Final Remedial Investigation Report

Goose Lake Site
Shelton, Washington

for
Rayonier Properties, LLC

July 12, 2012

GeoEngineers
Earth Science + Technology

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File No. 0137-010-10, Task 0300

July 12, 2012

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ACKNOWLEDGEMENTS

ENTRIX, Inc. collected fish tissue samples, surface water samples, and bathymetry data as part of the Goose Lake Site remedial investigation. ENTRIX also contributed to the preparation of this report.

EXECUTIVE SUMMARY

Rayonier Inc. conducted field studies for a remedial investigation (RI) at the Goose Lake Site (the "Site") in Shelton, Washington in 2002 and 2003, in accordance with the terms of an Agreed Order with the Washington State Department of Ecology. The RI evaluated potential environmental impacts related to the historical disposal of liquid pulp-mill wastes in Goose Lake and associated upland disposal lagoons, and solid wastes in a landfill at the lake's edge, between approximately 1931 and 1974. The waste materials were generated at Rayonier's former pulp mill and research facility in Shelton.

Shelton Hills Investors LLC acquired a portion of the Site in 2005. Shelton Hills Investors and the City of Shelton are developing plans for future use of the Goose Lake area. Current plans call for a combination of open space/recreational, residential, commercial, and light industrial uses. The results of this RI will be used during preparation of a feasibility study to evaluate cleanup action alternatives that are appropriate for the planned future land use.

The Agreed Order identified soil, sediment, surface water, and groundwater as media of potential environmental concern in Goose Lake, the inactive landfill, the former disposal lagoon area, and a nearby drainage ravine. The RI (and previous and supplemental studies summarized in this report) focused on assessing these areas and media for potential contamination associated with past disposal practices. The scope of the RI included reviewing historical information to identify potential mill-related contaminant sources; documenting the physical characteristics of the Site; developing a conceptual site model; collecting and analyzing samples of environmental media to characterize the nature and extent of mill-related contamination; and comparing detected constituent concentrations to screening levels based on the protection of human health and the environment.

The following constituents were detected during the RI, previous studies, or supplemental studies at concentrations exceeding the RI screening levels:

- Copper and/or mercury were detected in soil in five locations in the former disposal lagoon area at concentrations exceeding screening levels protective of groundwater as surface water and/or terrestrial ecological receptors (plants and/or soil biota). These exceedances were localized and were less than ten times the respective screening levels. The copper and mercury detections did not exceed screening levels protective of human health.
- Arsenic was detected in one groundwater sample at a concentration slightly exceeding the screening level protective of drinking water. Arsenic was not detected above the screening level protective of drinking water in previous or subsequent groundwater samples collected from the same monitoring well. No other constituents were detected in groundwater at concentrations exceeding screening levels protective of drinking water.
- Six constituents (chromium, copper, lead, mercury, polychlorinated biphenyls [PCBs], and dioxins) were detected in groundwater at concentrations exceeding screening levels protective of surface water. The detected concentrations of metals and dioxins were similar upgradient and downgradient of the former waste disposal areas, suggesting that the detections of these

constituents reflect area or natural background conditions rather than impacts from historical waste disposal activities.

- Some constituents were detected at concentrations exceeding soil and/or sediment screening levels at random locations in the waste horizon of the inactive landfill. These constituents include metals, carcinogenic polycyclic aromatic hydrocarbons, PCBs, dioxins, sulfide, and semivolatile organic compounds (SVOCs). There was also a limited number of screening level exceedances in the upper 8 feet of native soil below the landfill waste horizon.
- Arsenic and lead were detected in Goose Lake surface water at concentrations slightly exceeding screening levels. The RI data suggest that the source of the arsenic detected in Goose Lake surface water is natural background concentrations of arsenic in upgradient groundwater that discharges to the lake.
- Constituents detected in Goose Lake sediment at concentrations exceeding screening levels include mercury, PCBs, dioxins, and sulfide. The exceedances generally occurred in a 3-inch-thick surficial black silt layer encountered on the bottom of Goose Lake at most of the sediment sampling stations. Concentrations of these constituents in underlying native organic sediments were generally much lower or non-detectable.
- Constituents detected in shallow drainage ravine soil/sediment samples at concentrations exceeding screening levels include metals (chromium, copper, nickel, and mercury), PCBs, and dioxins. The exceedances occurred immediately upgradient (east) of several earthen dams in the ravine, and were only slightly greater than screening levels or consistent with background concentrations in soil.
- Dioxins were detected at concentrations slightly exceeding screening levels in two shallow soil samples obtained from “other areas” outside of the inactive landfill, the former disposal lagoon area, and areas immediately upgradient of the earthen dams in the drainage ravine. The dioxin concentrations in these samples are within the range of typical background concentrations in forested and/or open areas in western Washington. Metals and/or PCBs also were detected at concentrations slightly exceeding screening levels at two locations in these other areas.

Two supplemental studies were conducted in 2007 and 2008 to investigate the origin of brown, organic-rich sediment deposits that lie beneath the surficial black silt layer in Goose Lake. Both studies concluded that the brown organic sediment deposits are not mill-derived wastes, but rather, thick accumulations of native peat with alluvial silt and abundant decomposing soft plant material.

Collectively, the results of the RI and previous and subsequent investigations indicate that the areas and media that will likely require cleanup action include the thin surficial black silt layer on the bottom of Goose Lake, waste materials in the inactive landfill area, and shallow soil/sediment immediately upgradient (east) of the earthen dam closest to Goose Lake in the drainage ravine (Dam #1). The site characterization data and conceptual site model presented in this RI report provide the basis for evaluating cleanup action alternatives in a feasibility study.

1.0 INTRODUCTION

Rayonier Inc. has been identified as a “potentially liable person” (PLP), under Revised Code of Washington 70.105D.020(20), for the Goose Lake Site (the “Site”) in Shelton, Washington. The Site is located at 200 West Wallace Kneeland Boulevard, approximately 0.3 miles northwest of downtown Shelton (Figure 1). Rayonier used portions of the Site from about 1931 to 1974 for the disposal of wastes generated at its former pulp mill and research facility in Shelton. The Site includes properties currently owned by Rayonier Properties LLC and Shelton Hills Investors LLC.

The remedial investigation (RI) described in this report was conducted in 2002 and 2003 in accordance with the terms of Agreed Order No. DE 99TC-S260 with the Washington State Department of Ecology (Ecology). In the Agreed Order, the following areas and media of potential environmental concern were identified:

- Goose Lake surface water and sediment;
- Inactive landfill soil;
- Former disposal lagoon area soil; and
- Site-wide groundwater.

Subsequently, Ecology identified soil in the drainage ravine southwest of Goose Lake as an additional medium of potential environmental concern.

The Site layout is shown in Figure 2; sampling locations are shown in Figure 3. Prior to the RI, two environmental investigations were completed at the Site (Science Applications International Corporation [SAIC], 1997; Pacific Environmental Group [PEG], 1998). Additionally, after the RI field work was completed in 2003, several supplemental investigations were conducted at the Site in response to discussions with Ecology or as part of real estate due diligence activities. These supplemental investigations include limited soil and groundwater sampling in 2005 (Kleinfelder, 2006), Goose Lake sediment geomorphic studies in 2007 and 2008 (GeoEngineers, 2008; Pacific Rim Soil & Water, Inc. [PRSW], 2009), soil sampling in the drainage ravine and former disposal lagoons in 2008 (Floyd|Snider, 2009), and soil/sediment and groundwater sampling in 2010 (GeoEngineers, 2011a). The scope and results of the previous and supplemental investigations have been incorporated in this RI report. The Kleinfelder (2006), GeoEngineers (2008), PRSW (2009), and Floyd|Snider (2009) reports are included as appendices to this report.

Shelton Hills Investors LLC and the City of Shelton are in the process of developing plans for future use of the Goose Lake area. Current plans call for a mixed-use development, with the area of the former disposal lagoons west of Goose Lake (Figure 2) being developed for commercial use. Current and future land use is discussed further in Section 3.7.

1.1 Remedial Investigation Objectives

The RI had three main objectives:

- Investigate and document the history and physical characteristics of the Site relevant to potential environmental impairment;

- Characterize the nature and extent of contamination in Site soil, sediment, surface water, and groundwater potentially related to Rayonier's former pulp mill operations; and
- Assess potential risks posed by constituents of potential concern (COPCs) at the Site, by comparing detected COPC concentrations to numeric screening levels (protective concentrations) derived from applicable regulatory criteria and published risk-based concentrations.

1.2 Report Organization

This RI report is organized into 11 sections, as follows:

- Section 1.0 – Introduction.
- Section 2.0 – Background. Summarizes the Site history and previous investigations.
- Section 3.0 – Site Description. Describes the Site's surface features, geologic, hydrogeologic, and ecological conditions, and current and future land use.
- Section 4.0 – Remedial Investigation Activities. Describes the RI field program.
- Section 5.0 – Deviations from the Work Plan. Describes deviations from the RI work plan.
- Section 6.0 – Screening Levels. Presents the screening levels used to assess potential risks posed by COPCs at the Site.
- Section 7.0 – Conceptual Site Model. Presents the conceptual model for the Site.
- Section 8.0 – Site-Specific Terrestrial Ecological Evaluation (TEE). Presents the site-specific TEE completed for the Site.
- Section 9.0 – Remedial Investigation Results. Summarizes the results of the RI, including the physical characteristics of the areas and media sampled and the results of chemical analytical testing. Analytical testing results from previous and supplemental investigations are incorporated in this section.
- Section 10.0 – Discussion and Conclusions.
- Section 11.0 – References.

This report includes the following appendices:

- Appendix A – Exploration Logs (from the RI and the 2010 supplemental investigation).
- Appendix B – Data Quality Assessment Reports (for the RI and the 2010 supplemental investigation).
- Appendix C – Limited Environmental Assessment and Phase II Groundwater Characterization (letter report; Kleinfelder, 2006).
- Appendix D – Supplemental Sediment Sampling (letter report; GeoEngineers, 2008).
- Appendix E – Remedial Investigation Addendum Report: Additional Sampling Program, Drainage Ravine and Former Disposal Lagoons (Floyd|Snider, 2009).

- Appendix F – Evaluation of Goose Lake Organic Matter and Geomorphic History (letter report; PRSW, 2009).

2.0 BACKGROUND

2.1 Site History

The Goose Lake Site received spent calcium sulfite liquor generated at Rayonier's former pulp mill in Shelton, Washington, from about 1931 to 1943. The spent sulfite liquor was discharged to Goose Lake from May 1931 until September 1934 via a wood stave pipeline between the mill and Goose Lake. In 1934 the discharge point was moved to the disposal lagoons west of the lake (Figure 2). The liquor discharge was discontinued in August 1943. There is no information indicating that wood ash or wood char from the former mill operations was discharged to the lake.

The inactive landfill located at the east end of Goose Lake (Figure 2) received solid waste from Rayonier's mill and research laboratory, ash and char from the burning of sulfite liquor in the liquor incinerator that began operating at the mill in 1945, and demolition debris from the decommissioning of the former pulp mill. Unauthorized domestic refuse also was placed in the landfill. The landfill received waste from about 1936 to 1974.

2.2 Previous Investigations (Pre-RI)

Two environmental investigations were completed at the Site prior to the RI (SAIC, 1997; PEG, 1998). These investigations were conducted in 1997 and evaluated potential impacts to the Site as a result of past disposal activities. The investigations focused on Goose Lake, the inactive landfill, the former disposal lagoons, and groundwater in the Site vicinity. Based on the results of these previous investigations and known historical operations at the Site, Rayonier and Ecology developed a list of COPCs for the Site. The COPCs were identified in the Scope of Work attached to the Agreed Order; the RI work plan (GeoEngineers, 2002) was developed in accordance with this Scope of Work. The COPCs identified during the previous investigations are discussed below.

2.2.1 Goose Lake Sediment

The previous investigations identified the presence of two visually distinct sediment strata in Goose Lake. The shallowest stratum was characterized as black, fine-grained, organic-rich sediment and was estimated to be approximately 10 to 20 centimeters thick. This thin sediment layer on the bottom of Goose Lake is hereafter referred to in this RI report as "surficial black silt." A brown, silty, organic-rich sediment unit (characterized by SAIC as peat) was reported to be present beneath the surficial black silt. Samples of this brown organic sediment were not submitted for chemical analysis during the previous studies.

Samples of the surficial black silt were submitted for chemical analysis. The surficial black silt samples were found to contain sulfide, mercury, and the polychlorinated biphenyl (PCB) Aroclor-1260 at concentrations above background levels. The previous investigations compared the sediment analytical results to Washington State Sediment Management Standards (SMS) and Puget Sound Dredged Disposal Analysis (PSDDA) criteria. The SMS and PSDDA criteria were developed for assessment of marine sediments, not freshwater sediments. In addition to the chemical testing, limited bioassay testing was performed on samples of the surficial black silt. The bioassay results indicated high mortality rates or limited growth of some freshwater organisms.

2.2.2 Inactive Landfill Soil

Soil samples were obtained from the waste horizon of the inactive landfill (Figure 3) during PEG's 1997 investigation (PEG, 1998). The 1997 investigation compared the soil analytical results to Washington State Model Toxics Control Act (MTCA) Method A cleanup levels for unrestricted land use. Arsenic, lead, and mercury were detected at concentrations exceeding MTCA Method A cleanup levels in some of the landfill soil samples. The PCB Aroclor-1260 also was detected in landfill soil samples, but the detected concentrations were below the MTCA Method A cleanup level.

2.2.3 Disposal Lagoons Soil

The previous investigations compared the analytical results for soil samples obtained from the former disposal lagoons to MTCA Method A cleanup levels for unrestricted land use. No constituents were detected in the disposal lagoon soil samples at concentrations exceeding MTCA Method A cleanup levels.

2.2.4 Groundwater

Six groundwater monitoring wells were installed during the previous investigations (SAIC installed and sampled wells MW-01 through MW-03; PEG installed and sampled wells MW-04 through MW-06). Four of these wells (MW-01 through MW-03 and MW-06) were installed in the general vicinity of the inactive landfill, one well (MW-04) was installed south of Goose Lake, and one well (MW-05) was installed downgradient (south) of the former disposal lagoons. The locations of the monitoring wells are shown in Figure 2. The depth to groundwater in the monitoring wells ranged from approximately 10 to 25 feet below ground surface (bgs). Water level data obtained during the previous investigations indicated that groundwater beneath the Site generally flows toward the east/southeast.

