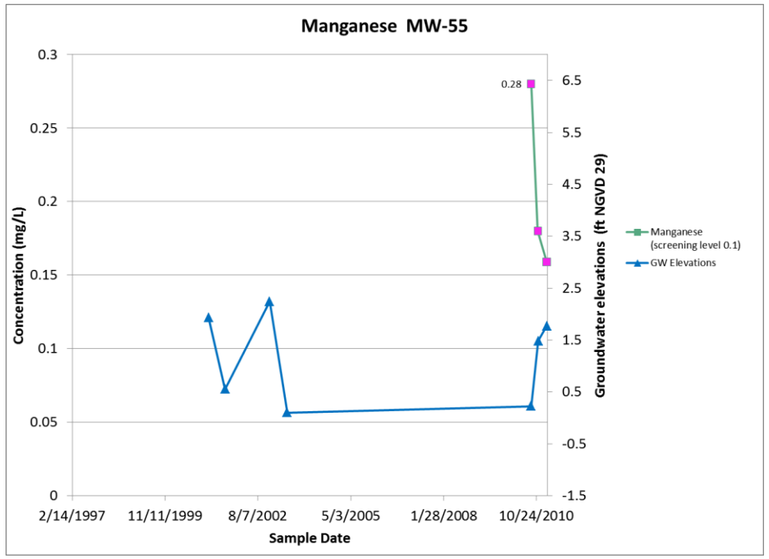
Figure E-41











Legend

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Filled symbol indicates detected result

Pink symbol indicates detected result above screening level

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1. For metals trend plots, plotted data generally represent dissolved metals results (filtered samples); for sampling events where only total metals (unfiltered samples) were analyzed, the totals data are plotted.
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Port Angeles Rayonier Mill
Port Angeles, Washington

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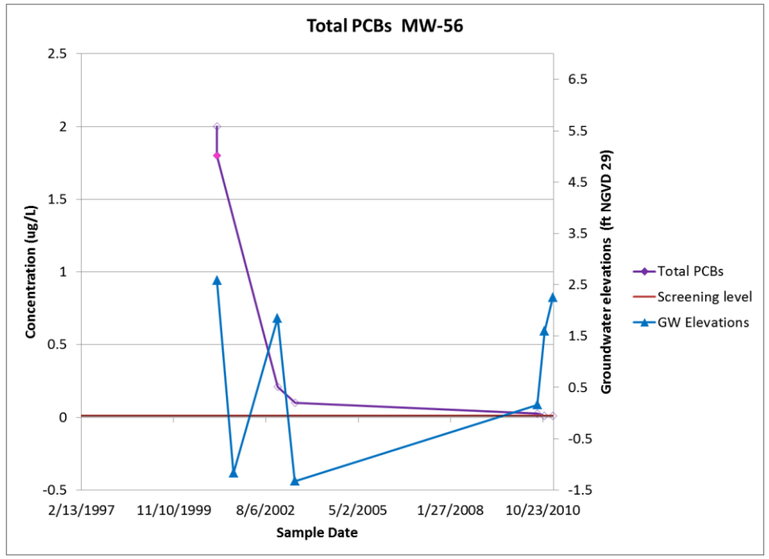
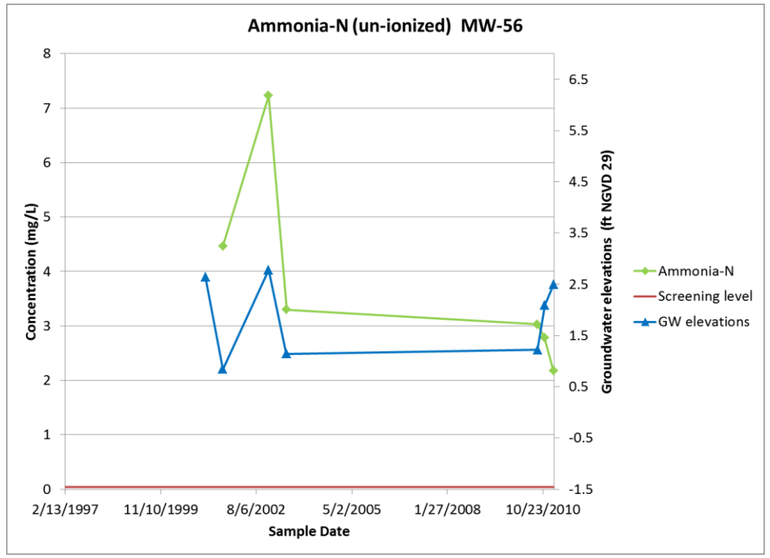
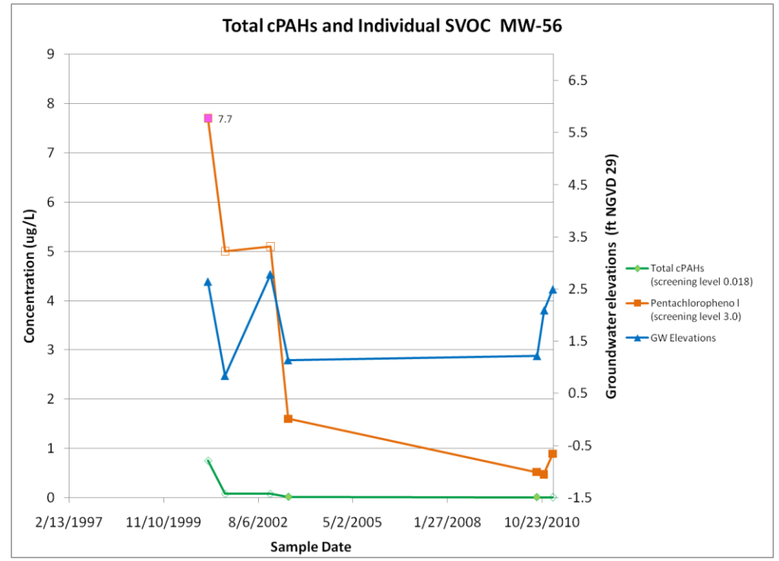
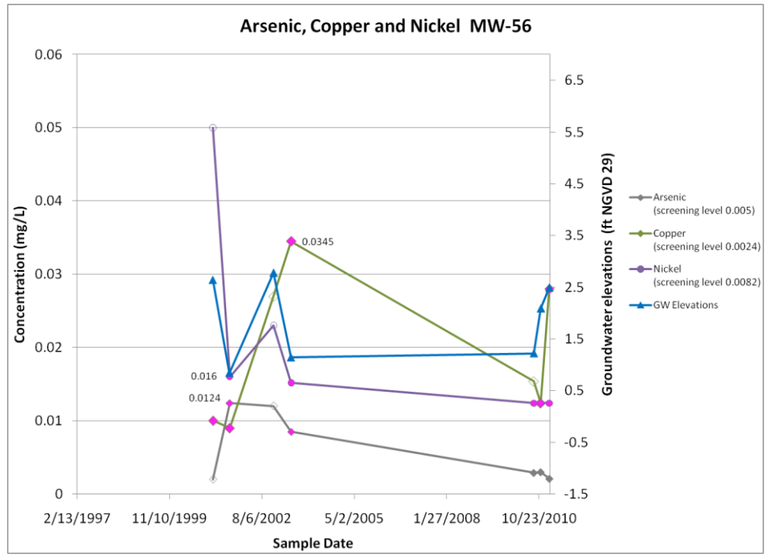
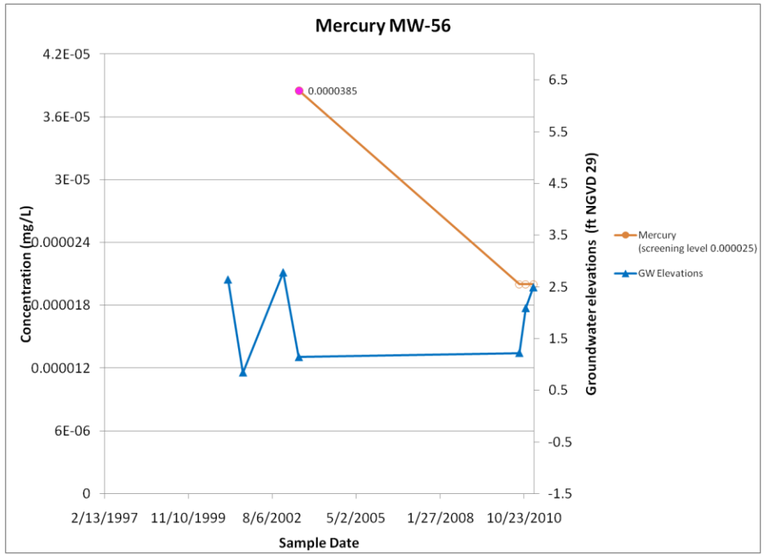
Figure E-42











Legend

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Port Angeles Rayonier Mill
Port Angeles, Washington

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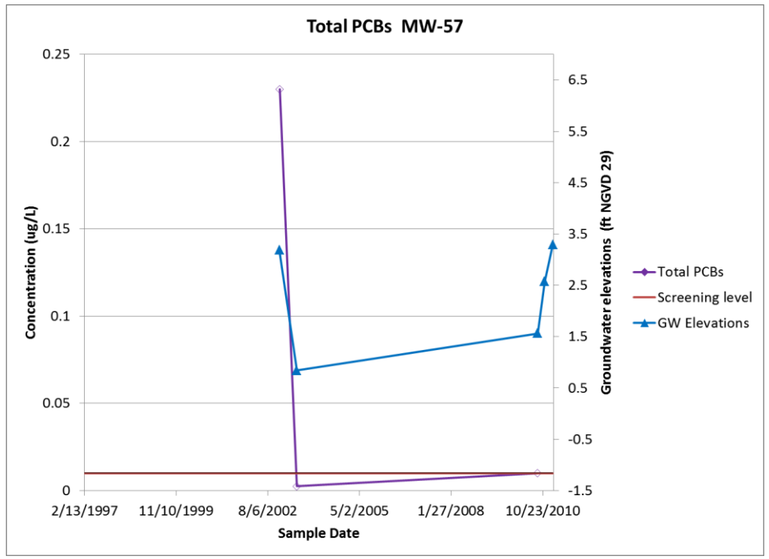
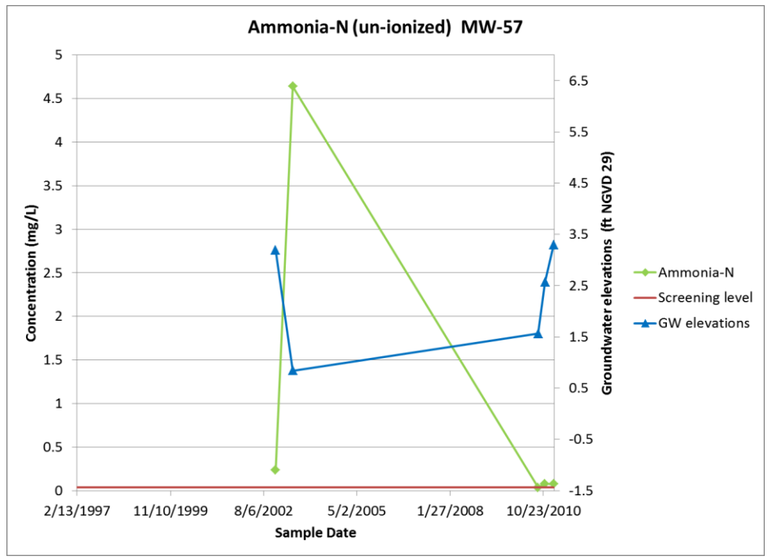
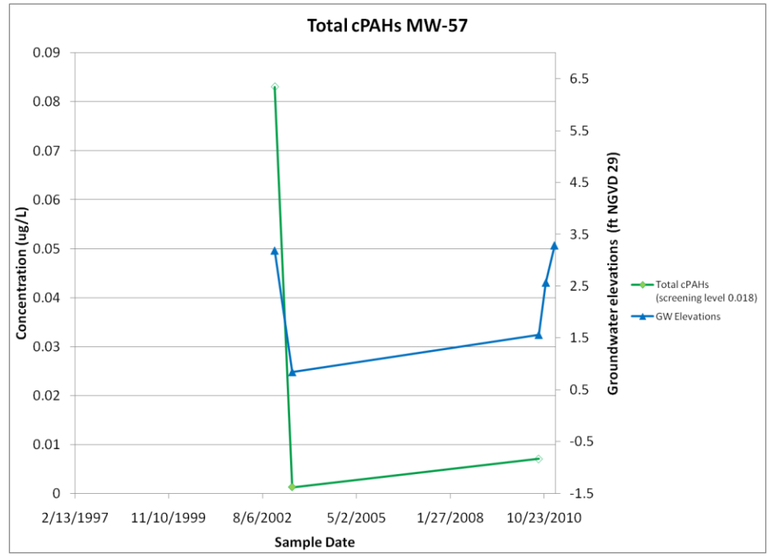
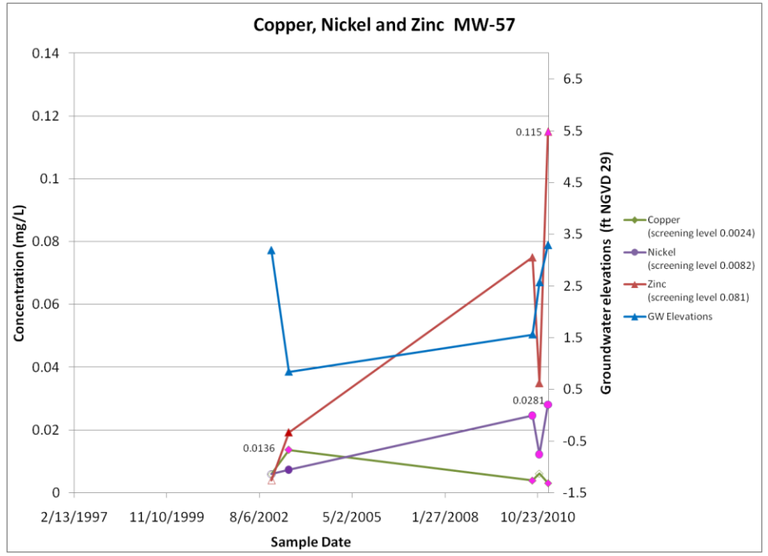
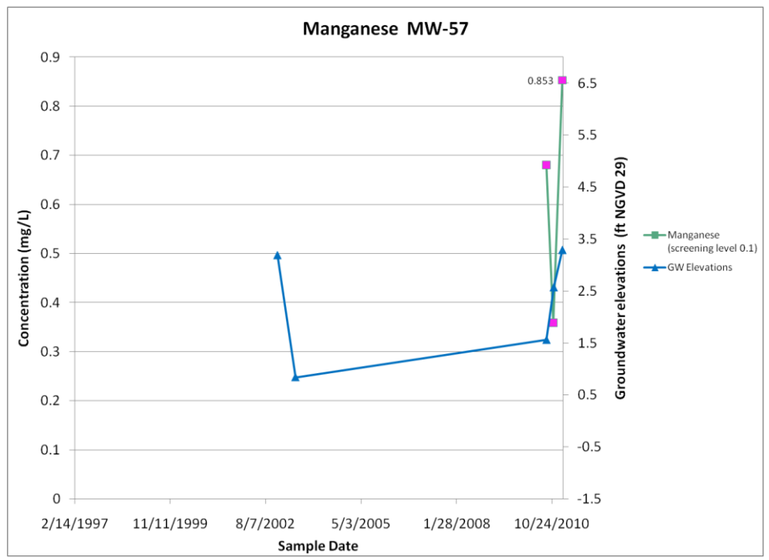
Figure E-43

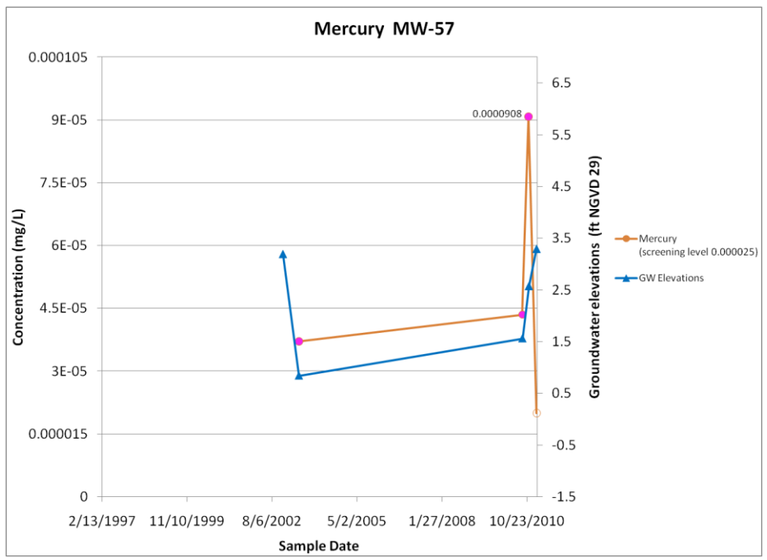












Legend

Open symbol indicates non-detected result

Filled symbol indicates detected result

Pink symbol indicates detected result above screening level

Notes:

1. For metals trend plots, plotted data generally represent dissolved metals results (filtered samples); for sampling events where only total metals (unfiltered samples) were analyzed, the totals data are plotted.
2. Only metals and individual SVOCs with at least one screening level exceedance are shown in this figure.
3. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Contaminants of Concern and Hydrograph (MW 57)

Port Angeles Rayonier Mill
Port Angeles, Washington

GeoEngineers

Figure E-44

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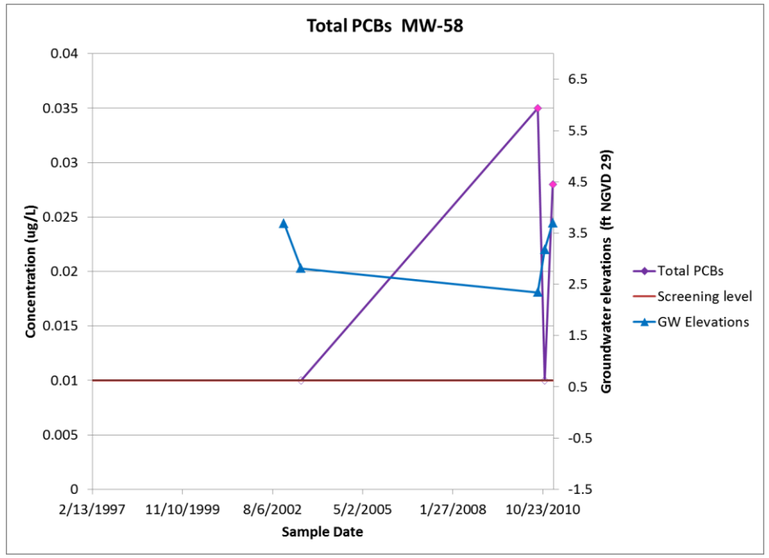

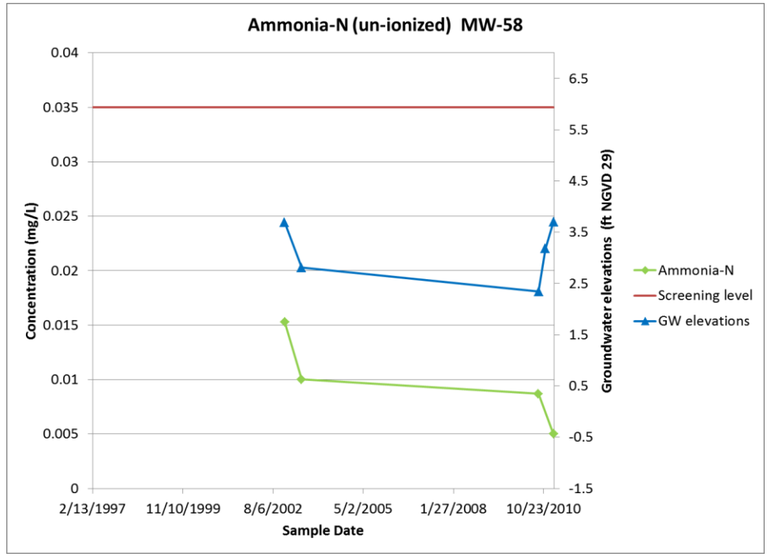

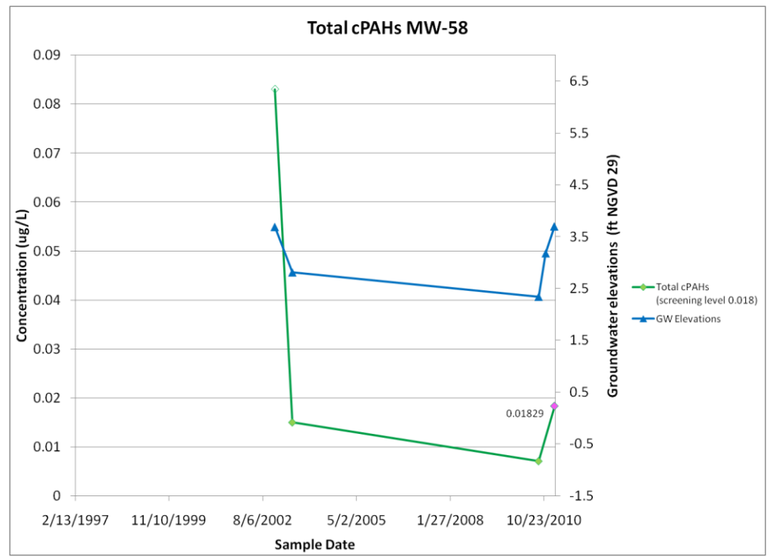

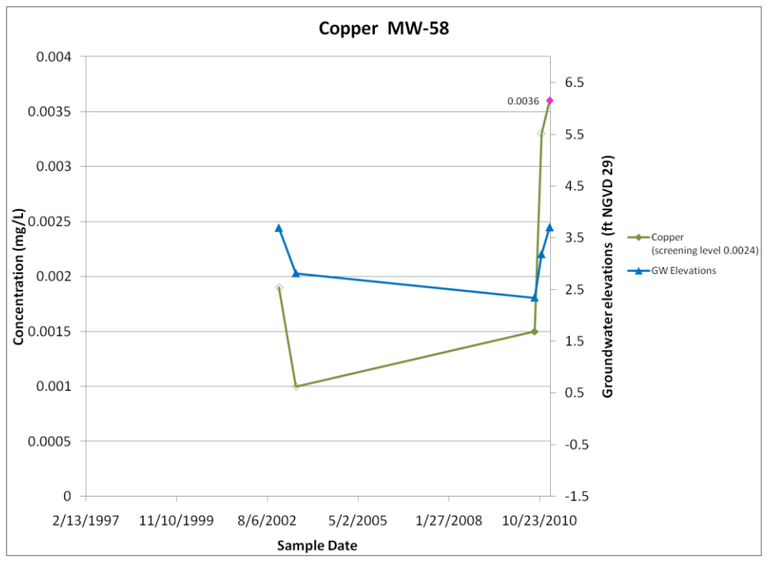

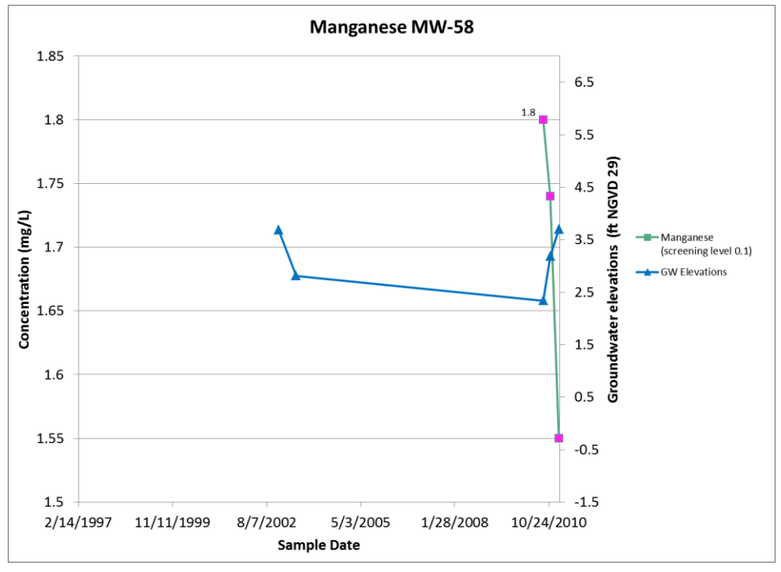

Legend

Open symbol indicates non-detected result

Filled symbol indicates detected result

Pink symbol indicates detected result above screening level

Notes:

1. For metals trend plots, plotted data generally represent dissolved metals results (filtered samples); for sampling events where only total metals (unfiltered samples) were analyzed, the totals data are plotted.
2. Only metals and individual SVOCs with at least one screening level exceedance are shown in this figure.
3. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

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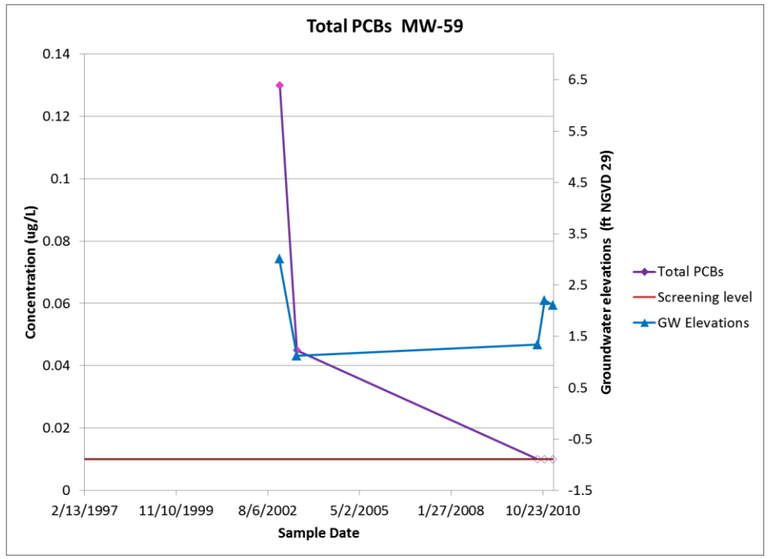
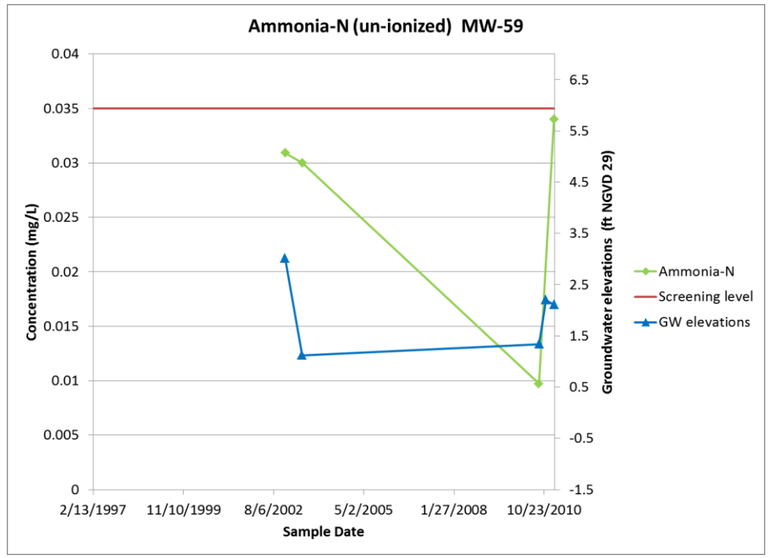
Contaminants of Concern and Hydrograph (MW 58)

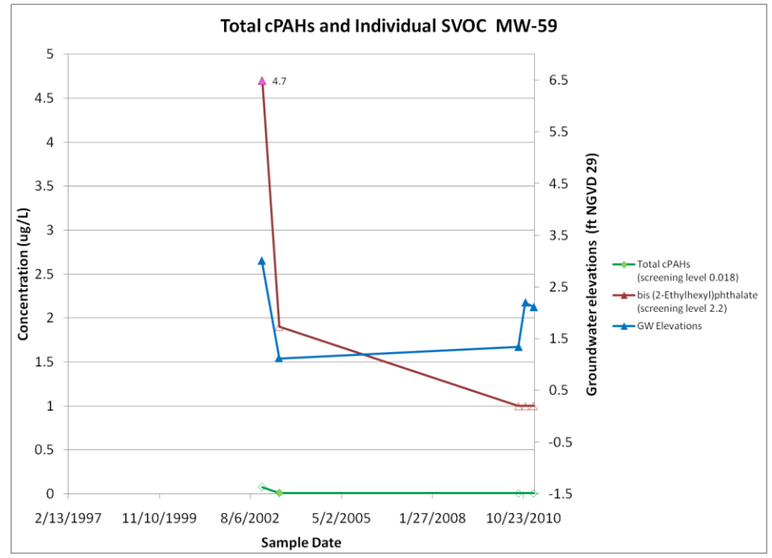
Port Angeles Rayonier Mill
Port Angeles, Washington

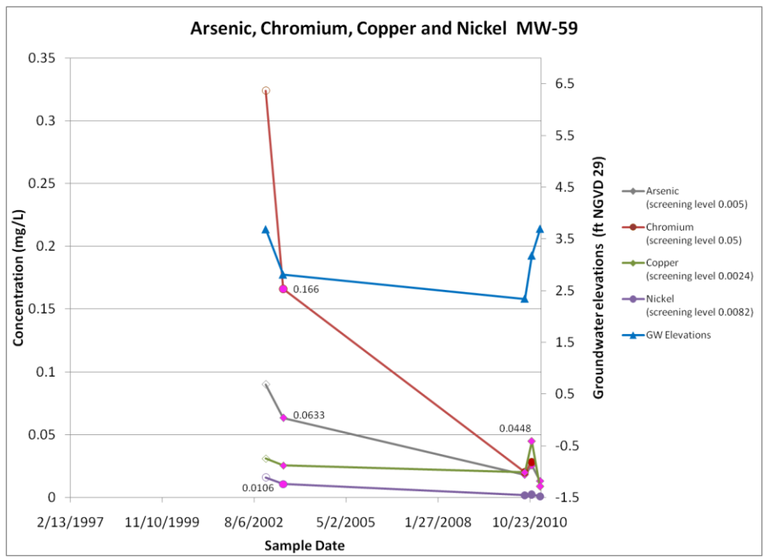
GeoEngineers

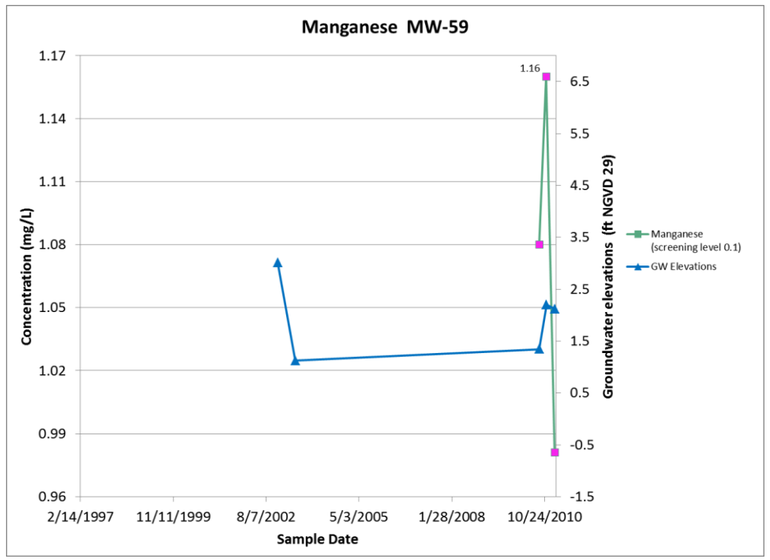
Figure E-45

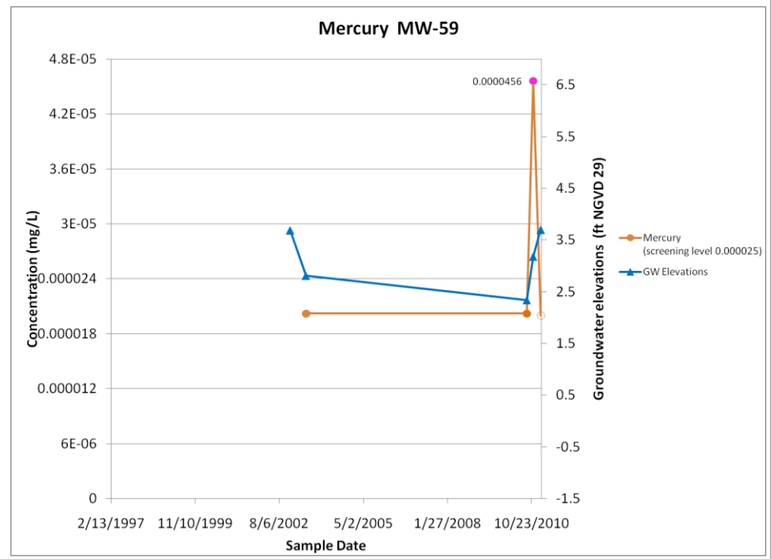












Legend

Open symbol indicates non-detected result

Filled symbol indicates detected result

Pink symbol indicates detected result above screening level

Notes:

1. For metals trend plots, plotted data generally represent dissolved metals results (filtered samples); for sampling events where only total metals (unfiltered samples) were analyzed, the totals data are plotted.
2. Only metals and individual SVOCs with at least one screening level exceedance are shown in this figure.
3. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

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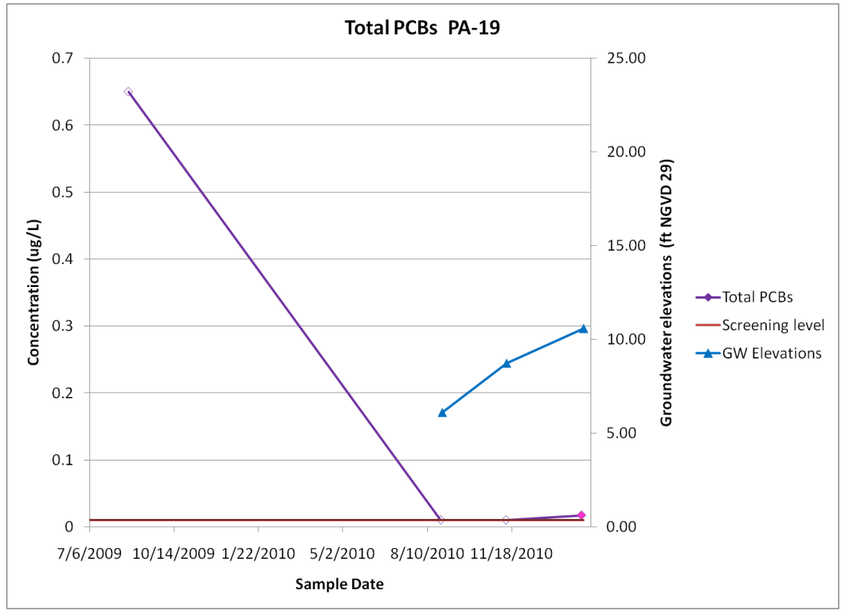
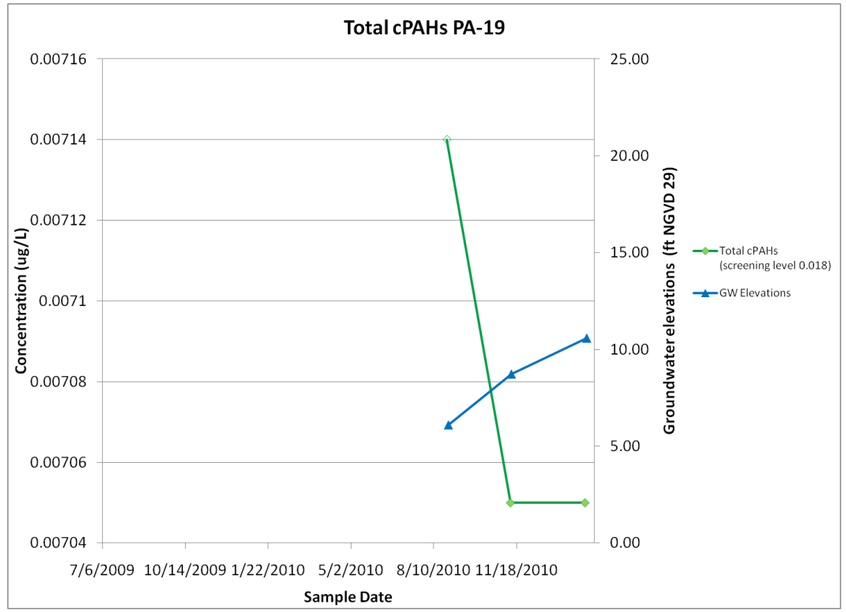
Contaminants of Concern and Hydrograph (MW 59)

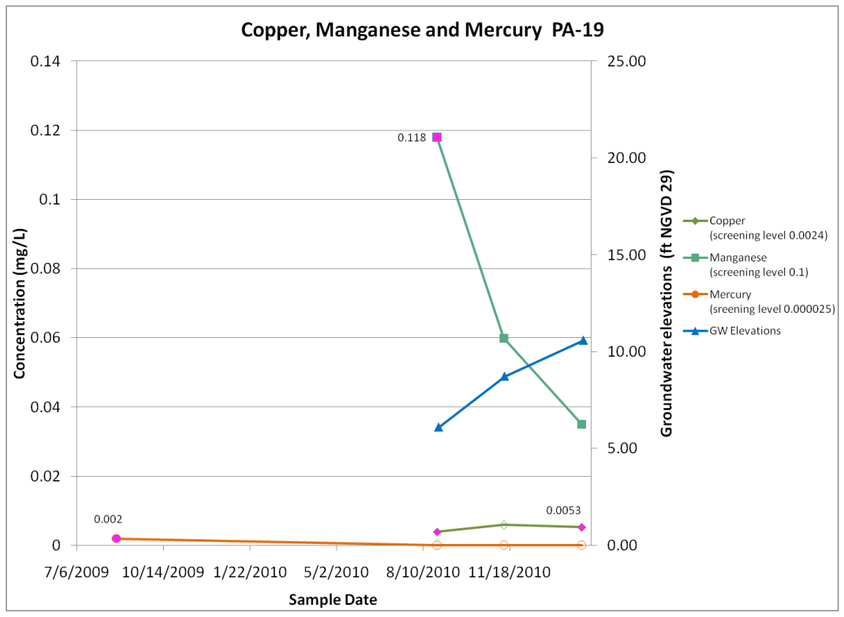
Port Angeles Rayonier Mill
Port Angeles, Washington