The groundwater samples obtained from wells MW-01, MW-02, and MW-03 were analyzed for metals, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, and PCBs. The groundwater samples obtained from wells MW-04, MW-05, and MW-06 were analyzed for metals, PCBs, and total sulfide. The previous investigations compared the groundwater analytical results to MTCA Method A cleanup levels and/or MTCA Method B cleanup levels (standard formula values) protective of drinking water use. Arsenic, chromium, and/or lead were detected at concentrations exceeding MTCA Method A and/or Method B cleanup levels in the groundwater samples obtained from wells MW-02, MW-03, MW-04, and MW-05. In addition, trace concentrations of two VOCs (carbon disulfide and trichloroethene) and two SVOCs (bis[2-ethylhexyl]phthalate and diethylphthalate) were detected in groundwater samples obtained from wells MW-01, MW-02, and MW-03. However, the detected concentrations of VOCs and SVOCs were significantly less than the respective MTCA Method A and Method B cleanup levels. Pesticides, PCBs, and total sulfide were not detected in the groundwater samples analyzed for these constituents.

3.0 SITE DESCRIPTION

3.1 General

The Site is located about 0.3 miles northwest of downtown Shelton in Mason County, Washington (Figure 1). The Site address is 200 West Wallace Kneeland Boulevard. The area within the Site boundary depicted in Figures 1 and 2 is approximately 170 acres; Goose Lake covers approximately 22 acres. An abandoned gravel pit is located northeast of Goose Lake. Access roads for timber harvest operations are also located in this vicinity. Timber has been harvested from most of the Site. There are no buildings within the Site boundary.

The inactive landfill is located on the eastern shore of Goose Lake (Figure 2). Rayonier formerly trucked waste materials from its Shelton pulp mill to this landfill. The landfill is covered by sand and gravel fill that was likely borrowed from the adjacent gravel pit to the north. Spent sulfite liquor was conveyed via pipeline from the Shelton pulp mill to Goose Lake for about three years (1931 to 1934), after which the spent liquor was discharged to the disposal lagoons in the western portion of the Site (Figure 2).

Historical aerial photographs (see Section 3.3) indicate that a small seasonal pond is occasionally present to the northeast of Goose Lake, just outside the Site boundary. Highway 101 is approximately 950 feet east of the Site. Island Lake is approximately 7,000 feet northeast of the Site, on the east side of Highway 101. Mason County Fairgrounds, Sanderson Air Field, and an industrial park are located north of the Site. Properties to the west and south of the Site are undeveloped.

3.2 Topography

The Site is situated within the glacially-formed topographic basin known as the Puget Sound lowland. The United States Geologic Survey (USGS) 7.5-minute topographic map titled “Shelton Valley, Washington” provides coverage of the Site; a portion of this map is used as the base map in Figures 1 and 4. The USGS map depicts a series of lakes and wetlands in a topographic depression that extends in a southwesterly direction from Island Lake to Goose Lake, then in a westerly direction along the southern boundary of the Site (Figures 1 and 4). This topographic depression intersects the Goldsborough Creek channel approximately 1 mile southwest of the Site. The USGS map and historical aerial photographs of the Site (see Section 3.3) show that the lakes and wetlands in the topographic depression, including Goose Lake, do not appear to be interconnected by surface water drainage channels.

The western portion of the Site generally slopes to the south, and the eastern portion of the Site slopes to the southeast. The highest area of the Site is located near the northern Site boundary, where ground surface elevations are approximately 265 feet (relative to National Geodetic Vertical Datum of 1929). The lowest area of the Site is located in the east-west trending drainage ravine along the southern Site boundary, where ground surface elevations are approximately 230 feet. The ground surface slopes upward relatively steeply on the south side of the drainage ravine. This slope separates the drainage ravine from a broad upland area south of the Site that is composed of glacial till (Figure 4). A steep slope also is present along the northern boundary of the abandoned gravel pit. This slope was presumably produced by the gravel mining operations.

Based on a review of Light Detection and Ranging (LIDAR) images and geologic and soil formation history, PRSW (2009) concluded that Goose Lake appears to be a natural glacial kettle lake (which may have been expanded from what was originally a smaller lake), similar to other natural kettle lakes that occur along the topographic depression extending from the area of Island Lake, through Goose Lake, to Goldsborough Creek. This topographic depression was interpreted geologically by PRSW as a former glacial outwash flood channel.

3.3 Surface Water Drainage

Surface water in the vicinity of Shelton generally drains to the east into Oakland Bay and Hammersley Inlet, which are inland arms of Puget Sound. The closest streams to the Site are Goldsborough Creek, which flows in an easterly direction about 2,500 feet south of the Site, and Shelton Creek, which flows in a southerly direction about 4,500 feet east of the Site. These streams discharge to Oakland Bay.

Surface water features on the Site include Goose Lake and small seasonal ponds in the drainage ravine. Goose Lake has no visible inlet or outlet. Based on the USGS topographic map of the area, there is no stream emanating from the drainage ravine, and no evidence of significant surface water flow within the drainage ravine was identified during the RI Site reconnaissance. Precipitation that falls on the Site likely infiltrates the shallow soils. Following periods of heavy or prolonged precipitation, local ponding may occur.

Historical drainage conditions at the Site were apparently different than those observed today. A map from Rayonier's files dated March 12, 1931 shows that a drainage channel was present between the northeast portion of Goose Lake and the small seasonal pond to the northeast. The 1931 map also shows that a dam existed near the point where the drainage channel had previously entered Goose Lake. This drainage channel and dam were located in the general area where the inactive landfill exists today.

The 1931 Rayonier map also shows an apparent outlet at the southwest end of Goose Lake that extended to the drainage ravine, and a series of four earthen dams in the drainage ravine. The earthen dams are still present today; their locations are shown in Figure 2. During past periods of heavy rainfall, surface water from Goose Lake likely discharged to a point immediately upstream of the easternmost dam (Dam #1). Prior to the construction of the dam at the former inlet to Goose Lake and construction of the dams in the drainage ravine, surface water in the drainage ravine may have discharged to Goldsborough Creek.

Aerial photographs of the Site vicinity dated 1956, 1961, 1966, 1981, 1990, 1996, and 1999 were obtained and reviewed during the RI. There is no clear evidence in these photographs of a surface water connection between the drainage ravine, Goose Lake, and/or the seasonal pond to the northeast of Goose Lake. Distinct areas of ponded surface water are visible within the drainage ravine in several of the photographs, but the ponded water does not appear to be interconnected. The dams in the drainage ravine are visible in many of the photographs. One of the dams (Dam #3) appears to be breached by a narrow channel in the 1956 photograph.

Based on topography, the 1931 Rayonier map, and the 1956 aerial photograph, surface water appears to flow into the drainage ravine from upland property located south of the Site. In particular, a drainage channel is identified on the 1931 map upslope (south) of Dam #2. This drainage channel also appears to be visible in the 1956 aerial photograph.

There may have been sporadic surface water connectivity between Goose Lake and the drainage ravine during the time mill wastes were being discharged to the lake (1931 to 1934). However, surface water flow from Goose Lake would have been impeded by the dams in the drainage ravine, as shown in the 1931 Rayonier map. There appears to have been very little sediment transport from Goose Lake to the drainage ravine, based on the physical and chemical characteristics of soil in the drainage ravine. Soil in the drainage ravine appears to consist of glacial outwash sediment overlain by a relatively thin horizon of organic silt and/or leaf litter/duff. Fine-grained black sediment similar to the surficial black silt observed in Goose Lake was not observed in the drainage ravine. Chemical analytical results obtained during the RI (discussed in Section 9.0) suggest that limited sediment transport may have occurred historically from Goose Lake to the area immediately east of Dam #1, but there is no evidence that sediment transport from Goose Lake occurred west of Dam #1.

During wetter periods of the year (generally late fall, winter, and early spring), groundwater may daylight in the drainage ravine and manifest as areas of ponded water. However, this ponded water would not be expected to have a significant overland flow component due to the nearly flat topography of the drainage ravine and the presence of the earthen dams. Although ponded water may occur seasonally in the drainage ravine, regional surface drainage patterns and groundwater elevation measurements in monitoring wells near the drainage ravine suggest that the primary direction of groundwater flow in the vicinity of the drainage ravine is towards the south-southeast (see groundwater elevation contour maps in Figures 20 through 24).

Analytical results for soil/sediment samples collected in the drainage ravine during the RI (locations S-4, SED-09 to SED-12 and SH-DR-01 to SH-DR-06; see Figure 3) are compared to both soil and sediment screening levels in Section 9.0 of this RI, because Site reconnaissance and historical aerial photographs indicate that the drainage ravine is generally dry during the dry season and contains ponded water during the wet season. Analytical results for the RI soil/sediment sample collected near the presumed former drainage channel between Goose Lake and the seasonal pond to the northeast (location S-2) also are compared to both soil and sediment screening levels. Likewise, the 2010 supplemental investigation sampling locations along the shoreline of Goose Lake (GEI-1 through GEI-6) can become submerged when the lake level is high, so soil/sediment sample results from these locations also are compared to both soil and sediment screening levels in Section 9.0.

3.4 Geology

Four publications (Washington State Department of Water Resources, 1970; Washington State Department of Natural Resources, 1958, 1987, and 2003) provide geologic and/or hydrogeologic information for the Site vicinity. Based on these publications, Quaternary glacial and fluvial deposits are present in the general Site vicinity. Three primary units have been identified in the broad upland plains surrounding the Site (Figure 4): Vashon glacial till, Vashon recessional outwash, and alluvial deposits. In addition, recent site studies performed by Shelton Hills LLC as part of development planning have shown that Vashon advance outwash underlies the Vashon glacial till in some areas south of Goose Lake (Kleinfelder, 2008). Glacial till is a poorly sorted mixture of gravel and cobbles in a silt and clay matrix. Till is typically very dense because it was over-ridden and compacted by glaciers. Recessional outwash is deposited by streams that emerge from glaciers as the glaciers melt and recede. Recessional outwash is typically composed of unconsolidated sand and gravel and is often deposited in topographic depressions on top of glacial till. Alluvial deposits consist of silt, sand, and gravel, and are typically associated with present-day drainages or topographic depressions that were likely active drainages in the recent past.

Alluvial deposits are reported to be present in the topographic depression that extends from the area of Island Lake through Goose Lake (Figure 4). Recessional outwash deposits are reported to be present at higher elevations along the northern boundary of the Site, and in the southeastern portion of the Site. Vashon till occurs in broad upland ridges to the south and northwest of the Site (Figure 4). The Vashon till unit most likely extends beneath the drainage ravine, forming a basin that is filled with Vashon recessional outwash and alluvial deposits.

The results of the RI suggest that the distribution of geologic units within the Site boundary generally corresponds to that shown on published maps. Cross sections showing the inferred distribution of geologic units developed from the RI field investigations are presented in Figures 5 through 7. Based on the Site reconnaissance and exploration activities conducted during the RI, recessional outwash deposits are likely present in all areas of the Site. Sediment cores collected in Goose Lake indicate that the lake is predominantly an area of fine-grained lacustrine deposits corresponding to the "Qal" unit (alluvial deposits) shown in Figure 4. Lake/landfill margin borings completed during the 2010 supplemental investigation encountered recessional outwash deposits below these fine-grained lacustrine deposits. Similarly, explorations in the drainage ravine revealed a thin veneer of fine-grained wetland and/or alluvial deposits overlying recessional outwash. The lacustrine, wetland, and alluvial deposits in Goose Lake and the drainage ravine are identified as "Qal" in Figures 5 through 7. Although Vashon till was not encountered in explorations completed during the RI, its presence in the broad upland area south of the Site was confirmed by other recent studies (Kleinfelder, 2008). It is also possible that very dense soil encountered at a depth of 36 feet bgs (beneath soil interpreted as recessional outwash) during drilling of monitoring well MW-15 (to the northwest of Goose Lake) was Vashon till.

Shallow soil in the northern (upland) portion of the western half of the Site is identified as Carstairs gravelly loam (United States Department of Agriculture, 1960). This soil typically develops in glacial outwash plains. Carstairs soil is typically very dark, friable, granular and porous. Soil in the remaining areas of the Site is identified as Grove gravelly sandy loam. Grove soil is similar to Carstairs soil, in that it also forms in outwash plains, is typically granular, and has limited runoff because it is relatively permeable.

Sediments in Goose Lake comprise two distinct strata or units: a thin upper unit and a thicker lower unit. The upper unit consists of a very thin surface layer of black, low-density, very fine-grained, organic-rich sediment ("surficial black silt"). The surficial black silt layer is underlain by brown, fine-grained, organic-rich sediment composed predominantly of fibrous/peaty material and decomposing soft plant material. This lower sediment unit was previously interpreted by SAIC (1997), and more recently by GeoEngineers (2008) and PRSW (2009), to be native peat deposits and silt derived from natural alluvial processes and decomposition of plants. Specifically, PRSW (2009) concluded that the lower sediment unit beneath Goose Lake is Mukilteo peat. Published studies (Logan, 2003; Rigg, 1958; USDA, 1960) indicate that Mukilteo peat deposits on the order of 25 to 35 feet thick overlying glacial drift are common in peat bogs and marshy areas in the vicinity of Shelton.

3.5 Hydrogeology

Water Supply Bulletin No. 29 (State of Washington Department of Water Resources, 1970) indicates that municipal water supplies in the Site vicinity are typically derived from aquifers beneath the Vashon till unit. Some wells produce water from Vashon advance outwash aquifers. However, the most prolific wells produce water from deeper pre-Vashon aquifers, including the Skokomish Gravel, Salmon Springs Drift, and other undifferentiated units. In the Site vicinity, the shallow water-bearing unit above the Vashon till reportedly is not used as a drinking water source.

Subsurface information from the vicinity of Island Lake suggests that this lake and groundwater in the adjacent recessional outwash unit may be perched on top of Vashon till. As discussed in Section 3.4, Goose Lake, the drainage ravine, and the shallow water-bearing unit beneath the Site also may be perched on top of Vashon till, although till was not encountered in explorations completed at the Site (with the possible exception of MW-15).

Shallow groundwater beneath the Site appears to be unconfined. The groundwater primarily occurs in Vashon recessional outwash deposits. Studies performed by SAIC (1997) and PEG (1998) indicated a horizontal hydraulic gradient of approximately 0.003 feet/foot in the vicinity of the inactive landfill, and 0.02 feet/foot over a broader area of the Site. SAIC (1997) estimated that the hydraulic conductivity of the shallow water-bearing unit ranges from about 0.1 to 1.0 centimeters per second, which corresponds to groundwater seepage velocities ranging from 2.83 to 28.3 feet per day using an assumed effective porosity of 30 percent. A discussion of hydrogeologic conditions observed during the RI is presented in Section 9.3.1.

3.6 Ecological Setting

Goose Lake is a shallow, mesotrophic (nutrient-containing) lake situated within a complex wetland and pond mosaic with moderate topographic relief. As described in Section 3.2, the wetland and pond mosaic lies within a topographic depression that extends in a southwesterly direction from Island Lake to Goose Lake, then west toward Goldsborough Creek. Goldsborough Creek flows in an easterly direction and drains to Oakland Bay in southern Puget Sound. The earthen dams between the former outlet at the southwestern end of Goose Lake and downstream through the drainage ravine towards Goldsborough Creek indicate historical measures taken to control surface flow from the lake.

Ecological communities supported by the Goose Lake ecosystem and the drainage ravine are consistent with those found in relatively undisturbed wetland mosaics in other areas within the Puget Sound lowland. Formal wetland and wildlife surveys were not conducted during the RI. However, much of the riparian fringe surrounding Goose Lake and the drainage ravine is recognized in National Wetland Inventory maps as wetlands.

Rainbow trout (*Oncorhynchus mykiss*) have previously been planted in Goose Lake to support recreational fishing, although no trout were observed during the RI. Amphibians known to be present on Site include the bullfrog (*Rana catesbeiana*), red-legged frog (*Rana aurora*), and rough-skinned newt (*Taricha granulose*). The following bird species were reportedly observed on June 21, 2001 by Ecology personnel: Osprey (*Pandion haliaetus*), red-tailed hawk (*Buteo jamaicensis*), turkey vulture (*Cathartes aura*), great blue heron (*Ardea herodias*), Northern raven (*Corvus corax*), common yellowthroat (*Geothlypis trichas*), Bohemian waxwing (*Bombycilla garrulus*), willow flycatcher (*Empidonax traillii*), American robin (*Turdus migratorius*), spotted towhee (*Pipilo maculatus*), Swainson's thrush (*Catharus ustulatus*), American goldfinch (*Carduelis tristis*), song sparrow (*Melospiza melodia*), red-winged blackbird (*Agelaius phoeniceus*), killdeer (*Charadrius vociferus*), and spotted sandpiper (*Actitis macularia*).

Although the Site is situated between the Sanderson Air Field and downtown Shelton, and has a history of timber harvest, gravel mining, and light industrial use (i.e., historical waste disposal activities), natural habitats within and adjacent to the Site remain supportive of a variety of plant communities and wildlife. Non-native invasive plants, particularly Scotch broom (*Cytisus scoparius*), dominate recently cleared or harvested upland areas in the northern, southern, and eastern portions of the Site, particularly along access roads leading to or around Goose Lake. In contrast, conditions in the drainage ravine and along the riparian fringe of Goose Lake appear to support a highly diverse native plant community representing a composite of palustrine emergent and forested wetland, and typical Puget Sound upland species. Typical upland species include Douglas fir (*Pseudotsuga menziesii*), western hemlock (*tsuga heterophylla*), vine maple (*Acer circinatum*), salal (*Gaultheria shallon*), Oregon grape (*Berberis aquifolium*), and trailing blackberry (*Rubus ursinus*). Typical wetland species observed within the littoral fringe of Goose Lake and in the drainage ravine include field horsetail (*Equisetum palustre*), willow (*Salix sp.*), water lily (*Nuphar polysepalum*), skunk cabbage (*Lysichiton americanum*), cattail (*Typha latifolia*), and a variety of sedge (*Carex sp.*) and rush (*Juncus sp.*) species. The area is also supportive of native Garry oak (*Quercus garryana*), observed intermixed in uplands fringing the drainage ravine. Due to loss of habitat, this species is becoming rarer in the Puget Sound lowland.

Despite the historical disturbance regime in the Site vicinity, the plant communities and habitats within and around the Site support a variety of avian, amphibian, and terrestrial wildlife. Evidence of raccoon (*Procyon lotor*), osprey, bald eagle (*Haliaeetus leucocephalus*), black-tailed deer (*Odocoileus hemionus*), various rodents, waterfowl, and a variety of passerine bird species has been observed during field work at the Site. As described later in this report, the only fish species apparently supported in Goose Lake at the time of the RI was largemouth bass (*Micropterus salmoides*). The largemouth bass are a non-native species that was introduced, although the date and manner of those introductions are unclear. The lake appears to support healthy populations of rough-skinned newt (*Taricha granulosa*), and other amphibians are also likely supported in the area. Based on our review of Site conditions, the habitat appears supportive of other State-priority species such as bobcat (*Lynx rufus*), cougar (*Puma concolor*), Roosevelt elk (*Cervus canadensis roosevelti*), American black bear (*Ursus americanus*), and mink (*Neovison vison*).

3.7 Land Use

3.7.1 Land Use and Zoning Designations

Based on information provided by Mason County and the City of Shelton, land use codes and zoning designations in the Site vicinity have been established in accordance with Mason County

Development Regulations dated December 2008 and "The City of Shelton 2004 Comprehensive Plan with 2005 and 2007 Amendments."

Land use for the majority of the Site appears to be Designated Forestland (8800). A limited western portion of the Site appears to have a Governmental (6700) land use designation. Land use designations for properties adjacent to the Site include Airfields (4311), Fairgrounds (7311), and Timber (9500) to the north, Designated Forestland (8800) to the east and south, and Governmental (6700) to the west.

The boundaries of the Site are within Shelton city limits. Zoning designations at the Site include "Commercial/Residential-Goose Lake" (eastern portion of the Site) and "Commercial/Industrial" (western portion of the Site). According to the City of Shelton Zoning Code, Chapter 21.14, a "Commercial/Residential-Goose Lake" designation refers to a "Commercial/Residential" zone specific to the Goose Lake area that "…is intended to provide for higher-density residential development with a mix of pedestrian-oriented commercial development…"

Adjacent properties to the west and south of the Site are zoned by Mason County as "rural residential" or by the City of Shelton as "Commercial/Industrial." Properties east of the Site generally appear to be zoned by the City of Shelton as "Commercial" or "Gateway Corridor Overlay." Properties south of the Site generally appear to be zoned by the City of Shelton as "Commercial," "Commercial/Industrial," or "Commercial/Residential-Goose Lake."

3.7.2 Current Site Use

The Site is undeveloped, with no public access. A small metal office/warehouse building is located south of Goose Lake, just outside the Site boundary. Shelton Hills Investors LLC currently has this building rented out to a construction contractor.

3.7.3 Potential Future Site Use

In January 2005, Shelton Hills Investors LLC purchased approximately 670 acres of property adjacent to the south and west sides of Goose Lake for planned future construction of a mixed-use development. The planned mixed-use development includes the areas of the former disposal lagoons and the drainage ravine, but does not currently include Goose Lake or the inactive landfill. A commercial business park is proposed for the area of the former disposal lagoons.

As part of the planning process for the Goose Lake cleanup and future property development, the City of Shelton and Shelton Hills Investors LLC recognized an opportunity to integrate the Goose Lake cleanup with the overall Site development activities and the City of Shelton future parks and recreational plans. Further discussions between Shelton Hills Investors LLC, Rayonier Properties LLC, and City of Shelton representatives proposed possibly transferring ownership of Goose Lake and the inactive landfill area to the City of Shelton after the Site cleanup is completed. The City of Shelton has expressed a desire to enhance the ecological habitats around and within Goose Lake and possibly create public recreational and open-space facilities.

4.0 REMEDIAL INVESTIGATION ACTIVITIES

4.1 General

The RI field activities were conducted in 2002 and 2003 in general accordance with the RI work plan (GeoEngineers, 2002). Soil, groundwater, surface water, sediment, and fish tissue samples were collected during the RI. Personnel from Ecology were present on Site for much of the sampling effort, and participated in discussions and decision-making when field conditions necessitated deviations from the RI work plan.

As noted previously, several environmental investigations were completed prior to and subsequent to the 2002-2003 RI. These additional investigations include soil, sediment, and groundwater sampling in 1997 (SAIC, 1997; PEG, 1998); limited soil and groundwater sampling in 2005 (Kleinfelder, 2006); Goose Lake sediment geomorphic studies in 2007 and 2008 (GeoEngineers, 2008; PRSW, 2009); soil sampling in the former disposal lagoon area and drainage ravine in 2008 (Floyd|Snider, 2009), and soil and groundwater sampling in 2010 (GeoEngineers, 2011a). The previous investigations completed in 1997 (SAIC, 1997; PEG, 1998) are summarized in Section 2.2.

This section provides a summary of the Site characterization activities completed during the RI and subsequent investigations. Detailed descriptions of field procedures such as field screening, sample collection, and equipment decontamination are not reproduced in this report. The field procedures for the RI are described in the RI work plan (GeoEngineers, 2002). The field procedures for subsequent investigations are discussed in the individual reports prepared for these investigations (Kleinfelder, 2006; GeoEngineers, 2008; PRSW, 2009; Floyd|Snider, 2009; GeoEngineers, 2011a).

4.2 Soil Evaluation

4.2.1 Inactive Landfill Area

The locations of all explorations completed in the inactive landfill area are shown in Figure 8.

Twenty-five test pits (TP-01 though TP-20 and TP-33 through TP-37) and four exploratory trenches (Trench-01 through Trench-04) were completed in the inactive landfill area during the RI. Test pits TP-01 through TP-20 and the four trenches were completed between July 8 and August 13, 2002; test pits TP-33 through TP-37 were completed on October 3, 2003. The RI explorations were completed using a tracked excavator and a backhoe. The test pits were excavated to depths ranging from 19 to 25 feet bgs at locations throughout the inactive landfill. The trenches were excavated to depths ranging from 6 to 18 feet bgs at four locations along the perimeter of the landfill. Test pit logs are included in Appendix A1; profiles of the exploratory trenches are presented in Figures 14 through 17.

A total of 27 soil samples were obtained from the RI test pits and trenches and submitted for chemical analysis. Seventeen samples were obtained from the landfill waste horizon, three samples were obtained from the landfill cover layer, and seven samples were obtained from the native soil beneath the landfill.

During the 2010 supplemental investigation (GeoEngineers, 2011a), 28 soil samples were collected from six soil borings (GEI-1 through GEI-6) and two monitoring wells (MW-16 and MW-17) completed in the landfill and along the lake/landfill margin. Boring logs and well logs for these supplemental explorations are included in Appendix A2. The maximum depth of exploration at these locations was 45 feet bgs. Because locations GEI-1 through GEI-6 can become submerged when the lake level is high (e.g., during the wet season), the sample matrix at these locations is referred to as “soil/sediment” in this RI, and the analytical testing results are compared to both soil and sediment screening levels.

4.2.2 Former Disposal Lagoon Area

The locations of all explorations completed in the former disposal lagoon area are shown in Figure 9.

Twelve test pits were completed in the area of the former disposal lagoons during the RI. The test pits were excavated between July 8 and August 13, 2002, at locations both outside (TP-21 through TP-28) and inside (TP-29 through TP-32) the boundary of the former disposal lagoons. The explorations were completed to depths ranging from 4 to 13 feet bgs using a tracked excavator and a backhoe. Eight soil samples were obtained from the RI test pit explorations.

Although the RI sampling results did not indicate the presence of soil contamination in the former disposal lagoon area (as discussed below), Ecology subsequently requested additional soil sampling in the disposal lagoon area to further assess subsurface soils for potential impacts from historical waste disposal activities. Ecology requested that a limited number of soil samples be collected and analyzed for PCBs, dioxins, and total sulfide. Consequently, in June 2008, Floyd|Snider excavated six test pits (SH-TP-01 through SH-TP-06) to a maximum depth of 14 feet bgs within the former disposal lagoons. One soil sample was obtained from each test pit for chemical analysis, at depths ranging from 2.5 to 3.0 feet bgs (Floyd|Snider, 2009; Appendix E).

4.2.3 Other Areas

Four groundwater monitoring wells (MW-07 through MW-10) were installed during the RI. (Monitoring wells MW-01 through MW-06 were installed during the previous investigations; see Section 2.2). The RI wells were installed on July 22 and 23, 2002 at the locations shown in Figure 10. The boreholes for these wells were advanced to depths between 21.5 and 46.5 feet bgs using a truck-mounted, hollow-stem auger drilling rig. Well MW-07 was installed downgradient (east) of the Site. Well MW-08 was installed along the upgradient boundary of the Site, north of the inactive landfill. Wells MW-09 and MW-10 were installed at locations downgradient and upgradient of the former disposal lagoons, respectively. Well logs for these wells are included in Appendix A1. One soil sample collected from each of the boreholes for wells MW-07 and MW-08 was submitted for chemical analysis.

Four shallow soil samples (S-2, S-4, S-5, and S-6A) were collected near Goose Lake and in the drainage ravine area between October 3 and October 15, 2003 (Figure 3). Sample S-2 was obtained from the presumed former drainage channel between Goose Lake and the seasonal pond to the northeast of Goose Lake. Sample S-4 was obtained from the easternmost portion of the drainage ravine, in an area (approximately 900 feet east of Dam #1) unlikely to have been affected by possible historical surface water flow/sediment transport from Goose Lake to the ravine.

Sample S-5 was obtained from the vicinity of the historical outlet from Goose Lake (there is no present-day expression of this outlet). Sample S-6A was obtained from the upland slope immediately south of Dam #1. These four soil samples were obtained from depths ranging from approximately 0.6 to 1 feet bgs using a spade. Because samples S-2 and S-4 were collected at locations that may become submerged under ponded surface water during periods of heavy rainfall (based on a review of historical aerial photographs), they are referred to in this RI as "soil/sediment" samples, and the analytical results for these samples are compared to both sediment and soil screening levels. Analytical results for samples S-5 and S-6A are compared only to soil screening levels because these samples were collected at upland locations that are not susceptible to seasonal surface water ponding.

Other soil/sediment samples collected in the drainage ravine during the RI (locations SED-09 through SED-12) are discussed in Section 4.5.2.

Two groundwater monitoring wells (MW-11 and MW-12) were installed on December 28, 2005 (Kleinfelder, 2006; Appendix C). The borehole for MW-11 was drilled to a depth of approximately 35 feet bgs near the southeastern corner of Goose Lake; the borehole for MW-12 was drilled to a depth of approximately 25 feet bgs near the southwestern corner of Goose Lake (Figure 10). One soil sample was obtained from a depth of 5 feet bgs in each borehole and submitted for chemical analysis.

During the 2010 supplemental investigation (GeoEngineers, 2011a), seven soil samples were collected from the boreholes for two monitoring wells (MW-15 and MW-18) installed west of Goose Lake (MW-15) and near the northeastern corner of the inactive landfill (MW-18). The boreholes for wells MW-15 and MW-18 were advanced to depths of 46.5 feet bgs and 26 feet bgs, respectively. Well logs for these wells are included in Appendix A2.

4.3 Groundwater Evaluation

Groundwater monitoring well locations are shown in Figure 10.

Groundwater monitoring wells MW-07 through MW-10 were installed during the RI, on July 22 and 23, 2002. The boreholes for these wells were advanced to depths ranging from 20 to 46.5 feet bgs. The wells were developed by removing approximately five well casing volumes of groundwater from each well.