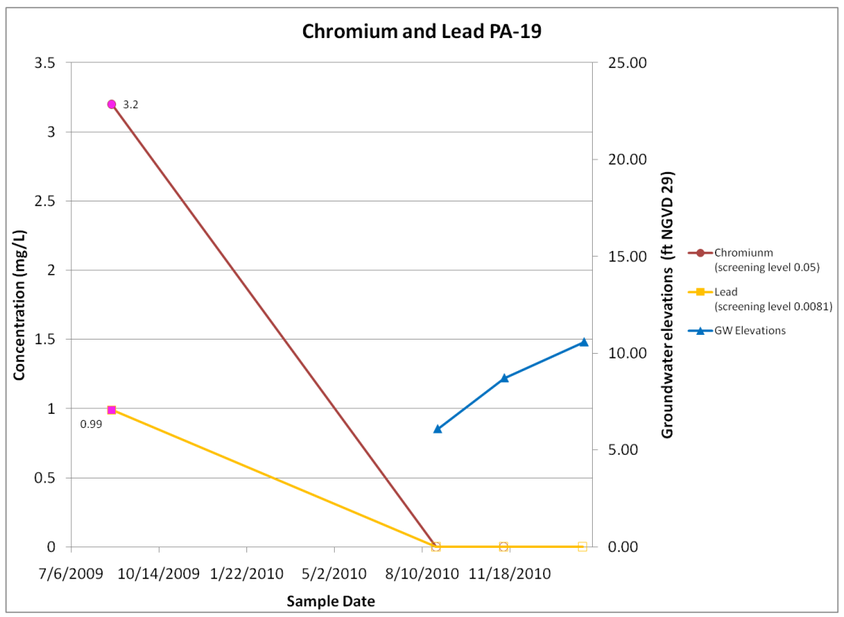
GeoEngineers

Figure E-46









Legend

Open symbol indicates non-detected result

Filled symbol indicates detected result

Pink symbol indicates detected result above screening level

Notes:

1. For metals trend plots, plotted data generally represent dissolved metals results (filtered samples); for sampling events where only total metals (unfiltered samples) were analyzed, the totals data are plotted.
2. Only metals and individual SVOCs with at least one screening level exceedance are shown in this figure.
3. Ammonia-N not shown in this figure because well was only sampled twice for this constituent.
4. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

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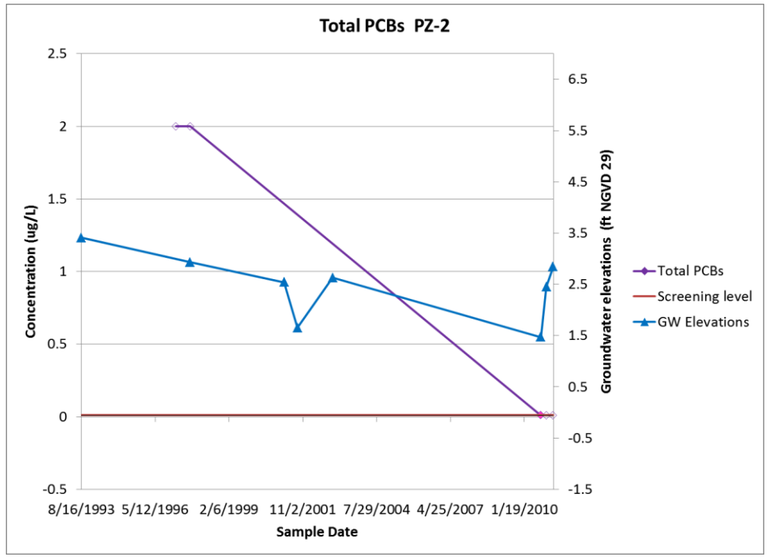
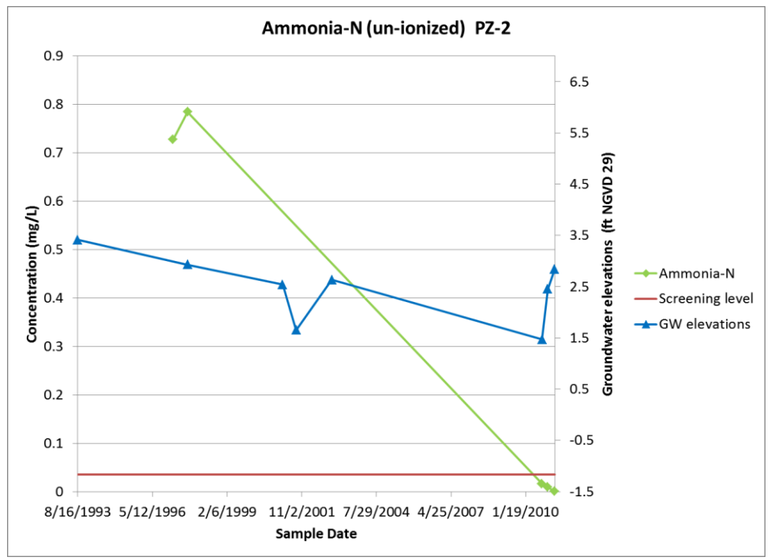
Contaminants of Concern and Hydrograph (PA 19)

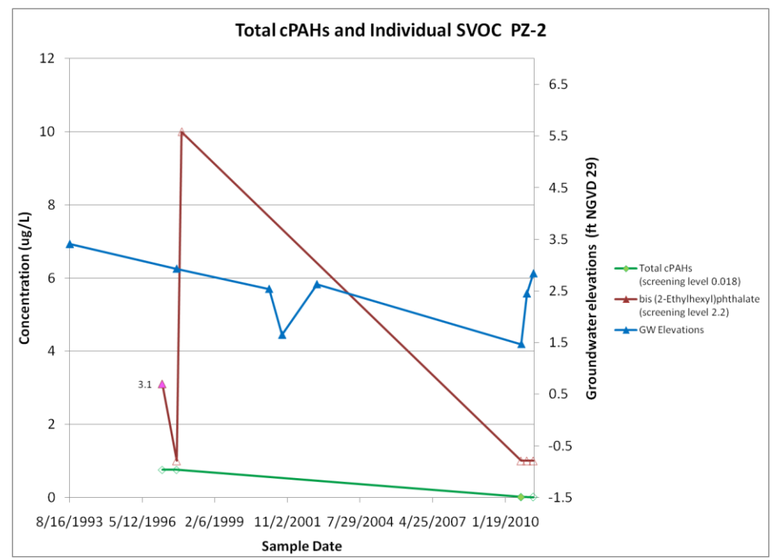
Port Angeles Rayonier Mill
Port Angeles, Washington

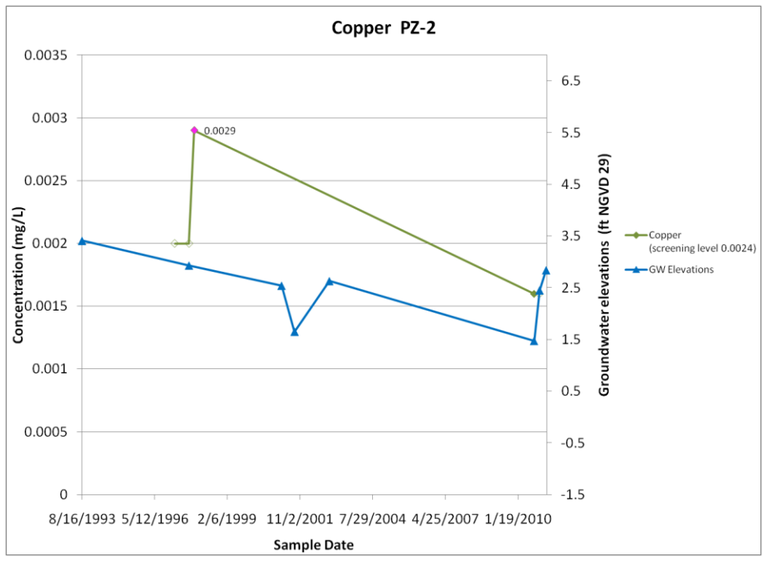
GeoEngineers

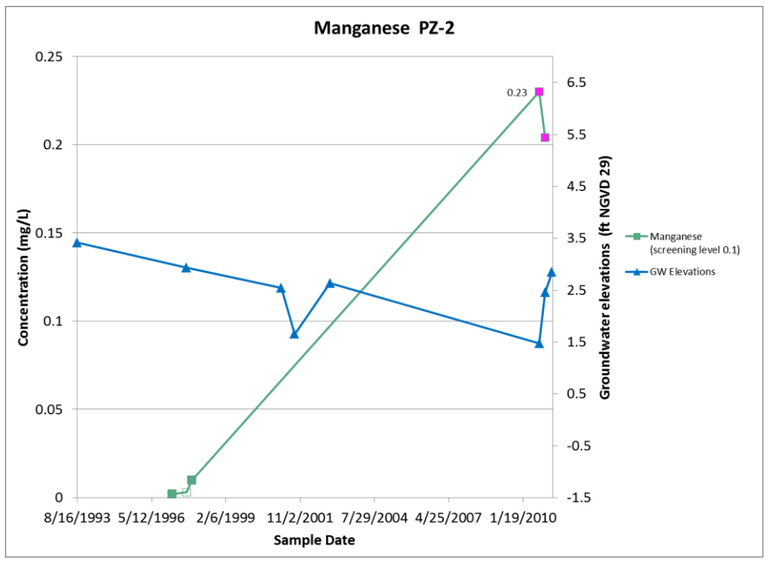
Figure E-47











Legend

Open symbol indicates non-detected result

Filled symbol indicates detected result

Pink symbol indicates detected result above screening level

Notes:

1. For metals trend plots, plotted data generally represent dissolved metals results (filtered samples); for sampling events where only total metals (unfiltered samples) were analyzed, the totals data are plotted.
2. Only metals and individual SVOCs with at least one screening level exceedance are shown in this figure.
3. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

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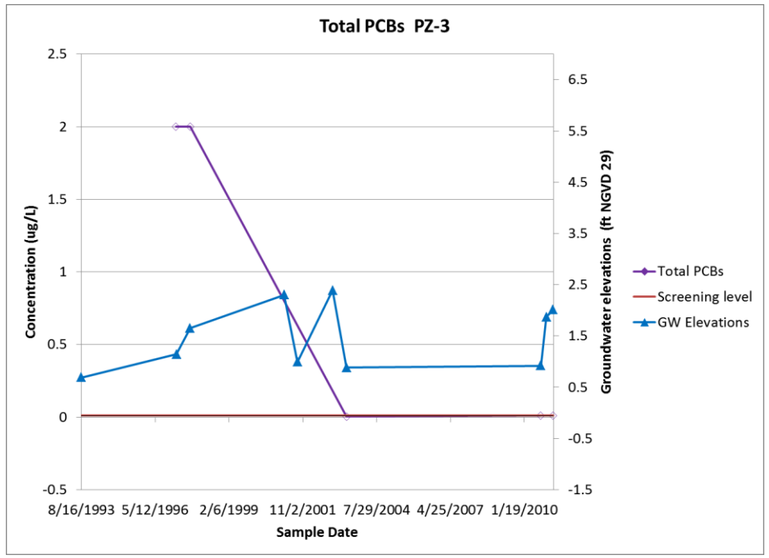
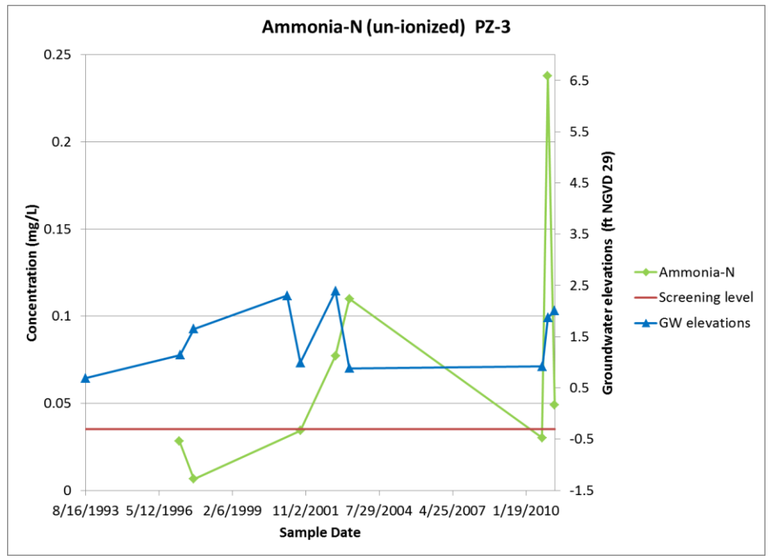
Contaminants of Concern and Hydrograph (PZ 2)

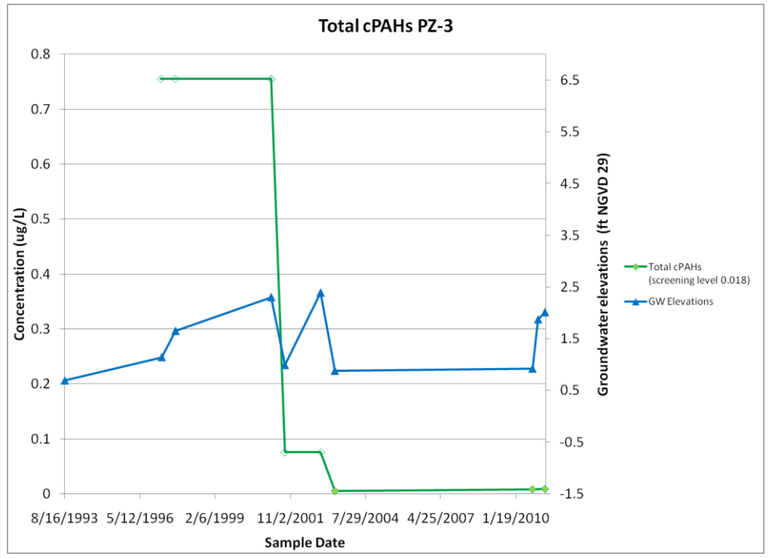
Port Angeles Rayonier Mill
Port Angeles, Washington

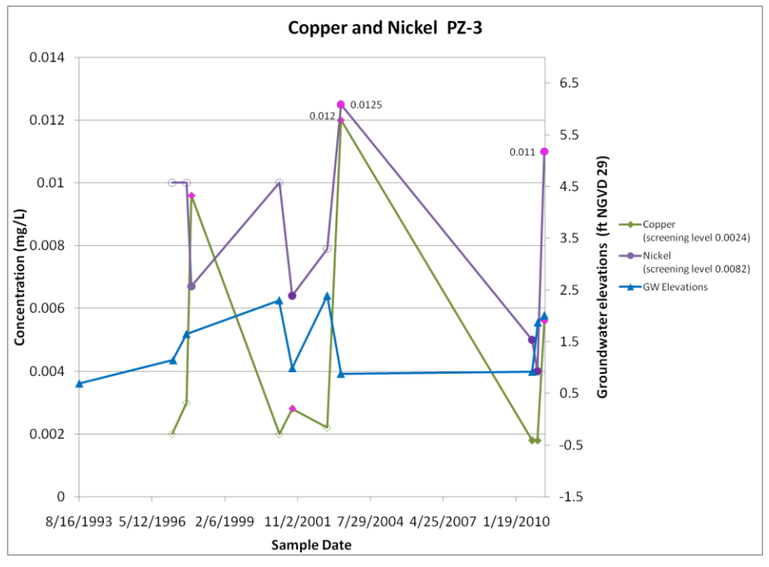
GeoEngineers

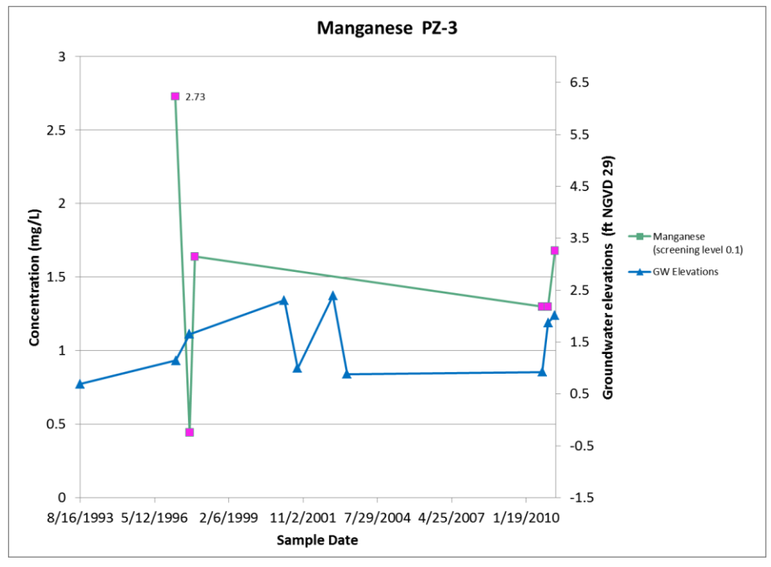
Figure E-48











Legend

Open symbol indicates non-detected result

Filled symbol indicates detected result

Pink symbol indicates detected result above screening level

Notes:

1. For metals trend plots, plotted data generally represent dissolved metals results (filtered samples); for sampling events where only total metals (unfiltered samples) were analyzed, the totals data are plotted.
2. Only metals and individual SVOCs with at least one screening level exceedance are shown in this figure.
3. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

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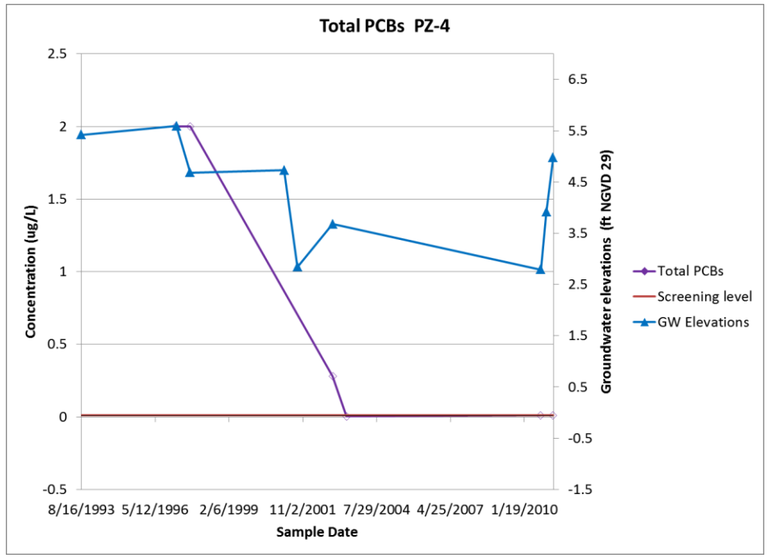
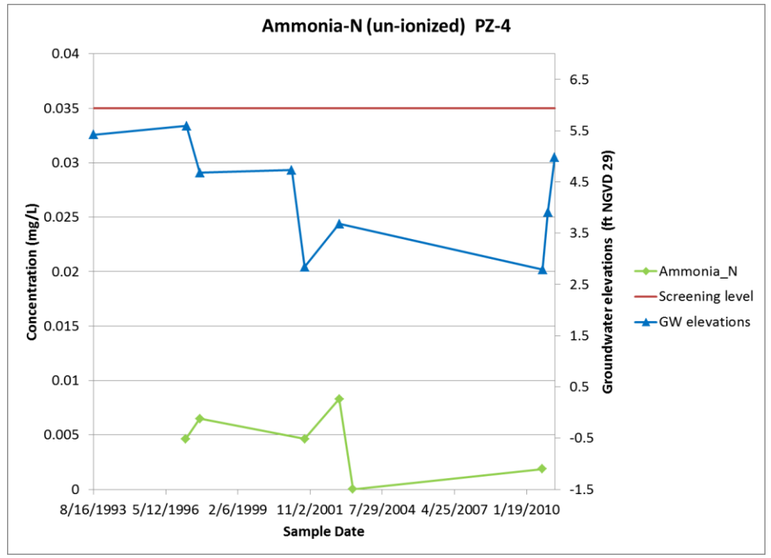
Contaminants of Concern and Hydrograph (PZ 3)

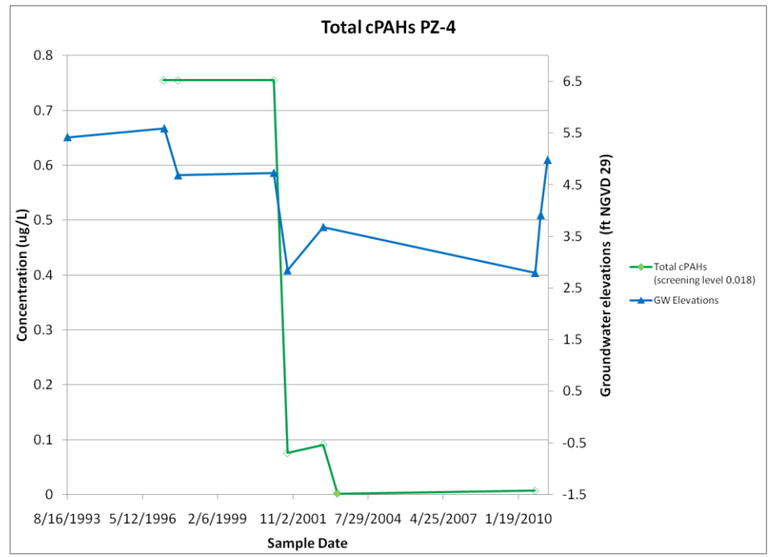
Port Angeles Rayonier Mill
Port Angeles, Washington

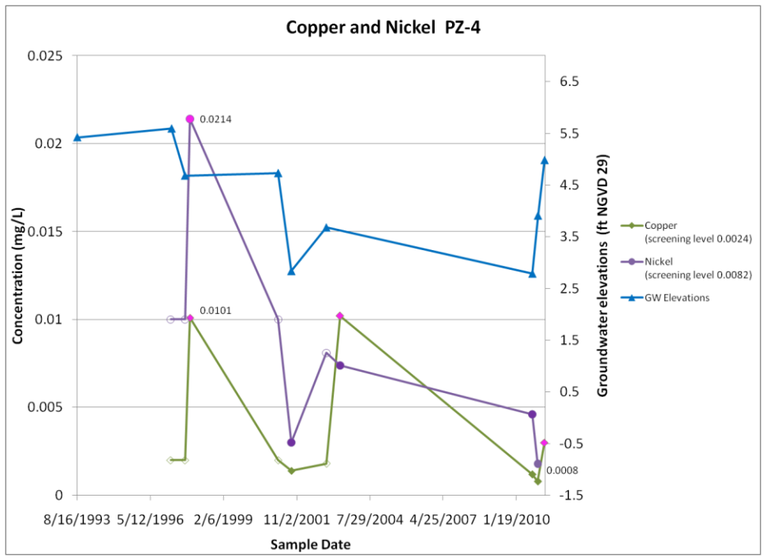
GeoEngineers

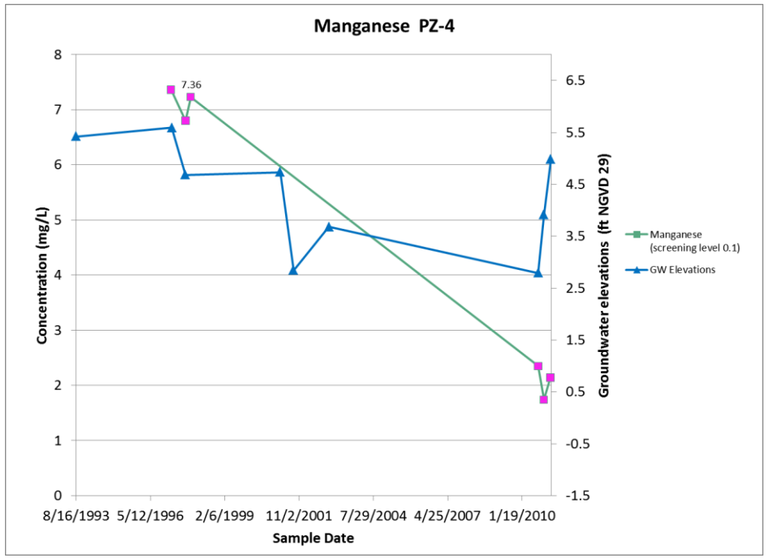
Figure E-49











Legend

Open symbol indicates non-detected result

Filled symbol indicates detected result

Pink symbol indicates detected result above screening level

Notes:

1. For metals trend plots, plotted data generally represent dissolved metals results (filtered samples); for sampling events where only total metals (unfiltered samples) were analyzed, the totals data are plotted.
2. Only metals and individual SVOCs with at least one screening level exceedance are shown in this figure.
3. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

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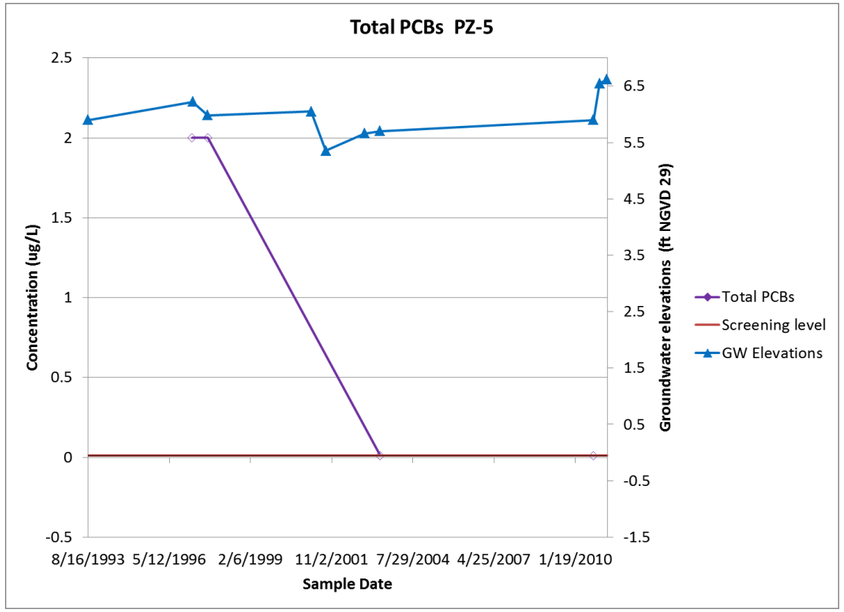
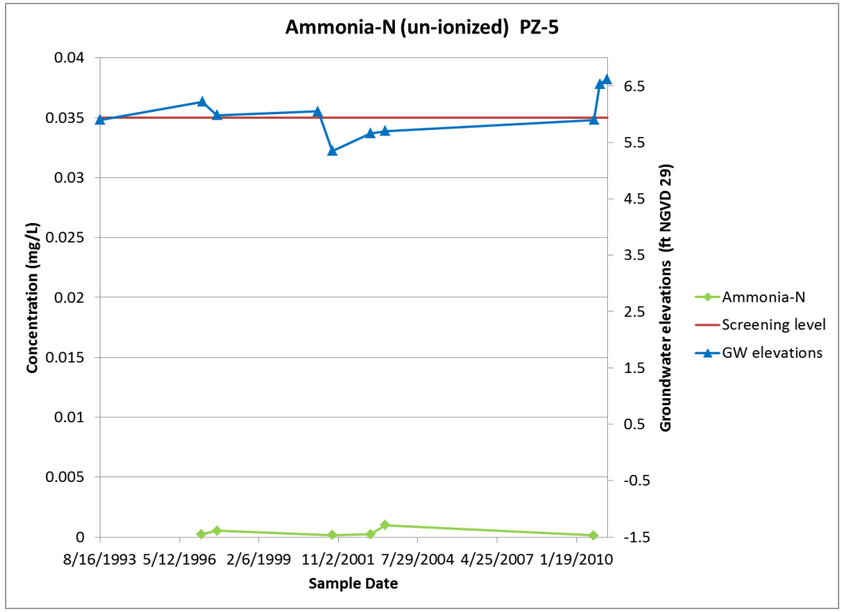
Contaminants of Concern and Hydrograph (PZ 4)

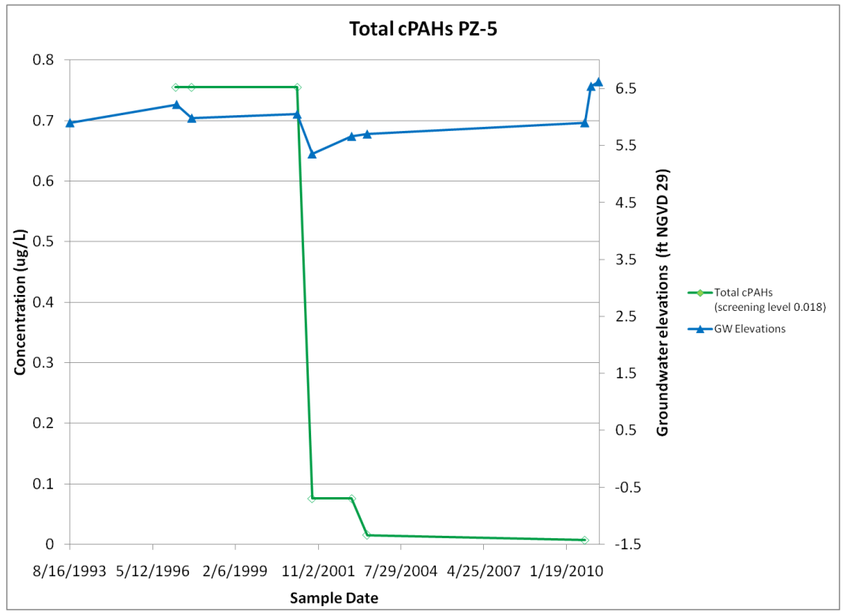
Port Angeles Rayonier Mill
Port Angeles, Washington

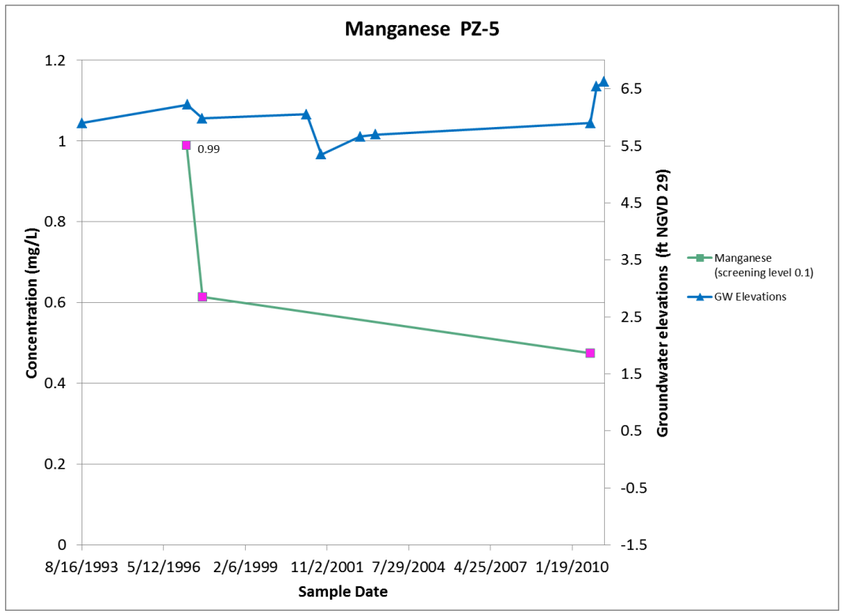
GeoEngineers

Figure E-50









Legend

Open symbol indicates non-detected result

Filled symbol indicates detected result

Pink symbol indicates detected result above screening level

Notes:

1. For metals trend plots, plotted data generally represent dissolved metals results (filtered samples); for sampling events where only total metals (unfiltered samples) were analyzed, the totals data are plotted.
2. Only metals and individual SVOCs with at least one screening level exceedance are shown in this figure.
3. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

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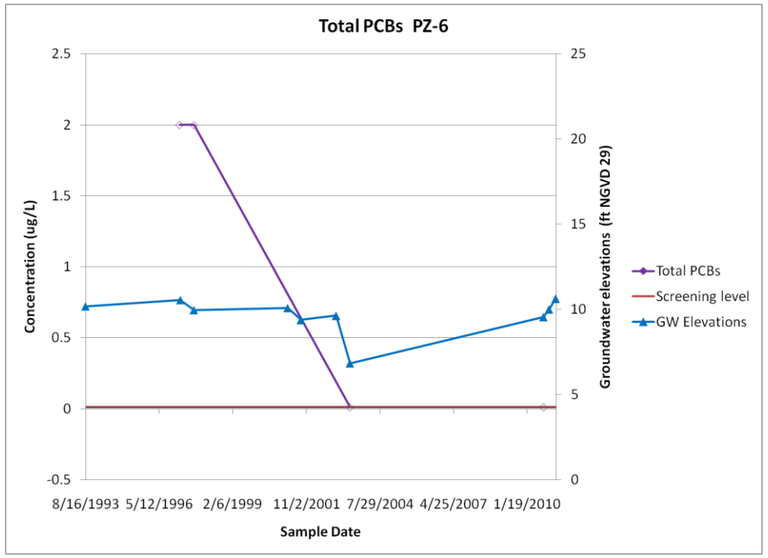
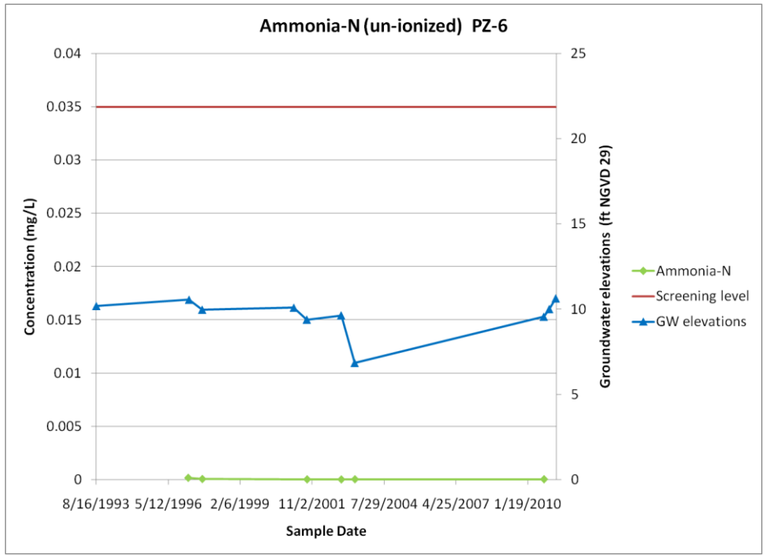
Contaminants of Concern and Hydrograph (PZ 5)

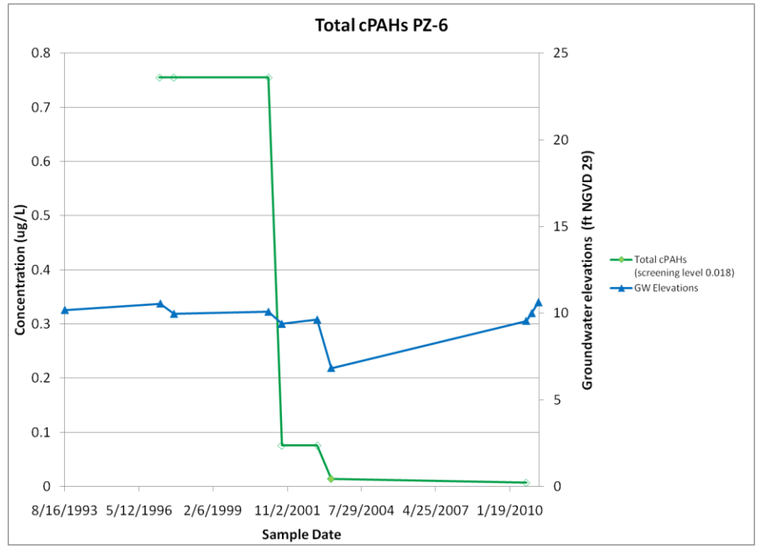
Port Angeles Rayonier Mill
Port Angeles, Washington

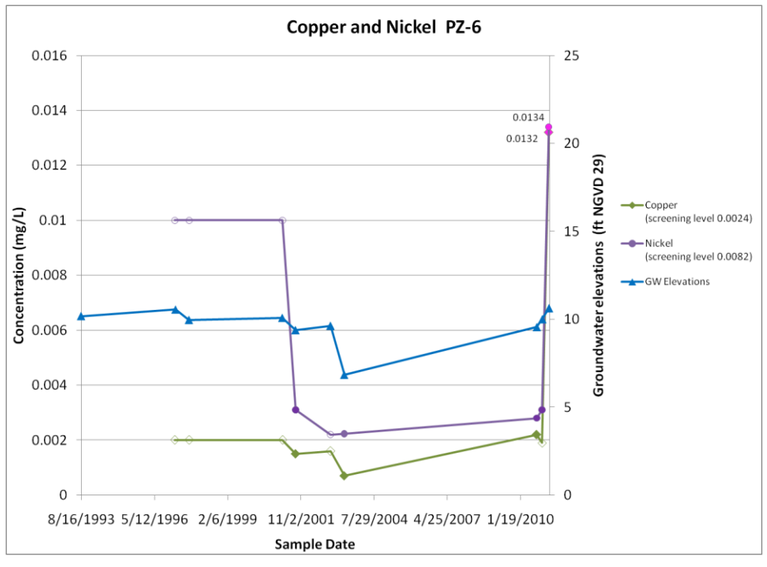
GeoEngineers

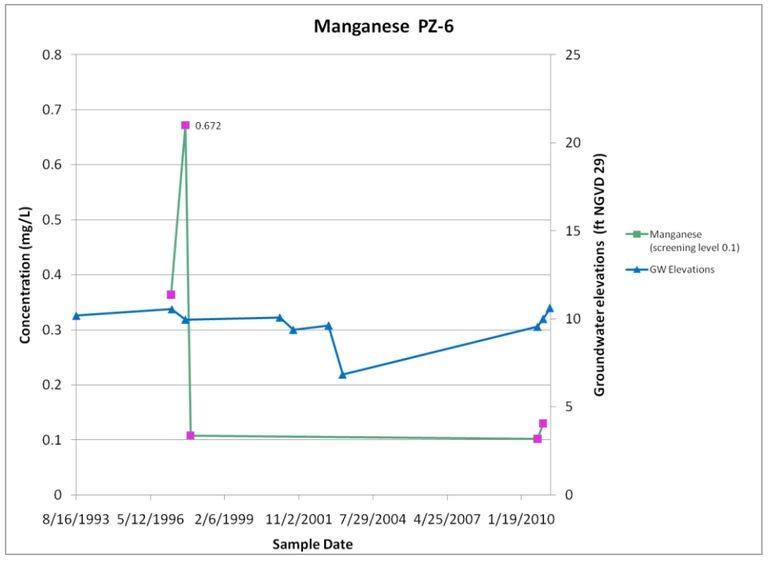
Figure E-51











Legend

Open symbol indicates non-detected result

Filled symbol indicates detected result

Pink symbol indicates detected result above screening level

Notes:

1. For metals trend plots, plotted data generally represent dissolved metals results (filtered samples); for sampling events where only total metals (unfiltered samples) were analyzed, the totals data are plotted.
2. Only metals and individual SVOCs with at least one screening level exceedance are shown in this figure.
3. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

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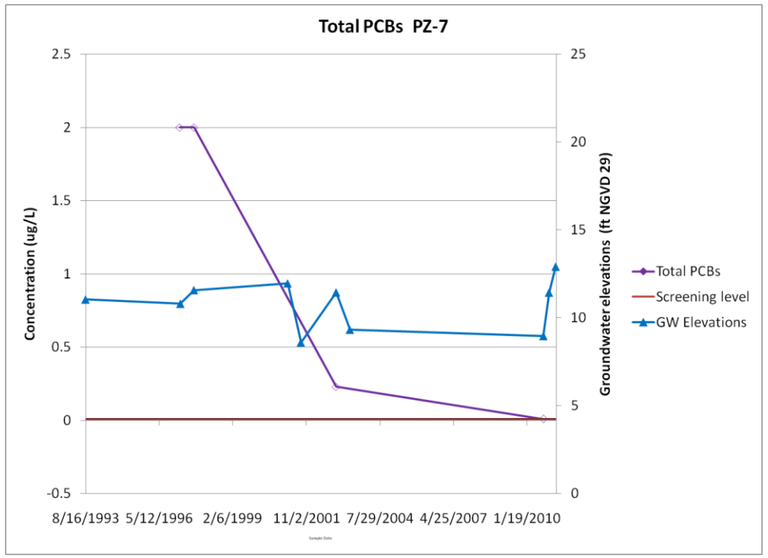
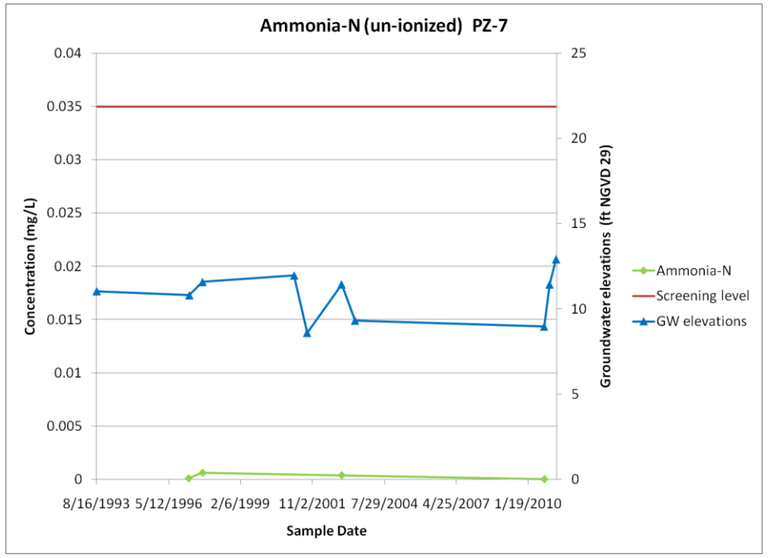
Contaminants of Concern and Hydrograph (PZ 6)

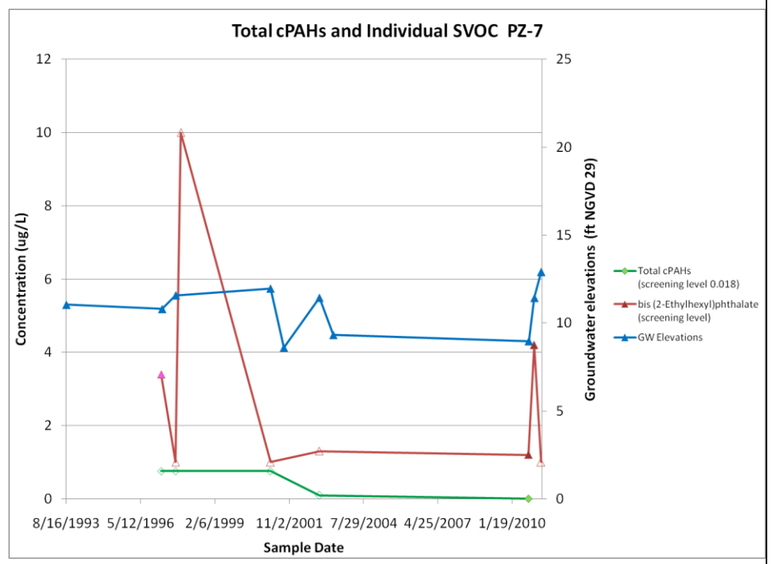
Port Angeles Rayonier Mill
Port Angeles, Washington

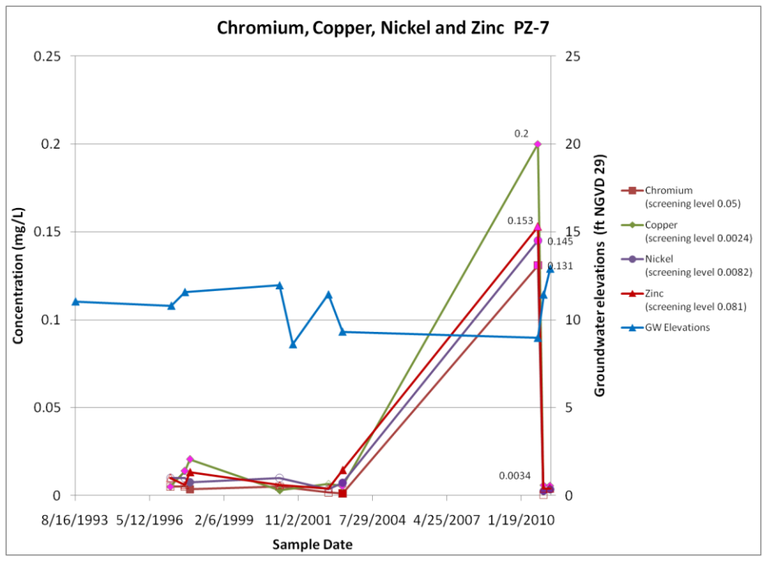
GeoEngineers

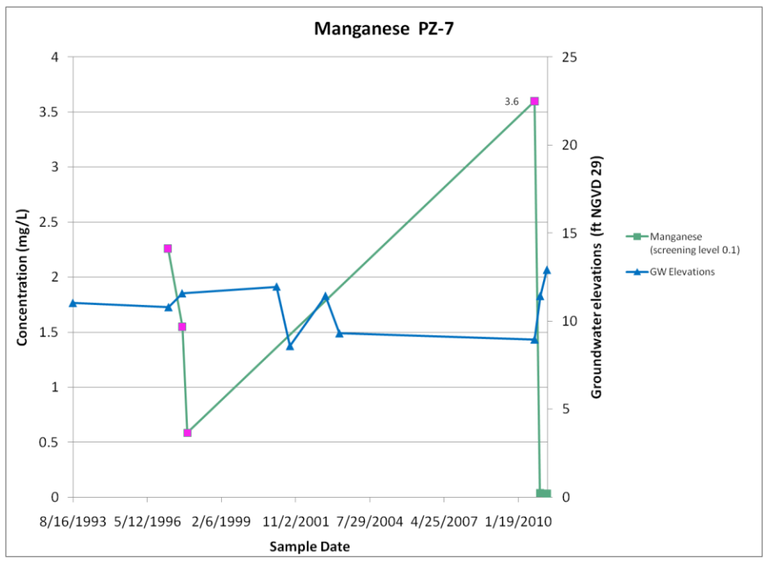
Figure E-52

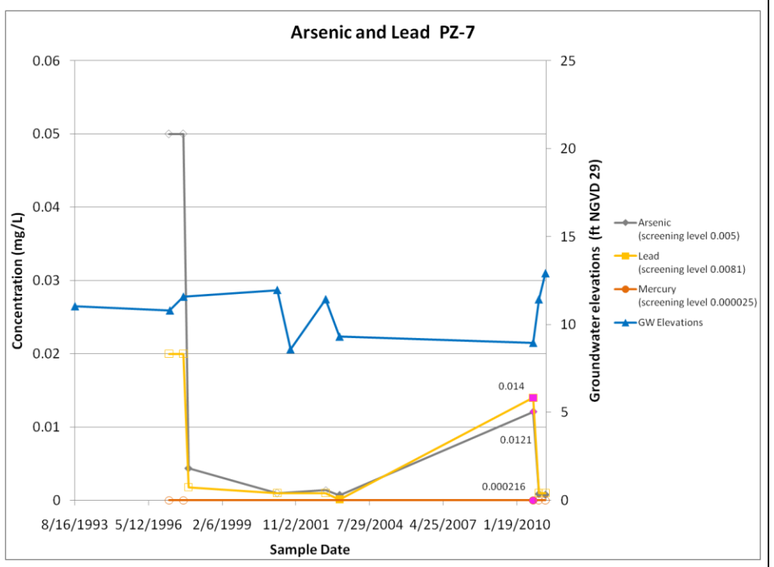












Legend

Open symbol indicates non-detected result

Filled symbol indicates detected result

Pink symbol indicates detected result above screening level

Notes:

1. For metals trend plots, plotted data generally represent dissolved metals results (filtered samples); for sampling events where only total metals (unfiltered samples) were analyzed, the totals data are plotted.
2. Only metals and individual SVOCs with at least one screening level exceedance are shown in this figure.
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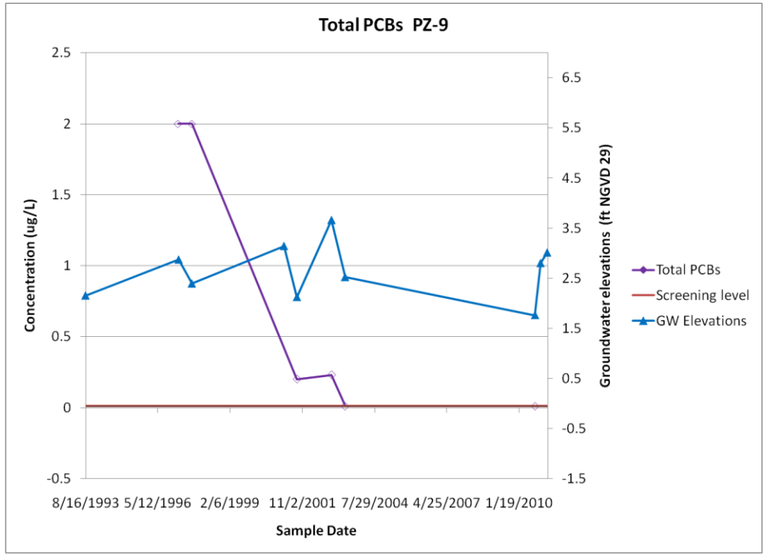
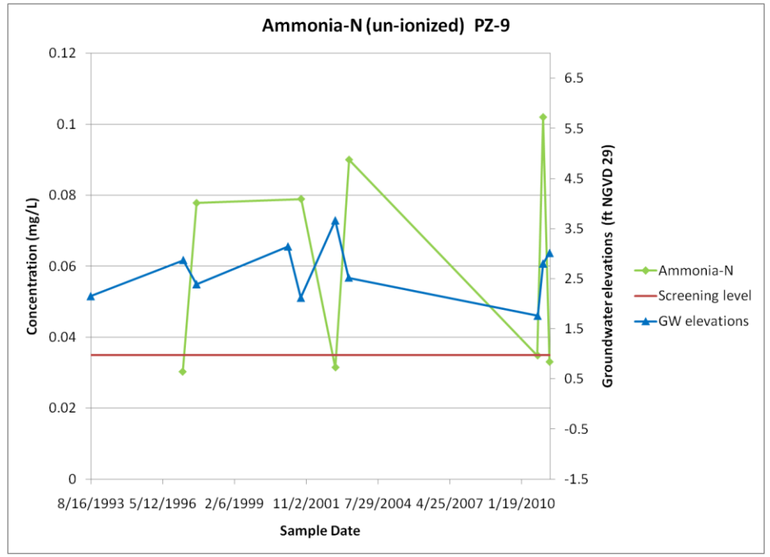
Contaminants of Concern and Hydrograph (PZ 7)

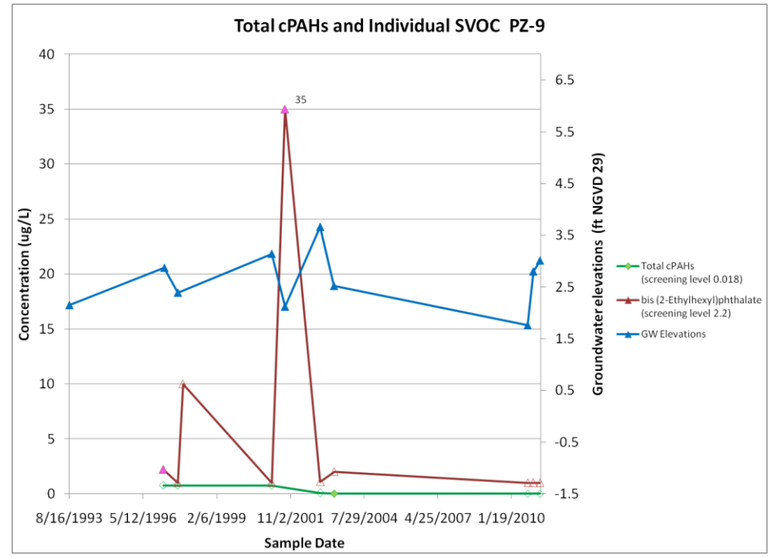
Port Angeles Rayonier Mill
Port Angeles, Washington

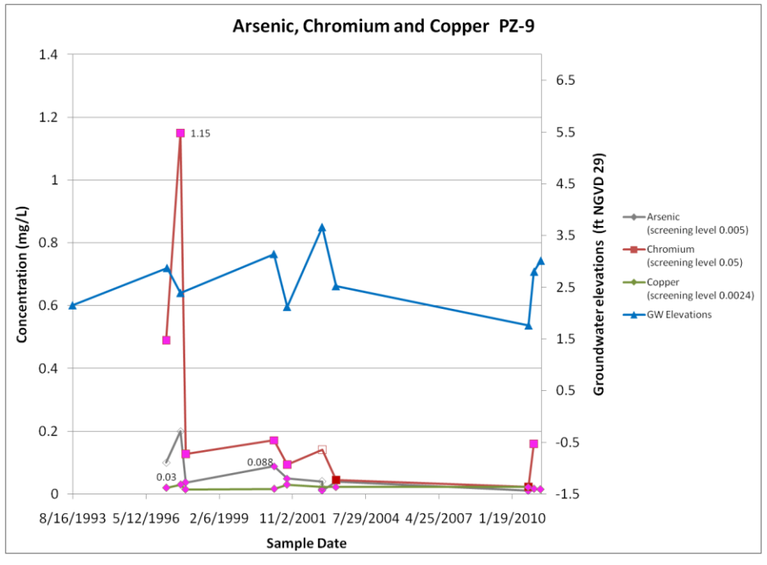
GeoEngineers

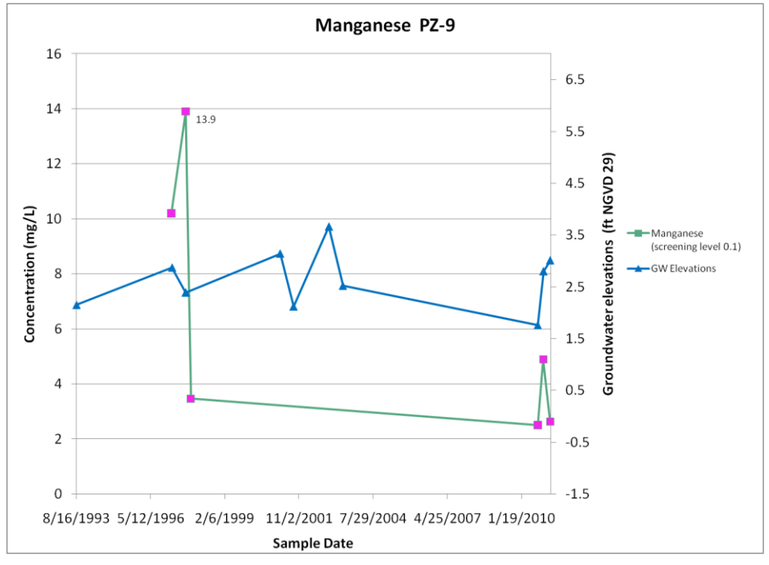
Figure E-53











Legend

Open symbol indicates non-detected result

Filled symbol indicates detected result

Pink symbol indicates detected result above screening level

Notes:

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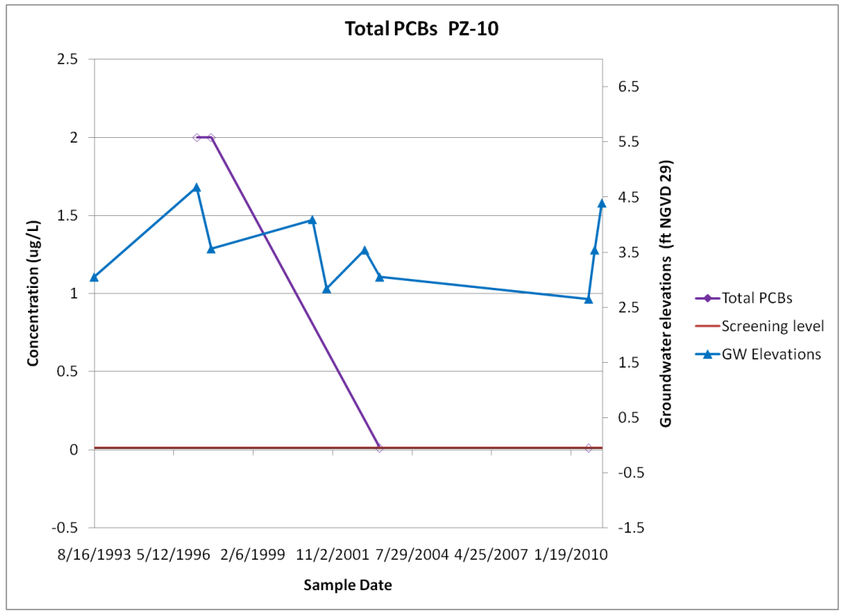
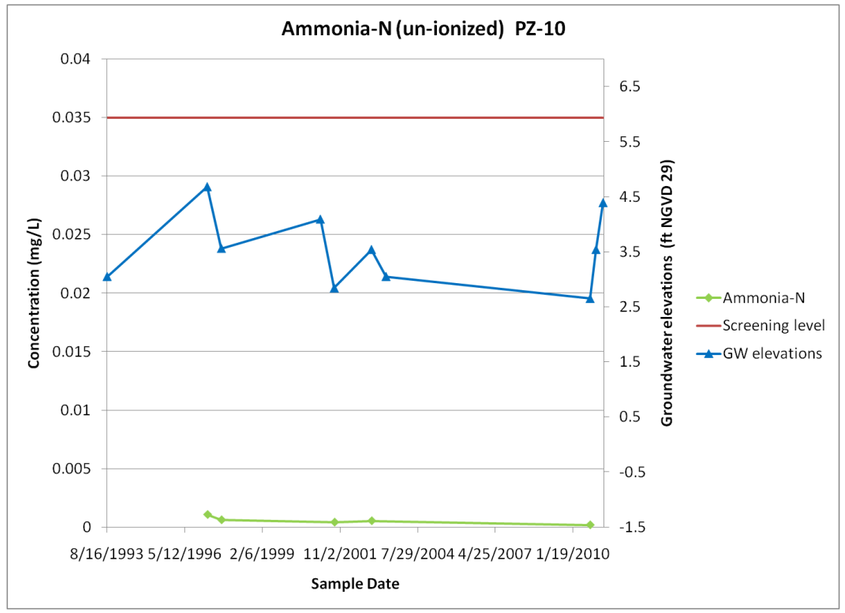
Contaminants of Concern and Hydrograph (PZ 9)

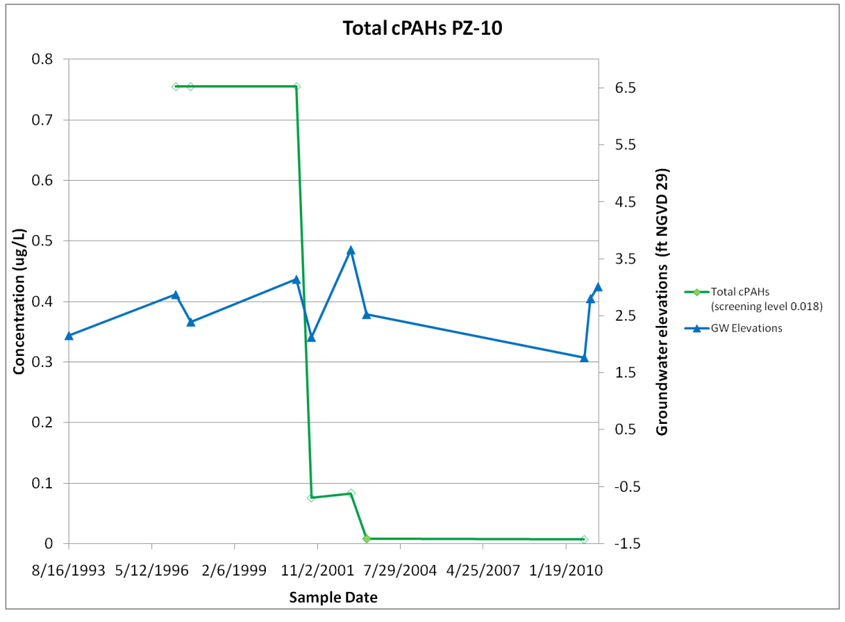
Port Angeles Rayonier Mill
Port Angeles, Washington

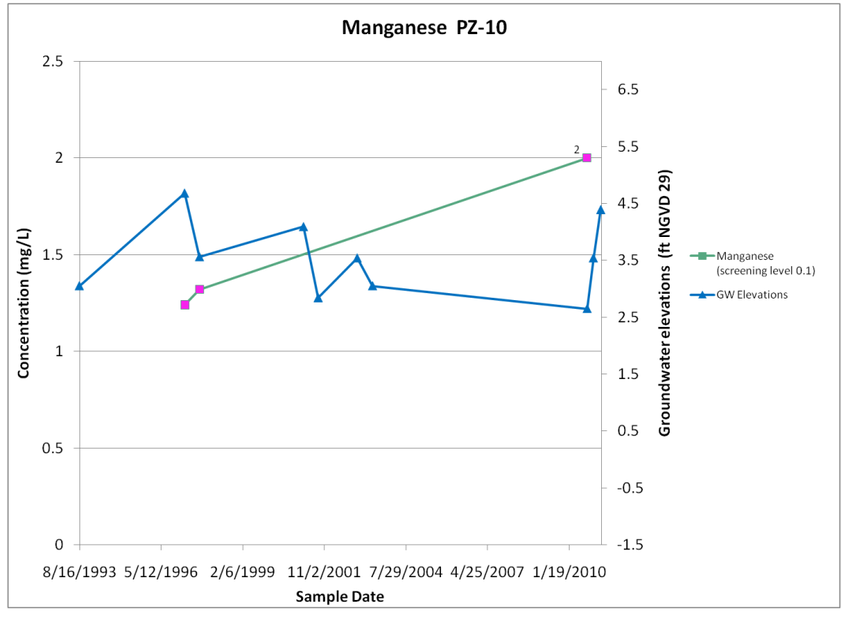
GeoEngineers

Figure E-54









Legend

Open symbol indicates non-detected result

Filled symbol indicates detected result

Pink symbol indicates detected result above screening level

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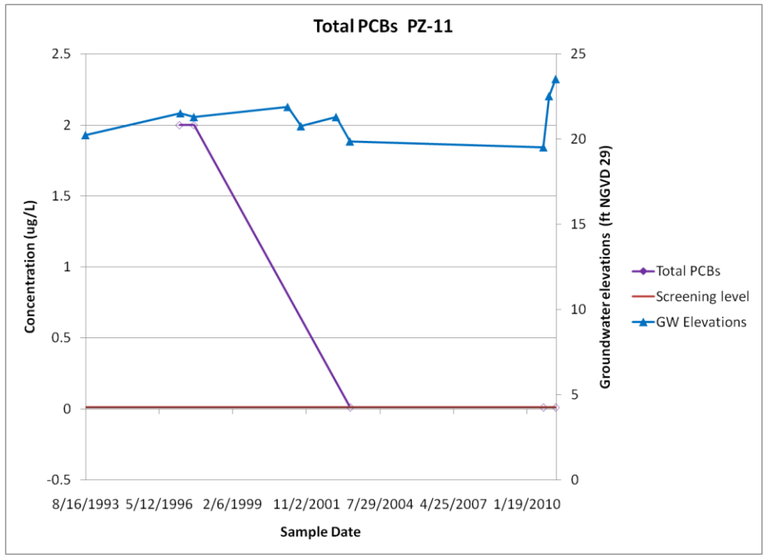
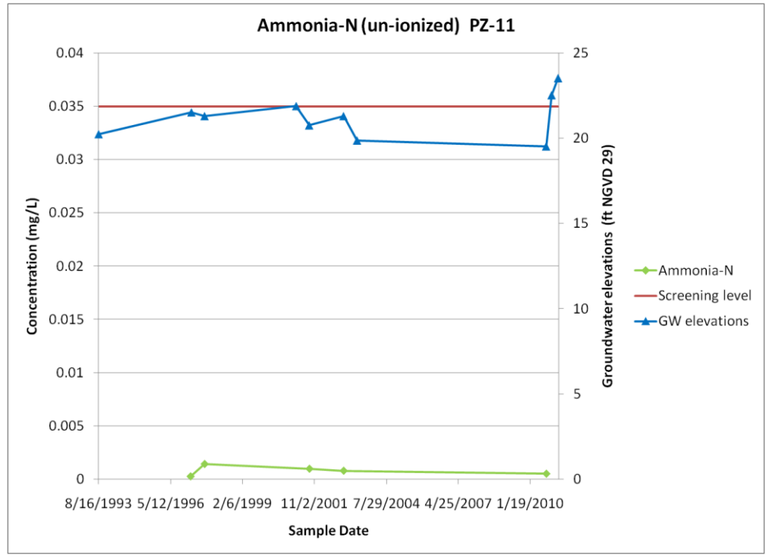
Contaminants of Concern and Hydrograph (PZ 10)

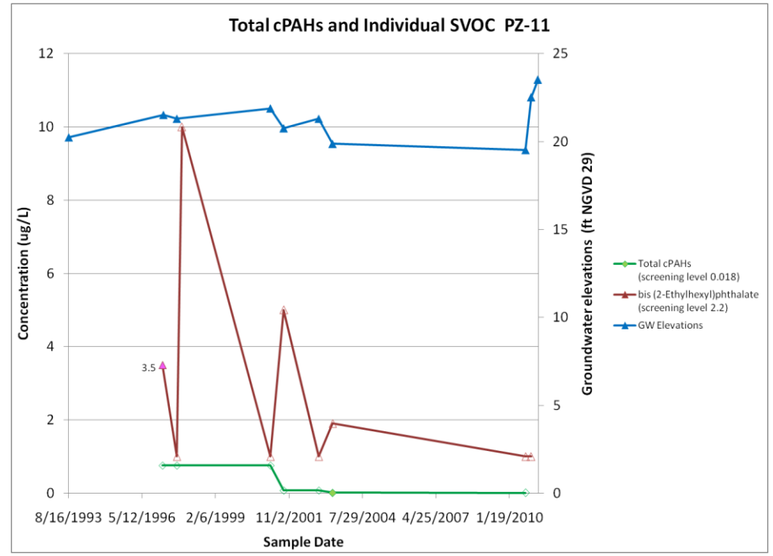
Port Angeles Rayonier Mill
Port Angeles, Washington

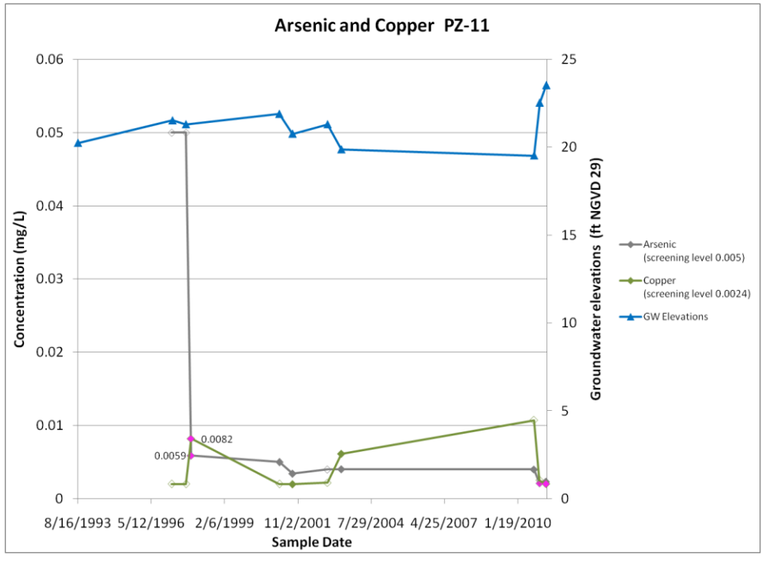
GeoEngineers

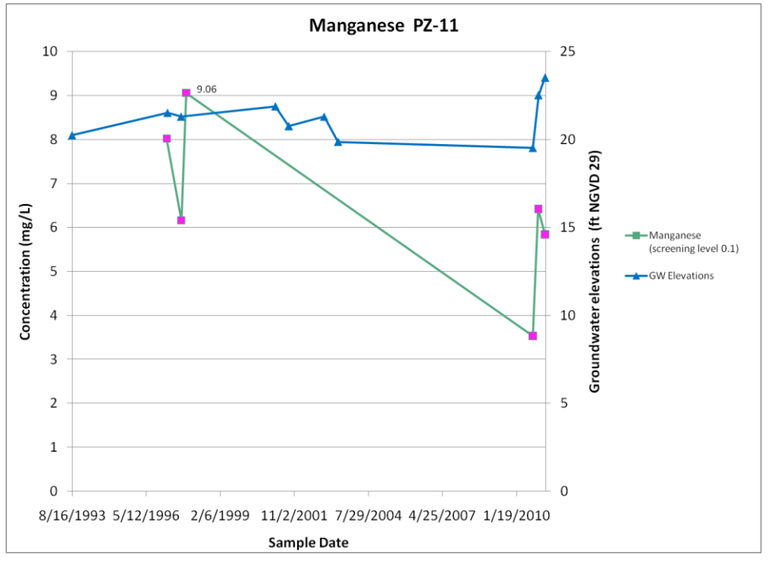
Figure E-55











Legend

Open symbol indicates non-detected result

Filled symbol indicates detected result

Pink symbol indicates detected result above screening level

Notes:

1. For metals trend plots, plotted data generally represent dissolved metals results (filtered samples); for sampling events where only total metals (unfiltered samples) were analyzed, the totals data are plotted.
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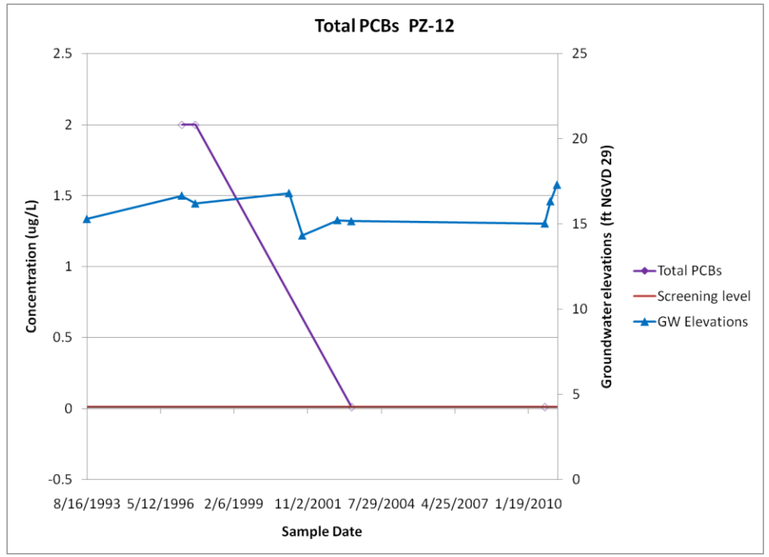
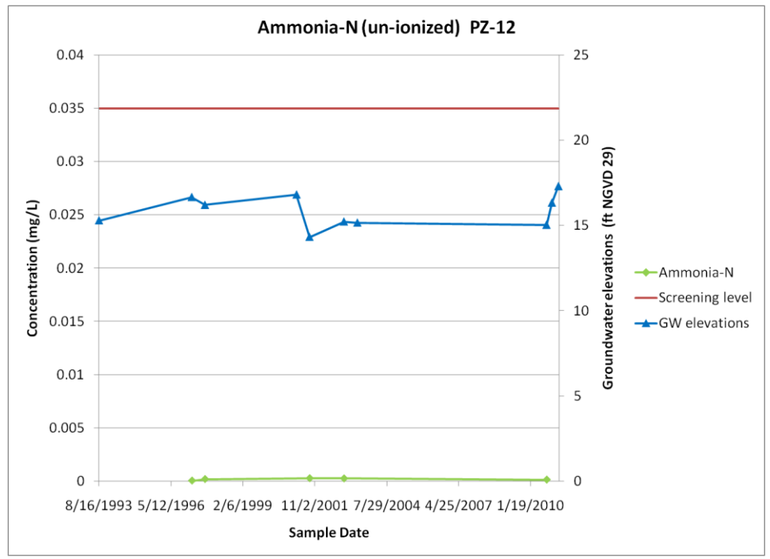
Contaminants of Concern and Hydrograph (PZ 11)

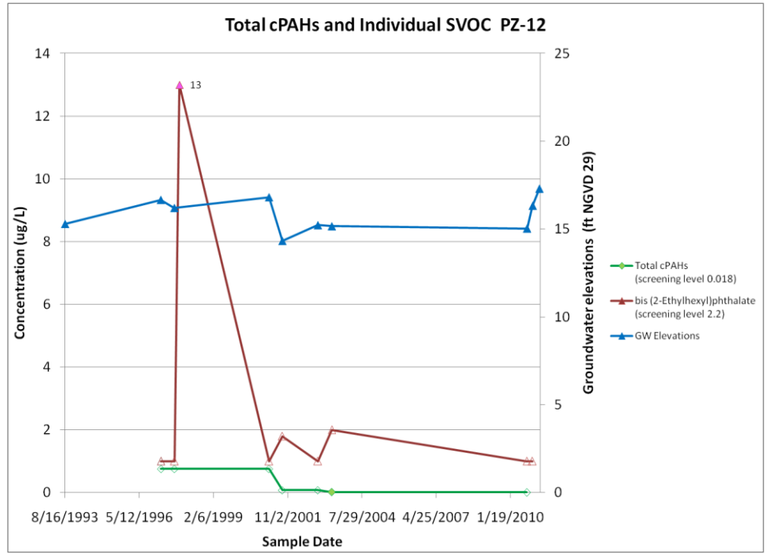
Port Angeles Rayonier Mill
Port Angeles, Washington

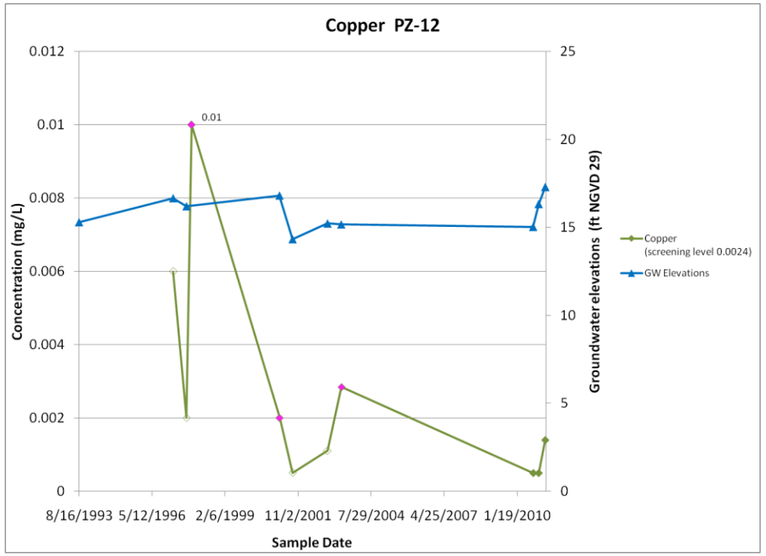
GeoEngineers

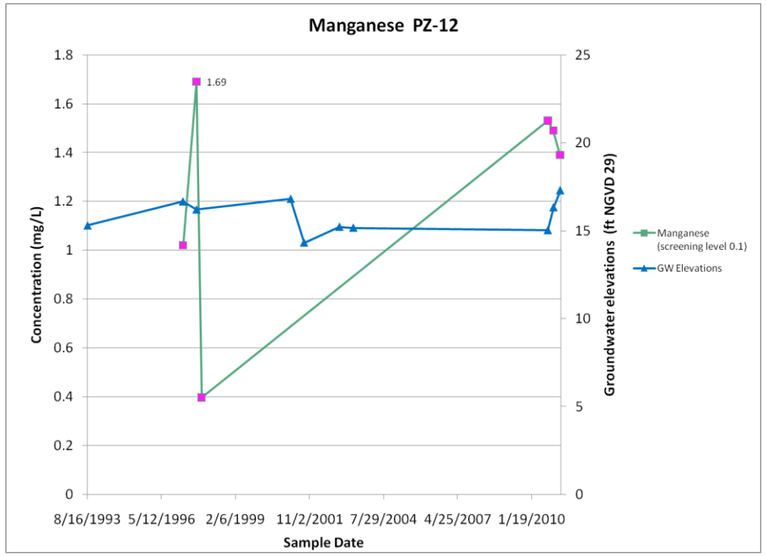
Figure E-56











Legend

Open symbol indicates non-detected result

Filled symbol indicates detected result

Pink symbol indicates detected result above screening level

Notes:

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2. Only metals and individual SVOCs with at least one screening level exceedance are shown in this figure.
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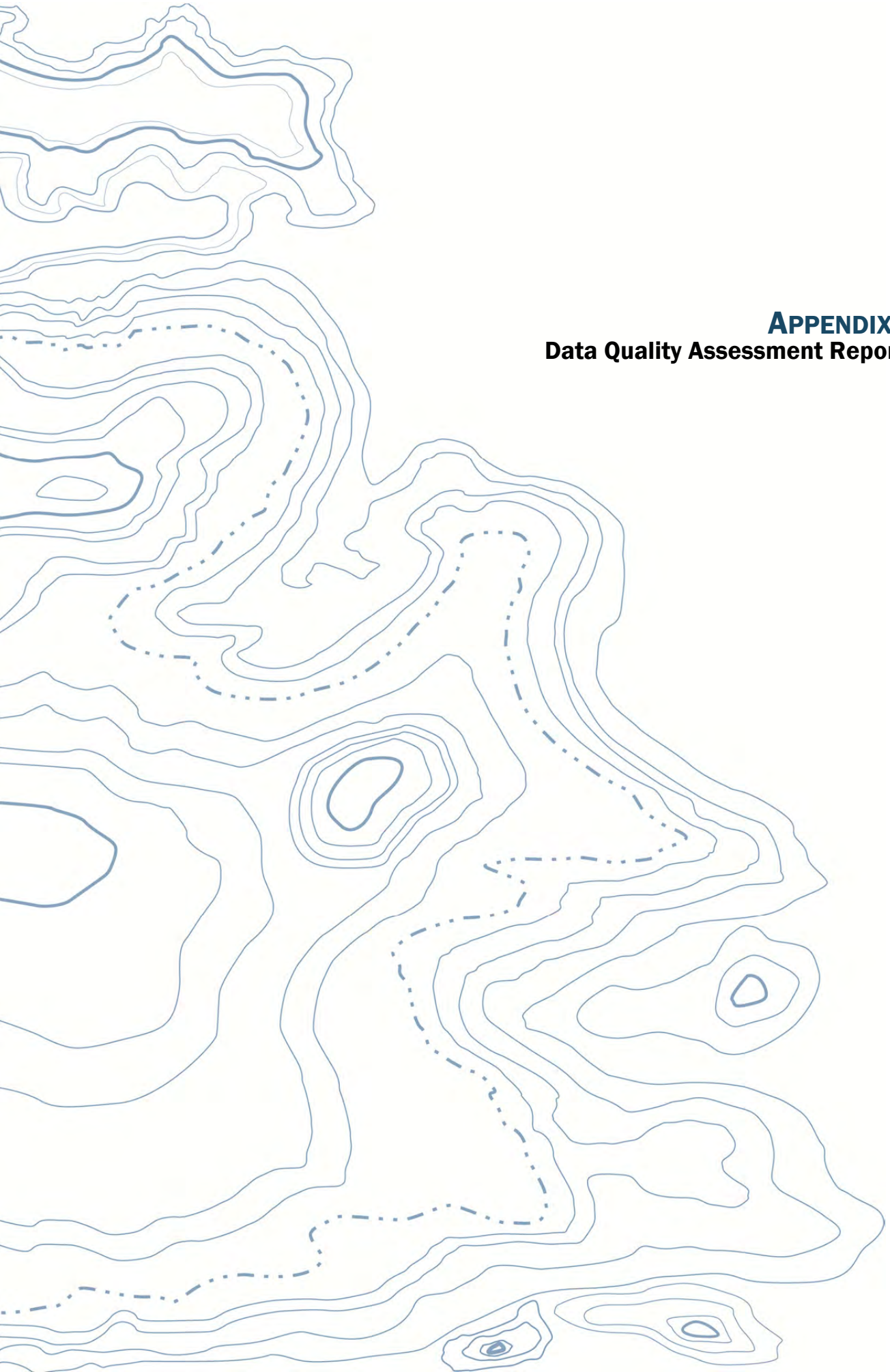
Contaminants of Concern and Hydrograph (PZ 12)

Port Angeles Rayonier Mill
Port Angeles, Washington

GeoEngineers

Figure E-57



APPENDIX F
Data Quality Assessment Reports

DATA QUALITY ASSESSMENT SUMMARY

DIOXINS/FURANS EPA 1613, VOLATILES BY METHOD SW8260, SEMIVOLATILES BY METHOD SW8270, PAHS BY METHOD SW8270-SIM, PESTICIDES BY METHOD SW8081, PCBS BY METHOD SW8082, TOTAL METALS (INCLUDING MERCURY) BY METHOD EPA6010, 200.8, 7471A, TOTAL PETROLEUM HYDROCARBONS BY METHODS NWTPH-GX AND NWTPH-DX

ARI Laboratory SDG (Frontier SDG)	Samples Validated (Bold indicates the sample was qualified)
RK98 (6327)	**MW-23, MW-52, MW-28, MW-29, RINSE082510, MW-51, PZ-3, MW-53, MW-57, PZ-9, PZ-10, RINSE082610, DUP082610, MW-58, MW-59,** TB082510GRL, TB082610GRL, and TB082710GRL
RL06 (6328)	**PZ-12, PZ-6, PZ-5**, and TRIP BLANK
RK99 (6329)	**PZ-11, PZ-7,** RINSE082710, **MW-55, MW-54, MW-56, PA-19,** SW-1, SW-2, SW-3, SW-4, SW-5, **PZ-2,** PZ-4, TB082510JBA, TB082610JBA, TB082710JBA, **RINSE-082710**

PROJECT: RAYONIER MILL (00137-015-03)

This report documents the results of an EPA level III data validation of analytical data from the analyses of groundwater and surface water samples and the associated laboratory quality control (QC) samples. This standard review included the following:

- Chain of Custody
- Holding Times
- Surrogates
- Method Blanks, Equipment Rinsate Blanks, and Trip Blanks
- Laboratory Control Samples/Laboratory Control Sample Duplicates
- Matrix Spikes/Matrix Spike Duplicates
- Laboratory and Field Duplicates
- Internal Standards
- DDT/Endrin Breakdown confirmations (Pesticides only)
- Instrument Initial Calibrations (ICALs)
- Instrument Continuing Calibrations (CCALs)
- Instrument Tunes
- Three HRGC/HRMS system performance checks (Dioxins/Furans only)
    1. Mass Calibration and Resolution

2. Selected Ion Monitoring switching times
3. GC Resolution

DATA PACKAGE COMPLETENESS

ARI, located in Tukwila, Washington, was the primary sub-contracted laboratory analyzing the samples evaluated as part of this data validation review. ARI analyzed all chemical parameters, with the exception of the dioxin/furan analyses. Frontier Analytical Laboratory in El Dorado Hills, California, as sub-contracted through ARI, conducted the Dioxin/Furan analyses. Both laboratories provided all required deliverables for the validation according to the National Functional Guidelines. Both laboratories followed adequate corrective action processes and all identified anomalies were discussed in the representative case narratives.

The following sections discuss the data. Based on the review, qualification of the laboratory data was performed because of no secondary column confirmation being performed at low levels in the dioxin analysis.

Based on this validation, data were qualified because of surrogate %R values, LCS/LCSD & MS %R outliers, and continuing calibration %D outliers, and because of no secondary column confirmation being performed at low levels in the dioxin analysis.

Based on this validation, data were rejected because of volatile temperature and holding time outliers, and an MS %R value being less than 10%.

OBJECTIVE

The objective of the data validation was to review laboratory analytical procedures and quality control (QC) results to evaluate whether:

- The samples were analyzed using well-defined and acceptable methods that provide detection limits below applicable regulatory criteria;
- The precision and accuracy of the data are well defined and sufficient to provide defensible data; and
- The quality assurance/quality control (QA/QC) procedures utilized by the laboratory meet acceptable industry practices and standards.

DATA QUALITY ASSESSMENT SUMMARY

The results for each of the QC elements are summarized below. The data assessment was performed using guidance in the USEPA Contract Laboratory Program *National Functional Guidelines for Inorganic Data Review* (USEPA 2002) and USEPA Contract Laboratory Program *National Functional Guidelines for Organic Data Review* (USEPA 2008).

Chain-of-Custody Documentation

Chain-of-custody (COC) forms were provided with the laboratory analytical reports. There were no anomalies noted on the COC forms; proper COC protocols appear to have been followed for this sampling event.

Holding Times

The holding time is defined as the time that elapses between sample collection and sample analysis. Maximum holding time criteria exist for each analysis to help ensure that the analyte concentrations found at the time of analysis reflect the concentration present at the time of sample collection. Established holding times were met for the analysis, with the following exceptions:

SDG RK99 (Volatiles): Sample RINSE-082710 was analyzed 4 days outside of the maximum hold time of 14 days. The laboratory noted in the case narrative that the sample containers had been stored at room temperature for at least 24 hours prior to the analysis. There were no positive results for any target analytes in the sample. Therefore, all reporting limits were rejected (R) because of the combined effect of the outliers on a volatile analysis.

SDG RK99 (Semivolatiles): Samples SW-4 and PZ-11 were analyzed 4 days outside of the holding time of 7 days. There were no positive results for any target analytes in these samples. All reporting limits were qualified as estimated (UJ) in these samples.

Surrogate/Labeled Compound Recoveries

A surrogate compound is a compound that is chemically similar to the analytes of interest, but unlikely to be found in any environmental sample. Surrogates are used for organic analyses and are added to all samples, standards, and blanks to serve as an accuracy and specificity check of each analysis. The surrogates are added at a known concentration and percent recoveries are calculated following analysis. All surrogate recoveries for field samples were within the laboratory control limits, with the exception below:

SDG RK98 (Semivolatiles): The percent recovery (%R) for one of four base/neutral surrogates, d4-1,2-dichlorobenzene, was less than the lower control limit (32%) in Sample MW-51. As the %R values in the other three base-neutral surrogates were within the control limits, and the outlier was not less than 10%, no action was taken.

SDG RK98 (Pesticides): The %R for the surrogate tetrachloromethylxylene (TCMX) was less than the lower control limit (30%) in Sample MW-57. There were no positive results for any target analytes in the sample. Therefore, the reporting limits for all target analytes were qualified as estimated (UJ) in this sample.

SDG RK98 (PCBs): The %R for the surrogate tetrachloromethylxylene (TCMX) was less than the lower control limit (30%) in Sample MW-57. There were no positive results for any target analytes in the sample. Therefore, the reporting limits for all target analytes were qualified as estimated (UJ) in this sample.

Method Blanks & Equipment Rinsate Blanks

Method blanks are analyzed to ensure that laboratory procedures and reagents do not introduce measurable concentrations of the analytes of interest. Method blanks were analyzed with each batch of samples, at a frequency of one per twenty samples. For all sample batches, method blanks for all applicable methods were analyzed at the required frequency.

None of the analytes of interest were detected above the reporting limits in any of the method blanks.

Equipment rinsate blanks are analyzed to provide an indication as to whether field decontamination and sampling procedures effectively prevent cross-contamination in field activities. Three equipment rinsate blanks were collected: RINSE082510, RINSE082610, and RINSE082710.

SDG RK98, RK99, RL06 (Metals): There was a positive result for manganese in the Equipment Blank RINSE082510. The positive results for manganese in the associated field samples were all greater than the appropriate action levels. No qualifiers were required.

Dioxin/Furans by 1613: There was a positive result for OCDD in the equipment blank RINSE082510 at a level that was below the QAPP required reporting limit of 10 pg/L. No further action was necessary.

Trip blanks are analyzed to provide an indication as to whether volatile compounds have cross-contaminated other like samples within the transportation process to the laboratory. Typically, samples are stored in a cooler for as much as 24 hours before arriving at the laboratory. Seven trip blanks were collected: TB082510GRL, TB082610GRL, TB082710GRL, TB082510JBA, TB082610JBA, TB082710JBA, and TRIP BLANK. None of the volatiles analytes were detected above the reporting limits in any of the trip blanks.

Matrix Spikes/Matrix Spike Duplicates (MS/MSD)

Because actual analyte concentration in environmental samples is not known, the accuracy of a particular analysis is usually inferred by performing a matrix spike (MS) analysis. One aliquot of sample is analyzed in the normal manner, than a second aliquot of the sample is spiked with a known amount of analyte concentration and analyzed. From these analyses, a percent recovery (%R) is calculated. Matrix spike duplicates (MSD) analyses are generally performed for organic analyses as a precision check. For some organic analytical methods, such as NWTPH-Dx, a laboratory control sample/ laboratory control sample duplicate (LCS/LCSD) sample set is performed in lieu of a MS/MSD analysis.

For inorganics methods, the matrix spike (referred to as a "spiked sample" is typically followed by a post spike sample if any element recoveries were outside the control limits in the "spike sample". In this case, the laboratory did not analyze a post spike sample. No other action was taken other than to note it here.

Matrix spike analyses should be performed once per analytical batch or every twenty field samples, whichever is more frequent. The recovery criteria for matrix spikes and laboratory control samples are specified in the laboratory documents as are the relative percent difference values. The frequency requirements were met for all analyses, and the %R/RPD values were within the proper control limits, with the following exceptions:

SDG RK98, RK99, RL06 (Metals): A single MS sample was performed on Sample PZ-9. There was no recovery for total manganese in this QC sample. There was no positive result for this compound in the parent sample. The parent concentration of total manganese was greater than four times the concentration spiked into the sample, no qualifiers were required.

SDG RK98: (SVOCs) A single MS sample was performed on Sample PZ-9. The MS %R values for N-Nitrosodiphenylamine was less than the control limit of 60%. There was no positive result for this compound in the parent sample. The reporting limits for N-Nitrosodiphenylamine were qualified (UJ) in the parent sample. Also, there was no recovery for 3,3'-Dichlorobenzidine in the same MS sample. As there was no positive result for this compound in the parent sample, the reporting limit for 3,3'-Dichlorobenzidine was rejected (R) in the parent sample.

SDG RK98: (Pesticides) A MS/MSD sample set was performed on Sample PZ-9. The %R values for 13 compounds exceeded their respective control limits. There were no positive results for these compounds in the parent sample. The reporting limits for all 13 compounds were qualified (UJ) in the parent sample only. The list of the 13 compounds are listed below:

4,4'DDE , 4,4'DDT, 4,4'DDD , Alpha-BHC, Delta-BHC, Heptachlor, Aldrin, Heptachlor Epoxide, Dieldrin, Endrin, Endosulfan II, Endosulfan Sulfate, Methoxychlor

Laboratory Control Samples/ Laboratory Control Sample Duplicates (LCS/LCSD)

A laboratory control sample is essentially a blank sample that is spiked with a known amount of analyte concentration and analyzed. It is to be treated much like a matrix spike, without the possibility for matrix interference. As there is no actual sample matrix in the analysis, the analytical expectations for accuracy

and precision are usually more rigorous and qualification would apply to all samples in the batch, instead of the parent sample only.

Laboratory control sample analyses should be performed once per analytical batch or every twenty field samples, whichever is more frequent. The recovery criteria for laboratory control samples are specified in the laboratory documents as are the relative percent difference values. The frequency requirements were met for all analyses, and the %R/RPD values were within the proper control limits, with the following exceptions:

SDG RK98 & RL06: (SVOCs) The %R values for N-Nitrosodiphenylamine were less than the control limit of 60% in the LCS/LCSD samples extracted on 8/30/10. There were no positive results for this compound in the associated batched samples. The reporting limits for N-Nitrosodiphenylamine were qualified (UJ) in all of the associated samples.

SDG RK98: (Pesticides) The %R values for delta-BHC, endosulfan II, endosulfan sulfate, and endrin aldehyde were less than the control limits of 30%, 68%, 60%, and 27% in the LCS sample extracted on 8/31/10. There were no positive results for these compounds in the associated batched samples. The reporting limits for delta-BHC, endosulfan II, endosulfan sulfate, and endrin aldehyde were qualified (UJ) in all of the associated samples.

SDG RL06: (Pesticides) The %R values for delta-BHC was less than the control limit of 30%in the LCS sample extracted on 9/2/10. There were no positive results for this compound in the associated batched samples. The reporting limits for delta-BHC were qualified (UJ) in all of the associated samples.

SDG RK99: (Pesticides) The %R values for delta-BHC and endosulfan sulfate were less than the control limits of 59%, and 60% in the LCS/LCSD sample set extracted on 9/7/10. There were no positive results for these compounds in the associated batched samples. The reporting limits for delta-BHC and endosulfan sulfate were qualified (UJ) in all of the associated samples.

Laboratory Duplicates (Inorganics analyses only)

Internal laboratory duplicate analyses are performed to monitor the precision of the analyses. Two separate aliquots of a sample are analyzed as distinct samples in the laboratory, and the RPD between the two results is calculated. Duplicate analyses should be performed once per analytical batch. If one or more of the samples used has a concentration greater than five times the reporting limit for that sample, the absolute difference is used instead of the RPD.

Laboratory duplicates were analyzed at the proper frequency and the specified acceptance criteria were met in all cases.

Field Replicates/Duplicates

Field duplicate samples were collected and analyzed along with the reviewed sample batches. The duplicate samples were analyzed for the same parameters as the associated parent samples. As mentioned above for the laboratory duplicates the RPD is used as the criteria for assessing precision, unless one or more of the samples used has a concentration greater than five times the reporting limit for that sample, the absolute difference is used instead of the RPD.

SDG RK98: One set of field duplicates, Samples PZ-9 and DUP082610, was submitted to the laboratory. All RPD and absolute difference values were within the control limits.

Pesticide Breakdown Check Standards

The laboratory analyzed a DDT Breakdown check standard at the beginning and end of every analytical

batch, All of the % breakdown results were greater than the control limit of 20 %.

Internal Standards (Low Resolution Mass Spectrometry)

Like the surrogate, an internal standard is a compound that is chemically similar to the analytes of interest, but unlikely to be found in any environmental sample. Internal standards are used only for the mass spectrometry (MS) instrumentation and are usually added to the sample aliquot after extraction has taken place. The internal standard should be analyzed at the beginning of a 12 hour sample run and the control limits for internal standard recoveries are -50% to +100% of the calibration standard. All internal standard recoveries were within the control limits.

Initial Calibrations (ICALs)

All initial calibrations were conducted according to the laboratory methods, and consisted of the appropriate number of standards. For the organics analyses, all percent relative standard deviation (%RSD) values were less than +/- 30% and all relative response factors (RRF) were greater than 0.05.

Continuing Calibration (CCALs)

All continuing calibrations were conducted according to the laboratory methods, and consisted of the appropriate number of standards. For the organics analyses, all percent difference (%D) values were less than +/- 25% and all relative response factors (RRF) were greater than 0.05, with the following exceptions:

SDG RK99 (PAHs): The percent difference (%D) values for pyrene were greater than the control limits of ±25% in the continuing calibration (CCAL) standards analyzed on 9/21/10 and 9/22/10. As this outlier is indicative of a high bias, only the positive results for this compound were qualified as estimated (J) in Samples MW-54, MW-55, MW-56, PA-19, PZ-2, PZ-7, and PZ-11.

Additional Data Quality Issues

The positive results for 2,3,7,8-TCDF were qualified as estimated (J) in Samples MW-23 and PZ-4 because this compound was not confirmed by a secondary column by the laboratory. The positive result for the corresponding TEC value was also qualified as estimated (J).

OVERALL ASSESSMENT

As was determined by this data validation, the laboratory followed the specified analytical methods. Accuracy was acceptable, as demonstrated by the surrogate, LCS/LCSD and MS/MSD %R values, with the exceptions below. Precision was also acceptable, as demonstrated by the LCS/LCSD, MS/MSD, and field duplicate RPD and absolute difference values, with the exceptions below:

Based on this validation, data were qualified because of surrogate %R values, LCS/LCSD & MS %R outliers, and continuing calibration %D outliers, and because of no secondary column confirmation being performed at low levels in the dioxin analysis.

Based on this validation, data were rejected because of volatile temperature and holding time outliers, and an MS %R value being less than 10%.

In general, the data are acceptable for use as qualified.

DATA QUALITY ASSESSMENT SUMMARY

DIOXINS/FURANS EPA 1613, VOLATILES BY METHOD SW8260, SEMIVOLATILES BY METHOD SW8270, PAHS BY METHOD SW8270-SIM, PESTICIDES BY METHOD SW8081, PCBS BY METHOD SW8082, CHLOROPHENOLS BY METHOD SW8041, TOTAL METALS (INCLUDING MERCURY) BY METHOD EPA6010, 200.8, 7471A TOTAL PETROLEUM HYDROCARBONS BY METHODS NWTPH-GX AND NWTPH-DX

ARI Laboratory SDG (Frontier SDG)	Samples Validated (Bold indicates the sample was qualified)
RT41, RT46	**MW-62-2-3.5, MW-62-5-6.5, MW-62-10-11.5, MW-62-15-16.5, MW-62-20-21.5,** MW-62-25-26.5, **SSB-2-2-3.5, SSB-2-5-6.5, SSB-2-10-11.5, SSB-2-15-16.5, SSB-2-20-20.5, SSB-2-21.25-21.5, DUPE1-102110**
RT40 (6433)	**MW-61-5-6.5, MW-61-10-11.5, MW-61-15-16.5, MW-61-20-21.25, MW-60-2-3.5, MW-60-10-11.5, MW-60-15-16.5, MW-60-20-20.75, MW-60-23-24.4, RB-10/18/10-W, RB-102110-W**
RT02	**SSB-3-2-3.5, SSB-3-10-11.5, SSB-3-15-16.5, SSB-3-20-21.5, SSB-3-25-26.5, SSB-3-27-28.5, RB-102210-W**
RU19 (6432)	SSB-1-7-8.5, SSB-1-10-11.5, SSB-1-15-16.5, **SSB-1-25-26.5**, SSB-20-21.5, DUPE2-102510
RU30, RU69, RU70	RB-102510-W, **RB-102610-W,** RB-102810-W, GWG-8-W
RS79	MW-63-23-24.5, MW-63-26-27.5
RU43, RU61 (6435, 6436)	SSB-10-2-3.5, SSB-10-5-6.5, SSB-10-10-11.5, **SSB-10-15-16.5, SSB-10-20-21.5, GWG-8-2-3.5, GWG-8-10-11.5, GWG-8-15-16.5, DUPE3-102810, SSB-7-2-3.5, SSB-7-10-11.5, SSB-7-20-21.5, SSB-7-25-26.5, SSB-7-30-30.75**
RV28, RV17 (6446)	GWG-1-2-3.5, GWG-1-5-6.5, GWG-1-7.5-9, GWG-1-10-11.5, GWG-1-15-16.5, GWG-1-20-21.5, GWG-6-2-3.5, GWG-6-5-6.5, GWG-6-10-11.5, GWG-7-2-3.5, GWG-7-5-6.5, GWG-7-7-8.5, GWG-5-2-3.5, GWG-5-5-6.5, GWG-5A-5-6.5, GWG-5A-10-11.5, GWG-5A-15-16.5, GWG-5A-20-21.5, GWG-5A-24-25.5, RB-110410, RB-110510-W
RV10, RV13 (6448)	**GWG-1-W**, GWG-2-W, **GWG-3-W**, GWG-4-W, **GWG-5-W**, GWG-6-W, GWG-7-W, RB-110210-W, RB-110310-W

PROJECT: RAYONIER MILL (00137-015-03)

This report documents the results of an EPA level III and EPA level IV (one SDG) data validation of analytical data from the analyses of soil and groundwater samples and the associated laboratory quality control (QC) samples. This standard review included the following:

- Chain of Custody
- Holding Times

- Surrogates/Labeled Compounds
- Method Blanks, Equipment Rinsate Blanks, and Trip Blanks
- Laboratory Control Samples/Laboratory Control Sample Duplicates
- Matrix Spikes/Matrix Spike Duplicates
- Laboratory and Field Duplicates
- Internal Standards (Mass Spectrometry)
- DDT/Endrin Breakdown and column confirmations (Pesticides only)
- Instrument Initial Calibrations (ICALs)
- Instrument Continuing Calibrations (CCALs)
- Instrument Tunes
- Three HRGC/HRMS system performance checks (Dioxins/Furans only)
    1. Mass Calibration and Resolution
    2. Selected Ion Monitoring switching times
    3. GC Resolution
- Reporting Limits
- 2,3,7,8-TCDF secondary column confirmation

DATA PACKAGE COMPLETENESS

ARI, located in Tukwila, Washington, was the primary sub-contracted laboratory analyzing the samples evaluated as part of this data validation review. ARI analyzed all chemical parameters, with the exception of the dioxin/furan analyses. Frontier Analytical Laboratory in El Dorado Hills, California, as sub-contracted through ARI, conducted the Dioxin/Furan analyses. Both laboratories provided all required deliverables for the validation according to the National Functional Guidelines. Both laboratories followed adequate corrective action processes and all identified anomalies were discussed in the representative case narratives.

OBJECTIVE

The objective of the data validation was to review laboratory analytical procedures and quality control (QC) results to evaluate whether:

- The samples were analyzed using well-defined and acceptable methods that provide detection limits below applicable regulatory criteria;
- The precision and accuracy of the data are well defined and sufficient to provide defensible data; and
- The quality assurance/quality control (QA/QC) procedures utilized by the laboratory meet acceptable industry practices and standards.

DATA QUALITY ASSESSMENT SUMMARY

The results for each of the QC elements are summarized below. The data assessment was performed using guidance in the USEPA Contract Laboratory Program *National Functional Guidelines for Inorganic Data Review* (USEPA 2002) and USEPA Contract Laboratory Program *National Functional Guidelines for Organic Data Review* (USEPA 2008), National functional Guidelines for Chlorinated Dibenzo-p-Dioxins (CDDs) and Chlorinated Dibenzofurans (CDFs) (USEPA 2005).

Chain-of-Custody Documentation

Chain-of-custody (COC) forms were provided with the laboratory analytical reports. There were no anomalies noted on the COC forms; proper COC protocols appear to have been followed for this sampling event.

Holding Times

The holding time is defined as the time that elapses between sample collection and sample analysis. Maximum holding time criteria exist for each analysis to help ensure that the analyte concentrations found at the time of analysis reflect the concentration present at the time of sample collection. Established holding times were met for the analysis, with the following exceptions:

SDG RT40 (Semivolatiles, CPAHs, & Pesticides): The Rinse Blank RB-10/18/10-W was analyzed 3 days outside of the holding time of 7 days. There were no positive results for any semivolatile, CPAH, or pesticides target analytes in this sample. All reporting limits for these three analyses were qualified as estimated (UJ) in this sample.

SDG RU19 (Pesticides): Sample SSB-1-25-26.5 was analyzed 32 days outside of the holding time of 14 days. The positive results and reporting limits for all target analytes were qualified as estimated (J/UJ) in this sample.

SDG RV10 (PCBs): Samples GWG-1-W and GWG-3-W were analyzed several days outside of the holding time of 14 days. These samples were originally extracted/analyzed within holding time, although one or more surrogate %R values were low in each sample. For this reason, the second set of data was chosen for use. The positive results and reporting limits for all target analytes were qualified as estimated (J/UJ) in these samples.

Surrogate/Labeled Compound Recoveries

A surrogate compound is a compound that is chemically similar to the analytes of interest, but unlikely to be found in any environmental sample. Surrogates are used for organic analyses and are added to all samples, standards, and blanks to serve as an accuracy and specificity check of each analysis. The surrogates are added at a known concentration and percent recoveries are calculated following analysis. All surrogate recoveries for field samples were within the laboratory control limits, with the following exceptions:

SDG RT41, RT46 (Semivolatiles): The percent recovery (%R) for at least one of four acid fraction surrogates were less than the laboratory lower control limits in Samples SSB-2-2-3.5, SSB-2-2-3.5 (Re-extraction), SSB-2-5-6.5, DUPE1-102110. As the %R values in at least two other acid-fraction surrogates were within the control limits, no action was taken.

SDG RT40 (CPAHs): The %R value for the surrogate d10-2-methylnapthalene was less than 10% in Sample MW-60-10-11.5. All positive results were qualified as estimated (J) in this sample.

SDG RT40 (VOCs): The %R value for the surrogate d4-1,2-dichloroethane exceeded the control limits in Sample MW-RB-102110-W. As the %R values in three other surrogates were within the control limits, no action was taken.

SDG 6448 (Dioxins): The %R value for the labeled compound 13C-1,2,3,4,6,7,8-HpCDF was less than the

control limit of 28% in Sample GWG-1-W. The positive result for the only associated compound 1,2,3,4,6,7,8-HpCDF was qualified as estimated (J) in this sample.

SDG RU19 (Pesticides): The %R for both surrogates were less than the lower control limits in Sample SSB-1-25-26.5. The positive results and reporting limits for all target analytes were qualified as estimated (J/UJ) in this sample.

SDG RU19 (Chlorophenols): There was no surrogate recovery in Samples SSB-1-7-8.5, SSB-1-10-11.5, and DUPE2-102510. The positive results were qualified as estimated (J) in these samples, while the reporting limits for any analytes that were not detected were rejected (R).

SDG RU43 (Chlorophenols): There was no surrogate recovery in Samples SSB-10-2-3.5, SSB-10-5-6.5, and SSB-10-11.5. The positive results were qualified as estimated (J) in these samples, while the reporting limits for any analytes that were not detected were rejected (R).

SDG RV10 (Pesticides): There was no recovery value for tetrachlorometaxylene (TCMX) in Sample GWG-1-W. The %R value for the surrogate decachlorobiphenyl (DCBP) was within the control limits. For this reason, the reporting limits for all target analytes were qualified (UJ), rather than rejected in Sample GWG-1-W.

Method Blanks & Equipment Rinsate Blanks

Method blanks are analyzed to ensure that laboratory procedures and reagents do not introduce measurable concentrations of the analytes of interest. Method blanks were analyzed with each batch of samples, at a frequency of one per twenty samples. For all sample batches, method blanks for all applicable methods were analyzed at the required frequency.

None of the analytes of interest were detected above the reporting limits in any of the method blanks, with the following exceptions:

SDG RT41, RT46 (Semivolatiles): The method blank analyzed on 11/2/10 reported positive detections for 1,4-dichlorobenzene and bis(2-ethylhexyl)phthalate. These compounds were also reported in the associated field samples at levels below the respective action limits. The positive results for this 1,4-dichlorobenzene were qualified as not detected (U) in Samples MW-62-2-3.5, MW-62-5-6.5, MW-62-10-11.5, MW-62-15-16.5, MW-62-20-21.5, SSB-2-5-6.5, SSB-2-10-11.5, SSB-2-15-16.5, SSB-2-20-20.5, SSB-2-25-26.5. The positive results for this bis(2-ethylhexyl)phthalate were qualified as not detected (U) in Samples MW-62-5-6.5, MW-62-10-11.5, MW-62-15-16.5, MW-62-20-21.5, SSB-2-10-11.5.

The method blank analyzed on 11/12/10 reported a positive detection for 1,4-dichlorobenzene. There were no positive results for these compounds greater than the action levels. No further action was necessary.

SDG RT40 (Semivolatiles): The method blank analyzed on 10/30/10 reported positive detections for 1,4-dichlorobenzene and bis(2-ethylhexyl)phthalate. These compounds were also reported in the associated field samples at levels below the respective action limits. The positive results for this 1,4-dichlorobenzene were qualified as not detected (U) in Samples MW-60-20-20.75 and MW-60-23-24.4. The positive results for this bis(2-ethylhexyl)phthalate were qualified as not detected (U) in Samples MW-61-5-6.5, MW-61-15-16.5, MW-60-2-3.5, MW-60-15-16.5, MW-60-20-20.75, MW-60-23-24.4.

SDG RT40 (CPAHs): The method blank analyzed on 10/30/10 reported positive detections for pyrene and total benzofluoranthenes. These compounds were also reported in the associated field samples at levels below the respective action limits. The positive results for pyrene were qualified as not detected (U) in Samples MW-61-20-21.25 and MW-60-23-24.4. The positive results for total benzofluoranthenes were qualified as not detected (U) in Samples MW-61-10-11.5, MW-61-15-16.5 and MW-60-20-20.75.

SDG RT02 (Semivolatiles): The method blank analyzed on 11/2/10 reported positive detections for

1,4-dichlorobenzene and bis(2-ethylhexyl)phthalate. These compounds were also reported in the associated field samples at levels below the respective action limits. The positive results for 1,4-dichlorobenzene were qualified as not detected (U) in Samples SSB-3-10-11.5, SSB-3-15-16.5, SSB-3-20-21.5, SSB-3-27-28.5. The positive results for this bis(2-ethylhexyl)phthalate were qualified as not detected (U) in Samples SSB-3-10-11.5, SSB-3-15-16.5, SSB-3-20-21.5, SSB-3-25-26.5.

SDG RU30, RU69, RU70 (CPAHs): The method blank analyzed on 11/1/10 reported positive detections for six out of the seven target analytes. Of these compounds, only pyrene and benzo(a)anthracene were also reported in any of the associated field samples at levels below the respective action limits. The positive results for pyrene and benzo(a)anthracene were qualified as not detected (U) in Sample RB-102610-W.

SDG RU43, RU61 (Semivolatiles): The method blank analyzed on 11/8/10 reported a positive detection for 1,4-dichlorobenzene. This compound was also reported in the associated field samples at levels below the respective action limits. The positive results for this 1,4-dichlorobenzene were qualified as not detected (U) in Samples SSB-10-15-16.5, SSB-10-20-21.5, GWG-8-2-3.5, GWG-8-10-11.5, GWG-8-15-16.5, DUPE3-102810, SSB-7-2-3.5, SSB-7-10-11.5, SSB-7-20-21.5, SSB-7-25-26.5, SSB-7-30-30.75.

SDG RU28, RV17 (Semivolatiles): The method blank analyzed on 11/10/10 reported positive detections for 1,4-dichlorobenzene and bis(2-ethylhexyl)phthalate. These compounds were also reported in the associated field samples at levels below the respective action limits. The positive results for 1,4-dichlorobenzene were qualified as not detected (U) in Samples GWG-6-2-3.5, GWG-6-5-6.5, GWG-6-10-11.5, GWG-7-2-3.5, GWG-7-5-6.5, GWG-7-7-8.5, GWG-5-2-3.5, GWG-5A-5-6.5, GWG-5A-10-11.5, GWG-5A-15-16.5, GWG-5A-24-25.5. The positive results for bis(2-ethylhexyl)phthalate were qualified as not detected (U) in Samples GWG-6-2-3.5, GWG-6-10-11.5, GWG-7-5-6.5, GWG-7-7-8.5, GWG-5A-5-6.5, GWG-5A-10-11.5, GWG-5A-15-16.5, GWG-5A-24-25.5.

Equipment rinsate blanks are analyzed to provide an indication as to whether field decontamination and sampling procedures effectively prevent cross-contamination in field activities. Three equipment rinsate blanks were collected: RB-10/18/10-W, RB-102110-W, RB-102210-W, RB-102510-W, RB-102610-W, RB-102710-W, RB-102810-W, RB-110110-W, RB-110210-W, RB-110310-W, RB-110410-W.

SDG RT40 & RT02 (Metals): There were positive results for copper, manganese, nickel, and vanadium in the equipment blanks RB-102110-W and RB-102210-W. The associated field samples for these rinsate blanks reported positive results for these elements at levels greater than the action levels. No further action was required.

SDG RV10 (Metals): There was a positive result for copper in the equipment blank RB-110210-W. Also, there was a positive result for manganese in the equipment blank RB-110310-W. The associated field samples for this rinsate blank reported positive results for this element at levels greater than the action levels. No further action was required.

SDG RV28 (Metals): There was a positive result for copper in the equipment blank RB-110410-W. The associated field samples for this rinsate blank reported positive results for this element at levels greater than the action levels. No further action was required.

SDG RU30, RU69, RU70 (Semivolatiles): There was a positive result for bis(2-ethylhexyl)phthalate in the equipment blank RB-102510-W. The associated field Samples SSB-1-7-8.5, SSB-1-10-11.5, SSB-1-15-16.5, SSB-1-25-26.5 reported positive results for this compound at levels greater than the action level for this compound. No further action was necessary.

SDG RV10, RV13 (Semivolatiles): There was a positive result for bis(2-ethylhexyl)phthalate in the equipment blank RB-110210-W. The associated field Sample GWG-6-W reported a positive result for this compound at levels that were less than the action level for this compound. The positive result for bis(2-ethylhexyl)phthalate was qualified as not detected (U) in Sample GWG-6-W.

SDG RU19 and RU30 (Dioxins): There was a positive result for OCDD in the equipment blank RB-102510-W. The associated field Samples SSB-1-7-8.5, SSB-1-10-11.5, SSB-1-15-16.5, SSB-1-20-

21.5, SSB-1-25-26.5 reported positive results at levels greater than ten times the blank concentration for this compound. No further action was necessary.

SDG RV10 (Dioxins): There was a positive result for OCDD in the equipment blank RB-110310-W. The associated field Samples GWG-1-2-3.5, GWG-1-5-6.5, GWG-1-7.5-9 and GWG-5-W reported positive results at levels greater than ten times the blank concentration for this compound. No further action was necessary.

Trip blanks are analyzed to provide an indication as to whether volatile compounds have cross-contaminated other like samples within the transportation process to the laboratory. Typically, samples are stored in a cooler for as much as 24 hours before arriving at the laboratory. Seven trip blanks were collected: TB082510GRL, TB082610GRL, TB082710GRL, TB082510JBA, TB082610JBA, TB082710JBA, and TRIP BLANK. None of the volatiles analytes were detected above the reporting limits in any of the trip blanks.

In all cases, the blank contamination qualified results should be recognized as a reporting limit, instead of a positive result for data users.

Matrix Spikes/Matrix Spike Duplicates (MS/MSD)

Because actual analyte concentration in environmental samples is not known, the accuracy of a particular analysis is usually inferred by performing a matrix spike (MS) analysis. One aliquot of sample is analyzed in the normal manner, than a second aliquot of the sample is spiked with a known amount of analyte concentration and analyzed. From these analyses, a percent recovery (%R) is calculated. Matrix spike duplicates (MSD) analyses are generally performed for organic analyses as a precision check. For some organic analytical methods, such as NWTPH-Dx, a laboratory control sample/ laboratory control sample duplicate (LCS/LCSD) sample set is performed in lieu of a MS/MSD analysis.