Four quarterly groundwater monitoring events were conducted between August 12, 2002 and May 13, 2003. During each monitoring event, groundwater levels were measured and groundwater samples were obtained from monitoring wells MW-01 through MW-10. Wells MW-04, MW-05, and MW-06 were dry, and thus were not sampled, during the November 12, 2002 monitoring event.

On December 28, 2005, two additional groundwater monitoring wells (MW-11 and MW-12) were installed and developed as part of a limited environmental assessment and groundwater study (Kleinfelder, 2006; Appendix C). On December 30, 2005, groundwater samples were obtained from wells MW-11 and MW-12 and previously installed wells MW-05, MW-07, and MW-10 for chemical analysis. The groundwater samples were analyzed for diesel-, and heavy oil-range total petroleum hydrocarbons (TPH), VOCs, SVOCs, metals, and PCBs.

In August 2007, two more monitoring wells (MW-13 and MW-14) were installed by Shelton Hills LLC as part of a geotechnical and stormwater infiltration evaluation (Kleinfelder, 2008).

During the 2010 supplemental investigation (GeoEngineers, 2011a), four more monitoring wells (MW-15 through MW-18) were installed. Well logs for these wells are included in Appendix A2. In addition, groundwater levels were measured in all 18 monitoring wells, and groundwater samples were obtained from 14 wells for chemical analysis (wells MW-04, MW-05, MW-09, and MW-14 were not sampled). The unfiltered groundwater samples were selectively analyzed for metals, PCBs, SVOCs, cPAHs, dioxins, and total sulfide.

Groundwater sampling results for wells MW-03, MW-05, MW-06, MW-08, MW-09, MW-10, MW-13, MW-15, MW-16, and MW-17 were compared to screening levels protective of drinking water use and screening levels protective of surface water (see Section 6.0) due to the proximity or upgradient location of these wells relative to Goose Lake, the drainage ravine, or the seasonal pond to the northeast of Goose Lake. Sampling results for wells MW-01, MW-02, MW-04, MW-07, MW-11, MW-12, and MW-18 were compared only to groundwater screening levels protective of drinking water use due to the downgradient location of these wells relative to Goose Lake and the drainage ravine. Well MW-14 has not been sampled.

4.4 Surface Water Evaluation

A reconnaissance survey of Goose Lake was completed on May 24, 2001, to establish a bathymetry profile for subsequent sediment and fish sampling. During this survey, the depth of the lake was measured along seven transects, each approximately 100 feet long. Observations regarding the physical conditions of the lake and gross characteristics of surficial sediment also were recorded during the survey.

Surface water samples were collected at three locations in Goose Lake on June 4, 2002, using a canoe as the sampling platform. Surface water sampling locations are shown in Figure 11. Samples were collected from two discrete depths at each location: 1 foot below the water surface and 1 foot above the lake bottom. Bathymetry data from the May 2001 reconnaissance survey were used to ensure that lake-bottom sediments were not disturbed during collection of the deeper water samples, which could have introduced suspended sediments into the surface water samples. A total of six primary samples and one field duplicate sample were collected using a 4-liter, polycarbonate Wildco® water sampler. The surface water samples were analyzed for metals, PCBs, total sulfide, hardness, and alkalinity. In addition, two of the samples were analyzed for pH, turbidity, and conductivity.

During surface water sampling on June 4, 2002, the field parameters pH, temperature, conductivity, and dissolved oxygen were measured with a Horiba® portable water quality meter at each location and depth sampled, to provide general information on surface water conditions that could potentially affect the success of subsequent efforts to collect fish tissue samples (see Section 4.6). Surface water field parameters were measured a second time on June 11, 2002 during a systematic check of the gill nets deployed for fish tissue sampling.

4.5 Sediment Evaluation

4.5.1 Goose Lake

Sediment samples were collected from eight locations in Goose Lake during the RI (locations SED-01 through SED-08). The sediment samples were collected on June 25 and 26, 2002 at the locations are shown in Figure 11. Four of the sediment sampling stations (SED-01 through SED-04) were oriented along a westerly transect beginning near the inactive landfill. The spacing between these sampling stations was approximately 200 feet. The other four sediment sampling stations (SED-05 through SED-08) were located in other areas of the lake. The measured lake depth at the sampling stations ranged from about 5.6 to 13.6 feet.

The sediment sampling was conducted from a pontoon boat. Sediment samples were obtained in general accordance with Ecology's *Sediment Sampling and Analysis Plan Appendix* (SAPA; Ecology, 2008b). Shallow sediment samples were obtained at each sampling station using a Van Veen grab sampler. The Van Veen sampler recovered sediment samples from approximately the upper 3 inches of the sediment column. In addition to the shallow sediment samples, core samples of deeper sediment were obtained at each station using vibracore equipment and 4-inch diameter aluminum coring tubes. The sediment cores were obtained from maximum depths ranging from 2 to 14 feet below the top of the sediment surface; the majority of the cores extended to a depth of 5 feet below the top of the sediment surface.

As many as three discrete sediment cores were obtained at each sampling station to provide sufficient sample volume for the required chemical analyses. A separate log was prepared in the field for each discrete core. The information from adjacent discrete cores was combined to produce one log per sampling station that is representative of sediment conditions at that location The sediment core logs are included in Appendix A1.

On November 20, 2007, GeoEngineers collected supplemental sediment cores from five locations (SED-13 through SED-17; Figure 3) spaced approximately 200 feet apart along a general westerly transect in the center of Goose Lake (GeoEngineers, 2008; Appendix D). These cores extended to a maximum depth of 2 feet below the top of the sediment surface, and were collected using a Wildco® 2424-series, 1-inch diameter, stainless steel sampler. The measured lake depths at these supplemental sampling stations ranged from 5 to 8 feet. The recovered sediment cores ranged in length from 8 to 10 inches. The purpose of the November 2007 supplemental sediment sampling was to assess whether the brown, organic-rich sediment underlying the surficial black silt layer is naturally occurring or derived from the historical discharge of pulp mill wastes to Goose Lake.

On November 6, 2008, PRSW performed additional sediment sampling at six locations along the eastern and southeastern perimeter of Goose Lake (locations HA-1 to HA-6; Figure 3) to further evaluate the origin of the brown organic sediment underlying the surficial black silt layer (PRSW, 2009; Appendix F). This supplemental sediment evaluation was requested by Ecology. PRSW completed six hand-auger borings to a depth of approximately 5 feet bgs. The lake level was unusually low during this sediment sampling event. PRSW visually analyzed the sediment samples to evaluate whether the brown organic sediment is naturally occurring or may be derived from the discharge of pulp mill wastes to Goose Lake.

4.5.2 Drainage Ravine

One shallow soil/sediment sample (SED-09) was collected in the drainage ravine east of Dam #1 on July 12, 2002 (Figure 3). Three additional soil/sediment samples (SED-10, SED-11, and SED-12) were collected east of Dams #2, #3 and #4, respectively, on October 3, 2003. The samples were obtained from depths ranging from approximately 1 to 5 feet bgs using a spade. Because samples SED-09 to SED-12 were collected at locations that may be seasonally submerged under ponded surface water, the analytical testing results for these samples are compared to both soil and sediment screening levels in this RI.

In June 2008, at Ecology's request, Floyd|Snider collected six shallow soil/sediment samples (locations SH-DR-01 through SH-DR-06; Figure 3) in the drainage ravine east of Dam #1 to further characterize the nature and extent of PCBs and dioxins that were detected at RI sampling location SED-09. One sample was collected at the same location as SED-09, and the other five samples were collected at locations within 40 to 300 feet of SED-09. The samples were obtained from depths ranging from 0 to 1 foot bgs; the sample collected at location SED-09 was obtained from a depth just below the depth of the RI sample collected at this location (Floyd|Snider, 2009; Appendix E). Because samples SH-DR-01 through SH-DR-06 were collected at locations that may become seasonally submerged under ponded surface water, the analytical testing results for these samples are compared to both soil and sediment screening levels in this RI.

Besides the sampling described in this section, one other soil/sediment sample was collected in the drainage ravine during the RI (sample S-4; Figure 3). This sample, and a soil/sediment sample collected near the edge of the seasonal pond to the northeast of Goose Lake (sample S-2), are discussed in Section 4.2.3.

4.6 Fish Tissue Evaluation

Fish were collected from Goose Lake for tissue analysis over a period of 13 days during the RI (June 6 through June 18, 2002). The fish were captured using three different methods: (1) baited long lines, (2) gill nets, and (3) a beach seine net. The fish collection locations are shown in Figure 11.

Two long lines were placed in the southwest and northeast portions of Goose Lake for the initial collection period (June 6 through June 11-12). These long lines were moved to different locations from June 11-12 to June 18 due to the lack of success catching fish in the initial locations. Each long line consisted of approximately ten baited monofilament lines suspended on a buoyed rope. The bait was positioned at depths of 2 to 6 feet below the water surface. Various baits were used, including power bait, minnows, scented rubber worms, salmon eggs, and nightcrawlers. The long lines were checked periodically and rebaited throughout the sampling period. Table 1 summarizes the fish collection methods.

Other methods used to collect fish included gill nets and a beach seine net. Gill nets (10 feet wide by 200 feet long) were used in three areas of Goose Lake between June 10 and June 18, 2002. A 10-foot by 100-foot beach seine net was used in the east cove of Goose Lake on June 10 and June 13, 2002. The seine net was deployed within approximately 20 feet of the lake's edge.

Despite the efforts undertaken to collect fish during the RI, only four fish were captured. This suggests that the Goose Lake fish population was small at the time the RI was conducted.

4.7 Analytical Testing Program

The analytical testing program for samples of soil, groundwater, surface water, sediment, and fish tissue collected during the RI is summarized in Table 2. The analyses performed on each matrix during the RI are described below. The analytical testing programs for samples collected during subsequent investigations are summarized in the individual reports prepared for these investigations (Kleinfelder, 2006; Floyd|Snider, 2009; GeoEngineers, 2011a). The analytical testing results for all samples, including samples collected during the RI and previous and subsequent investigations, are presented in Section 9.0.

4.7.1 Soil

Soil samples from the inactive landfill area were analyzed for one or more of the following constituents: metals (arsenic, total chromium, hexavalent chromium, copper, lead, and mercury), dioxins, PCBs, VOCs, SVOCs, and total sulfide.

Soil samples from the former disposal lagoon area were analyzed for one or more of the following constituents: metals (arsenic, total chromium, hexavalent chromium, copper, lead, and mercury), PCBs, VOCs, and total sulfide.

The two soil samples obtained from the boreholes for monitoring wells MW-07 and MW-08 were analyzed for metals (arsenic, total chromium, hexavalent chromium, copper, lead, and mercury), PCBs, VOCs, SVOCs, diesel- and heavy oil-range TPH, and total sulfide.

The shallow soil samples collected near the former outlet of Goose Lake (location S-5) and upslope of Dam #1 (location S-6A), and the shallow soil/sediment samples obtained from the drainage ravine (location S-4) and the presumed former drainage channel between Goose Lake and the seasonal pond to the northeast (location S-2), were analyzed for dioxins.

4.7.2 Groundwater

The groundwater samples collected from monitoring wells MW-01 through MW-10 in 2002 and 2003 were analyzed for total metals (arsenic, total chromium, hexavalent chromium, copper, lead, and mercury), PCBs, and total sulfide.

4.7.3 Surface Water

Filtered surface water samples were analyzed for dissolved arsenic, copper, and mercury. Unfiltered surface water samples were analyzed for cadmium, total chromium, hexavalent chromium, lead, mercury, PCBs, and the conventional parameters total sulfide, pH, turbidity, hardness, alkalinity, and conductivity. Turbidity, pH, and conductivity were analyzed for only two of the surface water samples (SW-2-bottom and SW-3-top), whereas total sulfide, hardness, and alkalinity were analyzed for all of the surface water samples.

4.7.4 Sediment

Representative samples of the surficial black silt and the brown organic sediment collected at Goose Lake sampling stations SED-01 to SED-08 were analyzed for one or more of the following constituents: metals (antimony, arsenic, cadmium, total chromium, hexavalent chromium, copper, lead, mercury, nickel, silver, and zinc), SVOCs, PCBs, and dioxins. Goose Lake sediment samples also were analyzed for the conventional chemistry parameters total sulfide, total organic carbon, ammonia, oxidation-reduction potential (ORP), pH, and total solids.

The soil/sediment sample collected at location SED-09 (east of Dam #1) in the drainage ravine was analyzed for metals (antimony, arsenic, cadmium, total chromium, hexavalent chromium, copper, lead, mercury, nickel, silver, and zinc), SVOCs, PCBs, dioxins, and conventional chemistry parameters (total sulfide, total organic carbon, ammonia, ORP, pH, and total solids). As specified in the RI work plan, the soil/sediment samples collected at locations SED-10, SED-11, and SED-12 in the drainage ravine were submitted for analysis based on the sediment analytical results from Goose Lake and Dam #1 (locations SED-01 through SED-09). The samples collected at locations SED-10 through SED-12 were analyzed for metals (total chromium, copper, lead, and nickel), PCBs, and dioxins.

4.7.5 Fish Tissue

Two types of fish tissue samples, fillet and whole-body samples, were submitted for chemical analysis. The whole-body samples consisted of the body remnants after the fish were filleted. The eight fish tissue samples (four fillet and four whole-body samples) were analyzed for metals (arsenic, cadmium, copper, lead, mercury, nickel, and zinc), dioxins, and PCB congeners.

5.0 DEVIATIONS FROM THE RI WORK PLAN

The RI activities were performed in general accordance with the RI work plan (GeoEngineers, 2002). Significant deviations from the RI work plan are summarized below.

5.1 Sampling Activities

5.1.1 Soil

- The low concentrations of metals detected in the soil samples collected in the former disposal lagoon area allowed a modification to the work plan. The work plan specified that the two samples from the former disposal lagoon area with the highest detected concentrations of metals would be submitted for toxicity characteristic leaching procedure (TCLP) analysis of those metals. However, TCLP testing was not performed on any soil samples due to the low concentrations of metals detected in the samples.
- Sampling was completed at nine locations that were not proposed in the RI work plan, including five test pits (TP-33 through TP-37) in the inactive landfill (Figure 8) and four shallow soil samples (S-2, S-4, S-5, and S-6A) collected at various locations (Figure 3). This sampling was conducted to evaluate dioxin concentrations in soil and sediment at the subject locations. The additional sampling was performed in general accordance with a supplemental sampling plan prepared in 2003 (GeoEngineers, 2003). Locations S-2, S-4, S-5, and S-6A were identified as background locations in the supplemental sampling plan.