For inorganics methods, the matrix spike (referred to as a "spiked sample" is typically followed by a post spike sample if any element recoveries were outside the control limits in the "spike sample".

Matrix spike analyses should be performed once per analytical batch or every twenty field samples, whichever is more frequent. The recovery criteria for matrix spikes and laboratory control samples are specified in the laboratory documents as are the relative percent difference values. The frequency requirements were met for all analyses, and the %R/RPD values were within the proper control limits, with the following exceptions:

SDG RU43, RU61 (Semivolatiles): A MS/MSD sample set was performed on Sample SSB-7-2-3.5. There were no recovery values for 3,3'-Dichlorobenzidine in either the MS or the MSD. There was no positive result for this compound in the parent sample. The reporting limits for 3,3'-Dichlorobenzidine were rejected (R) in the parent sample.

SDG RU28, RV17 (Semivolatiles): A MS/MSD sample set was performed on Sample GWG-6-5-6.5. The %R values for 2,4'-Dinitrotoluene were less than the control limits in both the MS and the MSD. There was no positive result for this compound in the parent sample. The reporting limits for 2,4'-Dinitrotoluene were qualified as estimated (UJ) in the parent sample.

SDG RT40 (Total Metals): A matrix spike sample set was performed on Sample MW-64-2-3.5. The %R value for antimony was less than 10% in the spiked sample. The %R values for antimony was within the control limits in the post digest spike sample. According to the National Functional Guidelines, no further action is required.

SDG RT41 (Total Metals): A matrix spike sample set was performed on Sample SSB-2-2-3.5. The %R value for antimony was less than 10% in the spiked sample. The %R values for antimony was within the

control limits in the post digest spike sample. According to the National Functional Guidelines, no further action is required.

SDG RT02 (Total Metals): A matrix spike sample set was performed on Sample SSB-4-5-6.5. The %R values for antimony, lead, nickel, and selenium were outside of the control limits in the spiked sample. The %R values for these elements were within the control limits in the post digest spike sample. According to the National Functional Guidelines, no further action is required.

SDG RU19 (Total Metals): A matrix spike sample set was performed on Sample SSB-8-2-3.5. The %R values for antimony, lead, nickel, and vanadium were outside of the control limits in the spiked sample. The %R values for these elements were within the control limits in the post digest spike sample. According to the National Functional Guidelines, no further action is required.

SDG RU43 (Total Metals): A matrix spike sample set was performed on Sample SSB-10-2-3.5. The %R values for antimony and nickel were outside of the control limits in the spiked sample. The %R values for these elements were within the control limits in the post digest spike sample. According to the National Functional Guidelines, no further action is required.

SDG RV17 (Total Metals): A matrix spike sample set was performed on Sample GWG-6-2-3.5. The %R value for antimony was outside of the control limits in the spiked sample. The %R value for this element was within the control limits in the post digest spike sample. According to the National Functional Guidelines, no further action is required.

SDG RV28 (Total Metals): A matrix spike sample set was performed on Sample GWG-5-2-3.5. The %R values for antimony, chromium, copper, lead, and mercury were outside of the control limits in the spiked sample. The %R value for these elements was within the control limits in the post digest spike sample. According to the National Functional Guidelines, no further action is required.

Laboratory Control Samples/ Laboratory Control Sample Duplicates (LCS/LCSD)

A laboratory control sample is essentially a blank sample that is spiked with a known amount of analyte concentration and analyzed. It is to be treated much like a matrix spike, without the possibility for matrix interference. As there is no actual sample matrix in the analysis, the analytical expectations for accuracy and precision are usually more rigorous and qualification would apply to all samples in the batch, instead of the parent sample only.

Laboratory control sample analyses should be performed once per analytical batch or every twenty field samples, whichever is more frequent. The recovery criteria for laboratory control samples are specified in the laboratory documents as are the relative percent difference values. The frequency requirements were met for all analyses, and the %R/RPD values were within the proper control limits.

Laboratory Duplicates (Inorganics analyses only)

Internal laboratory duplicate analyses are performed to monitor the precision of the analyses. Two separate aliquots of a sample are analyzed as distinct samples in the laboratory, and the RPD between the two results is calculated. Duplicate analyses should be performed once per analytical batch. If one or more of the samples used has a concentration greater than five times the reporting limit for that sample, the absolute difference is used instead of the RPD.

Laboratory duplicates were analyzed at the proper frequency and the specified acceptance criteria were met in all cases.

Field Replicates/Duplicates

Field duplicate samples were collected and analyzed along with the reviewed sample batches. The duplicate samples were analyzed for the same parameters as the associated parent samples. As mentioned above for the laboratory duplicates the RPD is used as the criteria for assessing precision, unless one or more of the samples used has a concentration greater than five times the reporting limit for that sample, the absolute difference is used instead of the RPD.

The RPD control limits for soil samples is 50%, while the RPD control limits for water samples is 35%. The absolute difference control limits for soil samples is twice the PQL value, while the absolute difference control limits for water samples is the same as the PQL value.

In cases where any of the cPAH compounds or Dioxin/Furan congeners were qualified for precision, the resulting TEC value was also qualified as estimated (J) in that sample.

SDG RT41,46 (CPAHs): One set of field duplicates, Samples SSB-2-5-6.5 & DUPE1-102110, was submitted to the laboratory. The RPD/absolute difference values for all CPAH compounds exceeded the control limits described above. All positive results were qualified as estimated (J) in both samples.

SDG RT41,46 (PCBs): One set of field duplicates, Samples SSB-2-5-6.5 & DUPE1-102110, was submitted to the laboratory. The RPD/absolute difference values for PCB 1260 and Total PCBs (sum of Aroclors) exceeded the control limits described above. All positive results were qualified as estimated (J) in both samples.

SDG RT43, RU61 (Semivolatiles): One set of field duplicates, Samples GWG-8-2-3.5 & DUPE3-102810, was submitted to the laboratory. The absolute difference value for bis(2-ethylhexyl)phthalate exceeded the control limit. This compound was qualified as estimated (J) in both parent and duplicate samples.

SDG RT43, RU61 (CPAHs), (Metals), (Fuels), (Chlorophenols): One set of field duplicates, Samples GWG-8-2-3.5 & DUPE3-102810, was submitted to the laboratory. The absolute difference value for chrysene exceeded the control limit. This compound was qualified as estimated (J) in both parent and duplicate samples.

SDG RT43, RU61 (Metals), (Fuels), (Chlorophenols): One set of field duplicates, Samples GWG-8-2-3.5 & DUPE3-102810, was submitted to the laboratory.

SDG RU19 (Pesticides & PCBs): One set of field duplicates, Samples SSB-1-10-11.5 & DUPE2-102510, was submitted to the laboratory. The precision requirements mentioned above were met for all target analytes.

Pesticide Breakdown Check Standards and Dual Column Confirmations

The laboratory analyzed a DDT Breakdown check standard at the beginning and end of every analytical batch, All of the % breakdown results were greater than the control limit of 20 %.

SDG RU61 (Pesticides): The Aroclor 1260 column confirmation RPD value was greater than 40% in Sample SSB-7-23.5. This positive result was qualified as estimated (J).

Internal Standards (Low Resolution Mass Spectroscopy)

Like the surrogate, an internal standard is a compound that is chemically similar to the analytes of interest, but unlikely to be found in any environmental sample. Internal standards are used only for the mass spectrometry (MS) instrumentation and are usually added to the sample aliquot after extraction has

taken place. The internal standard should be analyzed at the beginning of a 12 hour sample run and the control limits for internal standard recoveries are -50% to +100% of the calibration standard. All internal standard recoveries were within the control limits.

Initial Calibrations (ICALs)

All initial calibrations were conducted according to the laboratory methods, and consisted of the appropriate number of standards. For the organics analyses, all percent relative standard deviation (%RSD) values were less than +/- 30% and all relative response factors (RRF) were greater than 0.05.

SDG RU30 (Pesticides): The initial calibration (secondary column 11/11/10) used less than five standards for the analyte delta-BHC. However, this analyte was appropriately calibrated for on the primary column, and there were no positive detections for this compound in the associated field samples. No action was required.

Continuing Calibration (CCALs)

All continuing calibrations were conducted according to the laboratory methods, and consisted of the appropriate number of standards. For the organics analyses, all percent difference (%D) values were less than +/- 25% and all relative response factors (RRF) were greater than 0.05, with the following exceptions:

SDG RT41,46 (Semivolatiles): The percent difference (%D) values for 2,4-Dinitrotoluene were less than the control limits of ±25% in the continuing calibration (CCAL) standards analyzed on 11/5/10 and 11/15/10. The reporting limits for this compound were qualified as estimated (UJ) in Samples MW-62-2-3.5, SSB-2-2-3.5, DUPE1-102110.

SDG RT40 (Semivolatiles): The %D values for 2,4-Dinitrotoluene were less than the control limits of ±25% in the continuing calibration (CCAL) standards analyzed on 11/4/10. The reporting limits for this compound were qualified as estimated (UJ) in Samples RB-10/18/10-W, RB-102110-W.

SDG RT02 (Semivolatiles): The %D values for 2,4-Dinitrotoluene were less than the control limits of ±25% in the continuing calibration (CCAL) standards analyzed on 11/4/10. The reporting limit for this compound was qualified as estimated (UJ) in Sample RB-102210-W.

The %D values for 2,4-Dinitrotoluene were less than the control limits of ±25% in the continuing calibration (CCAL) standards analyzed on 11/5/10. The reporting limits for this compound were qualified as estimated (UJ) in Samples SSB-3-2-3.5, SSB-3-10-11.5, SSB-3-15-16.5, SSB-3-20-21.5, SSB-3-25-26.5, SSB-3-27-28.5.

SDG RU28, RV17 (Semivolatiles): The %D values for 2,4-Dinitrotoluene were less than the control limits of ±25% in the continuing calibration (CCAL) standards analyzed on 11/15/10. The reporting limits for this compound were qualified as estimated (UJ) in Samples GWG-6-2-3.5, GWG-6-5-6.5, GWG-6-10-11.5, GWG-7-2-3.5, GWG-7-5-6.5, GWG-7-7-8.5, GWG-5-2-3.5, GWG-5A-5-6.5, GWG-5A-10-11.5, GWG-5A-15-16.5, GWG-5A-20-21.5.

SDG RU19 (Pesticides): The secondary column %D values for delta-BHC and heptachlor were both outside of the control limits of ±25% in the opening and closing CCAL standards analyzed on 12/10/10 (18:09 and 20:35). The primary column %D values for these analytes were within the control limits, no qualification was required.

SDG RV17 (Pesticides): The secondary column %D value for 4,4-'DDD was outside of the control limit of ±25% in the CCAL standard analyzed on 11/28/10 (02:13). The primary column %D value for this analyte was within the control limits, no qualification was required.

Internal Standards (Low Resolution Mass Spectroscopy)

Like the surrogate, an internal standard is a compound that is chemically similar to the analytes of interest, but unlikely to be found in any environmental sample. Internal standards are used only for the mass spectrometry (MS) instrumentation and are usually added to the sample aliquot after extraction has taken place. The internal standard should be analyzed at the beginning of a 12 hour sample run and the control limits for internal standard recoveries are -50% to +100% of the calibration standard. All internal standard recoveries were within the control limits.

SDG 6432 (Dioxins): The positive result for 2,3,7,8-TCDF in Sample SSB-1-10-11.5 was not verified by a secondary column as described above. For this reason, the positive result for 2,3,7,8-TCDF was qualified as estimated (J) in this sample.

SDG 6448 (Dioxins): The positive results for 2,3,7,8-TCDF in Samples GWG-1-W, GWG-3-W, and GWG-5-W were not verified by a secondary column as described above. For this reason, the positive result for 2,3,7,8-TCDF was qualified as estimated (J) in this sample.

SDG 6446 (Dioxins): The positive result for 2,3,7,8-TCDF in Sample GWG-1-5-6.5 was not verified by a secondary column as described above. For this reason, the positive result for 2,3,7,8-TCDF was qualified as estimated (J) in this sample.

Reporting Limits and Miscellaneous

SDG RU43, RU61 (Semivolatiles): The compound bis(2-ethylhexyl)phthalate exceeded the linear range of the instrument in Samples SSB-7-20-21.5, SSB-10-10-11.5 and DUPE3-102810. For this reason, these samples were diluted by the laboratory and re-analyzed. Both sets of data were reported. In each sample, the initial reported result for bis(2-ethylhexyl)phthalate was labeled as "Not reportable" in the database. Also in each sample, the diluted reporting limits for all target analytes except bis(2-ethylhexyl)phthalate were labeled as "Not reportable" in the database.

SDG RU28, RV17 (Semivolatiles): The compound bis(2-ethylhexyl)phthalate exceeded the linear range of the instrument in Sample GWG-5A-20-21.5. For this reason, this sample was diluted by the laboratory and re-analyzed. Both sets of data were reported. In this sample, the initial reported result for bis(2-ethylhexyl)phthalate was labeled as "Not reportable" in the database. Also, the diluted reporting limits for all target analytes except bis(2-ethylhexyl)phthalate were labeled as "Not reportable" in the database.

These database qualifiers were assigned so that only one set of target analytes would be displayed in any data tables derived from the database.

SDG RT40 (CPAHs): The compound pyrene exceeded the linear range of the instrument in Sample MW-60-15-16.5. For this reason, this sample was diluted by the laboratory and re-analyzed. Both sets of data were reported. In each sample, the initial reported result for pyrene was labeled as "Not reportable" in the database. Also in each sample, the diluted reporting limits for all target analytes except pyrene were labeled as "Not reportable" in the database.

All Pesticides and PCBs: The laboratory indicated that several samples were screened before extraction because of the probable affects of natural matrix interference. In cases where certain Aroclors and pesticides could not be distinguished because of chromatographic interference, the laboratory raised the reporting limits, and indicated this with a "Y" qualifier. These data points were appropriately taken through the validation process, and these reporting limits were qualified (UI) in GeoEngineer's database.

OVERALL ASSESSMENT

As was determined by this data validation, the laboratory followed the specified analytical methods. Accuracy was acceptable, as demonstrated by the surrogate, LCS/LCSD and MS/MSD %R values, with the exceptions mentioned above. Precision was also acceptable, as demonstrated by the LCS/LCSD, MS/MSD, and field duplicate RPD and absolute difference values, with the exceptions mentioned above.

Data were qualified because of holding time, surrogate %R, MS/MSD %R, field duplicate RPD/absolute difference, dual column confirmation precision, CCAL %D outliers, and because of no secondary column confirmation being performed at low levels in the dioxin analysis.

Data were qualified as not detected because of method blank and equipment blank contamination.

In general, the data are acceptable for use as qualified.

DATA QUALITY ASSESSMENT SUMMARY

DIOXINS/FURANS EPA 1613,
VOLATILES BY METHOD SW8260,
SEMIVOLATILES BY METHOD SW8270,
PAHS BY METHOD SW8270-SIM,
PESTICIDES BY METHOD SW8081,
PCBS BY METHOD SW8082,
CHLOROPHENOLS BY METHOD SW8041,
TOTAL & DISSOLVED METALS (INCLUDING MERCURY) BY METHODS 200.8 & 7470A
TOTAL PETROLEUM HYDROCARBONS BY METHODS NWTPH-GX & NWTPH-DX

ARI Laboratory SDG (Frontier SDG)	Samples Validated (Bold indicates the sample was qualified)
RW11, RW23 Mercury only – **(6460)**	MW-51_101110, MW-52_101108, **MW-55_101108**, **MW-56_101109**, **MW-57_101108**, **MW-59_101110**, **PA-15_101109**, PZ-3_101109, PZ-4_101109, **PZ-6_101109**, PZ-7_101110, PZ-9_101110, PZ-11_101109, PZ-12_101109, **PA-23_101108**, **PA-24_101109**, R-101108, R-101109,
RW18, RW23 (Mercury only)	**MW-23_101110**, MW-28_101110, and TRIP BLANK_101108
RW56, RW23, RW60 (Mercury only) - **(6464)**	**MW-29_101111**, MW-54_101111, **MW-58_101111**, **PA-19_101111**, **PZ-2_101111**, R-101110, R-101111, and TRIP BLANK_101110

PROJECT: RAYONIER MILL (00137-015-06)

This report documents the results of an EPA level III and EPA level IV (one SDG) data validation of analytical data from the analyses of groundwater and the associated laboratory quality control (QC) samples. This standard review included the following:

- Chain of Custody
- Holding Times
- Surrogates/Labeled Compounds
- Method Blanks, Equipment Rinsate Blanks, and Trip Blanks
- Laboratory Control Samples/Laboratory Control Sample Duplicates
- Matrix Spikes/Matrix Spike Duplicates
- Laboratory and Field Duplicates
- Internal Standards (Mass Spectrometry)
- DDT/Endrin Breakdown confirmations (Pesticides only)
- Instrument Initial Calibrations (ICALs)
- Instrument Continuing Calibrations (CCALs)
- Instrument Tunes

- Three HRGC/HRMS system performance checks (Dioxins/Furans only)
  1. Mass Calibration and Resolution
  2. Selected Ion Monitoring switching times
  3. GC Resolution
- 2,3,7,8-TCDF secondary column confirmation

DATA PACKAGE COMPLETENESS

ARI, located in Tukwila, Washington, was the primary sub-contracted laboratory analyzing the samples evaluated as part of this data validation review. ARI analyzed all chemical parameters, with the exception of the dioxin/furan analyses. Frontier Analytical Laboratory in El Dorado Hills, California, as sub-contracted through ARI, conducted the Dioxin/Furan analyses. Both laboratories provided all required deliverables for the validation according to the National Functional Guidelines. Both laboratories followed adequate corrective action processes and all identified anomalies were discussed in the representative case narratives.

OBJECTIVE

The objective of the data validation was to review laboratory analytical procedures and quality control (QC) results to evaluate whether:

- The samples were analyzed using well-defined and acceptable methods that provide detection limits below applicable regulatory criteria;
- The precision and accuracy of the data are well defined and sufficient to provide defensible data; and
- The quality assurance/quality control (QA/QC) procedures utilized by the laboratory meet acceptable industry practices and standards.

DATA QUALITY ASSESSMENT SUMMARY

The results for each of the QC elements are summarized below. The data assessment was performed using guidance in the USEPA Contract Laboratory Program *National Functional Guidelines for Inorganic Data Review* (USEPA 2002) and USEPA Contract Laboratory Program *National Functional Guidelines for Organic Data Review* (USEPA 2008), National functional Guidelines for Chlorinated Dibenzo-p-Dioxins (CDDs) and Chlorinated Dibenzofurans (CDFs) (USEPA 2005).

Chain-of-Custody Documentation

Chain-of-custody (COC) forms were provided with the laboratory analytical reports. There were no anomalies noted on the COC forms; proper COC protocols appear to have been followed for this sampling event.

Holding Times

The holding time is defined as the time that elapses between sample collection and sample analysis. Maximum holding time criteria exist for each analysis to help ensure that the analyte concentrations found at the time of analysis reflect the concentration present at the time of sample collection.

Established holding times were met for all analyses, with the exceptions below:

RW11 (Semivolatiles): Sample PA-24_101109 was re-extracted and re-analyzed outside of the holding time of seven days because of low surrogate recoveries in the first analysis. Only the re-analyzed, second set of data was used in order to avoid duplicate reporting for the same sample information. The positive result was qualified as estimated (J) in the usable set of data for this sample.

Surrogate/Labeled Compound Recoveries

A surrogate compound is a compound that is chemically similar to the analytes of interest, but unlikely to be found in any environmental sample. Surrogates are used for organic analyses and are added to all samples, standards, and blanks to serve as an accuracy and specificity check of each analysis. The surrogates are added at a known concentration and percent recoveries are calculated following analysis. All surrogate recoveries for field samples were within the laboratory control limits, with the exceptions below:

RW56 (Volatiles): The percent recovery (%R) values for d4-dichloroethane were greater than the upper control limits of 120% in Samples MW-29_101111 and the Trip Blank taken on 11/11/10. The samples were each spiked with three other surrogates that exhibited %R values that were within control limits. No qualifiers were required.

RW11, RW56 (Pesticides): The %R values for decachlorobiphenyl were less than the lower control limits of 30% in Samples MW-56_101109, MW-58_101111, and MW-59_101110. These outliers were indicative of a low bias, and the reporting limits for all target analytes were qualified as estimated (UJ).

Method Blanks, Trip Blanks & Equipment Rinsate Blanks

Method blanks are analyzed to ensure that laboratory procedures and reagents do not introduce measurable concentrations of the analytes of interest. Method blanks were analyzed with each batch of samples, at a frequency of one per twenty samples. For all sample batches, method blanks for all applicable methods were analyzed at the required frequency.

None of the analytes of interest were detected above the reporting limits in any of the method blanks, with the exceptions below:

(Metals): The method blank for dissolved metals prepared on 11/19/10 reported a positive detection for manganese. The positive results for this element in the associated field samples were all greater than the action level. No qualifiers were required.

Equipment rinsate blanks are analyzed to provide an indication as to whether field decontamination and sampling procedures effectively prevent cross-contamination in field activities. Four equipment rinsate blanks were collected: R-101108, R-101109, R-101110, and R-101111.

RW11 (PAHs): There was a positive result for pyrene in the equipment blank R-101109. The associated field Sample PA-24_101109 reported a positive result for this compound, and this positive result was qualified as not-detected (U) in this sample.

RW11 (Metals): The equipment blank R-101108 reported positive detections for copper and manganese. The positive results for these elements in the associated field Samples MW-55_101108 and MW-64_101108 were qualified as not detected (U) in these samples. Also, the positive results for copper only in the associated field Samples MW-57_101108 and PA-23_101108 were qualified as not detected (U) in these samples.

The equipment blank R-101109 reported a positive detection for copper. The positive results for this element in the associated field Samples PA-15_101109 and PZ-6_101109 were qualified as not detected (U) in these samples.

The equipment blank R-101110 reported a positive detection for manganese. There were no positive

results for this element in the associated field samples that were less than the action level. No qualifiers were required.

The equipment blank R-101111 reported positive detections for copper and manganese. The positive results for copper in the associated field Samples MW-58_10111, MW-60_10111 (phase 2 investigation), MW-61_10111 (phase 2 investigation), PA-19_101111, and PZ-2_101111 were qualified as not detected (U) in these samples. Also, the positive results for manganese in the associated field Sample MW-29_101111 was qualified as not detected (U) in this sample.

Trip blanks are analyzed to provide an indication as to whether volatile compounds have cross-contaminated other like samples within the transportation process to the laboratory. Typically, samples are stored in a cooler for as long as 24 hours before arriving at the laboratory. Two trip blanks were collected in this sampling event: TRIP BLANK_101108 and TRIP BLANK_101110. There were no positive results for any volatile analytes above the reporting limits in these field QC samples.

In all cases, any blank contamination qualified results should be recognized as a reporting limit, instead of a positive result for data users.

Matrix Spikes/Matrix Spike Duplicates (MS/MSD)

Because actual analyte concentration in environmental samples is not known, the accuracy of a particular analysis is usually inferred by performing a matrix spike (MS) analysis. One aliquot of sample is analyzed in the normal manner, than a second aliquot of the sample is spiked with a known amount of analyte concentration and analyzed. From these analyses, a percent recovery (%R) is calculated. Matrix spike duplicates (MSD) analyses are generally performed for organic analyses and the relative percent difference (RPD) is used as a measurement of precision. For some organic analytical methods, such as NWTPH-Dx, a laboratory control sample/ laboratory control sample duplicate (LCS/LCSD) sample set is performed in lieu of a MS/MSD analysis.

For inorganics methods, the matrix spike (referred to as a "spiked sample" is typically followed by a post spike sample if any element recoveries were outside the control limits in the "spike sample".

Matrix spike analyses should be performed once per analytical batch or every twenty field samples, whichever is more frequent. The recovery criteria for matrix spikes and laboratory control samples are specified in the laboratory documents as are the relative percent difference values. The frequency requirements were met for all analyses, and the %R/RPD values were within the proper control limits, with the following exceptions:

(PCBs): The laboratory performed a MS/MSD sample set on Sample MW-60_101111. The RPD values for Aroclor 1016 and Aroclor 1260 were both greater than the control limit of 30%. There were no positive results for either of these two target analytes, no action was required.

(Metals): The laboratory performed a matrix spike on Sample MW-60_101111. The %R value for Total manganese was greater than the control limit of 125%. The parent sample concentration was greater than four times the amount spiked into the sample, no action was required.

Laboratory Control Samples/ Laboratory Control Sample Duplicates (LCS/LCSD)

A laboratory control sample is essentially a blank sample that is spiked with a known amount of analyte concentration and analyzed. It is to be treated much like a matrix spike, without the possibility for matrix interference. As there is no actual sample matrix in the analysis, the analytical expectations for accuracy and precision are usually more rigorous and qualification would apply to all samples in the batch, instead of the parent sample only.

Laboratory control sample analyses should be performed once per analytical batch or every twenty field

samples, whichever is more frequent. The recovery criteria for laboratory control samples are specified in the laboratory documents as are the relative percent difference values. The frequency requirements were met for all analyses, and the %R/RPD values were within the proper control limits.

Laboratory Duplicates (Inorganics analyses only)

Internal laboratory duplicate analyses are performed to monitor the precision of the analyses. Two separate aliquots of a sample are analyzed as distinct samples in the laboratory, and the RPD between the two results is calculated. Duplicate analyses should be performed once per analytical batch. If one or more of the samples used has a concentration greater than five times the reporting limit for that sample, the absolute difference is used instead of the RPD.

Laboratory duplicates were analyzed at the proper frequency and the specified acceptance criteria were met in all cases.

Field Replicates/Duplicates

There were no field duplicates for this phase of the project.

Pesticide Breakdown Check Standards

The laboratory analyzed a DDT Breakdown check standard at the beginning and end of every analytical batch, All of the % breakdown results were greater than the control limit of 20 %.

Initial Calibrations (ICALs)

All initial calibrations were conducted according to the laboratory methods, and consisted of the appropriate number of standards. For the organics analyses, all percent relative standard deviation (%RSD) values were less than +/- 30% and all relative response factors (RRF) were greater than 0.05.

Continuing Calibration (CCALs)

All continuing calibrations were conducted according to the laboratory methods, and consisted of the appropriate number of standards. For the organics analyses, all percent difference (%D) values were less than +/- 25% and all relative response factors (RRF) were greater than 0.05, with the exceptions below:

(Pesticides): The secondary column %D value for 4,4-'DDD was outside of the control limit of ±25% in the CCAL standards analyzed on 11/20/10 (20:13) and 11/21/10 (01:05). The primary column %D values for this analyte were within the control limits, no qualification was required.

Initial Three HRGC/HRMS system performance checks (Dioxins/Furans only)

There are three fundamental system performance checks that must be conducted for every analytical batch of dioxin/furan samples, according to method EPA 1613. Mass calibration and resolution is the first part of the three fundamental High Resolution Gas Chromatography/HRMS (HRGC/HRMS) system performance checks. The second fundamental performance check is the Mass Spectrometer Selected Ion Monitoring (SIM) scan descriptor switching times. The third fundamental performance check is Gas Chromatograph (GC) resolution.

All three of these performance checks were appropriately conducted and no findings of significance were observed from this validation.

2,3,7,8-TCDF secondary column confirmation

Isomer specificity for all 2,3,7,8-substituted dioxins and furans cannot be achieved on the one 60-meter DB-5 column alone. Historically, problems have been associated with the separation of 2,3,7,8-TCDF from 1,2,3,9-TCDF and 2,3,4,7-TCDF. There are significant toxicological concerns associated with 2,3,7,8-TCDF; therefore, a second column confirmation is used and additional analyses may be required for some samples.

The National Functional Guidelines state "If second-column confirmation is required but was not performed, qualify the 2,3,7,8-TCDF detects as unusable "R"". However, the laboratory (Frontier Analytical) is using calibration standards that are lower than the levels prescribed by EPA Method 1613 in order to achieve the concentration levels prescribed in the QAPP. In this analysis, the confirmation column (DB-225) cannot be relied on to see below 10 pg/L, as the target analyte peaks cannot be separated from chromatographic noise.

Reporting Limits

All Pesticides and PCBs: The laboratory indicated that several samples were screened before extraction because of the probable affects of natural matrix interference. In cases where certain Aroclors and pesticides could not be distinguished because of chromatographic interference, the laboratory raised the reporting limits, and indicated this with a "Y" qualifier. These data points were appropriately taken through the validation process, and these reporting limits were qualified (UI) in GeoEngineer's database.

OVERALL ASSESSMENT

As was determined by this data validation, the laboratory followed the specified analytical methods. Accuracy was acceptable, as demonstrated by the surrogate, LCS/LCSD and MS/MSD %R values, with the exceptions mentioned above. Precision was also acceptable, as demonstrated by the LCS/LCSD, MS/MSD, and field duplicate RPD and absolute difference values, with the exceptions noted above.

Data were qualified as estimated because of holding time outliers, surrogate %R outliers,

Data were qualified as not detected because of equipment rinsate blank contamination.

In general, the data are acceptable for use as qualified.

DATA QUALITY ASSESSMENT SUMMARY

DIOXINS/FURANS EPA 1613, SEMIVOLATILES BY METHOD SW8270, PAHS BY METHOD SW8270-SIM, PCBS BY METHOD SW8082, CHLOROPHENOLS BY METHOD SW8041, TOTAL & DISSOLVED METALS (INCLUDING MERCURY) BY METHODS 200.8, 6010A & 7470A TOTAL PETROLEUM HYDROCARBONS BY METHODS NWTPH-GX & NWTPH-DX

ARI Laboratory SDG (Frontier SDG)	Samples Validated (Bold indicates the sample was qualified)
SD95, SD99 (6524)	PIPE-1-SR23
SD94, SF62 (TCLP only)	TP-01-2', **TP-01-8'**, TP-01-10', TP-02-2', **TP-02-8'**, TP-02-9', TP-03-2', TP-03-4', TP-03-7', TP-12-2', TP-12-4', TP-DUPE-1,
SD96, SE71 (TCLP only)	TP-09-2', TP-09-3', TP-09-5', TP-10-2', TP-10-3', TP-11-2', **TP-11-5'**, TP-11-7', TP-14-2', TP-14-3', TP-14-5', TP-15-2', TP-15-4', TP-15-5', TP-16-2', TP-16-5', TP-21-3', TP-DUPE-3
SD98	TP-04-2', TP-04-7', TP-05-2', TP-05-6', TP-05-8', TP-06-3', TP-06-7', TP-07-2', TP-07-6',TP-07-8', TP-08-2', TP-08-5', TP-DUPE-2

PROJECT: RAYONIER MILL (00137-015-03)

This report documents the results of an EPA level III data validation of analytical data from the analyses of soil and groundwater and the associated laboratory quality control (QC) samples. This standard review included the following:

- Chain of Custody
- Holding Times
- Surrogates/Labeled Compounds
- Method Blanks, Equipment Rinsate Blanks, and Trip Blanks
- Laboratory Control Samples/Laboratory Control Sample Duplicates
- Matrix Spikes/Matrix Spike Duplicates
- Laboratory and Field Duplicates
- Internal Standards (Mass Spectrometry)
- DDT/Endrin Breakdown confirmations (Pesticides only)
- Instrument Initial Calibrations (ICALs)
- Instrument Continuing Calibrations (CCALs)

- Instrument Tunes
- Three HRGC/HRMS system performance checks (Dioxins/Furans only)
  1. Mass Calibration and Resolution
  2. Selected Ion Monitoring switching times
  3. GC Resolution
- Reporting Limits and Miscellaneous
- 2,3,7,8-TCDF secondary column confirmation

DATA PACKAGE COMPLETENESS

ARI, located in Tukwila, Washington, was the primary sub-contracted laboratory analyzing the samples evaluated as part of this data validation review. ARI analyzed all chemical parameters, with the exception of the dioxin/furan analyses. Frontier Analytical Laboratory in El Dorado Hills, California, as sub-contracted through ARI, conducted the Dioxin/Furan analyses. Both laboratories provided all required deliverables for the validation according to the National Functional Guidelines. Both laboratories followed adequate corrective action processes and all identified anomalies were discussed in the representative case narratives.

OBJECTIVE

The objective of the data validation was to review laboratory analytical procedures and quality control (QC) results to evaluate whether:

- The samples were analyzed using well-defined and acceptable methods that provide detection limits below applicable regulatory criteria;
- The precision and accuracy of the data are well defined and sufficient to provide defensible data; and
- The quality assurance/quality control (QA/QC) procedures utilized by the laboratory meet acceptable industry practices and standards.

DATA QUALITY ASSESSMENT SUMMARY

The results for each of the QC elements are summarized below. The data assessment was performed using guidance in the USEPA Contract Laboratory Program *National Functional Guidelines for Inorganic Data Review* (USEPA 2002) and USEPA Contract Laboratory Program *National Functional Guidelines for Organic Data Review* (USEPA 2008), National functional Guidelines for Chlorinated Dibenzo-p-Dioxins (CDDs) and Chlorinated Dibenzofurans (CDFs) (USEPA 2005).

Chain-of-Custody Documentation

Chain-of-custody (COC) forms were provided with the laboratory analytical reports. There were no anomalies noted on the COC forms; proper COC protocols appear to have been followed for this sampling event.

Holding Times

The holding time is defined as the time that elapses between sample collection and sample analysis. Maximum holding time criteria exist for each analysis to help ensure that the analyte concentrations found at the time of analysis reflect the concentration present at the time of sample collection. Established holding times were met for all analyses, with the exceptions below:

Surrogate/Labeled Compound Recoveries

A surrogate compound is a compound that is chemically similar to the analytes of interest, but unlikely to be found in any environmental sample. Surrogates are used for organic analyses and are added to all samples, standards, and blanks to serve as an accuracy and specificity check of each analysis. The surrogates are added at a known concentration and percent recoveries are calculated following analysis. All surrogate recoveries for field samples were within the laboratory control limits, with the exceptions below:

SD94 (Semivolatiles): The percent recovery (%R) value for 2,4,6-tribromophenol was less than the control limit in Sample TP-12-2'. There were three other acidic surrogates with %R values that were within the control limits. No qualifiers were required.

SD95 (Semivolatiles): The %R value for d14-p-Terphenyl was less than the control limits in Sample PIPE-1-SR23. There were three other base-neutral surrogates with %R values that were within the control limits. No qualifiers were required.

SD98 (Semivolatiles): The %R values for the acidic fraction surrogates d5-phenol, 2-fluorophenol, 2,4,6-tribromophenol, and d4-2-chlorophenol were all less than 10% in Samples TP-4-2' and TP-4-7'. The SVOC target analyte list only included base-neutral compounds in this phase of the project. For this reason, no qualifiers were required in either case.

SD94 (CPAHs): The %R value for d10-2-methylnapthalene was greater than the control limit in Sample TP-2-8'. The positive results for pyrene, benzo(a)pyrene, and the resulting TEQ value were qualified as estimated (J) in this sample.

SD96 (CPAHs): The %R value for d10-2-methylnapthalene was greater than the control limit in Sample TP-11-5'. The positive results for six target analytes and the resulting TEQ value were qualified as estimated (J) in this sample.

Method Blanks, Trip Blanks & Equipment Rinsate Blanks

Method blanks are analyzed to ensure that laboratory procedures and reagents do not introduce measurable concentrations of the analytes of interest. Method blanks were analyzed with each batch of samples, at a frequency of one per twenty samples. For all sample batches, method blanks for all applicable methods were analyzed at the required frequency.

None of the analytes of interest were detected above the reporting limits in any of the method blanks.

In all cases, any blank contamination qualified results should be recognized as a reporting limit, instead of a positive result for data users.

Matrix Spikes/Matrix Spike Duplicates (MS/MSD)

Because actual analyte concentration in environmental samples is not known, the accuracy of a particular analysis is usually inferred by performing a matrix spike (MS) analysis. One aliquot of sample is analyzed in the normal manner, than a second aliquot of the sample is spiked with a known amount of analyte concentration and analyzed. From these analyses, a percent recovery (%R) is calculated. Matrix spike duplicates (MSD) analyses are generally performed for organic analyses and the relative percent difference (RPD) is used as a measurement of precision. For some organic analytical methods, such as

NWTPH-Dx, a laboratory control sample/ laboratory control sample duplicate (LCS/LCSD) sample set is performed in lieu of a MS/MSD analysis.

For inorganics methods, the matrix spike (referred to as a "spiked sample" is typically followed by a post spike sample if any element recoveries were outside the control limits in the "spike sample".

Matrix spike analyses should be performed once per analytical batch or every twenty field samples, whichever is more frequent. The recovery criteria for matrix spikes and laboratory control samples are specified in the laboratory documents as are the relative percent difference values. The frequency requirements were met for all analyses, and the %R/RPD values were within the proper control limits, with the exception below:

SD94 (Semivolatiles): An MS/MSD sample set was performed on Sample TP-01-8'. The %R value for 3,3'-dichlorobenzidine was less than 10% in the MS, while the %R value was acceptable in the MSD. The reporting limit for this analyte was qualified as estimated (UJ), rather than rejected (R) in the parent sample.

SD94 (CPAHs): An MS/MSD sample set was performed on Sample TP-03-4'. The %R values for several analytes were greater than the control limits in the MS and MSD. The parent sample had at least one analyte that had a concentration that exceeded the linear range of the instrument. For this reason, no qualifiers were required.

SD94 (Metals): The laboratory performed a matrix spike on Sample TP-02-2'. The %R values for Total Antimony and Total Manganese were greater outside of the control limits of 75% to 125%. The Total Antimony recovery in the post spike was within the control limits. The parent sample concentration of manganese was greater than four times the amount spiked into the sample, no action was required.

SD96 (Metals): The laboratory performed a matrix spike on Sample TP-05-2'. The %R values for Total Antimony and Total Manganese were greater outside of the control limits of 75% to 125%. The Total Antimony recovery in the post spike was within the control limits. The parent sample concentration of manganese was greater than four times the amount spiked into the sample, no action was required.

SD98 (Metals): The laboratory performed a matrix spike on Sample TP-05-2'. The %R values for Total Antimony and Total Manganese were greater outside of the control limits of 75% to 125%. The Total Antimony recovery in the post spike was within the control limits. The parent sample concentration of manganese was greater than four times the amount spiked into the sample, no action was required.

Laboratory Control Samples/ Laboratory Control Sample Duplicates (LCS/LCSD)

A laboratory control sample is essentially a blank sample that is spiked with a known amount of analyte concentration and analyzed. It is to be treated much like a matrix spike, without the possibility for matrix interference. As there is no actual sample matrix in the analysis, the analytical expectations for accuracy and precision are usually more rigorous and qualification would apply to all samples in the batch, instead of the parent sample only.