5.1.2 Groundwater

- Groundwater samples were not obtained from monitoring wells MW-04, MW-05, and MW-06 during the November 2002 monitoring event because these wells were dry during this event (i.e., the groundwater level was below the bottom of the wells).
- Monitoring well MW-09 was installed at a different location than proposed in the RI work plan, to better accomplish the objectives of the RI. The purpose of installing well MW-09 was to evaluate groundwater conditions downgradient of the former disposal lagoons and well MW-05. The revised location of MW-09 was more directly downgradient of these areas than the original proposed location.
- The RI work plan indicated that a minimum of one trip blank would accompany water samples submitted for chemical analysis, to assess possible VOC contamination of the samples during sample storage and transport to the analytical laboratory. This requirement should not have been included in the work plan because surface water and groundwater samples were not analyzed for VOCs during the RI. Consequently, trip blanks were not analyzed.

5.1.3 Sediment

- Stratigraphy in the drainage ravine was different than anticipated, necessitating a change in the sampling procedures in this area (with the concurrence of an on-site Ecology representative). There was very little, and in one case, no fine-grained soil or sediment present between surficial leaf-fall litter/duff and underlying native gravel deposits (recessional outwash). Consequently, to provide sufficient sample volume for chemical analysis, leaf-fall litter and humus were included in samples obtained from locations SED-09, SED-11, and SED-12. The Ecology representative participated in selecting specific sampling locations and depths in the drainage ravine.

5.1.4 Fish Tissue

- Despite intensive efforts to collect fish using a variety of capture methods in several areas of Goose Lake, only four fish were captured. This fell significantly short of the work plan goal of capturing at least 20 fish for tissue analysis.

5.2 Analytical Testing/Data Evaluation

5.2.1 Sediment

Sediment samples from Goose Lake with detected total PCB concentrations (sum of detected PCB Aroclors) greater than 21 micrograms per kilogram (ug/kg) were not analyzed for PCB congeners as specified in the RI work plan. As directed by Ecology, sediment analytical results for PCBs and other COPCs (except dioxins; see below) were compared to screening levels derived from Washington State draft freshwater sediment quality values (Ecology, 2003). State freshwater sediment quality values are available for Aroclor-1254, Aroclor-1260, and total PCBs; however, there are no State freshwater sediment quality values for PCB congeners or PCB toxicity equivalency quotients (TEQs). Accordingly, congener-specific analysis of PCBs was unnecessary.

Preliminary biota-sediment accumulation factors (BSAFs) for dioxins were not derived from sediment and fish tissue data. The RI work plan indicated that preliminary site-specific BSAFs would be derived for possible use in assessing site-specific risks to fish and wildlife (mammals and birds) from the bioaccumulation of sediment-based dioxins in fish and the consumption of fish by wildlife. Instead, potential risks associated with the dioxins detected in sediment were assessed by comparing the analytical data to risk-based concentrations published by the United States Environmental Protection Agency (USEPA) for the protection of fish, birds, and mammals (USEPA, 1993).

5.2.2 Fish Tissue

As noted above, preliminary BSAFs for dioxins were not derived from sediment and fish tissue data. In addition, analytical results for fish tissue samples were not compared to tissue residue-based lowest observable effect concentrations as specified in the RI work plan, due to uncertainties associated with the small number of fish captured (four; see Sections 4.6 and 5.1.4), and also because Washington State draft freshwater sediment quality values became available after the RI work plan was published (Ecology, 2003). The draft freshwater sediment quality values provide a more direct means of assessing potential impacts of contaminated sediments on aquatic life than inferences drawn from fish tissue analyses. This topic is discussed further in Section 6.5.

6.0 SCREENING LEVELS

The RI analytical data were evaluated, and potential risks to human and ecological receptors were assessed, by comparing the analytical data to screening levels developed from published numeric criteria. Risk-based screening levels for soil, groundwater, and surface water were developed for the constituents analyzed in these media that have numerical regulatory criteria (or toxicity data that can be used to calculate protective criteria) listed in Ecology’s on-line Cleanup Levels and Risk Calculations (CLARC) database (Ecology, 2012b). The screening levels used in this RI are presented in Tables 3 through 7. An exceedance of a screening level does not indicate that a cleanup action will be required. Rather, screening levels are used in conjunction with the conceptual site model (CSM) presented in Section 7.0 to assess relative risks associated with COPCs at the Site. The potential risks posed by Site COPCs may be further evaluated as necessary during the feasibility study to develop appropriate cleanup action alternatives.

This section discusses the numerical criteria used to derive the RI screening levels. Consistent with the MTCA Cleanup Regulation (Chapter 173-340 of the Washington Administrative Code [WAC]; Ecology, 2007), the development of screening levels also included identification of potential exposure pathways for human and environmental impacts based on the current and planned future use of the Site. Potential exposure pathways are discussed in Section 7.0.

6.1 Soil

Table 3 shows the soil screening levels used to evaluate the RI soil analytical data, and the numerical criteria from which the screening levels were derived. In general, the most conservative (lowest) published numerical values were selected from among the following regulatory criteria:

- MTCA Method B soil cleanup levels (standard formula values for carcinogens and non-carcinogens) protective of human health for unrestricted land use (WAC 173-340-740[3]), obtained from Ecology’s CLARC database (Ecology 2012b). Where values were available for both carcinogenic and non-carcinogenic/toxic effects, the lower value (typically the carcinogenic value) was used.

- Soil concentrations protective of groundwater as drinking water and surface water, calculated using the MTCA fixed parameter three-phase partitioning model (WAC 173-340-747[3][a]). Separate values were calculated for soil concentrations protective of groundwater as drinking water and for soil concentrations protective of groundwater as surface water. Protective soil concentrations were calculated only for constituents that exceeded groundwater screening levels in at least one groundwater sample. Default assumptions provided in WAC 173-340-747(4) for unsaturated and saturated zone soil were used in the calculations, and model input parameter values were taken directly from Ecology's CLARC database.

- MTCA ecological indicator soil concentrations for the protection of terrestrial plants and animals. Section 3.6 of this report describes the ecological setting of the Site, including vegetation and wildlife species observed or expected to be present in the Site vicinity. A site-specific TEE was determined to be appropriate for the Goose Lake Site because: (1) the Site does not qualify for an exclusion from a TEE under WAC 173-340-7491(1); and (2) as defined in WAC 173-340-7491(2), the Site "…is located on, or directly adjacent to, an area where management or land use plans will maintain or restore native or semi-native vegetation." Section 8.0 presents the site-specific TEE.

  The ecological indicator soil concentrations listed in Table 3 were obtained from MTCA Table 749-3 (WAC 173-340-900) or were derived in the site-specific TEE (see Section 8.0). Ecological indicator soil concentrations are chemical concentrations that are expected to be protective of terrestrial ecological receptors at any MTCA site, and are intended to be used in eliminating hazardous substances from further consideration under WAC 173-340-7493(2)(a)(i). The lowest of the ecological indicator soil concentrations for plants, soil biota, and wildlife (site-specific values or default values from MTCA Table 749-3) were used.

Natural Background and Practical Quantitation Limits. Section 173-340-705(6) of the MTCA Cleanup Regulation specifies that the cleanup level (or screening level) for a given constituent derived using Method B shall not be set at a level below the natural background concentration or the analytical practical quantitation limit (PQL), whichever is higher. Preliminary soil screening levels were selected as the lowest of the applicable numerical regulatory criteria. The preliminary screening levels were then adjusted as necessary based on background concentrations and PQLs to derive the final soil screening levels used in this RI. Information regarding background chemical concentrations in soil was obtained from the following references:

- *Natural Background Soil Metals Concentrations in Washington State* (Ecology, 1994). The Puget Sound Basin 90th percentile values published in this reference were used.

- *Ecology's 2010 Technical Memorandum #8* (Ecology, 2010), and *Screening Survey for Metals and Dioxins in Fertilizer Products and Soils in Washington State* (Ecology, 1999). Mean background dioxin/furan TEQs calculated from dioxin and furan concentrations detected in representative soil samples collected statewide were used. The background dioxin/furan TEQs were calculated using the 2005 World Health Organization (WHO) toxic equivalency factors (TEFs) for humans and mammals (Van den Berg et al., 2006) and the USEPA TEFs for birds (USEPA, 2003).

The analytical PQLs for soil samples used in the screening level derivation were obtained from Analytical Resources Incorporated of Tukwila, Washington (ARI). Discussions with this laboratory regarding the analytical requirements for this project indicate that the soil PQLs listed in Table 3 are the lowest practicably attainable values using conventional/accepted (although not necessarily the most commonly used) analytical methods, without performing extensive custom calibration studies (which may or may not result in lower PQLs) or increasing the probability of unacceptably high matrix interferences. For those analytes with PQLs that exceed the lowest applicable regulatory criteria, PQLs below the regulatory criteria cannot be practicably achieved. Constituents analyzed in soil that have PQLs greater than the lowest applicable regulatory criteria include benzidine and total PCBs.

Dioxin data were evaluated using the toxicity equivalency approach, in accordance with WAC 173-340-708(8)(d). Dioxin/furan TEQs were calculated using the 2005 WHO TEFs for humans and mammals (Van den Berg et al., 2006) and the USEPA TEFs for birds (USEPA, 2003). The method used to calculate dioxin/furan TEQs is described in the Data Quality Assessment Report (Appendix B1). The dioxin analytical results for soil samples were compared to screening levels protective of human health and ecological receptors (mammals and birds). Risk to human health was evaluated using the MTCA Method B standard formula value for 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD). Screening levels protective of wildlife (mammals and birds) were derived in the site-specific TEE (Section 8.0).

Total PCB concentrations in soil were calculated from the RI analytical data in accordance with WAC 173-340-708(8)(f)(i), WAC 173-340-708(8)(f)(iii)(A), and guidance contained in Ecology's SAPA document (Ecology, 2008b). In accordance with the SAPA guidance, total PCBs were calculated by summing all detected PCB Aroclors in a given sample. For samples with no Aroclor detections, the single highest Aroclor PQL reported for the sample was used as the PQL for total PCBs.

Carcinogenic polycyclic aromatic hydrocarbon (cPAH) data were evaluated using the toxicity equivalency approach, in accordance with WAC 173-340-708(8)(e). The MTCA Method B standard formula value for benzo(a)pyrene protective of human health was used as the soil screening level for total cPAHs. cPAH TEQs were calculated using the 2005 California Environmental Protection Agency (Cal-EPA) TEFs for humans (Cal-EPA, 2005). For non-detect results, if there was at least one positive detection of the associated cPAH compound in any soil or sediment sample, one-half the PQL was used in the TEQ calculations. Otherwise, zero was used for non-detect results.

6.2 Groundwater

Two sets of groundwater screening levels were developed to evaluate the RI groundwater analytical data. All groundwater results were compared to screening levels protective of drinking water use. In addition, groundwater results from monitoring wells that are in close proximity to or upgradient of Goose Lake, the drainage ravine, and the seasonal pond northeast of Goose Lake (wells MW-03, MW-05, MW-06, MW-08, MW-09, MW-10, MW-13, MW-15, MW-16, and MW-17) also were compared to screening levels protective of surface water.

6.2.1 Groundwater Screening Levels Protective of Drinking Water Use

Table 4 presents the groundwater screening levels protective of drinking water use and the numerical criteria from which these screening levels were derived. In general, the most conservative (lowest) published numerical values were selected from among the following regulatory criteria:

- **MTCA Method B Standard Formula Values.** MTCA Method B standard formula values for human health protection, which are based on a drinking water (groundwater ingestion and vapor inhalation) exposure scenario, were obtained from Ecology's CLARC online database. Where values were available for both carcinogenic and non-carcinogenic/toxic effects, the lower value (typically the carcinogenic value) was used.
- **Federal and State Maximum Contaminant Levels (MCLs).** MCLs established under the Federal Safe Drinking Water Act and published in Title 40 of the Code of Federal Regulations (C.F.R.) Part 141, and MCLs established by the Washington State Board of Health and published in Chapter 246-290 WAC.

Practical Quantitation Limits. In addition to the criteria listed above, PQLs were considered when deriving groundwater screening levels, in accordance with WAC 173-340-705(6) and WAC 173-340-707. For any given COPC, if the lowest published regulatory criterion was less than the PQL, the PQL was used as the screening level. The analytical PQLs for groundwater samples used in the screening level derivation were obtained from ARI and Frontier Global Sciences. Discussions with these laboratories regarding the analytical requirements for this project indicate that the groundwater PQLs listed in Table 4 are the lowest practicably attainable values using conventional/accepted (although not necessarily the most commonly used) analytical methods, without performing extensive custom calibration studies (which may or may not result in lower PQLs), collecting unreasonably large sample volumes in the field (e.g., four times the normal volume), or increasing the probability of unacceptably high matrix interferences. For those analytes with PQLs that exceed the lowest applicable regulatory criteria, PQLs below the regulatory criteria cannot be practicably achieved. Constituents analyzed in groundwater that have PQLs greater than the lowest applicable regulatory criteria protective of drinking water include VOCs (1,2-dibromoethane, 1,2,3-trichloropropane, and vinyl chloride) and SVOCs (azobenzene, benzidine, bis[2-chloroethyl]ether, 3,3-dichlorobenzidine, 1,2-diphenylhydrazine, hexachlorobenzene, hexachlorobutadiene, pentachlorophenol, and 2,4,6-trichlorophenol).

Dioxin data were evaluated using the toxicity equivalency approach, in accordance with WAC 173-340-708(8)(d). Dioxin/furan TEQs were calculated using the 2005 WHO TEFs for humans and mammals (Van den Berg et al., 2006). The method used to calculate dioxin/furan TEQs is described in the Data Quality Assessment Report (Appendix B1). For non-detect dioxin/furan congener results, since there was at least one positive detection of each congener in groundwater at the Site, one-half the method detection limit (MDL) was used in the TEQ calculations.

Total PCB concentrations in groundwater were calculated in accordance with WAC 173-340-708(8)(f)(i), WAC 173-340-708(8)(f)(iii)(A), and SAPA guidance (i.e., total PCBs were calculated as the sum of all detected PCB Aroclors, or, when no Aroclors were detected, the single highest Aroclor PQL was used; Ecology, 2008b).

cPAH data were evaluated using the toxicity equivalency approach, in accordance with WAC 173-340-708(8)(e). cPAH TEQs were calculated using the 2005 Cal-EPA TEFs for humans (Cal-EPA, 2005). Although there were no positive detections of any cPAHs in the RI groundwater samples, one-half the PQL was used for non-detect results in the TEQ calculations so that the cPAH TEQ values would not all be zero.

6.2.2 Groundwater Screening Levels Protective of Surface Water

Table 5 presents the groundwater screening levels protective of surface water and the numerical criteria from which these screening levels were derived. In general, the most conservative (lowest) published numerical values were selected from among the following regulatory criteria:

- **MTCA Method B Standard Formula Values.** MTCA Method B standard formula values for human health protection, which are based on human consumption of fish, were obtained from Ecology's CLARC online database. Where values were available for both carcinogenic and non-carcinogenic/toxic effects, the lower value (typically the carcinogenic value) was used.
- **Water Quality Standards for Surface Waters of the State of Washington.** Surface water criteria for protection of aquatic life (chronic exposures) published in Chapter 173-201A WAC.
- **Federal National Recommended Water Quality Criteria.** Surface water criteria for protection of aquatic life (chronic exposures) and human health (fish consumption) established under Section 304 of the Clean Water Act.
- **National Toxics Rule Federal Water Quality Criteria.** Surface water criteria for protection of aquatic life (chronic exposures) and human health (fish consumption) published in 40 C.F.R. 131.36.

Practical Quantitation Limits. In addition to the criteria listed above, PQLs were considered when deriving groundwater screening levels, in accordance with WAC 173-340-705(6) and WAC 173-340-707. For any given COPC, if the lowest published regulatory criterion was less than the PQL, the PQL was used as the groundwater screening level. The analytical PQLs for groundwater samples used in the screening level derivation were obtained from ARI and Frontier Global Sciences. As discussed in Section 6.2.1, for those analytes with PQLs that exceed the lowest applicable regulatory criteria, PQLs below the regulatory criteria cannot be practicably achieved. Constituents analyzed in groundwater that have PQLs greater than the lowest applicable regulatory criteria protective of surface water include Aroclor-1016, Aroclor-1254, total PCBs, dioxins/furans TEQ, VOCs (1,1-dichloroethene, hexachlorobutadiene, 1,1,2,2-tetrachloroethane, and vinyl chloride), and SVOCs (benzo[a]pyrene, cPAHs TEQ, benzidine, bis[2-chloroethyl]ether, 3,3'-dichloro-benzidine, 2,4-dinitrotoluene, 1,2-diphenylhydrazine, hexachlorobenzene, hexachlorobutadiene, n-nitroso-di-n-propylamine, pentachlorophenol, 1,2,4,5-tetrachlorobenzene, and 2,4,6-trichloro-phenol).

Groundwater data for dioxins, PCBs, and cPAHs were evaluated as described in Section 6.2.1.

6.3 Surface Water

Table 6 presents the surface water screening levels and the numerical criteria from which these screening levels were derived. In general, the most conservative (lowest) published numerical values were selected from among the following regulatory criteria:

- **MTCA Method B Standard Formula Values.** MTCA Method B standard formula values for human health protection, which are based on human consumption of fish, were obtained from Ecology's CLARC online database. Where values were available for both carcinogenic and non-carcinogenic toxic effects, the lower value (typically the carcinogenic value) was used.
- **Water Quality Standards for Surface Waters of the State of Washington.** Surface water criteria for protection of aquatic life (chronic exposures) published in Chapter 173-201A WAC.
- **Federal National Recommended Water Quality Criteria.** Surface water criteria for protection of aquatic life (chronic exposures) and human health (fish consumption) established under Section 304 of the Clean Water Act.
- **National Toxics Rule Federal Water Quality Criteria.** Surface water criteria for protection of aquatic life (chronic exposures) and human health (fish consumption) published in 40 C.F.R. 131.36.

Practical Quantitation Limits. In addition to the criteria listed above, PQLs were considered when deriving surface water screening levels, in accordance with WAC 173-340-705(6) and WAC 173-340-707. For any given COPC, if the lowest published regulatory criterion was less than the PQL, the PQL was used as the surface water screening level. The analytical PQLs for surface water samples used in the screening level derivation were obtained from ARI and Frontier Global Sciences. As discussed in Section 6.2.1, for those analytes with PQLs that exceed the lowest applicable regulatory criteria, PQLs below the regulatory criteria cannot be practicably achieved. Constituents analyzed in surface water that have PQLs greater than the lowest applicable regulatory criteria include Aroclor-1016, Aroclor-1254, and total PCBs.

Surface water data for PCBs were evaluated as described in Section 6.2.1.

6.4 Sediment

Table 7 presents the sediment screening levels and the numerical criteria from which these screening levels were derived. In general, the sediment screening levels were selected from the most conservative (lowest) numerical values published in the following document:

- **Development of Freshwater Sediment Quality Values for Use in Washington State (Ecology, 2003).** Sediment results for total metals, SVOCs, and PCBs were screened against the lowest Apparent Effects Threshold (AET) values listed in Table 3-3 of this document (note: these are draft values that have not been promulgated). The AET represents the sediment concentration above which biological effects are always expected. The lowest AET and the second lowest AET (LAET and 2LAET) values published in this document and listed in Table 7 were derived from four aquatic organism bioassay endpoints. The LAET value of 9.82 percent for total organic carbon (TOC) is used only for general comparison purposes in this RI. TOC is not considered a COPC at the Goose Lake Site because it occurs naturally in the organic-rich sediments at the Site.

Practical Quantitation Limits. In addition to the criteria listed above, PQLs were considered when deriving sediment screening levels, in accordance with WAC 173-340-705(6) and WAC 173-340-707. For any given COPC, if the lowest published regulatory criterion was less than the PQL, the PQL was used as the sediment screening level. The analytical PQLs for sediment samples used in the screening level derivation were obtained from ARI. Discussions with this laboratory regarding the analytical requirements for this project indicate that the sediment PQLs listed in Table 7 are the lowest practicably attainable values using conventional/accepted (although not necessarily the most commonly used) analytical methods, without performing extensive custom calibration studies (which may or may not result in lower PQLs) or increasing the probability of unacceptably high matrix interferences. For those analytes with PQLs that exceed the lowest applicable regulatory criteria, PQLs below the regulatory criteria cannot be practicably achieved. The only constituent analyzed in sediment that has a PQL greater than the lowest applicable regulatory criteria is di-n-octylphthalate.

Dioxin data were evaluated using the toxicity equivalency approach, in accordance with WAC 173-340-708(8)(d). Dioxin/furan TEQs were calculated using the 2005 WHO TEFs for mammals (Van den Berg et al., 2006) and the USEPA TEFs for birds and fish (USEPA, 2003). The method used to calculate dioxin/furan TEQs is described in the Data Quality Assessment Report (Appendix B1). Because Ecology's 2003 draft freshwater sediment quality values do not include AET values for dioxins, sediment results were screened against low- and high-risk dioxin concentrations published in USEPA's *Interim Report on the Data and Methods for Assessment of 2,3,7,8 Tetrachlorodibenzo-p-dioxin Risks to Aquatic Life and Associated Wildlife* (USEPA, 1993). This reference provides screening values for fish, mammalian, and avian (bird) receptors.

Sediment data for PCBs were evaluated as described in Section 6.2.1.

Historical aerial photographs indicate that some areas of the drainage ravine have been submerged under impounded surface water in the past, and these areas are likely still susceptible to surface water ponding following periods of heavy or prolonged rainfall. Consequently, analytical results for soil/sediment samples collected in the drainage ravine during the RI and subsequent investigations (locations S-4, SED-09 through SED-12, and SH-DR-01 through SH-DR-06) are compared to both sediment and soil screening levels. Analytical results for the soil/sediment samples collected along the lake/landfill margin (locations GEI-1 through GEI-6) and near the presumed former drainage channel between Goose Lake and the seasonal pond to the northeast of Goose Lake (location S-2) are also compared to both sediment and soil screening levels, because these locations also may become submerged during the wet season.

6.5 Fish Tissue

As described in the RI work plan (GeoEngineers, 2002), the primary intent of the Goose Lake fish tissue sampling and analysis was to document the concentrations of COPCs in the tissue of the fish species most likely to be consumed by humans or wildlife. It was originally intended that the analytical results for fish tissue samples would be compared to tissue residue-based lowest observable effect concentrations. However, due to uncertainty associated with the small number of fish (four) captured for tissue analysis (see Sections 4.6 and 5.1.4), and also because Washington State draft freshwater sediment quality values became available after the RI work plan was published (Ecology, 2003), the fish tissue data were not compared to numerical screening criteria. This is appropriate because the Ecology (2003) freshwater sediment quality values provide conservative screening criteria that can be used to directly assess potential risks to aquatic life from COPCs present in sediment. Direct comparison of sediment data to these conservative screening criteria provides a more robust means of assessing potential risks associated with Goose Lake sediment than inferences drawn from a limited screening evaluation of tissue samples from only four fish. Accordingly, the fish tissue analytical results are presented in this RI for information only, without comparison to numerical screening criteria. Potential risks to fish, as well as associated risks to wildlife and humans from fish consumption, were assessed by comparing the sediment and surface water analytical results to the screening levels developed for these media.

7.0 CONCEPTUAL SITE MODEL

To provide a framework for interpreting the data presented in this report, a conceptual model of the Goose Lake Site was developed. In particular, the CSM was developed for the purpose of identifying exposure pathways and potential receptors for the COPCs detected in various environmental media at the Site. Potential Site-related risks were assessed by comparing the RI analytical results to screening levels derived from published or calculated risk-based criteria appropriate for the exposure pathways and receptors identified in the CSM. The CSM was developed based on Site physical features, historical Site activities, and field observations, and is depicted graphically in Figure 12 (Conceptual Site Schematic) and Figure 13 (Conceptual Exposure Diagram).

Figure 12 is a schematic illustration showing the general location of the former waste disposal areas in relation to other Site features. Figure 13 is a graphical depiction of the contaminant sources, contaminant release and transport mechanisms, exposure media, and potential receptors identified for the Site. As discussed in Section 2.1, liquid waste from Rayonier's former Shelton pulp mill was discharged to Goose Lake and the former disposal lagoons, and solid waste was placed in the landfill. There are no records indicating that liquid wastes were discharged to the landfill. These potential sources of contamination are identified in Figure 13 as "primary sources." Figure 13 also identifies release and transport mechanisms by which contaminants potentially migrated from primary to secondary and tertiary sources and exposure media. Complete potential exposure pathways (including potential receptors), and the numerical criteria used to derive screening levels protective of these pathways, are identified on the right-hand side of the exposure diagram (Figure 13).

A complete potential exposure pathway consists of: (1) a contaminant source, (2) a release mechanism and transport pathway(s) to exposure point locations where potential receptors may come in contact with COPCs, and (3) an exposure route (e.g., ingestion) through which potential receptors may become exposed to COPCs. In Figure 13, complete potential exposure pathways for the Goose Lake Site are highlighted, and applicable numerical criteria for the various exposure scenarios are shown. These are the same numerical criteria that were used to derive screening levels as described in Section 6.0 and presented in Tables 3 through 7. Exposure pathways considered to be incomplete are not evaluated in this RI.

7.1 Complete Potential Exposure Pathways – Humans

Currently, use of the Goose Lake Site by humans is generally limited to occasional trespassers. Shelton Hills LLC plans to develop a portion of the Site for mixed residential, commercial, and/or light industrial use. People that could potentially be exposed to COPCs at the Site in the short term include trespassers. After the Site is developed, future residents, workers, and visitors could be exposed, depending on the public access elements of the development. Because residential exposures and risks are typically greater than exposures/risks to trespassers, workers, and visitors, a hypothetical residential scenario (i.e., unrestricted land use) was assumed for the purpose of assessing potential human health risks in this RI.

7.1.1 Soil

A complete potential pathway exists for human exposure to COPCs that may be present in disposal lagoon and landfill soils, and in drainage ravine soil/sediment, via incidental ingestion (hypothetical residential scenario). Humans could also potentially be exposed to COPCs in soil via leaching/partitioning to groundwater and subsequent ingestion of affected groundwater or discharge of groundwater to surface water (see Section 7.1.2). Numerical criteria applicable to these exposure pathways that were used to derive soil screening levels are identified in Figure 13 and discussed in Section 6.1.

7.1.2 Groundwater

A complete potential pathway exists for human exposure to COPCs in Site-wide groundwater via groundwater ingestion and inhalation of vapors (hypothetical drinking water use scenario). Numerical criteria applicable to this exposure pathway that were used to derive groundwater screening levels are identified in Figure 13 and discussed in Section 6.2. Additionally, humans could potentially be exposed to COPCs in groundwater indirectly where groundwater discharges to surface water (e.g., in Goose Lake). Potential pathways for human exposure to COPCs in surface water are discussed in Section 7.1.3.

7.1.3 Surface Water and Sediment Pore Water

A complete potential pathway exists for human exposure to COPCs in surface water and sediment pore water of Goose Lake via consumption of fish caught in the lake. Numerical criteria applicable to this exposure pathway that were used to derive surface water screening levels are identified in Figure 13 and discussed in Section 6.3. Because fish are unlikely to exist in shallow impounded surface water in seasonally submerged areas of the drainage ravine, human exposure to COPCs in drainage ravine surface water is considered an incomplete pathway.

Goose Lake does not currently serve as a source of potable water. The City of Shelton and surrounding areas are served by municipal water, so it is unlikely that Goose Lake would serve as a potable water supply in the future. Human exposure to surface water from occasional incidental ingestion (while swimming or boating, for example) was considered as a possible exposure pathway during development of the CSM. However, potential exposures from occasional incidental ingestion of surface water are unlikely to exceed the hypothetical human exposures from fish consumption that form the basis for several numerical criteria used in this RI to derive surface water screening levels (for example, the MTCA Method B standard formula values for human health protection assume a conservative fish consumption rate of 54 grams per day; WAC 173-340-730[3][b][iii]). Consequently, the surface water incidental ingestion pathway was not considered further.

7.1.4 Sediment

A complete potential pathway exists for human exposure to COPCs in Goose Lake sediments via consumption of fish caught in the lake. No published numerical criteria are available that specifically address this exposure pathway. As noted in Figure 13, the other criteria used to derive sediment screening levels (discussed in Section 6.4) are assumed to be protective of human exposure to COPCs in Goose Lake sediment via fish consumption.

As noted in Section 7.1.1, a complete potential pathway also exists for human exposure to COPCs in drainage ravine soil/sediment via incidental ingestion (hypothetical residential exposure scenario). This exposure pathway is addressed in this RI by comparing the drainage ravine soil/sediment analytical results to soil screening levels. Numerical criteria applicable to this exposure pathway that were used to derive soil screening levels are identified in Figure 13 and discussed in Section 6.1.

7.2 Complete Potential Exposure Pathways – Ecological Receptors

Several complete potential exposure pathways exist for ecological receptors under current and likely future Site use conditions. Ecological receptors that may be exposed to COPCs include plants, soil biota, and wildlife (mammals and birds) in the terrestrial environment, and benthic invertebrates, fish, and wildlife in the aquatic environment.

7.2.1 Soil

Complete potential pathways exist for exposure of terrestrial ecological receptors to COPCs in disposal lagoon and landfill soil and drainage ravine soil/sediment via direct contact (plants and soil biota), incidental ingestion (wildlife), and consumption of plants or soil biota (wildlife – food chain exposures). Ecological receptors could also potentially be exposed to COPCs in soil via leaching/partitioning to groundwater and subsequent discharge of affected groundwater to surface water (see Section 7.2.2). Numerical criteria applicable to these exposure pathways that were used to derive soil screening levels are identified in Figure 13 and discussed in Section 6.1.