Laboratory control sample analyses should be performed once per analytical batch or every twenty field samples, whichever is more frequent. The recovery criteria for laboratory control samples are specified in the laboratory documents as are the relative percent difference values. The frequency requirements were met for all analyses, and the %R/RPD values were within the proper control limits.

Laboratory Duplicates (Inorganics analyses only)

Internal laboratory duplicate analyses are performed to monitor the precision of the analyses. Two separate aliquots of a sample are analyzed as distinct samples in the laboratory, and the RPD between the two results is calculated. Duplicate analyses should be performed once per analytical batch. If one or more of the samples used has a concentration greater than five times the reporting limit for that sample, the absolute difference is used instead of the RPD.

Laboratory duplicates were analyzed at the proper frequency and the specified acceptance criteria were met in all cases.

Field Replicates/Duplicates

Field duplicate samples were collected and analyzed along with the reviewed sample batches. The duplicate samples were analyzed for the same parameters as the associated parent samples. As mentioned above for the laboratory duplicates the RPD is used as the criteria for assessing precision, unless one or more of the samples used has a concentration greater than five times the reporting limit for that sample, the absolute difference is used instead of the RPD.

The RPD control limits for soil samples is 50%, while the RPD control limits for water samples is 35%. The absolute difference control limits for soil samples is twice the PQL value, while the absolute difference control limits for water samples is the same as the PQL value.

In cases where any of the cPAH compounds or Dioxin/Furan congeners were qualified for precision, the resulting TEC value was also qualified as estimated (J) in that sample.

SDG SD94: One set of field duplicates, Samples TP-02-8' & TP-DUPE-1, was submitted to the laboratory.

(SVOCs): There were no positive results in either sample. However, the reporting limits for Sample TP-DUPE-1 were more than twice the reporting limits in Sample TP-02-8'. This indicates a potential lack of precision in the field duplicates. For this reason, all reporting limits in both samples were qualified as estimated (UJ).

(CPAHs): The RPD/absolute difference values for chrysene, benzo(a)pyrene, total benzofluoranthenes, and the TEQ value exceeded the control limits described above. All positive results and reporting limits were qualified as estimated (J/UJ) in both samples.

(PCBs, Chlorophenols, Fuels, Metals): The precision requirements mentioned above were met for all target analytes.

SDG SD96: One set of field duplicates, Samples TP-11-5' & TP-DUPE-3, was submitted to the laboratory.

(SVOCs, CPAHs, PCBs, Chlorophenols, Fuels, Metals): The precision requirements mentioned above were met for all target analytes.

SDG SD98: One set of field duplicates, Samples TP-07-2' & TP-DUPE-2, was submitted to the laboratory.

(SVOCs, PCBs, Chlorophenols, Fuels): The precision requirements mentioned above were met for all target analytes.

(CPAHs): The absolute difference value for benzo(a)pyrene exceeded the control limits described above. The positive results were qualified as estimated (J) in both samples.

(PCBs): The absolute difference value for benzo(a)pyrene exceeded the control limits described above. The positive results were qualified as estimated (J) in both samples.

(Total Metals): The RPD value for arsenic exceeded the control limits described above. The positive results were arsenic were qualified as estimated (J) in all samples in the sample delivery group.

Internal Standards (Low Resolution Mass Spectrometry)

Like the surrogate, an internal standard is a compound that is chemically similar to the analytes of interest, but unlikely to be found in any environmental sample. Internal standards are used only for the mass spectrometry (MS) instrumentation and are usually added to the sample aliquot after extraction has taken place. The internal standard should be analyzed at the beginning of a 12 hour sample run and the control limits for internal standard recoveries are -50% to +100% of the calibration standard. All internal standard recoveries were within the control limits.

(CPAHs): Several internal standard recovery values were greater than the control limits mentioned above. These outliers were indicative of an instrumental high bias, leaving the reporting limits for non-detected analytes unaffected.

(SDG SD94): The positive results for all target analytes and the resulting TEQ values were qualified as estimated (J) in Samples TP-03-2', TP-03-4', and TP-01-8' because the internal standards d12-chrysene and d12-perylene were outside the control limits. The positive results for pyrene, benzo(a)anthracene, chrysene, and the resulting TEQ values were qualified as estimated (J) in Samples TP-02-4', TP-12-2', and TP-12-4' because the internal standard d12-chrysene was outside the control limits.

(SDG SD96): The positive results for all target analytes and the resulting TEQ values were qualified as estimated (J) in Samples TP-11-5', TP-15-2', and TP-DUPE-3' because the internal standards d12-chrysene and d12-perylene were outside the control limits. The positive results for pyrene, benzo(a)anthracene, chrysene, and the resulting TEQ value were qualified as estimated (J) in Sample TP-14-3' because the internal standard d12-chrysene was outside the control limits. The positive results for benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenz(a,h)anthracene, total benzofluoranthenes, and the resulting TEQ values were qualified as estimated (J) in Samples TP-09-3' and TP-11-2' because the internal standard d12-perylene was outside the control limits.

(SDG SD98): The positive results for benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenz(a,h)anthracene, total benzofluoranthenes, and the resulting TEQ values were qualified as estimated (J) in Samples TP-07-2' and TP-08-2' because the internal standard d12-perylene was outside the control limits.

Initial Calibrations (ICALs)

All initial calibrations were conducted according to the laboratory methods, and consisted of the appropriate number of standards. For the organics analyses, all percent relative standard deviation (%RSD) values were less than +/- 30% and all relative response factors (RRF) were greater than 0.05.

Continuing Calibration (CCALs)

All continuing calibrations were conducted according to the laboratory methods, and consisted of the appropriate number of standards. For the organics analyses, all percent difference (%D) values were less than +/- 25% and all relative response factors (RRF) were greater than 0.05.

Initial Three HRGC/HRMS system performance checks (Dioxins/Furans only)

There are three fundamental system performance checks that must be conducted for every analytical batch of dioxin/furan samples, according to method EPA 1613. Mass calibration and resolution is the first part of the three fundamental High Resolution Gas Chromatography/HRMS (HRGC/HRMS) system performance checks. The second fundamental performance check is the Mass Spectrometer Selected Ion Monitoring (SIM) scan descriptor switching times. The third fundamental performance check is Gas Chromatograph (GC) resolution.

All three of these performance checks were appropriately conducted and no findings of significance were observed from this validation.

Reporting Limits and Miscellaneous

CPAHs: The laboratory flagged several results with an "M", indicating that there was a low spectral match which reduced confidence in the qualitative analysis of the sample result. Consequently, the results listed below were qualified as tentatively identified (NJ) in the associated samples. The resulting TEQ values from these samples should be considered estimates.

Sample ID	Analytes
TP-02-2'	Total Benzofluoranthenes
TP-02-8'	Pyrene
TP-03-7'	Benzo(a)anthracene, Benzo(a)pyrene, Total Benzofluoranthenes, Chrysene
TP-DUPE-1	Benzo(a)pyrene, Total Benzofluoranthenes, Chrysene, pyrene

SDG SD95 (CPAHs): The compound pyrene exceeded the linear range of the instrument in Sample PIPE-1-SR23. For this reason, this sample was diluted by the laboratory and re-analyzed. Both sets of data were reported. In each sample, the initial reported result for pyrene was qualified as "Not reportable" in the database. Also in each sample, the diluted reporting limits for all target analytes except pyrene were qualified as "Not reportable" in the database.

SDG SD95 (Chlorophenols): The positive result for pentachlorophenol could not be confirmed by a secondary column confirmation by the laboratory because of chromatographic interference. For this reason, the positive result for this target analyte was qualified as tentatively identified (NJ).

Reporting Limits

SVOCs: Samples TP-02-8', TP-03-7', TP-12-2', TP-12-4', TP-DUPE-1, TP-11-5', TP-14-3; TP-15-2', and TP-DUPE-3' were analyzed at dilutions or used a lower amount of mass in the initial extraction. In any case the outcome was to effectively raise the reporting limits to levels greater than those prescribed in the QAPP due to potential matrix interference. There were no positive results for any target analytes in these samples.

CPAHs: Samples TP-01-8', TP-02-2', TP-02-8', TP-12-2', TP-12-4, 'TP-DUPE-1, TP-11-5', TP-14-3; TP-15-2', and TP-DUPE-3' were analyzed at dilutions or used a lower amount of mass in the initial extraction. In any case the outcome was to effectively raise the reporting limits to levels greater than those prescribed in the QAPP due to potential matrix interference. There were no positive results for any target analytes in these samples.

All Chlorophenols and/or PCBs: The laboratory indicated that several samples were screened before extraction because of the probable affects of natural matrix interference. In cases where certain Aroclors and pesticides could not be distinguished because of chromatographic interference, the laboratory raised the reporting limits, and indicated this with a "Y" qualifier. These data points were appropriately taken through the validation process, and these reporting limits were qualified (UI) in GeoEngineer's database.

OVERALL ASSESSMENT

As was determined by this data validation, the laboratory followed the specified analytical methods. Accuracy was acceptable, as demonstrated by the surrogate, LCS/LCSD and MS/MSD %R values, with the exceptions mentioned above. Precision was also acceptable, as demonstrated by the LCS/LCSD, MS/MSD, and field duplicate RPD and absolute difference values, with the exceptions noted above.

Data were qualified as estimated because of surrogate outliers, MS/MSD %R outliers, field duplicate precision outliers, and internal standard recovery outliers.

Data were tentatively identified because of LR/MS poor spectral matches.

Several reporting limits were elevated because of chromatographic/spectral interferences.

In general, the data are acceptable for use as qualified.

DATA QUALITY ASSESSMENT SUMMARY

DIOXINS/FURANS EPA 1613,
VOLATILES BY METHOD SW8260,
SEMIVOLATILES BY METHOD SW8270,
PAHS BY METHOD SW8270-SIM,
PESTICIDES BY METHOD SW8081,
PCBS BY METHOD SW8082,
CHLOROPHENOLS BY METHOD SW8041,
TOTAL METALS (INCLUDING MERCURY) BY METHOD EPA6010, 200.8, 7471A
TOTAL PETROLEUM HYDROCARBONS BY METHODS NWTPH-DX

ARI Laboratory SDG (Frontier SDG)	Samples Validated (Bold indicates the sample was qualified)
SI14 (6593)	MW-23_110209, **MW-28_110208,** MW-29_110208, MW-52_110209, MW-60_110209, MW-63_110208, MW-63_110208D, MW-64_110207, PZ-2_110207, PZ-5_110208, PZ-7_110208, PZ-9_110208, **PZ-11_110208, PA-19_110209, PA-19_110209D,** RINSE_110208
SI67 (6594)	MW-51_110211, MW-53_110211, MW-54_110211, MW-55_110211, **MW-56_110211, MW-58_110211, MW-59_110210,** MW-61_110211, MW-62_110210, PA-17_110211, PA-24_110211, PZ-3_110210

PROJECT: RAYONIER MILL (00137-015-05)

This report documents the results of an EPA level III data validation of analytical data from the analyses of groundwater and the associated laboratory quality control (QC) samples. This standard review included the following:

- Chain of Custody
- Holding Times
- Surrogates/Labeled Compounds
- Method Blanks, Equipment Rinsate Blanks, and Trip Blanks
- Laboratory Control Samples/Laboratory Control Sample Duplicates
- Matrix Spikes/Matrix Spike Duplicates
- Laboratory and Field Duplicates
- Internal Standards (Mass Spectrometry)
- DDT/Endrin Breakdown confirmations (Pesticides only)
- Instrument Initial Calibrations (ICALs)
- Instrument Continuing Calibrations (CCALs)
- Instrument Tunes
- Three HRGC/HRMS system performance checks (Dioxins/Furans only)
    1. Mass Calibration and Resolution

2. Selected Ion Monitoring switching times
3. GC Resolution

DATA PACKAGE COMPLETENESS

ARI, located in Tukwila, Washington, was the primary sub-contracted laboratory analyzing the samples evaluated as part of this data validation review. ARI analyzed all chemical parameters, with the exception of the dioxin/furan analyses. Frontier Analytical Laboratory in El Dorado Hills, California, as sub-contracted through ARI, conducted the Dioxin/Furan analyses. Both laboratories provided all required deliverables for the validation according to the National Functional Guidelines. Both laboratories followed adequate corrective action processes and all identified anomalies were discussed in the representative case narratives.

OBJECTIVE

The objective of the data validation was to review laboratory analytical procedures and quality control (QC) results to evaluate whether:

- The samples were analyzed using well-defined and acceptable methods that provide detection limits below applicable regulatory criteria;
- The precision and accuracy of the data are well defined and sufficient to provide defensible data; and
- The quality assurance/quality control (QA/QC) procedures utilized by the laboratory meet acceptable industry practices and standards.

DATA QUALITY ASSESSMENT SUMMARY

The results for each of the QC elements are summarized below. The data assessment was performed using guidance in the USEPA Contract Laboratory Program *National Functional Guidelines for Inorganic Data Review* (USEPA 2002) and USEPA Contract Laboratory Program *National Functional Guidelines for Organic Data Review* (USEPA 2008), National functional Guidelines for Chlorinated Dibenzo-p-Dioxins (CDDs) and Chlorinated Dibenzofurans (CDFs) (USEPA 2005).

Chain-of-Custody Documentation

Chain-of-custody (COC) forms were provided with the laboratory analytical reports. There were no anomalies noted on the COC forms; proper COC protocols appear to have been followed for this sampling event.

Holding Times

The holding time is defined as the time that elapses between sample collection and sample analysis. Maximum holding time criteria exist for each analysis to help ensure that the analyte concentrations found at the time of analysis reflect the concentration present at the time of sample collection. Established holding times were met for all analyses.

Surrogate/Labeled Compound Recoveries

A surrogate compound is a compound that is chemically similar to the analytes of interest, but unlikely to be found in any environmental sample. Surrogates are used for organic analyses and are added to all samples, standards, and blanks to serve as an accuracy and specificity check of each analysis. The surrogates are added at a known concentration and percent recoveries are calculated following analysis. All surrogate recoveries for field samples were within the laboratory control limits, with the exceptions below:

SDG SI14 and SI67 (Pesticides): The percent recovery (%R) values for decachlorobiphenyl were less than the lower control limits of 30% in Samples MW-56_110211, MW-58_110211, MW-59_110211, and PZ-11_110208. There were no positive results for any target analytes in these samples. These outliers were indicative of a low bias; for this reason, all reporting limits were qualified as estimated (UJ) in each of these samples.

SDG SI14 and SI67 (PCBs): The %R values for decachlorobiphenyl were less than the lower control limits of 30% in Samples MW-51_110211 and MW-56_110211. There were no positive results for any target analytes in these samples. These outliers were indicative of a low bias; for this reason, all reporting limits were qualified as estimated (UJ) in each of these samples.

Method Blanks, Trip Blanks & Equipment Rinsate Blanks

Method blanks are analyzed to ensure that laboratory procedures and reagents do not introduce measurable concentrations of the analytes of interest. Method blanks were analyzed with each batch of samples, at a frequency of one per twenty samples. For all sample batches, method blanks for all applicable methods were analyzed at the required frequency.

None of the analytes of interest were detected above the reporting limits in any of the method blanks, with the exceptions below:

SDG SI14 (Semivolatiles): The method blank extracted on 2/10/11 reported a positive detection for bis(2-ethylhexyl)phthalate. There were no positive results for this compound in the associated samples. No qualifiers were required.

Equipment rinsate blanks are analyzed to provide an indication as to whether field decontamination and sampling procedures effectively prevent cross-contamination in field activities. One equipment rinsate blank was collected: Rinse (collected on 2/8/11).

SDG SI14 (PAHs): There was a positive result for pyrene in the equipment blank collected on 2/8/11. The associated field Sample SSB MW-28_110208 reported a positive result for this compound at a level greater than the action level for this compound. No qualifiers were required.

Trip blanks are analyzed to provide an indication as to whether volatile compounds have cross-contaminated other like samples within the transportation process to the laboratory. Typically, samples are stored in a cooler for as long as 24 hours before arriving at the laboratory. One trip blank was collected in this sampling event: TRIP BLANK (collected on 2/7/11). None of the volatiles analytes were detected above the reporting limits in this sample.

In all cases, the blank contamination qualified results should be recognized as a reporting limit, instead of a positive result for data users.

Matrix Spikes/Matrix Spike Duplicates (MS/MSD)

Because actual analyte concentration in environmental samples is not known, the accuracy of a particular analysis is usually inferred by performing a matrix spike (MS) analysis. One aliquot of sample is analyzed in the normal manner, than a second aliquot of the sample is spiked with a known amount of analyte concentration and analyzed. From these analyses, a percent recovery (%R) is calculated. Matrix

spike duplicates (MSD) analyses are generally performed for organic analyses as a precision check. For some organic analytical methods, such as NWTPH-Dx, a laboratory control sample/ laboratory control sample duplicate (LCS/LCSD) sample set is performed in lieu of a MS/MSD analysis.

For inorganics methods, the matrix spike (referred to as a "spiked sample" is typically followed by a post spike sample if any element recoveries were outside the control limits in the "spike sample".

Matrix spike analyses should be performed once per analytical batch or every twenty field samples, whichever is more frequent. The recovery criteria for matrix spikes and laboratory control samples are specified in the laboratory documents as are the relative percent difference values. The frequency requirements were met for all analyses, and the %R/RPD values were within the proper control limits.

Laboratory Control Samples/ Laboratory Control Sample Duplicates (LCS/LCSD)

A laboratory control sample is essentially a blank sample that is spiked with a known amount of analyte concentration and analyzed. It is to be treated much like a matrix spike, without the possibility for matrix interference. As there is no actual sample matrix in the analysis, the analytical expectations for accuracy and precision are usually more rigorous and qualification would apply to all samples in the batch, instead of the parent sample only.

Laboratory control sample analyses should be performed once per analytical batch or every twenty field samples, whichever is more frequent. The recovery criteria for laboratory control samples are specified in the laboratory documents as are the relative percent difference values. The frequency requirements were met for all analyses, and the %R/RPD values were within the proper control limits.

Laboratory Duplicates (Inorganics analyses only)

Internal laboratory duplicate analyses are performed to monitor the precision of the analyses. Two separate aliquots of a sample are analyzed as distinct samples in the laboratory, and the RPD between the two results is calculated. Duplicate analyses should be performed once per analytical batch. If one or more of the samples used has a concentration greater than five times the reporting limit for that sample, the absolute difference is used instead of the RPD.

Laboratory duplicates were analyzed at the proper frequency and the specified acceptance criteria were met in all cases.

Field Replicates/Duplicates

Field duplicate samples were collected and analyzed along with the reviewed sample batches. The duplicate samples were analyzed for the same parameters as the associated parent samples. As mentioned above for the laboratory duplicates the RPD is used as the criteria for assessing precision, unless one or more of the samples used has a concentration greater than five times the reporting limit for that sample, the absolute difference is used instead of the RPD.

The RPD control limits for soil samples is 50%, while the RPD control limits for water samples is 35%. The absolute difference control limits for soil samples is twice the PQL value, while the absolute difference control limits for water samples is the same as the PQL value.

In cases where any of the cPAH compounds or Dioxin/Furan congeners were qualified for precision, the resulting TEC value was also qualified as estimated (J) in that sample.

SDG SI14 (6593)

(Dioxin/Furans): One set of field duplicates, Samples PA-19_110209 & PA-19_110209D, was submitted to the laboratory. The RPD value for the Total Dioxin/Furan TEQ value exceeded the control limits described above. The positive results were qualified as estimated (J) in both samples.

(PAHs): One set of field duplicates, Samples PA-19_110209 & PA-19_110209D, was submitted to the laboratory. Pyrene was detected in Sample PA-19_110209, while reported as being not detected in Sample PA-19_110209D. In this case, the positive result was greater than twice the reporting limit. For this reason, the positive result and reporting limit for this compound was qualified (J/UJ) in the respective samples.

(Pesticides, PCBs, and Chlorophenols): One set of field duplicates, Samples PA-19_110209 & PA-19_110209D, was submitted to the laboratory. The RPD/absolute difference values for all target analytes were within the control limits described above. No qualifiers were required.

(Volatiles and Semivolatiles): One set of field duplicates, Samples MW-63_110208 & MW-63_110208D, was submitted to the laboratory. The RPD/absolute difference values for all target analytes were within the control limits described above. No qualifiers were required.

Pesticide Breakdown Check Standards

The laboratory analyzed a DDT Breakdown check standard at the beginning and end of every analytical batch, All of the % breakdown results were greater than the control limit of 20 %.

Initial Calibrations (ICALs)

All initial calibrations were conducted according to the laboratory methods, and consisted of the appropriate number of standards. For the organics analyses, all percent relative standard deviation (%RSD) values were less than +/- 30% and all relative response factors (RRF) were greater than 0.05.

Continuing Calibration (CCALs)

All continuing calibrations were conducted according to the laboratory methods, and consisted of the appropriate number of standards. For the organics analyses, all percent difference (%D) values were less than +/- 25% and all relative response factors (RRF) were greater than 0.05.

Additional Data Quality Issues

The laboratory flagged several results with a "D" (polychlorinated diphenyl ether [PCDE] interference) where interfering substances reduced confidence in the sample result. Consequently, the results listed below were qualified as not detected in the associated samples.

Sample ID	Analytes
*MW-28_110208	None

* = The positive results for 2,3,7,8-TCDF were qualified as estimated (J) because this compound was not confirmed by a secondary column by the laboratory. The positive result for the corresponding TEC value was also qualified as estimated (J).

Reporting Limits and Miscellaneous

SDG SI14 and SI67 (Pesticides): The reporting limits for certain analytes in the following samples were elevated because of chromatographic interference. The reporting limits for these compounds were qualified (UY) in order to specify this discrepency:

Sample ID	Analytes
MW-56_110211	Heptachlor
PA-19_110209	alpha-Chlordane
PA-19_110209D	alpha-Chlordane

OVERALL ASSESSMENT

As was determined by this data validation, the laboratory followed the specified analytical methods. Accuracy was acceptable, as demonstrated by the surrogate, LCS/LCSD and MS/MSD %R values, with the exceptions mentioned above. Precision was also acceptable, as demonstrated by the LCS/LCSD, MS/MSD, and field duplicate RPD and absolute difference values, with the exceptions mentioned above.

Data were qualified because of surrogate %R outliers and field duplicate precision outliers. Data were also qualified because the appropriate column confirmation was not performed.

Reporting limits were qualified in order to indicate elevated reporting limits.

In general, the data are acceptable for use as qualified.

DATA QUALITY ASSESSMENT SUMMARY

DIOXINS/FURANS EPA 1613, PAHS BY METHOD SW8270-SIM, PCBS BY METHOD SW8082, CHLOROPHENOLS BY METHOD SW8041, TOTAL METALS (INCLUDING MERCURY) BY METHOD EPA6010, 200.8, 7471A TOTAL PETROLEUM HYDROCARBONS BY METHODS NWTPH-DX

ARI Laboratory SDG (Frontier SDG)	Samples Validated (Bold indicates the sample was qualified)
SN00, SN06, SN01 (Mercury only) **(6667)**	MW-65-110311-W, MW-66-110311-W, MW-67-110311-W, RB-110309-W_*2011, RB-110310-W_*2011
SN03 (6667)	MW-65-5-6.5, MW-65-15-16.5, MW-66-2.5-4, MW-66-15-16.5, MW-66-30-30.5, MW-67-2-3.5, MW-67-15-16.5, MW-67-25-25.5

PROJECT: RAYONIER MILL (00137-015-03)

This report documents the results of an EPA level III data validation of analytical data from the analyses of soil and groundwater and the associated laboratory quality control (QC) samples. This standard review included the following:

- Chain of Custody
- Holding Times
- Surrogates/Labeled Compounds
- Method Blanks, Equipment Rinsate Blanks, and Trip Blanks
- Laboratory Control Samples/Laboratory Control Sample Duplicates
- Matrix Spikes/Matrix Spike Duplicates
- Laboratory and Field Duplicates
- Internal Standards (Mass Spectrometry)
- DDT/Endrin Breakdown confirmations (Pesticides only)
- Instrument Initial Calibrations (ICALs)
- Instrument Continuing Calibrations (CCALs)
- Instrument Tunes
- Three HRGC/HRMS system performance checks (Dioxins/Furans only)
    1. Mass Calibration and Resolution
    2. Selected Ion Monitoring switching times
    3. GC Resolution

- 2,3,7,8-TCDF secondary column confirmation

DATA PACKAGE COMPLETENESS

ARI, located in Tukwila, Washington, was the primary sub-contracted laboratory analyzing the samples evaluated as part of this data validation review. ARI analyzed all chemical parameters, with the exception of the dioxin/furan analyses. Frontier Analytical Laboratory in El Dorado Hills, California, as sub-contracted through ARI, conducted the Dioxin/Furan analyses. Both laboratories provided all required deliverables for the validation according to the National Functional Guidelines. Both laboratories followed adequate corrective action processes and all identified anomalies were discussed in the representative case narratives.

OBJECTIVE

The objective of the data validation was to review laboratory analytical procedures and quality control (QC) results to evaluate whether:

- The samples were analyzed using well-defined and acceptable methods that provide detection limits below applicable regulatory criteria;
- The precision and accuracy of the data are well defined and sufficient to provide defensible data; and
- The quality assurance/quality control (QA/QC) procedures utilized by the laboratory meet acceptable industry practices and standards.

DATA QUALITY ASSESSMENT SUMMARY

The results for each of the QC elements are summarized below. The data assessment was performed using guidance in the USEPA Contract Laboratory Program *National Functional Guidelines for Inorganic Data Review* (USEPA 2002) and USEPA Contract Laboratory Program *National Functional Guidelines for Organic Data Review* (USEPA 2008), National functional Guidelines for Chlorinated Dibenzo-p-Dioxins (CDDs) and Chlorinated Dibenzofurans (CDFs) (USEPA 2005).

Chain-of-Custody Documentation

Chain-of-custody (COC) forms were provided with the laboratory analytical reports. There were no anomalies noted on the COC forms; proper COC protocols appear to have been followed for this sampling event.

Holding Times

The holding time is defined as the time that elapses between sample collection and sample analysis. Maximum holding time criteria exist for each analysis to help ensure that the analyte concentrations found at the time of analysis reflect the concentration present at the time of sample collection. Established holding times were met for all analyses.

Surrogate/Labeled Compound Recoveries

A surrogate compound is a compound that is chemically similar to the analytes of interest, but unlikely to be found in any environmental sample. Surrogates are used for organic analyses and are added to all samples, standards, and blanks to serve as an accuracy and specificity check of each analysis. The surrogates are added at a known concentration and percent recoveries are calculated following analysis. All surrogate recoveries for field samples were within the laboratory control limits.

Method Blanks, Trip Blanks & Equipment Rinsate Blanks

Method blanks are analyzed to ensure that laboratory procedures and reagents do not introduce measurable concentrations of the analytes of interest. Method blanks were analyzed with each batch of samples, at a frequency of one per twenty samples. For all sample batches, method blanks for all applicable methods were analyzed at the required frequency.

None of the analytes of interest were detected above the reporting limits in any of the method blanks, with the exceptions below:

Equipment rinsate blanks are analyzed to provide an indication as to whether field decontamination and sampling procedures effectively prevent cross-contamination in field activities. Two equipment rinsate blanks were collected: RB-110309-W (collected on 3/9/11) and RB-110310-W (collected on 3/10/11).

SDG SN06 (Metals): There was a positive result for manganese in the equipment blank collected on 3/9/11. The associated field Samples MW-66-2.5-4, MW-66-15-16.5, MW-66-30-30.5, MW-67-2-3.5, MW-67-15-16.5, and MW-67-25-25.5 reported positive results for this compound at a levels greater than the action level for this compound. No qualifiers were required.

Trip blanks are analyzed to provide an indication as to whether volatile compounds have cross-contaminated other like samples within the transportation process to the laboratory. No Trip Blanks were collected in this sampling event.

In all cases, the blank contamination qualified results should be recognized as a reporting limit, instead of a positive result for data users.

Matrix Spikes/Matrix Spike Duplicates (MS/MSD)

Because actual analyte concentration in environmental samples is not known, the accuracy of a particular analysis is usually inferred by performing a matrix spike (MS) analysis. One aliquot of sample is analyzed in the normal manner, than a second aliquot of the sample is spiked with a known amount of analyte concentration and analyzed. From these analyses, a percent recovery (%R) is calculated. Matrix spike duplicates (MSD) analyses are generally performed for organic analyses as a precision check. For some organic analytical methods, such as NWTPH-Dx, a laboratory control sample/ laboratory control sample duplicate (LCS/LCSD) sample set is performed in lieu of a MS/MSD analysis.

For inorganics methods, the matrix spike (referred to as a "spiked sample" is typically followed by a post spike sample if any element recoveries were outside the control limits in the "spiked sample". If the post spiked sample recoveries are within the control limits, no qualifiers are required.

Matrix spike analyses should be performed once per analytical batch or every twenty field samples, whichever is more frequent. The recovery criteria for matrix spikes and laboratory control samples are specified in the laboratory documents as are the relative percent difference values. The frequency requirements were met for all analyses, and the %R/RPD values were within the proper control limits.

SN03 (Metals): The laboratory performed a matrix spike on Sample MW-65-5-6.5. The %R values for Total Antimony and Total Vanadium were less than the control limits of 75% to 125%. The Total Antimony and Total Vanadium recoveries in the post spike were within the control limits, no action was required.

Laboratory Control Samples/ Laboratory Control Sample Duplicates (LCS/LCSD) or Ongoing Precision & Accuracy (OPR) Samples

A laboratory control sample is essentially a blank sample that is spiked with a known amount of analyte concentration and analyzed. It is to be treated much like a matrix spike, without the possibility for matrix interference. As there is no actual sample matrix in the analysis, the analytical expectations for accuracy and precision are usually more rigorous and qualification would apply to all samples in the batch, instead of the parent sample only.

Laboratory control sample analyses should be performed once per analytical batch or every twenty field samples, whichever is more frequent. The recovery criteria for laboratory control samples are specified in the laboratory documents as are the relative percent difference values. The frequency requirements were met for all analyses, and the %R/RPD values were within the proper control limits.

Laboratory Duplicates (Inorganics analyses only)

Internal laboratory duplicate analyses are performed to monitor the precision of the analyses. Two separate aliquots of a sample are analyzed as distinct samples in the laboratory, and the RPD between the two results is calculated. Duplicate analyses should be performed once per analytical batch. If one or more of the samples used has a concentration greater than five times the reporting limit for that sample, the absolute difference is used instead of the RPD.

Laboratory duplicates were analyzed at the proper frequency and the specified acceptance criteria were met in all cases.

Field Replicates/Duplicates

Field duplicate samples were collected and analyzed along with the reviewed sample batches. The duplicate samples were analyzed for the same parameters as the associated parent samples. As mentioned above for the laboratory duplicates the RPD is used as the criteria for assessing precision, unless one or more of the samples used has a concentration greater than five times the reporting limit for that sample, the absolute difference is used instead of the RPD.

The RPD control limits for soil samples is 50%, while the RPD control limits for water samples is 35%. The absolute difference control limits for soil samples is twice the PQL value, while the absolute difference control limits for water samples is the same as the PQL value.

In cases where any of the cPAH compounds or Dioxin/Furan congeners were qualified for precision, the resulting TEC value was also qualified as estimated (J) in that sample.

Pesticide Breakdown Check Standards

The laboratory analyzed a DDT Breakdown check standard at the beginning and end of every analytical batch, All of the % breakdown results were greater than the control limit of 20 %.

Internal Standards (Low Resolution Mass Spectrometry)

Like the surrogate, an internal standard is a compound that is chemically similar to the analytes of interest, but unlikely to be found in any environmental sample. Internal standards are used only for the mass spectrometry (MS) instrumentation and are usually added to the sample aliquot after extraction has taken place. The internal standard should be analyzed at the beginning of a 12 hour sample run and the

control limits for internal standard recoveries are -50% to +100% of the calibration standard. All internal standard recoveries were within the control limits.

(CPAHs): Several internal standard recovery values were less than the control limits mentioned above. These outliers were indicative of an instrumental low bias. Therefore, the reporting limits for non-detected analytes were qualified as well as the positive results.

(SDG SN03): The reporting limits for pyrene, benzo(a)anthracene, chrysene, and the resulting TEQ value were qualified as estimated (UJ) in Samples MW-65-15-16.5 and MW-67-15-16.5 because the internal standard d12-chrysene was lower than the control limits. The positive results and reporting limits for benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenz(a,h)anthracene, total benzofluoranthenes, and the resulting TEQ value were qualified as estimated (J/UJ) in Sample MW-65-5-6.5 because the internal standard d12-perylene was outside the control limits.

Initial Three HRGC/HRMS system performance checks (Dioxins/Furans only)

There are three fundamental system performance checks that must be conducted for every analytical batch of dioxin/furan samples, according to method EPA 1613. Mass calibration and resolution is the first part of the three fundamental High Resolution Gas Chromatography/HRMS (HRGC/HRMS) system performance checks. The second fundamental performance check is the Mass Spectrometer Selected Ion Monitoring (SIM) scan descriptor switching times. The third fundamental performance check is Gas Chromatograph (GC) resolution.

All three of these performance checks were appropriately conducted and no findings of significance were observed from this validation.

3,7,8-TCDF secondary column confirmation

Isomer specificity for all 2,3,7,8-substituted dioxins and furans cannot be achieved on the one 60-meter DB-5 column alone. Historically, problems have been associated with the separation of 2,3,7,8-TCDF from 1,2,3,9-TCDF and 2,3,4,7-TCDF. There are significant toxicological concerns associated with 2,3,7,8-TCDF; therefore, a second column confirmation is used and additional analyses may be required for some samples.

The National Functional Guidelines state “If second-column confirmation is required but was not performed, qualify the 2,3,7,8-TCDF detects as unusable "R"”. However, the laboratory (Frontier Analytical) is using calibration standards that are lower than the levels prescribed by EPA Method 1613 in order to achieve the concentration levels prescribed in the QAPP. In this analysis, the confirmation column (DB-225) cannot be relied on to see below 10 pg/L, as the target analyte peaks cannot be separated from chromatographic noise. For this reason, any positive results that have not been confirmed by a secondary column were qualified as estimated (J), rather than rejected, in the following samples.

SDG 6667: MW-65-5-6.5, MW-66-2.5-4, MW-66-15-16.5

Initial Calibrations (ICALs)

All initial calibrations were conducted according to the laboratory methods, and consisted of the appropriate number of standards. For the organics analyses, all percent relative standard deviation (%RSD) values were less than +/- 30% and all relative response factors (RRF) were greater than 0.05.

Continuing Calibration (CCALs)

All continuing calibrations were conducted according to the laboratory methods, and consisted of the appropriate number of standards. For the organics analyses, all percent difference (%D) values were less than +/- 25% and all relative response factors (RRF) were greater than 0.05.

Reporting Limits and Miscellaneous

CPAHs: The laboratory flagged several results with an "M", indicating that there was a low spectral match which reduced confidence in the qualitative analysis of the sample result. Consequently, the results listed below were qualified as tentatively identified (NJ) in the associated samples. The resulting TEQ values from these samples should be considered estimates.

Sample ID	Analytes
MW-66-110311-W	Dibenz(a,h)anthracene

SDG SN00 (CPAHs): The compound pyrene exceeded the linear range of the instrument in Samples MW-66-110311-W and MW-66-2.5-4. For this reason, these samples were diluted by the laboratory and re-analyzed. Both sets of data were reported. In each sample, the initial reported result for pyrene was qualified as "Not reportable" in the database. Also in each sample, the diluted reporting limits for all target analytes except pyrene were qualified as "Not reportable" in the database.

These database qualifiers were assigned so that only one set of target analytes would be displayed in any data tables derived from the database.

All Chlorophenols and/or PCBs: The laboratory indicated that several samples were screened before extraction because of the probable affects of natural matrix interference. In cases where certain Aroclors and pesticides could not be distinguished because of chromatographic interference, the laboratory raised the reporting limits, and indicated this with a "Y" qualifier. These data points were appropriately taken through the validation process, and these reporting limits were qualified (UI) in GeoEngineer's database.

OVERALL ASSESSMENT

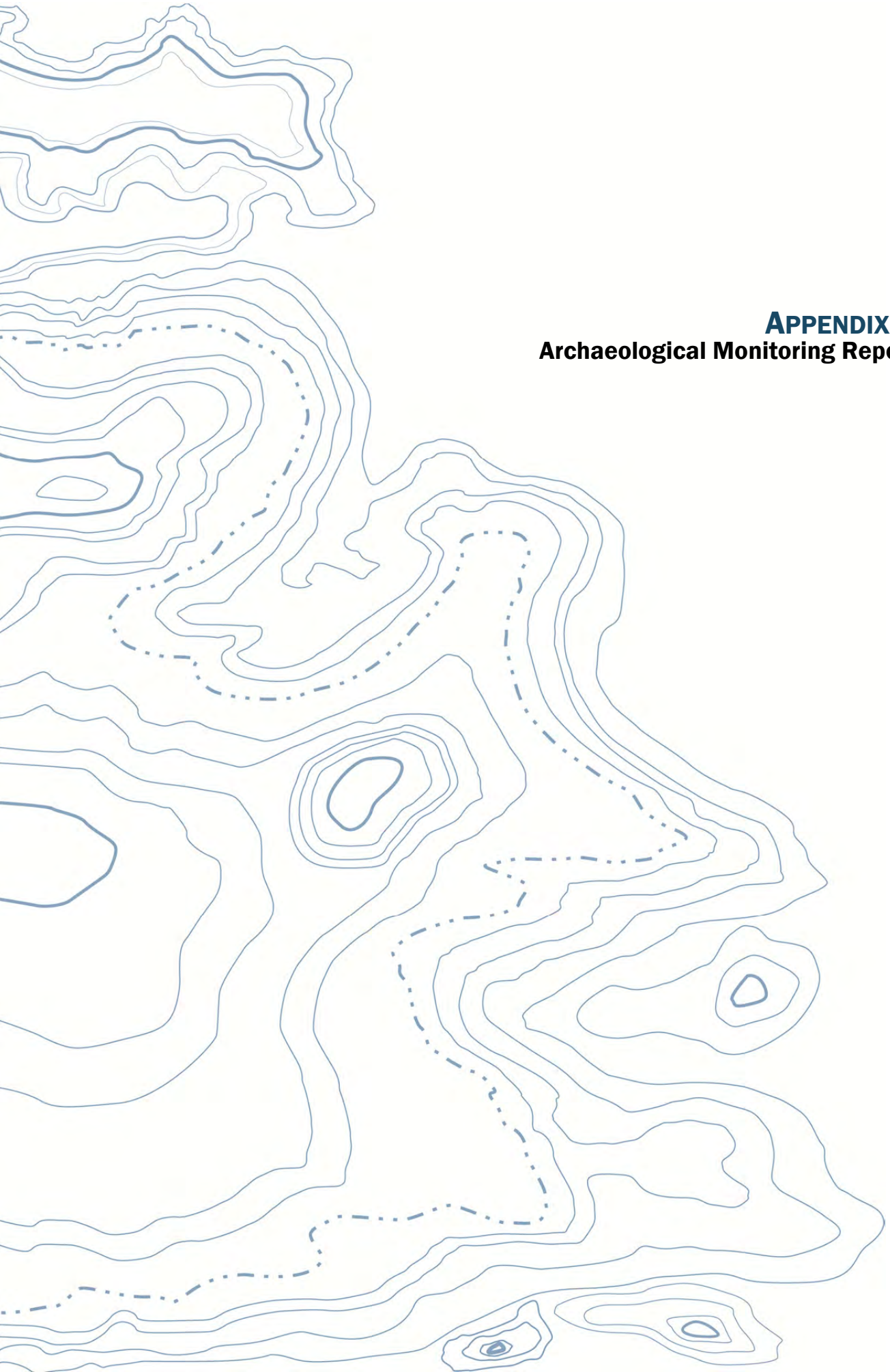
As was determined by this data validation, the laboratory followed the specified analytical methods. Accuracy was acceptable, as demonstrated by the surrogate, LCS/LCSD and MS/MSD %R values, with the exceptions mentioned above. Precision was also acceptable, as demonstrated by the LCS/LCSD, MS/MSD, and field duplicate RPD and absolute difference values, with the exceptions mentioned above.