7.2.2 Groundwater

No complete pathways exist for direct exposure of ecological receptors to COPCs in groundwater. However, ecological receptors could potentially be exposed to COPCs in groundwater indirectly at locations where groundwater discharges to surface water (e.g., in Goose Lake, the drainage ravine, or the seasonal pond northeast of Goose Lake). Potential pathways for ecological exposure to COPCs in surface water are discussed in Section 7.2.3.

7.2.3 Surface Water and Sediment Pore Water

A complete potential pathway exists for benthic invertebrate and/or fish exposure to COPCs in surface water and sediment pore water via direct contact. Numerical criteria applicable to this exposure pathway that were used to derive surface water screening levels are identified in Figure 13 and discussed in Section 6.3.

Complete potential pathways also exist for wildlife exposure to COPCs in surface water via surface water ingestion and consumption of benthic invertebrates and/or fish (food chain exposures). No published numerical criteria are available that specifically address these exposure pathways. As noted in Figure 13, the other criteria used to derive surface water screening levels (discussed in Section 6.3) are assumed to be protective of wildlife exposure to COPCs in surface water via surface water ingestion and benthic invertebrate/fish consumption.

7.2.4 Sediment

Complete potential pathways exist for exposure of aquatic ecological receptors to COPCs in Goose Lake sediment and drainage ravine soil/sediment via direct contact (benthic invertebrates and/or fish) and consumption of benthic invertebrates and/or fish (wildlife – food chain exposures). Numerical criteria applicable to these exposure pathways that were used to derive sediment screening levels are identified in Figure 13 and discussed in Section 6.4.

As noted in Section 7.2.1, complete potential pathways also exist for exposure of terrestrial ecological receptors to COPCs in drainage ravine soil/sediment via direct contact (plants and soil biota), incidental ingestion (wildlife), and consumption of plants or soil biota (wildlife – food chain exposures). These exposure pathways are evaluated in this RI by comparing the drainage ravine soil/sediment analytical results to soil screening levels. Numerical criteria applicable to these exposure pathways that were used to derive soil screening levels are identified in Figure 13 and discussed in Section 6.1.

8.0 TERRESTRIAL ECOLOGICAL EVALUATION

A site-specific TEE was determined to be appropriate for the Goose Lake Site because: (1) the Site does not qualify for an exclusion from a TEE under WAC 173-340-7491(1); and (2) as defined in WAC 173-340-7491(2), the Site "…is located on, or directly adjacent to, an area where management or land use plans will maintain or restore native or semi-native vegetation."

WAC 173-340-7493 outlines the procedures for a site-specific TEE. The purpose of the TEE is to: (1) determine if constituents of potential ecological concern (COPECs) present a threat to the terrestrial environment, (2) characterize threats to terrestrial ecological receptors from exposure to soil COPECs, and (3) establish site-specific cleanup standards for the protection of terrestrial ecological receptors. Additionally, the site-specific TEE is intended to "facilitate selection of a cleanup action by developing information necessary to conduct evaluations of cleanup action alternatives in the feasibility study."

According to WAC 173-340-7493, there are two major steps involved in conducting a site-specific TEE: (1) problem formulation, and (2) the selection of appropriate evaluation methods. The selection of appropriate evaluation methods involves either the use of ecological soil indicator concentrations listed in Table 749-3 of the MTCA Cleanup Regulation as cleanup levels, or the use of alternative evaluation methods such as literature surveys, wildlife exposure models, biomarkers, site-specific field studies, and a weight-of-evidence approach.

8.1 Problem Formulation

The objective of the problem formulation step is to provide a framework for the completion of the TEE. Problem formulation involves identifying COPECs, exposure pathways, and terrestrial ecological receptors of concern, and conducting a toxicological assessment. These four steps are outlined in the subsections below.

8.1.1 Constituents of Potential Ecological Concern

COPECs were identified by comparing maximum detected constituent concentrations in Site soils to ecological indicator concentrations presented in MTCA Table 749-3. Table 749-3 includes ecological indicator concentrations for plants, soil biota, and wildlife. The most conservative (lowest) ecological indicator concentration for each constituent detected in soil at Goose Lake was used to identify COPECs. The details of this comparison are included in Section 9.0; the COPECs identified through this process are:

- Dioxins: total chlorinated dibenzo-p-dioxins (total dioxins) and total chlorinated dibenzofurans (total furans).
- Metals: antimony, arsenic, total chromium, copper, lead, mercury, nickel, silver, and zinc.
- PCBs: total PCBs.

The lowest ecological indicator concentration for total PCBs is the wildlife value of 650 ug/kg. Because this value is greater than several other criteria used to evaluate total PCBs (see Table 3), total PCB concentrations protective of terrestrial ecological receptors were not further evaluated.

8.1.2 Exposure Pathways

Potential exposure pathways for ecological receptors are discussed in Section 7.2 and shown in Figure 13. The primary potential exposure pathways for soil at Goose Lake include the following:

- Soil biota and plants: direct contact.
- Wildlife: ingestion of soil biota and plants and incidental ingestion of soil.

8.1.3 Terrestrial Ecological Receptors of Concern

Terrestrial plants and animals known or anticipated to be present at the Site are discussed in Section 3.6 (Ecological Setting). WAC 173-340-7490(3)(b) states that the terrestrial ecological receptors to be protected at sites that are not industrial or commercial include “terrestrial plants, wildlife, and ecologically important functions of soil biota that affect plants and wildlife.” Accordingly, receptors of concern selected for the Goose Lake TEE include plants, soil biota, and the following surrogate receptors used in the MTCA wildlife exposure model (WAC 173-340-7493[3][c]; MTCA Table 749-4): the shrew (*Sorex* sp.), representing a mammalian predator, the American robin (*Turdus migratorius*), representing an avian predator, and the vole (*Microtus sp.*), representing a mammalian herbivore.

8.1.4 Toxicological Assessment

As discussed in Section 8.2.2, the ecological indicator soil concentrations calculated in the site-specific TEE were derived using the toxicity reference values (TRVs) for shrews, voles, and robins listed in MTCA Table 749-5.

8.2 Selection of Appropriate Terrestrial Ecological Evaluation Methods

The problem formulation step identified the need for further evaluation of terrestrial ecological risks at the Site, because COPECs, complete exposure pathways, and ecological receptors of concern were determined to be present. One option for defining chemical concentrations in soil that are protective of wildlife is to select the ecological indicator soil concentrations listed in MTCA Table 749-3, which may be used as cleanup levels for a site-specific TEE. Alternative methods include literature surveys, soil bioassays, wildlife exposure models, biomarkers, site-specific field studies, and a weight-of-evidence approach (WAC 173-340-7493[3]).

A literature survey was conducted in accordance with WAC 173-340-7493(4) to:

- Identify soil concentrations for the protection of plants or soil biota that are more relevant to site-specific conditions than the values listed in Table 749-3 (WAC 173-340-7493[3][a][ii]).
- Obtain values for wildlife exposure model variables listed in Table 749-5 to calculate soil concentrations for the protection of wildlife more relevant to site-specific conditions than the values listed in Table 749-3 (WAC 173-340-7493[3][a][iii]).

The purpose of conducting the TEE literature survey for Goose Lake was to help assess whether the metals and dioxins detected in drainage ravine and disposal lagoon area soils at concentrations exceeding conservative ecological indicator soil concentrations (MTCA Table 749-3) pose a risk to ecological receptors, or whether potential terrestrial ecological risks associated with the metals and dioxins can be eliminated from further consideration in the feasibility study.

The following table presents the MTCA ecological indicator soil concentrations. The values in this table are from MTCA Table 749-3, with the exception of some of the wildlife values, which were calculated by GeoEngineers. MTCA Table 749-3 presents only the lowest of the three wildlife values (mammalian herbivore, mammalian predator, and avian predator). GeoEngineers calculated the remaining wildlife values using the equations in MTCA Table 749-4 and the default parameter values provided in MTCA Tables 749-4 and 749-5. In the table below, the values in bold typeface are the basis for the default MTCA ecological indicator concentrations; these are the default MTCA ecological indicator concentrations presented in the table of RI soil screening levels (Table 3).

MTCA ECOLOGICAL INDICATOR SOIL CONCENTRATIONS (milligrams per kilogram [mg/kg])

COPEC	MTCA Default Ecological Indicator Concentration	Plants	Soil Biota	Wildlife – Mammalian Herbivore (Vole)	Wildlife – Mammalian Predator (Shrew)	Wildlife – Avian Predator (Robin)
Total Dioxins	2E-06	--	--	--	--	**2E-06**
Total Furans	2E-06	--	--	2E-03	**2E-06**	3E-05
Antimony	5	**5**	--	--	--	--
Arsenic III	7 (as total As)	--	--	43	**7**	--
Arsenic V	7 (as total As)	10	60	1,300	130	150
Cadmium	4	**4**	20	290	14	39

COPEC	MTCA Default Ecological Indicator Concentration	Plants	Soil Biota	Wildlife – Mammalian Herbivore (Vole)	Wildlife – Mammalian Predator (Shrew)	Wildlife – Avian Predator (Robin)
Chromium	42	**42**	**42**	–	310	67
Copper	50	100	**50**	2,400	220	530
Lead	50	**50**	500	2,100	130	120
Mercury	0.1	0.3	**0.1**	63	9.5	5.5
Nickel	30	**30**	200	5,900	980	1,000
Silver	2	**2**	--	–	--	--
Zinc	86	**86**	200	14,000	970	360

Notes:

As = Arsenic

Values in bold are the basis for the default MTCA ecological indicator concentrations.

8.2.1 Ecological Indicator Soil Concentrations – Plants and Soil Biota

As noted above, the first step of the literature survey was to identify soil concentrations for the protection of plants or soil biota that are more relevant to site-specific conditions than the ecological indicator concentrations listed in MTCA Table 749-3. For the Goose Lake Site, USEPA Ecological Soil Screening Levels (SSLs) for plants and soil biota/invertebrates (USEPA, 2005a) may be more relevant than the MTCA ecological indicator concentrations. Mr. Dave Sternberg (formerly at Ecology) recommended the use of the USEPA Ecological SSLs for Ecology's Irondale Iron and Steel Plant Remedial Investigation/Feasibility Study (GeoEngineers, 2009b). USEPA Ecological SSLs for the Site COPECs are presented in the table below titled "Recommended Goose Lake Ecological Indicator Soil Concentrations."

8.2.2 Ecological Indicator Soil Concentrations – Wildlife Exposure Model

Wildlife exposure model variables in MTCA Table 749-5 include chemical-specific earthworm bioaccumulation factors (BAF_{worm}), plant uptake coefficients (K_{plant}), and TRVs. Because the default MTCA ecological indicator concentrations for dioxins and furans are based on avian predator (robin) and mammalian predator (shrew) exposure scenarios, the site-specific TEE for potential dioxin/furan exposures at Goose Lake focused on BAF_{worm} and TRV values. In the MTCA exposure model, the variable K_{plant} is used to calculate ecological indicator concentrations for mammalian herbivore (vole) exposure scenarios. For the metals of potential concern at the Site, the ecological indicator soil concentrations for mammalian herbivores are greater than the lower of the indicator concentrations protective of mammalian or avian predators. Consequently, literature values for K_{plant} were not researched.

USEPA's Ecological SSL guidance document (*Guidance for Developing Ecological Soil Screening Levels*; USEPA, 2005) includes a hierarchy "concerning the use of available data to estimate contaminant concentrations in biota types" (e.g., earthworms). This hierarchy includes the following in order of preference: (1) use an existing regression equation, (2) calculate and use a new regression equation, and (3) use an existing BAF or calculate a BAF using empirical/analytical data if the regressions were not significant. According to Sample et al. (1998), the use of log-linear regression equations to estimate chemical concentrations in earthworms is recommended because bioaccumulation by earthworms is non-linear, decreasing as chemical concentrations in soil increase. The primary source of existing earthworm regression equations used in the USEPA Ecological SSL guidance is a study published by Sample et al. (1999). The use of log-linear regression equations is consistent with USEPA's Ecological SSL guidance (EPA, 2005). The recommended regression equations for dioxins, furans, and metals are shown in the table below.

EARTHWORM BIOACCUMULATION MODELS

COPEC	MTCA Default BAF_{worm}	Uptake Model to Calculate Concentration of COPEC in Earthworms	Uptake Model Type	Uptake Model Reference
Total Dioxins	48	In[worm] = 1.182 * In[soil] + 3.533	Log-linear	Sample et al., 1998
Total Furans	48	In[worm] = 1.182 * In[soil] + 3.533	Log-linear	Sample et al., 1998
Arsenic III	1.16	In[worm] = 0.706 * In[soil] – 1.421	Log-linear	USEPA, 2005b
Arsenic V	1.16	In[worm] = 0.706 * In[soil] – 1.421	Log-linear	USEPA, 2005b
Cadmium	4.6	In[worm] = 0.795 * In[soil] + 2.114	Log-linear	USEPA, 2005c
Chromium	0.49	[worm] = 0.306 * [soil]	Linear	USEPA, 2008
Copper	0.88	[worm] = 0.515 * [soil]	Linear	USEPA, 2007a
Lead	0.69	In[worm] = 0.807 * In[soil] – 0.218	Log-linear	USEPA, 2005d
Mercury	1.32	In[worm] = 0.3369 * In[soil] + 0.0781	Log-linear	Sample et al., 1998
Nickel	0.78	No change (update not available)	--	USEPA, 2007b
Zinc	3.19	In[worm] = 0.328 * In[soil] – 4.449	Log-linear	USEPA, 2007c

MTCA Table 749-4 includes the exposure model equations for calculating soil concentrations protective of mammalian and avian predators and mammalian herbivores. Equation 1 below is a generic equation applicable to mammalian and avian predators.

Equation 1:

$$SC_{pred} = TRV/[(FIR_{pred,dw} \text{ x } P_{pred} \text{ x } BAF_{worm}) + (SIR_{pred} \text{ x } RGAF_{soil,pred})]$$

Where:

SC_{pred} = protective soil concentration (mg/kg) for the predator (shrew or robin)

TRV = mammalian or avian toxicity reference value (mg of chemical/kg body weight-day) for a given chemical

FIR_{pred} = food ingestion rate (kg dry food/kg body weight-day) for the predator

P_{pred} = proportion of contaminated food (earthworms) in the predator diet (unitless)

BAF_{worm} = bioaccumulation factor for earthworms, dry weight basis ([mg chemical-kg soil]/[mg chemical-kg worm])

SIR_{pred} = soil ingestion rate (kg dry soil/kg body weight-day) for the predator

$RGAF_{soil,pred}$ = gut absorption factor (absorption of a chemical from soil relative to absorption of a chemical from food).