Data were tentatively identified because of LR/MS poor spectral matches.

Several reporting limits were elevated because of chromatographic/spectral interferences.

Data were qualified as estimated because no secondary column confirmation could be performed at low levels.

In general, the data are acceptable for use as qualified.



APPENDIX G
Archaeological Monitoring Report

CULTURAL RESOURCES REPORT COVER SHEET

Author: Margaret Nelson, Sarah Thompson and Anthony Cagle

Title of Report: Archaeological Monitoring of Phases 2, 3, and 4 of the Supplemental Upland Data Collection Investigation at the Former Port Angeles Rayonier Mill, Clallam County, Washington

Date of Report: June 14, 2011

County(ies): Clallam Section: 2, 11, 12 Township: 30 N Range: 6 W

Quad: Port Angeles, WA, 1985 Acres: 80

PDF of report submitted (REQUIRED) ☒ Yes

Historic Property Export Files submitted? ☐ Yes ☒ No

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

TCP(s) found? ☐ Yes ☒ No

Replace a draft? ☐ Yes ☒ No

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

DAHP Archaeological Site #:
45CA235 (vicinity)
_____
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- Submission of paper copy is required.
- Please submit paper copies of reports ***unbound.***
- Submission of PDFs is required.
- Please be sure that any PDF submitted to DAHP has its cover sheet, figures, graphics, appendices, attachments, correspondence, etc., compiled into one single PDF file.
- Please check that the PDF displays correctly when opened.

ARCHAEOLOGICAL MONITORING OF PHASES 2, 3, AND 4 OF THE SUPPLEMENTAL UPLAND DATA COLLECTION INVESTIGATION AT THE FORMER PORT ANGELES RAYONIER MILL

CLALLAM COUNTY, WASHINGTON

by
Margaret Nelson
Sarah Thompson
Anthony Cagle

Prepared for
Rayonier Inc.
Jacksonville, FL

Submitted to
GeoEngineers, Inc.
Redmond, WA

June 14, 2011

CASCADIA ARCHAEOLOGY
P.O. Box 51058
Seattle, WA 98115

ABSTRACT

Rayonier Inc. conducted a supplemental upland field investigation at its former Port Angeles Mill site involving soil and groundwater sampling and testing under the oversight of the Washington Department of Ecology. Cascadia Archaeology, LLC was retained to monitor three phases of data collection excavations (Phases 2, 3, and 4) between October 2010 and May 2011. The former mill site, which Rayonier operated from the 1930s to the 1990s, is in the vicinity of a 19th century Klallam village, *I'e'nis*; the 1880s to 1890s-era Puget Sound Cooperative Colony; and a mill built by the U.S. Army Spruce Division during World War I. One Phase 2 soil boring between the dock and mouth of Ennis Creek contained possible shell midden. Phase 3 test pits in the vicinity of the former Wood Mill contained subsurface concrete foundations, cribbing, and pilings from the Rayonier mill that were left when the above-ground structures were razed in 1997. These elements were documented and left in place. No cultural material was observed in borings excavated in Phase 4.

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1.0 INTRODUCTION

Rayonier Inc. (Rayonier) is in the process of characterizing the nature and extent of contamination at its former Port Angeles Mill property. After the pulp mill was closed in 1997, the buildings and other structures were dismantled to ground level. A plan for investigation of the site was then developed by Rayonier and the Washington State Department of Ecology (Ecology) pursuant to the Model Toxic Control Act (Washington State Department of Ecology 1997; Rayonier 1997, cited in Robbins et al. 1997:1). Because a known historic period Klallam village and prehistoric archaeological resources are located on and in the vicinity of the Rayonier property, the Lower Elwha Klallam Tribe and Rayonier have an agreement specifying that an archaeological monitor will be present during ground-disturbing activities that could encounter intact sediments.

GeoEngineers, Inc. has been conducting soil and groundwater sampling and testing at the former Rayonier mill. Cascadia Archaeology, LLC was retained by GeoEngineers to provide archaeological monitoring of test excavations for Phases 2, 3, and 4 of the Supplemental Upland Data Collection Field Investigation. The project is subject to Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, and other federal laws and regulations because of federal agency involvement in the project through the Environmental Protection Agency (EPA). Historic or prehistoric cultural resources that are determined to be significant, i.e., eligible to the National Register of Historic Places (NRHP) under Section 106 must be avoided or, if that is not possible, mitigation measures must be developed in consultation with interested parties, including the Affected Tribes. The agreement between Rayonier and the Lower Elwha Klallam Tribe (LEKT) states that an archaeological monitor must be present whenever intact sediments could be disturbed. Both the LEKT and City of Port Angeles were notified of the project and expected fieldwork dates by GeoEngineers before each phase began.

The following sections of this report provide a description of the project and a brief summary of background information relevant to the current project. This information is mostly extracted from a longer summary of the natural and cultural settings in a report prepared by Cascadia Archaeology for GeoEngineers and Rayonier in 2006 (Nelson 2006). The most comprehensive recent overview of the mill is provided in a cultural resource assessment prepared for Rayonier by Larson Anthropological/Archaeological Services in 1997, when the mill was closed (Robbins et al. 1997).

1.1 Project Location and Description

The Rayonier mill property encompasses 80 acres adjacent to Port Angeles Harbor on the east side of Port Angeles, in Township 30 North, Range 6 West, Willamette Meridian, Sections 2, 11, and 12 (Figure 1). The site is situated on the south shore of the Strait of Juan de Fuca at the mouth of Ennis Creek. The Rayonier mill was built on the Ennis Creek delta, which extended out from the bluff as much as 500 ft. before it was altered by development in the first half of the 20th century (Robbins et al. 1997). The main areas of

Figure 1. Project vicinity, T. 30 N., R. 6 W. (USGS 7.5' quadrangle Port Angeles, WA., 1985).

the mill were built on fill that extended out from the natural shoreline to create a surface approximately 11 ft. above sea level (asl).

Phase 2 of the supplemental upland investigation consisted of collecting soil and/or groundwater samples at 27 boring locations using a truck-mounted auger. The borings included monitoring wells (MW), supplemental soil borings (SSB), and groundwater grab sample borings (GWG). The borings were planned to extend to unaltered glacial sediments, estimated to occur at 25 to 35 ft. below surface (bs).

Phase 3 consisted of excavating test pits intended to measure contaminant levels remaining in portions of the main mill area where past interim actions had been completed (GeoEngineers 2006). The Phase 3 test pits were excavated with a trackhoe to groundwater level, about 10 to 12 ft. bs.

Phase 4 was intended to further characterize concentrations of constituents of potential concern (COPCs) on the Rayonier Mill property. In Phase 4A, which took place in March 2011, three groundwater monitoring wells, MW-65, MW-66, and MW-67, were installed. Three additional groundwater monitoring wells, MW-68, MW-69, and MW-70, were installed in May 2011 during Phase 4B.

Exploration locations for Phases 2 and 3 are shown in Figure 2. Exploration locations for Phases 4A and 4B are shown in Figures 3 and 4, respectively. Note that the numbers for Phase 4B wells MW-68 and MW-70 are incorrect on the map and should be reversed (so that the correct numbering, from west to east, is MW-68, MW-69, and MW-70). More detailed descriptions of excavation, sampling, and archaeological monitoring methods are in Section 4.

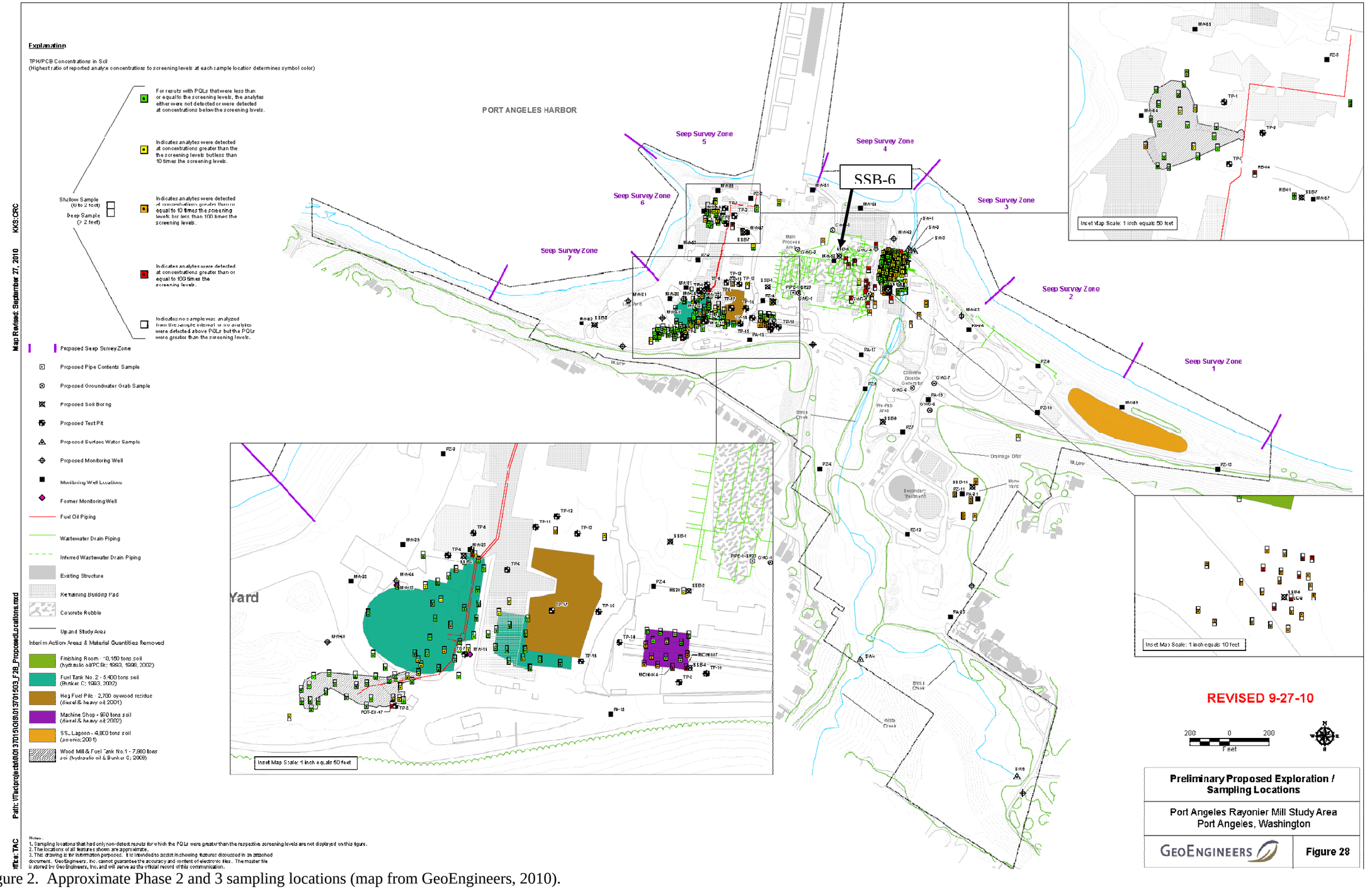

Figure 2. Approximate Phase 2 and 3 sampling locations (map from GeoEngineers, 2010).

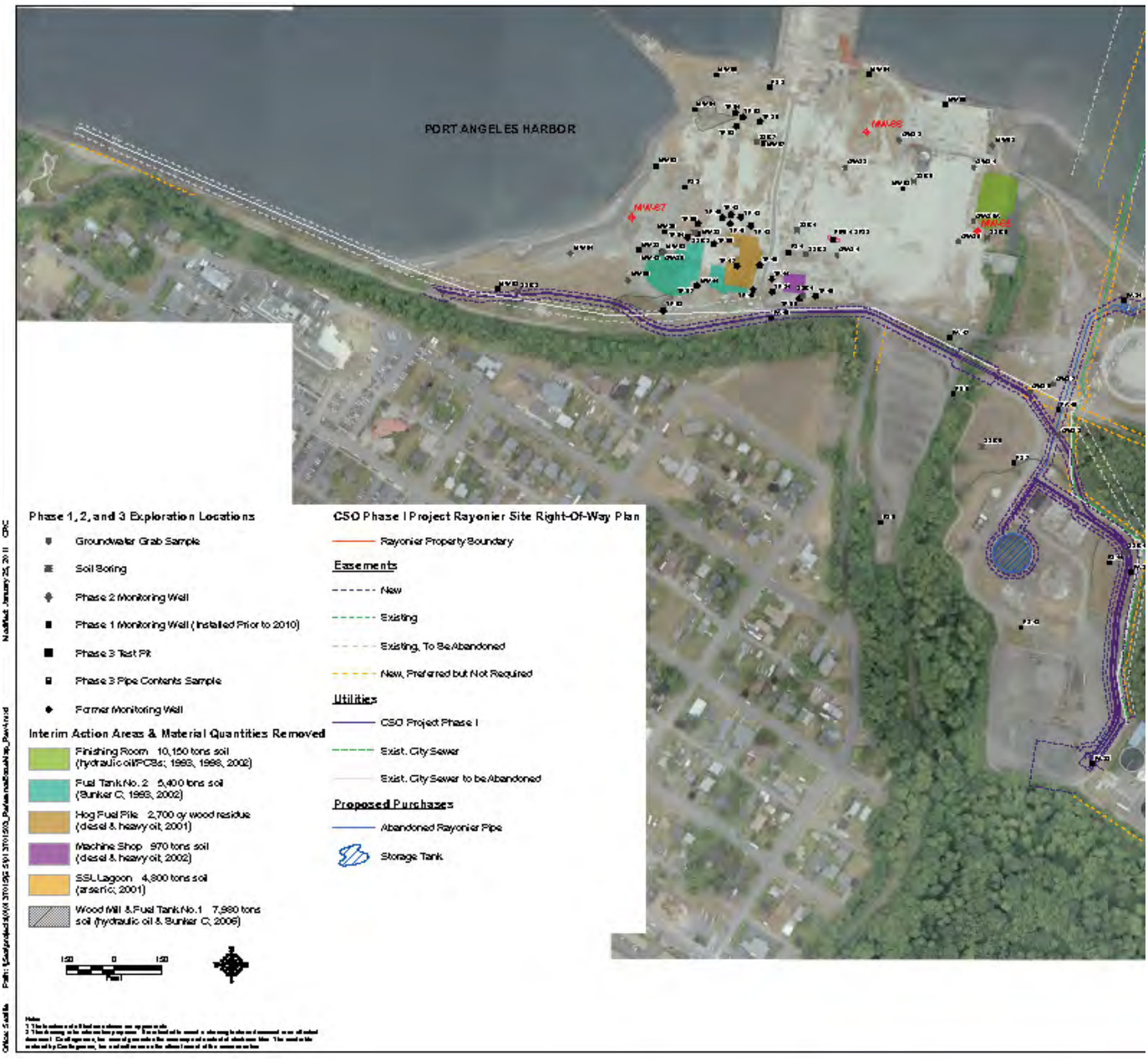

Figure 3. Approximate Phase 4A monitoring well locations, shown in red, shown in red.

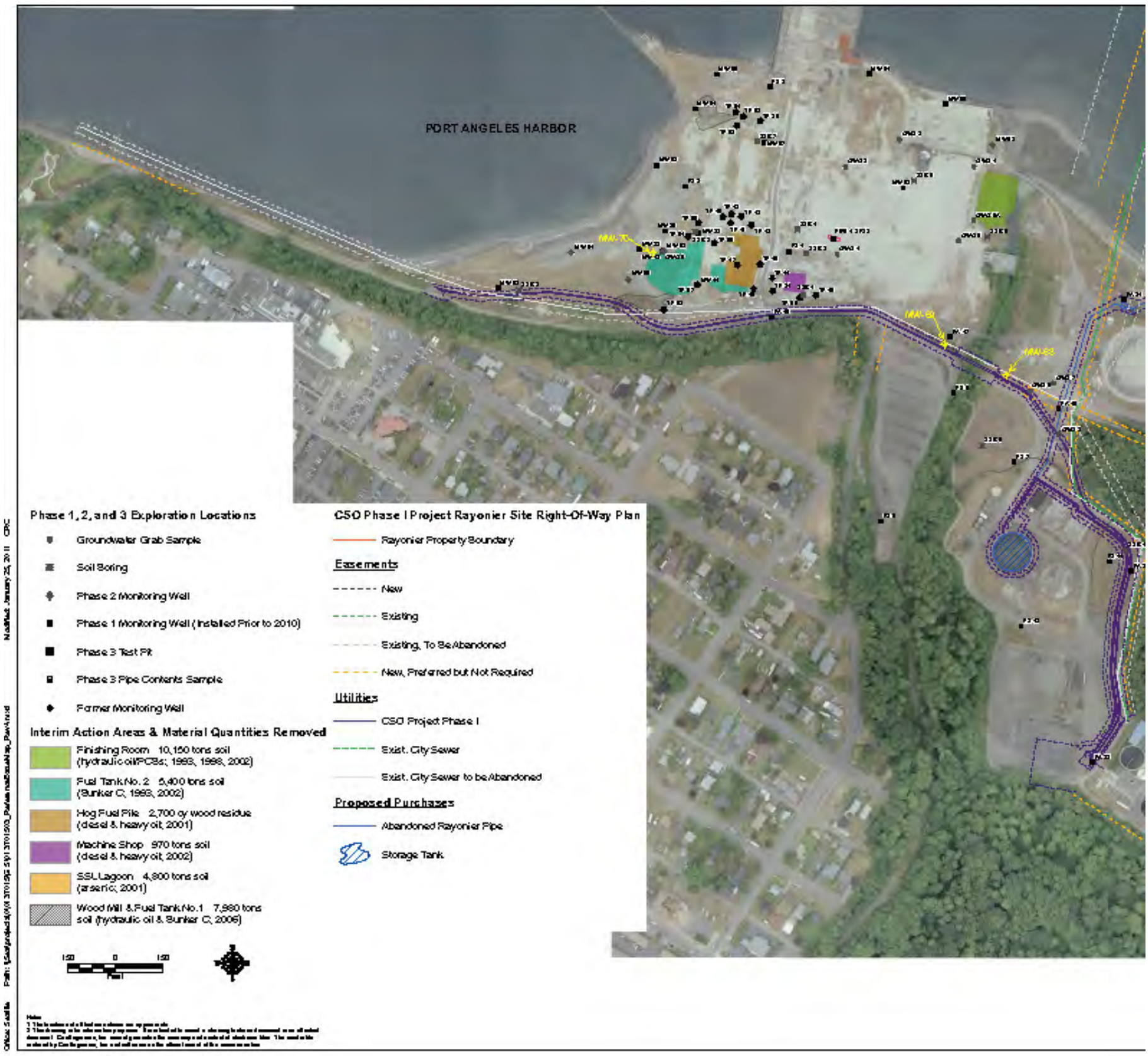

Figure 4. Approximate Phase 4B monitoring well locations, shown in yellow. Note that MW-68 and MW-70 numbers are reversed in this figure.

2.0 NATURAL AND CULTURAL SETTING

2.1 Natural Environment

The northern Olympic Peninsula is characterized by a maritime climate with moderate, wet winters, and cool, dry summers. Rainfall is abundant and dense coniferous forests covered lower and middle elevations of the peninsula historically. Western red cedar, hemlock, and spruce thrived in the humid climate. Valley bottoms were relatively narrow and flood-prone with dense thickets of alder. Douglas fir grew in slightly drier and more open areas, along with a wider variety of shrub and herbaceous species.

Because of the density of northern Olympic Peninsula forests, terrestrial game such as deer and elk would have been scarce relative to areas such as Sequim Prairie, where vegetation density was lower and usable biomass higher. Periods with higher effective temperature and lower effective moisture, such as the early Holocene, also would have provided better conditions for large and medium-sized terrestrial animals. Plant species commonly harvested as food resources by Native Americans on the southern Northwest Coast, such as huckleberries, camas, and bracken fern roots, would have been present in suitable habitats on the north peninsula, including the margins of meadows, prairies, and burned-over areas.

Marine resources, including fish and sea mammals, were abundant in the waters of the Strait of Juan de Fuca. The most important marine resource to Native Americans of the Northwest Coast was salmon, and prior to dam construction, the Elwha River supported the most productive salmon runs on the Olympic Peninsula. Ennis Creek, which empties into the Strait of Juan de Fuca on the Rayonier Mill property, was also a salmon-bearing stream. Shellfish were available in a variety of shoreline and intertidal habitats, although protected beaches where they are most abundant are few relative to Puget Sound and the Gulf and San Juan Islands.

2.2 Cultural Setting

The Rayonier Mill project area is in the early historic period territory of the Klallam, a Central Coast Salish grouping subdivided by language (Suttles 1990:453). The Klallam lived on the northern Olympic Peninsula between the Hoko River and Discovery Bay. During the mid-19th century, they expanded north to southern Vancouver Island and east to Port Townsend (Castile 1985; Gunther 1927). They also had a site on the west side of Whidbey Island where they collected camas.

The Rayonier Port Angeles Mill was constructed near a 19th century Klallam village, *I'e'nis* (also transcribed as *I-eh-nus* or *Y'innis*). According to late 19th century accounts by members of the Puget Sound Cooperative Colony (PSCC) who settled on the west side of the creek, the village was on the east side of the mouth of Ennis Creek (LeWarne 1975:33). Sketches made by the artist Paul Kane, who traveled through the region in

1847, show the stockaded village and several graves a short distance to its east (Harper 1971:304; Robbins et al. 1997:11).

Sustained Euroamerican use of lower Ennis Creek began when the PSCC, the first of several utopian communities built in the Puget Sound region during the late nineteenth and early twentieth centuries, was established in 1887 (Figure 5) (LeWarne 1975). Buildings were initially constructed on the west side of the creek while Klallam people still occupied their village on the east side of the creek. The PSCC built a mill along the shoreline near the bluff, which provided lumber for the growing Colony and also supplied materials for a number of early structures in Port Angeles that were built by Colony members. The lumber market collapsed during the depression of 1893 and the same year, the PSCC sawmill burned down (Harper 1969; LeWarne 1975). In 1904, the site was abandoned.

During World War I, the U.S. Army Spruce Production Division was formed to provide spruce to be used in airplanes for the war effort. The Spruce Division began laying railroad tracks to convey spruce from the forests of western Clallam County to a huge new mill at the former PSCC site in Port Angeles. The mill was constructed on pilings on the beach and below the high tide line just west of Ennis Creek. The war ended before the mill and connecting railroad line were completed so the mill never went into operation for its original purpose. The mill complex included a sawmill and other buildings covering an area over 700 ft. (E-W) by 350 to 400 ft. (N-S) (Robbins et al. 1997:Figures 14-16).

In 1929, the spruce mill was purchased by the Olympic Forest Products Company for operation of a pulp and paper mill. The company expanded the site to the north with the addition of fill and riprap to raise the intertidal zone to an elevation of 11 ft. asl. Fill was also placed in the area where the spruce mill had been built. Many of the spruce mill buildings were razed and new buildings constructed on fill and pilings in the early 1930s (Robbins et al. 1997:23). In 1933, the lower Ennis Creek channel was diverted eastward some 200 ft. north of the Chicago, Milwaukee, St. Paul and Pacific (Milwaukee Road) railroad grade (Robbins et al. 1997:Figure 13). The creek also appears to have been diverted eastward prior to 1933, according to engineering drawings and photos (Robbins et al. 1997:23, Figures 4, 12). In 1937, Olympic Forest Products merged with the Rainier and Grays Harbor Pulp and Paper companies, forming Rayonier. Rayonier operated the mill until it was closed in 1997. Figure 6 identifies mill structures during the Rayonier era. Shortly after the mill closed, most of the structures were demolished to ground level.

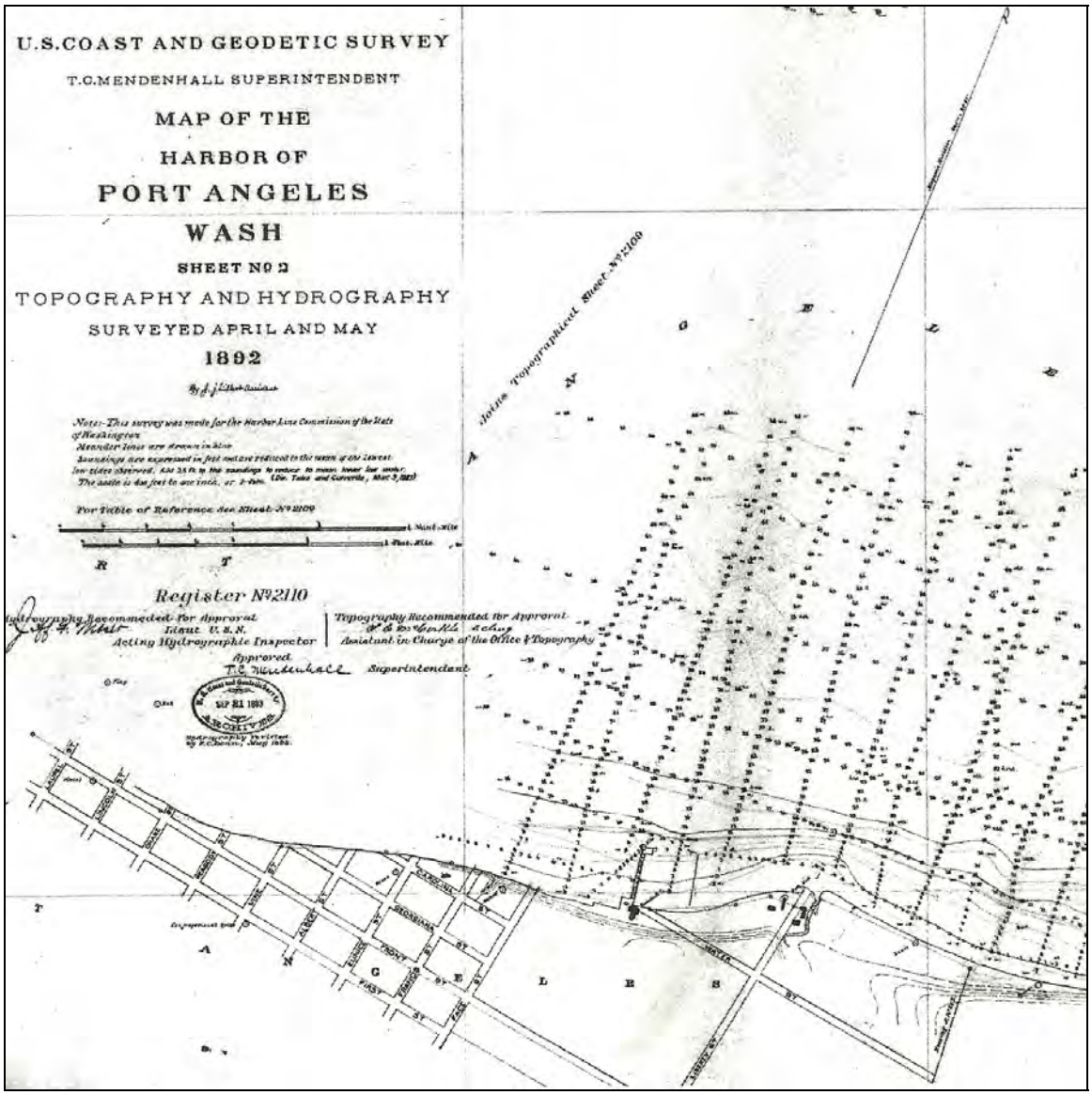

Figure 5. 1892 U.S. Coast and Geodetic Survey map showing mouth of Ennis Creek and PSCC buildings (North Olympic Library System, Port Angeles).

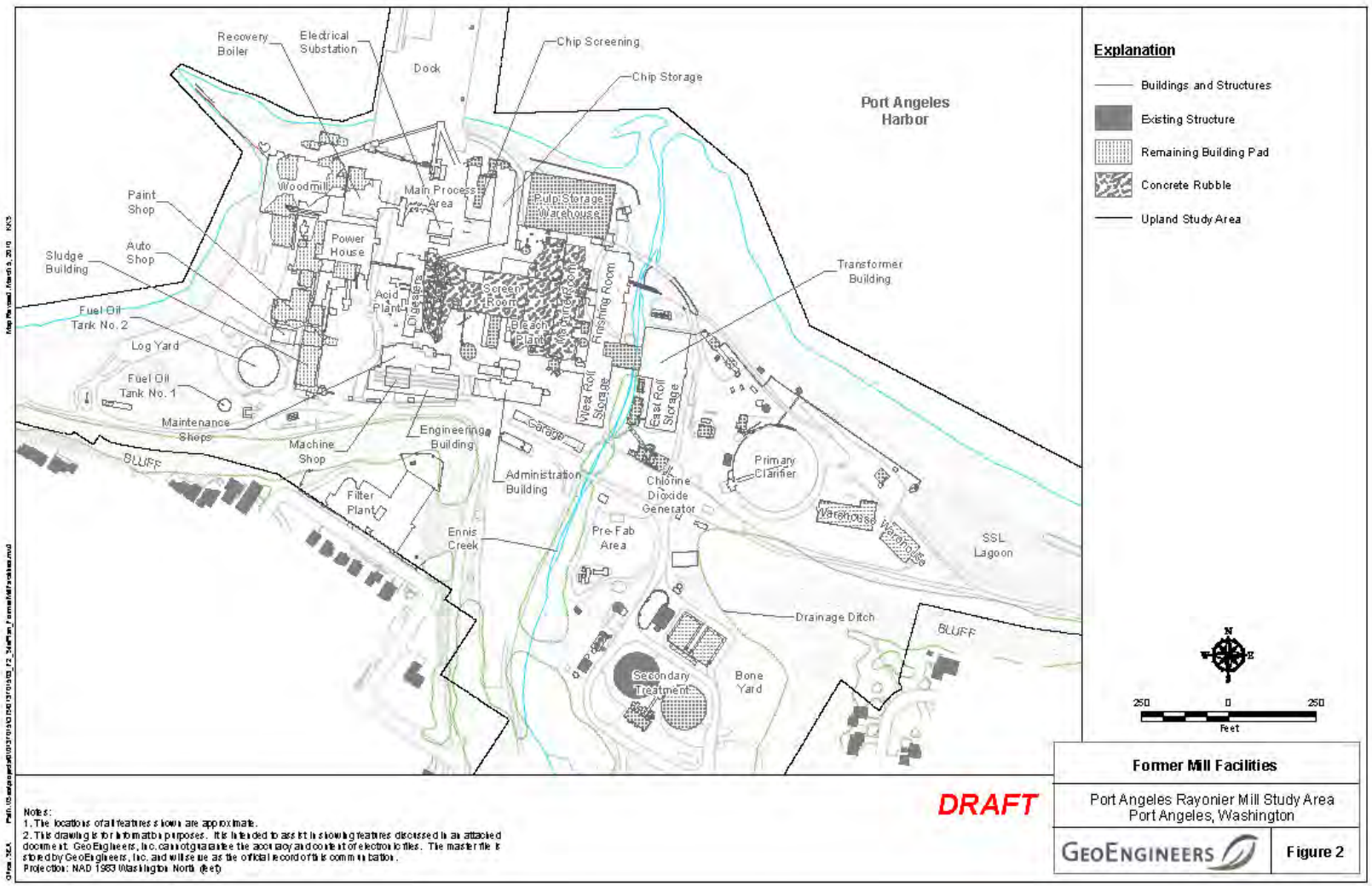

Figure 6. Former Rayonier mill structures (map from GeoEngineers, 2010).

3.0 EXPECTATIONS

Previous archaeological investigations in the vicinity, including a survey along the east bank of Ennis Creek at the Rayonier Port Angeles Mill (Robbins et al. 1997), which identified prehistoric site 45CA468, and data recovery excavations at *Tse-whit-sen*, a 2,700 year old village at Ediz Hook that was occupied into the historic period, as well as information on the historic Klallam village of *I'e'nis* (site 45CA235), suggest a medium to high probability of prehistoric to historic period Native American cultural resources within the project area. Some of the Phase 2 borings east of the dock are within the high probability area delineated by Robbins et al. (1997:33). Ennis Creek is a spawning stream for salmon and steelhead, and villages or seasonal camps were often located in such settings during the prehistoric and early historic periods. The majority of the former Rayonier mill area is less likely to have intact evidence of pre-mill activities because that area was intertidal and subtidal, and was covered with large amounts of fill during the 1930s.

Presently, the mouth of Ennis Creek is about 200 to 225 ft. east of where it was just before it was diverted in the 1930s, and it may have been farther east of that during the late 1880s, if Robbins et al.'s interpretation of an historical photo is correct (Robbins et al. 1997:Figure 12). The lower channel likely had also shifted its course at earlier times as its delta prograded. During the 19th century, I'e'nis was on the east side of the creek, so the primary locus of cultural activity during that period is well east of the Phase 3 test pits, although some of the Phase 2 borings are located in that general part of the mill property.

While I'e'nis was on the east bank of the creek in the historic period, earlier occupation around the mouth of the creek could have been on either or both banks, although given the steeply incised channel cut through the bluff, the creek probably would have been no nearer than about 300 ft. from the former Wood Mill area. Historical photographs and written descriptions also record Klallam people camping along Hollywood Beach between Ennis Creek and Ediz Hook, and evidence of short-term camps or resource collecting sites could be encountered near the south end of the mill site.

Evidence of historic use of the property is most likely to consist of foundations, pilings, pipes, and other structural elements of the Rayonier mill. Some of this material potentially could have originated as part of the World War I-era Spruce Mill, but subsequent mill operations would probably have destroyed or significantly altered any remains of the Spruce Mill that would be encountered. Remains of the PSCC would most likely be found close to lower Ennis Creek before it was re-channeled eastward, or near the bluff to the west, where the PSCC mill was located. None of the excavations completed for Phase 2, 3, or 4 are at the approximate locations of major PSCC structures, including the sawmill, East End Hotel, and school (See Robbins et al. 1997:Figure 4), although some of the Phase 2 and 4B borings could encounter remains of smaller structures or other debris associated with the PSCC.

Historic to modern remains of the mill were expected to be found during Phases 2, 3, and 4. The Wood Mill and Recovery Boiler were located in the vicinity of the northern cluster of explorations shown as an enlarged section in Figure 2. The Paint Shop, Auto Shop, Sludge Building, Fuel Oil Tank No. 2, and Hog Fuel Pile were located in the vicinity of the southern cluster of explorations shown in Figure 2 (southern enlarged section) and the Finishing Room was located in vicinity of the eastern cluster of explorations shown in Figure 2 (eastern enlarged section). When evaluated in 1997 these buildings were not considered significant or were not historic, and after the mill closed the above-ground portions were removed.

4.0 FIELD METHODS

The Phase 2 field investigation took place between October 18 and November 5, 2010. Before each phase of work started, GeoEngineers informed the LEKT archaeologist (Bill White) and the City of Port Angeles archaeologist (Derek Beery) of the work schedule so that they could be on-site to observe if desired. Tribal representatives, including Larry Dunn and Bill White, did observe the excavations on a number of occasions.

Excavation during Phase 2 consisted of soil borings with a 2 in.-diameter split spoon sampler on a truck-mounted auger drilling rig utilizing 8-inch diameter hollow-stem augers (Figure 7). Samples were taken by GeoEngineers geologist Aaron Waggoner. The archaeological monitor (Sarah Thompson during weeks 1 and 3, Tony Cagle during week 2) examined the auger cuttings and the samples as they were removed from the split spoon sampler. The geologist was consulted in cases where the soil type or origin was not clear. Descriptions of the soils and contents were recorded on field monitoring forms by depth in feet below surface (ft. bs). Five monitoring wells (MW), ten supplemental soil borings (SSB) and nine groundwater grab borings (GWG) were excavated with the drilling rig and monitored during Phase 2.

Figure 7. Drill rig (jetty in background). Facing N.

The MWs and SSBs were excavated down to glacial drift, which was reached at an average depth of 25 ft. bs. The GWGs were excavated to depths of 9 to 30 ft. bs. In most of the SSBs, soil cores were collected about every 5 ft. (see Appendix A, Tables 1 and 2). Samples were gathered by driving an 18-in. long, 3-inch diameter split spoon sampler into the soils with a 300-pound free-falling weight or auto-hammer. The recovered soil cores were 2 in. in diameter and anywhere from 1 to 18 inches long (Figure 8). The

Figure 8. Split spoon sample from SSB-2, 10 to 11.5 ft. bs.

samples were broken up by the geologist, which allowed for a clearer view of the sample by the monitor. Cuttings were shoveled into a metal barrel for disposal.

The Phase 3 field investigation took place between January 4 and January 7, 2011, with Sarah Thompson present as archaeological monitor. The explorations consisted of 17 scheduled test pits (TPs) and four extra test pits to provide additional soil information around TPs 2, 11, and 14 (Figure 2 and Appendix B, Figures B1, B2, and B3). The TPs were excavated using a trackhoe with a 5 ft.-wide toothed bucket (Figure 9). The pits measured an average of 5 ft. wide by 13 ft. long (1.5-4 m), and were excavated down to groundwater, which was exposed at an average depth of 5 to 6.5 ft. (1.5 to 2 m). One exploratory trench, located about 165 ft. (50 m) northeast of TP-10, was excavated in an attempt to expose a suspected wastewater drain pipe in the blow pits/wastewater drain piping area.

Phase 4A excavations were conducted on March 9 and 10, 2011 (see Figure 3), with Sarah Thompson again present as the archaeological monitor. All three monitoring wells, MW-65 through MW-67, were excavated to glacial drift deposits, typically 25-30 ft. bs. As in Phase 2, Phase 4A soil samples were collected every 5 ft. by driving an 18-inch long, 3-inch diameter split spoon sampler into undisturbed soil. The recovered soil cores were 2 inches in diameter and between 1 and 18 inches long. The samples were broken up by GeoEngineers geologist Aaron Waggoner and then examined by the archaeological monitor.

Phase 4B excavations occurred on May 4-6, 2011 (see Figure 4) and were monitored by archaeologist Tony Cagle. Two of the three groundwater monitoring wells, MW-69 and MW-70, were excavated to 25-30 ft. bs, while MW-68 was to be a deep well (60-100 ft. bs) screened within the glacial deposits. Cores were taken at all depths and were brought up in 5 to 10-foot lengths using a 4 or 6-in. diameter core barrel, depending on depth.

Figure 9. Excavator at TP-18. Facing NW.

The smaller diameter core barrel was used below the top of the glacial deposits. Samples were bagged in approximately 2.5-foot segments and opened for inspection. In addition to noting any cultural material or deposits, the monitor recorded descriptions of the soils and their depths in consultation with the geologist.

5.0 RESULTS

Phase 2

Results of the Phase 2 test borings are shown in Tables A1 and A2 (Appendix A). In general, the upper 5 to 15 ft. was fill containing clay, sand, silt, and gravel, often with concrete, metal, and woody debris mixed in some of the layers. Below that were layers of sand and gravelly sand, and in some cases silt or silty sand. These strata, representing what appeared to be generally undisturbed beach deposits, were most common between about 10 and 25 ft. bs. Below this was glacial drift, typically consisting of compact gray silty clay with pebbles.

On October 26, 2010, archaeological monitor Tony Cagle observed a large quantity of fragmented and nearly intact marine shells mixed with tan to brown sand in a sample obtained from boring SSB-6 (Figures 2 and 10). This sample came from between 5 and 6.5 ft. bs, directly beneath a layer of concrete rubble and fill sediment. The shells did not show evidence of water-rolling and were of a much higher density than was observed in previous bore holes. The shells appeared to be in clean sands with no associated dark organic staining, fire-modified rock, bone, or artifacts, so Cagle did not immediately halt drilling. The next sample, taken between 10 ft and 11.5 ft., also contained a large quantity of sharp-edged shell in a clean, tan to brown sand, though the shells appeared to be decreasing in frequency. Cagle stopped the drill crew at that point to consult with monitoring supervisor Meg Nelson about whether the dense shell layer could be a cultural deposit. Nelson instructed Cagle to send a sample of the material to the offices of Cascadia Archaeology and to suspend drilling at that location.

Figure 10. Fragmented shell and sand from SSB-6, about 6 ft. below surface.

Nelson and other Cascadia archaeologists examined the sample and concluded that the deposit was not typical of shell middens (i.e., it consisted of clean beach sand, not organically stained, and contained no artifacts, bone, or charcoal), but the density of shell in the matrix, fragmentation size, and sharpness of the breaks appeared more cultural than natural. It seemed more likely that the shell could have been fragmented as a result of mill activities or perhaps the PSCC occupation. Nelson reported the findings to the DAHP as a possible cultural deposit. State Archaeologist Rob Whitlam was not available, so Assistant State Archaeologist Stephenie Kramer approved completion of the boring. Bill White, archaeologist for the LEKT, and City of Port Angeles archaeologist Derek Beery were also informed of the possible find and visited the site. They observed some of the material in question and the SSB-6 location, and raised no objection to having the drilling continue.

Sarah Thompson returned to the site on November 1 and monitored the completion of SSB-6. Because the augers had been removed, SSB-6 was relocated 5 ft. east of its original location. The drill crew advanced the augers to 15 ft. bs without taking samples because samples had been taken to that depth in the original SSB-6 bore hole. Thompson did not observe any shell in the auger cuttings, but did encounter a low density of fragmented, water-rolled shell in gray, gravelly sand between 25 ft. and 25.75 ft. bs. This shell was typical of a natural marine deposit and unlike what had been observed by Cagle in SSB-6.

Phase 3

Test Pits (TP) 1-3 and 20 were located in the northwest corner of the property, 40 m southwest of the main wharf/dock, in the vicinity of the demolished Wood Mill. All four TPs contained fill material to the base of excavation (Table A2). Concrete footers and walls were present in TPs 1, 2, and 20, and wood pilings were present in TPs 2 and 3 (Figure 11; Table 1; Appendix B, Figures B1 and B4). Concrete walls were exposed between 10 and 30 centimeters below surface (cmbs) and were an average height of 60 cm (2 ft.). Width and length of the walls often could not be precisely ascertained because they weren't fully exposed within the test pit.

Test Pit 20 was moved three times because of the presence of a "honey-comb" of rebar-reinforced concrete walls which had been filled with building debris. The first attempt (TP-20.1) was placed 50 ft. (15 m) east of TP-2 and reached only to 20 in. bs (50 cm). The second attempt (TP-20.2), approximately 2 ft. (60 cm) west of the previous attempt, encountered more concrete walls or footers and was terminated after 20 in. (50 cm). The third attempt (TP-20.3) was placed further west, 15 ft. (4.6 m) east of TP-2. This test pit exposed concrete in the north and south walls, as well as two vertical wood beams just north of the southern concrete wall at roughly 3 ft. (90 cm) bs (Table 1; Figures B1 and B4).

Test Pits 4, 5 and 7 were located in the vicinity of the removed Fuel Oil Tank No. 2. These TPs were excavated to an average depth of 6.5 ft. (2 m) bs. Coarse gray beach sands were exposed at the base of TPs 5 and 7, and TP-5 contained some water-rolled,

Figure 11. Concrete footer/foundation wall in TP-1.

Table 1. Features observed in Phase 3 Test Pits.

Test Pit #	Feature Observed	Location	Dimensions (exposed)	Orientation	Notes
1	Concrete wall	West wall	15 ft. long x 2 ft. high	North/south	Only one side exposed so width difficult to determine
	Wood beam	West wall	12 in. x 5 ft. x 10 in.	East/west	Removed from immediately below concrete wall, in gray sandy gravel fill, along with additional lumber pieces
2	Concrete wall	South wall	3.5 ft. x 2 ft. high	East/west	Only one side exposed, so width difficult to determine
	Concrete wall	SE corner of east wall	10 in. wide x 2 ft. high	East/ west	2 ft. north of south wall. Extends 8 in. into TP
	Wood piling	South end of TP	~12 in. diameter		8 ft. below suface
3	Wood piling	Southeast corner	~12 in. diameter		5 to 6 ft. below surface. Approximately 5 ft. apart from other pilings
	Wood piling	Northeast corner	~12 in. diameter		5 to 6 ft. below surface. Approximately 5 ft. apart from other pilings
	Wood piling	Southwest corner	~12 in. diameter		5 to 6 ft. below surface. Approximately 5 ft. apart from other pilings
6	Wood piling	Northwest corner	~12 in. diameter		Approximately 3.5 ft. below surface
	Wood piling	Northeast corner	~12 in. diameter		Approximately 3.5 ft. below surface
	Wire-wrapped wood stave pipe	South wall	~12 in. diameter, 4 ft. long		Sloped at 35° angle and connected to 6-in. PVC pipe encased in red concrete
14	Concrete	East wall	5 ft. long x 15-in.	North/south	Only one side exposed, so

	wall/floor		high		unable to determine width
20.1	Concrete wall	North wall	4 ft. long	East/west	Width and height difficult to determine due to excavation limitations
	Concrete wall	South wall	4 ft. long	East/west	Width and height difficult to determine due to excavation limitations
	Concrete wall	West wall	12 ft. long x 10 in. wide	North/south	Height difficult to determine due to excavation limitations
20.2	Concrete wall	North wall		East/west	TP not fully excavated. Not able to determine dimensions
	Concrete wall	South wall		East/west	TP not fully excavated. Not able to determine dimensions
	Concrete wall	West wall		North/south	TP not fully excavated. Not able to determine dimensions
20.3	Concrete wall	North wall	4 ft. long x 2 ft. high	East/west	Width difficult to determine due to limitations of excavation.
	Concrete wall/Footer	South wall	4 ft. long	East/west	Height and width difficult to determine due to limitations of excavation.
	Wood beams	~20 cm N of concrete in S wall	12 in. long x 6 in. wide	East/west	Observed about 3 ft. below surface. Top 12 in. exposed.
Pipe-1-SR23	Concrete footer	East wall	8 ft. long x 2 ft. wide x 2.5 ft. high	North/south	Footer appeared "stepped". At roughly 1.5 ft. below top of structure, footer extends approx. 1 ft. west into trench.

fragmented shell within the sandy deposit. No cultural material was associated with this shell and it was interpreted as a natural marine deposit. Excavations in TP-4 never exceeded the depth of fill material. No concrete walls or other structural remains of the mill were exposed in these three TPs.

Test Pit 6 was located in the vicinity of Fuel Oil Tank No. 2 and the Hog Fuel Storage Pile. Only fill material was encountered during excavation. This TP contained two wood pilings and a wire-wrapped wood stave pipe that appeared to be connected to a 6-in. diameter PVC pipe that was surrounded by red concrete housing (see Table 1; Figures 12, B2, and B4). The pilings and wood pipe were left in place.

Test Pit 8 was located in the southwest portion of the mill property, in the vicinity of the removed Fuel Oil Tank No. 1. This TP contained fill material to 6.5 ft. (2 m) bs. Natural coarse beach sands were observed at the base of excavation.

Test Pits 9 and 10 were located in the vicinity of the now-demolished Machine Shop. No evidence of foundations or other building elements was observed during excavation. The soils consisted of 4.3 to 5 ft. (130 to 150 cm) of fill material, and both TPs showed evidence of an extensive burning episode starting at 16 and 28 in. (40 and 70 cm) bs and extending to 4.3 to 5 ft. (130 to 150 cm) bs.

Figure 12. TP-6, showing wood stave pipe (left arrow) and piling (right arrow). Facing S.

Within TP-9, three stacked train rails, oriented NNE-SSW (28/208º), were uncovered at the south end of the TP. One possible railroad tie was removed about 20 in. (50 cm) north of the rails within the same burned fill stratum. The tie was surrounded by burned woody debris, brick fragments, and concrete rubble. The arrangement of the tie and rails as well as the presence of assorted construction debris suggests that they were used as fill and do not represent an *in situ* rail track or spur.

Test Pit 10 contained one intact clear glass *Wonder Beverages* brand orange-flavored 7 fluid oz. soda bottle (Figure 13). It was found in the back dirt surrounded by burned fill and fragmented building material. The bottle showed no evidence of having been heated. Online research (www.ca-yd.com/textfile/bottles/ACLWEB_W.HTM) indicates that similar bottles from this company date to 1944.

Test Pits 11-13 and 15-19 were all located in the vicinity of the Hog Fuel Pile. Excavations in TPs 12, 13, 15, 17 and 18 encountered only fill material. Excavations in TPs 11 and 16 exposed clean coarse gray beach sands between 5.9 and 7.2 ft. (180 and 220 cm) bs. Within TP-19, coarse gray beach sands with fragmented and water-rolled marine shells were exposed at 6.5 ft. (200 cm) bs. No cultural material was associated with the shell fragments and they were interpreted as a natural deposit. No concrete or wood structures were exposed within these test pits.

Test Pits 14 and 21 were placed in the vicinity of the Machine Shop and Hog Fuel Pile. Both TPs were excavated to approximately 4.9 ft. (150 cm) bs, but only in TP-14 was natural coarse sand exposed at the base of excavation. Excavation in TP-21 encountered only fill material. TP-14 also contained a 15-in. thick concrete footer or floor within the east wall profile (see Table 1; Figures B2 and B4).

Figure 13. *Wonder Beverage* bottle from TP 10.

One exploratory trench was excavated at location Pipe-1-SR23, approximately 165 ft. (50 m) northeast of TP-10, in the Blow Pits/Wastewater Drain piping area. This trench was roughly 30 ft. x 8 ft. x 8 ft. (10 x 2.5 x 2.5 m) in size and encountered only fill materials during excavation. One 25 ft. (7.6 m) long ductal iron pipe was exposed 6 ft. (2 m) bs in the north wall. A very large concrete footer was exposed in the east wall of the trench (Table 1; Figures B3 and B5).

Phase 4A

Monitoring well MW-65 was installed on the west side of Ennis Creek approximately 60 m south of its mouth (Figure 14). This area is in the vicinity of the former Finishing Room (see Figure 6). The upper 12 ft. was fill material followed by alluvial overbank and channel deposits from the creek to a depth of 36 ft. bs. A clear sample of glacial till was not recovered, though the geologist believed some of the fine silty material recovered at the base of the boring may have been churned till. Some woody debris was observed in the sample between 20 and 21.5 ft. bs, but did not appear to be cultural.

MW-66 was installed approximately 200 ft. southeast of the southeast corner of the dock in the vicinity of the former Chip Storage Building. The upper 4 ft. was an organic woodchip layer mixed with medium gray-brown sand. One large construction staple was recovered in the sample; it appeared to have been deposited recently and was not interpreted as historic. Fine to coarse sands were encountered to a depth of 31 ft. bs, with a few pieces of naturally deposited sharp-edged shell recovered from the 30 to 31.5 ft. sample. Glacial drift was present in the bottom portion of this sample.

Figure 14. Drill rig at MW-65, taken from Ennis Creek. Facing 234°.

MW-67 was installed on the western edge of the mill property, approximately 375 ft. south-southwest of the jetty. Sandy gravel fill was encountered down to 7 ft. bs with coarse gray sand below. Glacial till was encountered around 25 ft. bs. Two small pieces of woody debris and a fragment of water-rolled shell were recovered from a small amount of sand that had heaved into the bore hole above the glacial drift. No cultural material was observed.

Phase 4B

Monitoring well boring MW-68 was drilled near the west end of the mill near Fuel Oil Tank No. 2 (Figure 15). Initial drilling of the bore hole for this well, which extended to 100 ft. bs, lasted all day on both May 4 and 5. Upper deposits were fill, followed by beach sands and gravels (Figure 16), with glacial drift from about 28 to 100 ft. bs. No cultural material was observed. Small shell fragments were seen in samples from 10-15 ft. bs and 15-25 ft. bs, which were interpreted as non-cultural. The MW-68 bore hole was abandoned at 100 ft. bs and backfilled with bentonite due to concerns of possible hydraulic communication between groundwater in the fill horizon and the glacial deposits.

Monitoring well MW-70, located about 80 ft. east of Ennis Creek and just north of the road nearest the existing City of Port Angeles sewer line, was drilled and installed on the afternoon of May 6, 2011. The soils recovered in the samples appeared to be primarily alluvial overbank and channel deposits to a depth of 22 to 25 ft. bs, below which glacial deposits were encountered. No cultural material was observed in MW-70.

Monitoring well MW-69 also was installed on May 6, 2011. This well is approximately 100 ft. west of Ennis Creek near well PA-17. Soils were saturated below about 5 ft. bs and several samples could not be recovered. Soil in MW-69 also appeared to be stream deposits from Ennis Creek. No cultural material was observed.

Figure 15. Setting up at MW-68. Facing SW.

Figure 16. MW-68 core with beach sediments.

6.0 SUMMARY AND CONCLUSIONS

Cultural materials, primarily bits of concrete and brick, were observed within the top 3.5 to 11.5 ft. of several of the Phase 2 bore holes. This material appears to come from the vicinity of the Paint Shop (SSB-2), Machine Shop (SSB-4, GWG-8), Finishing Room (SSB-5, GWG-7), Power House/Recovery Boiler (SSB-7), and Pulp Storage Warehouse (GWG-4, GWG-5, SSB-6). The only possible prehistoric material, fragmented shell found in SSB-6, came from the area occupied historically by the Bleach Plant, Machine Room, and Pulp Storage Warehouse. This area would have been in shallow waters during the early historic period (prior to 1917), according to Robbins et al. (1997:Figure 4), although it could have been above the tide level in the last several thousand years, when sea levels were slightly lower than they are today. In any case, there was no direct evidence, such as artifacts, fire-modified rock, burned bone or shell, that this sample represented prehistoric cultural material.

Remains of the mill were observed in nearly all the Phase 3 test pits and in the exploratory trench Pipe-1-SR23. Test Pits 1, 2, 14, 20, 20.1, 20.2, and 20.3 all contained remains of rebar-reinforced concrete foundation walls. The foundations and pilings observed in TPs 1, 2, 3, 20, 20.1, 20.2, and 20.3 are likely from the former Wood Mill and Recovery Boiler, based on their position relative to the foundations of those buildings visible in an aerial photo from 2000 (Figure B1). The tops of building foundations are still visible on the surface in this area, left after the above-ground portions of the mill buildings were razed in 1997. Pilings in TP 6 appear to be related to the Sludge Building, and the foundation wall in TP 14 to the Machine Shop (Figure B2). A concrete pad or footing at the east end of the exploratory trench is adjacent to a former circular water/wastewater storage tank (Figure B3).

None of the concrete observed appeared to be old enough to be remains of the spruce mill or other earlier mill structures, or of the PSCC. However, the wood pilings or wood-stave pipe could have originated as parts of the spruce mill complex that continued to be used during the Rayonier Mill era.

With the exception of fill material in the upper parts of MW-65, MW-66, and MW-67, no cultural material was observed during Phase 4A monitoring. The small amount of shell and woody debris encountered appeared to be naturally deposited. The soil samples taken from boring MW-65 contained sands, silts, and gravels that appeared to be mostly stream channel and alluvial overbank deposits. Borings MW-66 and MW-67 both contained what were interpreted as beach sands. No evidence of stable surfaces with buried organic soils was observed at the monitoring well locations.

No cultural material was observed during Phase 4B monitoring, except for fill in the upper part of boring MW-70. The deposits in the two borings in the east part of the mill, MW-69 and MW-70, contained sands, silts, and gravels that appeared to be mostly stream channel and alluvial overbank deposits. The area near Ennis Creek was considered to have a higher probability for prehistoric cultural remains than most other

areas, but no evidence of stable surfaces with buried organic soils was observed at the monitoring well locations.

In summary, no clear evidence of prehistoric or historic period Native American activity was exposed by the explorations, while evidence of historic period mill activity appeared to be associated with the Rayonier era rather than earlier periods. The lack of evidence of Native American occupation of this area probably reflects both the small diameter of the bore holes completed in Phases 2 and 4, and the locations from which many of the samples were taken. Most of the Phase 3 test pits were in areas that had been substantially altered by filling and mill construction, and fill extended to or near the base of excavation in many cases. Areas most likely to contain preserved remains of Native American use of this area are thought to be in the vicinity of the East Roll Storage building east of Ennis Creek; near Ennis Creek west of the Secondary Treatment tanks; and near the shoreline in the southwest part of the mill property (vicinity of Fuel Oil Tank No. 1, south of Sludge Building). These areas were less affected by mill construction and filling and more likely to have been available and desirable occupation surfaces during the late prehistoric to early historic periods. The approximate location of the ethnographically recorded village of I'e'nis as well as finds of burial remains and a small area of shell midden were mapped near Ennis Creek in areas described above.

This report should be submitted to the appropriate agencies, including the Department of Ecology, Department of Archaeology and Historic Preservation, and the Lower Elwha Klallam Tribe, for comment.

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APPENDIX A: Phase 2 Auger Sample Descriptions

Table A1. Primary Strata Encountered in Phase 2 Bore Holes.

Designation	Description
I	Concrete rubble and other building debris.
II	Tan-brown to reddish-brown silty sandy fill
III	Gray-brown to reddish-brown sandy gravelly fill
IV	Dark brown to black woody debris fill
V	Fine gray to black sand.
VI	Gray to tan clay or sandy clay fill.
VII	Coarse gray gravelly sands. Probable beach deposit.
VIII	Fine brown silt.
IX	Brown to gray silty sand.
X	Glacial drift. Compact gray silt clay, some small pebbles.

Table A2. Phase 2 Auger Sample Descriptions.

Monitoring Well	Depth (ft. bs)	Soil Strata	Content	Notes
60	2’-3’6”	III		Fill
	5’-6’6”	II		Fill
	10’-11’6”	V	Woody debris	Bunker C oil in sample
	15’-16’6”	V		
	20’-20’7”	V		Geologist believed sample was slough from auger
	23’-24’’ 6”	V/X		Only bottom 6” is glacial drift
61	2’-2’3”	N/A		No recovery
	5’-6’6"	III		Fill
	10’-11’6”	III		Fill—wet
	15’-16’6”	VII		
	20’-21’3”	VII/X		Bottom 4” contained glacial drift
62	2’-3’6”	III		Fill. Located approximately 150 ft NW of mouth of Ennis creek
	5’-6’6”	III	1 fragmented water-rolled shell	Fill
	10’-11’6”	VII		
	15’-16’6”	VII		
	21’-21’6”	VII		
	25’-26’6”	VII/V		
	30’-31’6”	V		
	35’-36’6”	IX	1 fragmented water-rolled shell	
	40’-41’6”	IX		
	45’-46’6”	IX/X		Possible glacial drift at base of sample
	50’-51’6”	N/A		No recovery
63	2’-2’6”	I/II		Fill
	5’-5’6”	II		Fill
	10’-11’6”	VIII		Some angular gravels
	15’-16’3”	VIII/V		Bottom 8” is fine sand
	20’-21’6”	IX	Woody debris and 1 shell fragment	
	23’-24’6”	VII		

	26’-27’6”	VII/X		Bottom 4” is glacial drift, auger slough above
	27’6”-28’	VII/X		Bottom 6” is glacial drift with auger slough above
64	3’-4’6”	VIII	Some road gravel	Southeast of Ennis Creek culvert
	5’.5’6”	IX	Large pebbles	
	10’-11’6”	IX		Water at 10 ft. Possible perched water table
	15’-16’6”	IX		Bottom 6 inches is dry and grayer in color
	20’-20’8”	X		
	21’-21’9”	X		Moist
Soil Sample Bore	**Depth (ft. bs)**	**Soil Strat**	**Content**	**Notes**
1	7’-8’6”	II		Concrete rubble fill above first sample
	10’-11’6”	III		Fill
	15’-16’6”	VII	Shell fragments	
	20’-21’6”	N/A		No recovery other than minimal amount of auger slough
	25’-26’6”	X		
2	2’-3’6”	II	Concrete fragments and woody debris	Fill
	5’-6’6”	II	Decomposing granite or concrete	Fill
	10’-11’6”	VII	Water-rolled shell fragments	
	15’-16’6”	VII		
	20’-20’6”	VII	Woody debris	
	21’-22’6”	X		
3	2’-3’6”	II		Fill
	5’-6’6”	N/A		No recovery
	10’-11’6”	VII	Woody debris	
	15’-16’6”	VII		
	20’-21’6”	VII		
	25’-26’6”	VII/X		Bottom 6” is glacial drift
	27’-28’6”	VII		Auger slough
	30’-31’	VII/X		Auger slough with 3” of glacial drift
4	2’-3’6”	I/II		Fill
	5’-6’	I/II		Fill. Terminated due to concrete pad/footer
4a	2’-3’6”	I/VIII	Fragmented bottle glass	10 ft S of SSB-4. Silt is dark in color, but contains no cultural materials other than fragmented glass.
	5’-6’6”	II/III	Woody debris	Fill. Wood soaked in creosote
	10’-11’6”	III/VI	Woody debris	Woody debris in upper 6” of sandy slough
	15’-16’6”	VI/VII		Very mucky wet. Looks like a mixture of auger slough with coarse sands.
	20’-20’6”	X		
	2’-22’3”	VII/X		Glacial drift with bands of coarse sand
	23’-24’6”	X/VII		Mucky-wet; auger slough mixture
5	2’-3’6”	III	Brick fragments	Fill
	5’-6’6”	III/VIII	Brick fragments	Silt present near bottom of sample
	10’-11’6”	VIII/IX		

	15’-16’6”	IX		Starting to get wet
	20’-21’6”	IX		Gravels numerous
	25’-26’6”	IX		Gravels numerous
	30’-31’6”	IX		Gravels numerous
6	5’-6’6”	I/VII	80% fragmented shell. 1 whole shell	Tan to brown sand. Shell edges are sharp and interior surfaces shiny. No associated FMR, organically stained soil, or artifacts. Possible midden.
	10’-11’6”	VII	Fragmented shell	See previous note. Shell quantity decreased
6a	15’-16’6”	II		Fill. Moved 5 ft E of original bore hole and augered to 15 ft without sampling. Cuttings monitored for potential midden deposits--none observed
	20’-21’6”	II/VII		Bottom 2 in. is coarse sand
	25’-25’9”	VII	Few shell fragments	Water-rolled. Appears natural
	28’-29’6”	X		
7	5’	I	Brick fragment	Fill. Sampler unable to penetrate through dense building rubble
	10’-11’6”	III	Brick fragments	Fill
	15’-16’3”	N/A		No recovery, but evidence of marine sands at base of sample
	20’-21’6”	VII	Shell fragments	Natural marine deposit
	25’-26’6”	VII		
	30’-31’6”	VII/X		Glacial drift at base
8	2’-3’6”	I		Fill
	10’-11’6”	III/IV		Band of sawdust
	15’-16’6”	III	Woody debris	Fill
	20’-21’6”	III/II		Fill. Coarse sandy gravel at top of sample, grades to fine silty sand at base
	25’-26’6”	VII		
	30’-31’6”	X		Till with auger slough above
9	2’-3’6”	VI	Some charcoal	Silt with some clay. Reddish-orange color
	5’-6’6”	VI/VII		Sandier and grayer at bottom of sample
	10’-11’6”	VI/VII		
	15’-16’6”	VIII		Gray in color with some black root casts. Few gravels
	20’-21’6”	VIII		Gravel content increases
	25’-26’6”	VII		More gravel than is typical
	30’-31’6”	VII		More gravel than is typical
10	2’-3’6”	III/VIII		Reddish-orange gravel overlying black silt
	5’-6’6”	VIII		Black in color. Chemical smell
	10’-11’6”	VIII		Greenish-gray with reddish -orange oxidation near bottom
	15’-16’6”	VII		Wet
	20’-21’6”	X		
	25’-26’6”	X		
Ground-water Grab	**Depth (ft.. bs)**	**Soil Strat**	**Content**	**Notes**
1	2’-3’6”	II/III		Fill
	5’-6’6”	III		Fill

	7’ 6”-8’6”	II		Fill
	10’-11’6”	II/VII		Wet and dark in color
	15’-16’6”	VII		Not as dark
	20’-21’6”	X		
2	N/A	N/A		No samples taken and no auger cuttings to observe. Most of the hole was created by using a hydraulic hammer.
3	N/A	N/A		See comment for GWG-2
4	8’-9’6”	VII/V	Ceramic fragments	Augered through 8 ft of fill with large amount of building rubble. Bottom 7 in. is fine gray sand
	10’-11’6”	II/VII		
	15’-16’6”	VII/X		Some glacial drift, looks mixed with coarse sands
	20’-21’6”	V	Woody debris	Gray-brown peaty material in with sand
	26’-27’6”	VII/X	Few shell fragments	Bottom 4 in. is glacial drift
	27’-6’29”	N/A		No recovery
	30’-31’6”	X		
5	2’-3’6”	III		Fill
	5’-5’6”	II		Fill
	10’-10’3”	II		Fill. Hit concrete and broke auger bit. Need to relocate hole
5a	5’-6’6”	II		Fill. 30 m NE of GWG-5 to avoid concrete
	10’-11’6”	VII		
	15’-16’6”	VII		
	20’-21’6”	IX/X		Looks like weathered glacial drift. Some silt, sand, and gravel present
	24’-25’6”	IX/X		Silty, sandy, gravel slough above drift
	26’-27’6”	VII/X		Slough above drift
6	2’-3’6”	III		Fill
	5’-6’6”	II/VII	Charcoal flecks	Sand at bottom of sample is reddish-orange
	10’-11’6”	IX		Possible creek deposits
7	2’-3’6”	II		Fill. Driller felt wood in hole, but none in sample
	5’-6’6”	III		Fill. Hit pipe at 9 ft bs
7a	2’-3’6”	II		Fill
	5’-6’6”	II/VII		Some clay in with silty sand. Coarse gray sand at bottom of sample
	7’-8’6”	VII/VI		Stratum VI contains some sand and mottled oxidation
8	2’-3’6”	III	Brick fragments	Fill
	5’-6’6”	III		Fill
	10’-11’6”	VI		Oxidation throughout
	15’-16’6”	IX		Possible creek deposits
9	1’-15’	II/VIII		No samples taken. Archaeologist observed cuttings from auger down to approximate level of groundwater.

APPENDIX B: Mill Remains Observed in Phase 3 Test Pits.

Figure B1. TPs 1, 2, 3, 20.1, 20.2, and 20.3, showing Rayonier mill structural elements.

Figure B2. TPs 6 and 14 showing Rayonier mill structural elements.

Figure B3. Rayonier mill structural elements in exploratory trench.

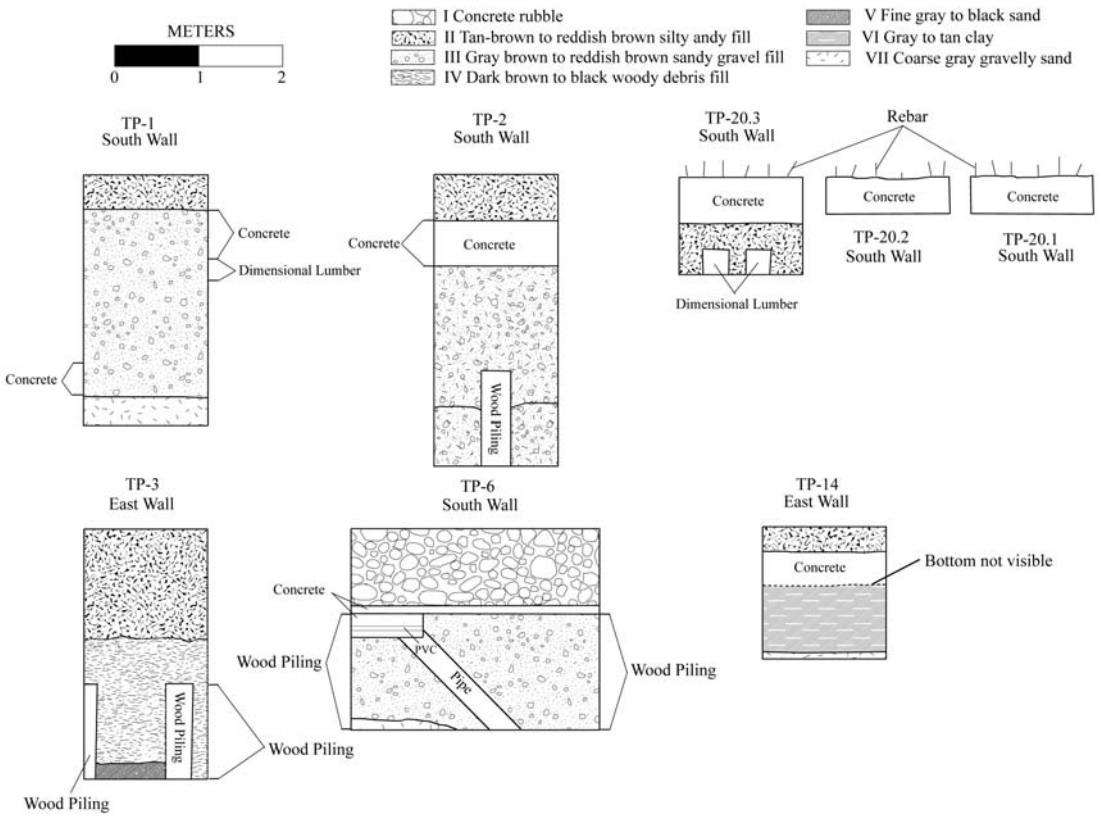

Figure B4. Profiles along ~ east-west transect (see Figure 2), top row; and in TPs 3, 6, and 14, bottom row.

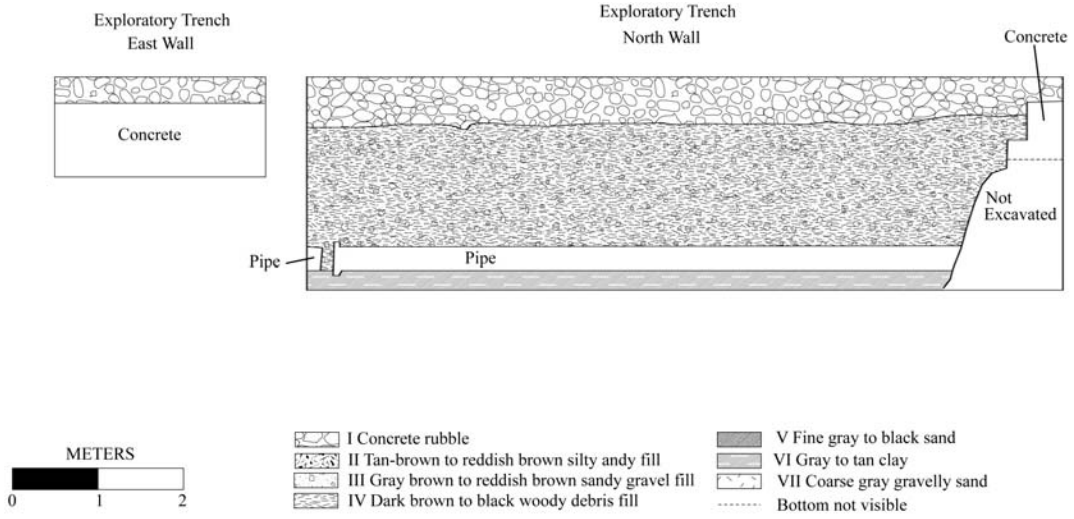

Figure B5. Profile of exploratory trench (see Figure B1).

APPENDIX C: Phase 4 Auger Sample Descriptions

Table C1. Primary Strata Encountered in Phase 4 Bore Holes.

Designation	Description
I	Concrete rubble and other building debris.
II	Tan-brown to reddish-brown silty sandy fill
III	Gray-brown to reddish-brown sandy gravelly fill
IV	Dark brown to black woody debris fill
V	Fine gray to black sand.
VI	Gray to tan clay or sandy clay fill.
VII	Coarse gray gravelly sands. Probable beach deposit.
VIII	Fine brown silt.
IX	Brown to gray silty sand.
X	Glacial drift. Compact gray silt clay, some small pebbles.
XI	Dark gray sand/silt with abundant gravel. Probable stream channel/bank deposits.
XII	Dark gray to brown silt/silty sand/silty clay. Probable stream overbank deposits.

Note: Tables C1 and A1 are the same except for the inclusion of strata XI and XII in Table C1.

Table C2. Phase 4 Auger Sample Descriptions.

Monitoring Well	Depth (ft. bs)	Soil Strata	Content/Description	Notes
65	5'-6.5'	II		Fill
	10'-11.5'	III		Fill. Wet and mucky.
	15'-16.5'	VII		
	20'-21.5'	VIII-VII	Woody debris	Woody debris; appears to be non-cultural.
	25'-26.5'	XI		
	30'-31.5'	XI		
	35'-36.5'	XI-X		Glacial seds. soupy and appear "munched up" by sampler.
66	2'-3.5'	IV	N=1 construction staple	In woodchip storage area.
	5'-6.5'	IX-VII		
	10'-11.5'	V		
	15'-16.5'	V		
	20'-21.5'	VII		
	25'-26.5'	VII		
	30'-31.5'	VII-X	Fragmented shell in upper 7"	Shell appears to be non-cultural. Possibly heaved into hole from upper level.
67	2'-3.5'	III		Fill
	5'-6.5'	III		Fill
	10'-11.5'	VII		Hit ground water
	15'-16.5'	VII		
	20'-21.5'	VII-X		6" of weathered glacial drift at base of sample.
	25'-26'.5'	VII-X	N=1 water-rolled shell fragment and woody debris.	Woody debris and shell appears to be non-cultural. Heaved into hole from upper level (?).
68	2.5'-10'	III		Fill
	10'-15'	VII	Includes v. small shell fragments (<1mm)	Shell appears to be non-cultural beach deposit
	15'-25'	VII	Abundant shell fragments, 1-5	Shell appears to be non-cultural

			mm	beach deposit
	25’-28’	N/A		No recovery; glacial @ 28’ bs
	29’-32’	X		
	32’-35’	N/A		No recovery
	35’-100’	X	Alternating layers of gray sand and silt.	Abandoned @ 100’
69	0-5’	XII	Gray silty clay, then red-brn sand	
	5’-12.5’	N/A		No recovery. Very wet.
	12.5’-15’	XII	Gray silt then silt + heavy gravel	
	15’-17.5’	N/A		No recovery. Very wet.
	17.5’-24’	XI	Gray silt + gravel, cobbles. Woody material.	Wood not cultural.
	24’-27.5’	XI	Gray sand + gravel	
	27.5’-30’’	XI/XII	Mostly silt + some gravel	Gravels not fully rounded, appear to be stream deposits
70	0-2.5’	III	Brown, rocky	Fill
	2.5-7’	XI	Light brown sand, gravel	Wet
	7-12.5’	XII/XI	Sand, then brown sand + heavy gravel	
	12.5-17’	XII/XI	Silt/clay, possibly laminated, then grey sand + gravel, then red-brown sand/silt + gravel	Sandy-gravelly layers probably same deposit differing in color
	17-22’	XII	Dk. gray silt, then browner, finer silt	
	22-25’	XI/X	Dk gray sand + gravel	Glacial drift at 22 or 25’
	25-27.5’	X	Dk gray silty sand + gravel	