For chromium, copper, and nickel, soil concentrations protective of mammalian and avian predators were calculated using Equation 1 and either the USEPA BAF_{worm} values listed in the above table (chromium and copper) or the default BAF_{worm} from MTCA Table 749-5 (nickel). Model parameter values besides BAF_{worm} were obtained from MTCA Table 749-4. For the remaining COPECs listed in the above table, Equation 1 was rearranged to incorporate the appropriate log-linear regression equation. An example of a rearranged equation (incorporating the log-linear regression equation for dioxins) is shown below.

Equation 2:

$$1 = [e^{(1.182 \times \ln(SC_{pred}) + 3.533)} \times FIR_{pred} \times P_{pred} + SC_{pred} + SIR_{pred} \times RGAF_{soil,pred}]/TRV$$

The default model parameter values in MTCA Table 749-4 and Microsoft Excel's Goal Seek function were used to solve the rearranged equations for the COPEC soil concentrations protective of mammalian and avian predators. The site-specific protective concentrations (ecological indicator soil concentrations) for mammalian and avian predators, calculated using the BAF_{worm} values derived from the regression equations in the above table ("Earthworm Bioaccumulation Models"), are presented in the last two columns of the table below ("Site-Specific Ecological Indicator Soil Concentrations").

The TRVs recommended in the USEPA Ecological SSL studies are based on the geometric mean of no observed adverse effects levels (NOAELs). However, WAC 173-340-7493(4)(a) requires that TRVs established from the literature represent the lowest relevant LOAEL (lowest observed adverse effect level) found in the literature. Consequently, the USEPA-recommended TRVs were not used in calculating the site-specific ecological indicator soil concentrations presented in the table below. Instead, the TRVs listed in MTCA Table 749-5 were used.

The lowest site-specific ecological indicator soil concentrations listed in the table below were used in developing the soil screening levels for the Site (see Section 6.1 and Table 3).

SITE-SPECIFIC ECOLOGICAL INDICATOR SOIL CONCENTRATIONS (mg/kg)

COPEC	Lowest Site-Specific Ecological Indicator Soil Concentration	Plants (USEPA SSL)	Soil Biota (USEPA SSL)	Wildlife – Mammalian Predator (Revised BAF_{worm})	Wildlife – Avian Predator (Revised BAF_{worm})
Total Dioxins	2E-05	--	--	**2E-05**	2E-04
Total Furans	2E-05	--	--	--	**2E-05**
Antimony	5	**5***	78	--	--

COPEC	Lowest Site-Specific Ecological Indicator Soil Concentration	Plants (USEPA SSL)	Soil Biota (USEPA SSL)	Wildlife – Mammalian Predator (Revised BAF$_{worm}$)	Wildlife – Avian Predator (Revised BAF$_{worm}$)
Arsenic III	18 (as total As)	**18** (as total As)	--	100	--
Arsenic V	18 (as total As)	**18** (as total As)	60*	3,700	880
Cadmium	14	32	140	**14**	47
Chromium	42	**42***	**42***	480	92
Copper	70	**70**	80	370	800
Lead	120	**120**	1,700	310	220
Mercury	0.1	0.3*	**0.1***	26	280
Nickel	38	**38**	280	980	1,000
Silver	560	**560**	--	--	--
Zinc	120	160	**120**	30,000	1,400

Notes:

As = Arsenic

Values in bold are the basis for the site-specific ecological indicator soil concentrations.

* USEPA Ecological SSL not available; value shown is the MTCA default value.

9.0 REMEDIAL INVESTIGATION RESULTS

Analytical testing results, water level data, and Goose Lake bathymetry data generated during the RI are summarized in Tables 8 through 50. Electronic copies of the RI laboratory data packages were provided to Ecology in May 2005. Analytical data from the previous and subsequent investigations relevant to site characterization and decision-making also are included in Tables 8 through 50. In the subsections that follow, the descriptions of subsurface physical conditions and analytical testing results are primarily based on explorations completed during the RI and the 2010 supplemental investigation. The conclusions presented in Section 10.0 are based on the entire body of relevant site characterization data generated to date.

9.1 Data Quality

9.1.1 General

The quality of the analytical data generated during the RI and 2010 supplemental investigation was assessed as described in the Data Quality Assessment Reports (Appendix B). Analytical data were assessed relative to quality control (QC) criteria for holding times, QC blanks, precision, and accuracy. A conservative approach was used, including rejecting data with unacceptably high analytical uncertainty.

The majority of the analytical data generated during the RI and 2010 supplemental investigation are of acceptable quality for decision-making purposes, within the limitations implied by the associated data qualifiers. A limited number of sample results were rejected and should not be used for any purpose. The data assessment was performed using best professional judgment. Data users may review and re-interpret data quality for specific uses.

The general findings of the data quality assessments can be summarized as follows (see Appendix B for details):

- A small number of soil SVOC results were rejected because of low matrix spike or laboratory control sample recoveries.
- Analytical results for samples that exceeded holding times were qualified as estimated ("UJ" flag for non-detect results, "J" flag for detected results). None of the data was rejected based on holding time exceedances because the holding times were not grossly exceeded. For several sulfide analyses in sediment, holding times were exceeded because the sediment samples were reanalyzed to address initial laboratory QC issues. The reanalysis resolved the QC issues but resulted in some analyses being performed outside the recommended holding times. The sulfide results for these sediment samples were qualified as estimated; however, the sulfide data are considered acceptable for decision-making purposes.
- Laboratory contamination was detected in some method blanks. In the majority of instances, no qualification was required due to the relatively high concentrations of the analytes reported in the project samples compared to the method blank detections. However, some low-level detections in project samples were qualified as not detected based on the method blank results. Some rinsate blanks also contained detectable levels of metals and SVOCs, resulting in the qualification of some detected sample results as not detected ("U" flag).
- The laboratory reported significant matrix interference and low spike recoveries for hexavalent chromium analyses in sediment. ORP and pH analyses indicated that the sediment samples consisted of a reducing matrix. Chromium is unlikely to exist in the hexavalent form under such reducing conditions.
- The laboratory reported that the relative percent difference for lead in one of the fish tissue duplicate sample pairs was outside the laboratory's normal QC limits. This was presumed to be due to the heterogeneous distribution of lead in the sample; consequently, no data qualification was required.
- PCB congener analysis in fish tissue samples resulted in several minor QC considerations. There were issues with spike recovery of the surrogate hexabromobiphenyl on one of the instrument columns used to separate the congeners. The PQLs for one of the tissue samples were elevated because elevated concentrations of congeners in the sample required that the sample be diluted for congener quantitation. The matrix spike recovery for PCB congener 187 in four samples was outside the QC limits listed in the laboratory QC results summary.
- Dioxin analysis in fish tissue samples resulted in one sample being qualified with a "K" flag (off-scale low results; actual values are known to be less than the values given). The laboratory estimated the maximum possible dioxin concentrations in this sample. Four tissue samples required reanalysis on a different instrument column to confirm 2,3,7,8-tetrachlorodibenzo-furan concentrations.
- Several groundwater samples collected from monitoring well MW-01 were affected by possible matrix interference. The groundwater data from well MW-01 are useable for site

characterization purposes but should not be relied upon where decisions are based solely on results from this well.

- For some non-detect results, laboratory PQLs or MDLs were higher than the associated RI screening levels. The PQLs or MDLs for some soil and sediment samples were elevated due to necessary sample dilutions or high moisture content of the samples. Non-detect results with PQLs or MDLs exceeding RI screening levels are identified in the analytical results tables. It should be noted that the PQLs used to develop the RI screening levels (Tables 3 through 7) represent present-day PQLs. Since some of the analytical results summarized in this report date back to 1997, the reporting limits for some non-detect results exceed screening levels because of the different analytical methods and less sophisticated laboratory instrumentation used at the time of the older analyses. The reporting limits are in most cases the lowest values attainable by the analytical laboratory at the time of analysis. It should also be noted that for the most recent groundwater monitoring event completed at the Site (November/December 2010), a different laboratory than was used for the other monitoring events was used for metals analysis, to achieve the lowest possible PQLs using Ecology-approved test methods.

9.1.2 Significant Qualification

Significant qualification refers to data qualification actions that can significantly impact data uses or interpretations; examples include qualifying detected results as non-detect, and rejecting data due to significant QC issues. Some detected results were qualified as non-detect ("U" flag) based on method blank and rinsate blank detections. A limited number of sample results were rejected ("R" flag) and should not be used for any purpose. Rejected data are identified in the analytical results tables.

9.1.3 Minor Qualification

Minor data qualification generally consisted of detected or non-detect results being qualified as estimated. Estimated results are statistically less certain than non-estimated results, and may be biased higher or lower than the analytical method would typically achieve. These qualifications reflect minor exceedances of specific QC criteria or a combination of QC criteria. Approximately 10 percent of the RI data were qualified as estimated ("J" or "UJ" flag). Although the qualified results are useable, some bias may be present.

9.2 Soil and Soil/Sediment Characterization – Inactive Landfill, Former Disposal Lagoons, and Other Areas

9.2.1 Inactive Landfill – Physical Conditions

GENERAL

The inactive landfill has a gently undulating sand/gravel surface that extends from the shoreline of Goose Lake to an estimated elevation of approximately 20 feet above the lake water level. The estimated upland boundary of the inactive landfill is shown in Figure 8. The landfill area is generally devoid of mature trees. Small stockpiles of sand and gravel, likely originating from the adjacent gravel pit to the north, are present at several locations on the landfill surface. A limited amount of metal debris, a portion of an automobile, and an empty, rusted 55-gallon drum were observed in the vicinity of test pit TP-11 during the RI. Staining or other evidence of potential contamination was not observed in the vicinity of this debris.

Three different soil horizons were encountered in the landfill explorations: a landfill cover, a waste horizon, and underlying native soil consisting of native peat/organic soil or glacial deposits. These horizons are shown on cross-sections C-C' and D-D' (Figures 6 and 7), and are identified in analytical data tables for the landfill (Tables 8 through 14). Groundwater was encountered in all but two of the test pits (TP-35 and TP-37), and in one of the trench excavations (Trench-04). The depth to the water table in the test pit and trench explorations ranged from about 9 to 19.5 feet bgs, which was within the landfill waste horizon. Many of the test pit excavations extended below the water table. Descriptions of soil/fill encountered below the water table should be considered estimates because sloughing occurred below the water table.

LANDFILL COVER

Landfill cover material was generally encountered in the RI and 2010 supplemental investigation explorations to depths ranging from about 0.5 to 7 feet bgs. Cover material generally consisted of sand with varying amounts of silt and gravel. This material generally appeared to be dense, based on the level of effort exerted by the excavation equipment. However, the landfill cover material likely ranges from loose to dense based on the assumption that it was not placed in a controlled manner. Landfill cover material was not present in portions of two trench excavations (Trench-03 and Trench-04). Apparent dried cooking liquor (see description below) was present at the ground surface in these areas. Field-screening evidence of potential contamination (e.g., staining, moderate or heavy sheens, and/or elevated headspace vapors) was not observed in the landfill cover horizon during the RI or 2010 supplemental investigation.

WASTE HORIZON

The contact between the landfill waste horizon and the underlying native soil was encountered in the RI and 2010 supplemental investigation explorations at depths ranging from about 4 feet to 24.5 feet bgs. The waste horizon extended below the maximum depth explored in seven of the test pits (TP-01, -04, -09, -12, -13, -16, and -17). During the RI, the lateral extent of the landfill waste horizon in the upland area east of Goose Lake was identified in four trench explorations (Trench-01 through Trench-04; Figure 8 and Figures 14 through 17). The upland extent of the waste horizon near the present-day shoreline was estimated by comparing Rayonier's 1931 map, which shows the original pre-landfill shoreline of Goose Lake, to later aerial photographs of the Site. The upland boundary of the inactive landfill shown in various figures of this report was estimated from these field observations and information sources. The estimated submerged extent of the landfill in Goose Lake is depicted in Figures 6 and 7. The exact point at which the landfill waste horizon pinches out on the lake bottom is uncertain. Since native peat was encountered within 1 foot of the sediment surface at sediment sampling stations SED-01, SED-05, and SED-08, and no landfill waste materials were encountered at these locations, the landfill waste horizon is assumed to pinch out between shoreline borings GEI-1 through GEI-6 and sampling stations SED-01, SED-05, and SED-08.

The following general types of materials were encountered in the landfill waste horizon during the RI:

- Construction/demolition debris – bricks, concrete, asphalt, plywood, and dimensional lumber of various sizes.

- Inferred pulp mill waste – sawdust, wood chips, wood pulp material, sulfur waste, and apparent dried cooking liquor. The apparent cooking liquor is a black granular material ranging in size from medium sand to coarse gravel.
- Miscellaneous debris – broken glass including laboratory bottleware, plastic and metal debris, light bulbs, automobile tires, railroad ties, foam rubber, yard waste, and miscellaneous domestic refuse.
- Granular fill material – sand and gravel that was possibly obtained from the on-site gravel pit are present throughout the waste horizon. This granular fill may have been placed in the landfill on a routine basis as a temporary cover.

Field-screening evidence of potential contamination (e.g., staining, moderate or heavy sheens, and/or elevated headspace vapors) was observed in six soil samples obtained from five explorations in the landfill waste horizon (test pits TP-02, -03, -08, -13, and -16). These six soil samples were submitted for chemical analysis. Soil samples that did not exhibit field screening evidence of potential contamination also were submitted for chemical analysis. The locations and depths of these samples were selected to characterize the landfill waste horizon over a wide area.

NATIVE SOIL

Native soil was encountered beneath the waste horizon in 13 of the RI test pits, all 6 shoreline borings (GEI-1 through GEI-6), and the boreholes for monitoring wells MW-16 and MW-17. Native soil also was encountered in each of RI the trench excavations (Trench -01 through Trench -04). The depth of the contact between the landfill waste horizon and the underlying native soil in these explorations ranged from about 4 to 24.5 feet bgs.

The native soil generally consisted of brown peat or dense gravel with varying amounts of silt and sand, and dense sand with varying amounts of silt and gravel. The native soil encountered in most of the RI test pits consisted of glacial deposits. The native sands and gravels are likely Vashon recessional outwash deposits. The native soil encountered in shoreline borings GEI-1 through GEI-6, wells MW-16 and MW-17, and test pit TP-19 consisted of brown peat overlying glacial deposits. Similar peat was observed in sediment cores recovered from Goose Lake during the RI. PRSW also encountered brown peat in 2008 in hand-auger borings completed along the eastern and southeastern shoreline of Goose Lake (PRSW, 2009; Appendix F). PRSW noted that the peat was consistent with the Mukilteo peat mapped throughout the topographic depression between Island Lake and Goldsborough Creek, and concluded that the material was most likely derived from the decomposition of sedge and other grass-like plant species. Soils sampled along the southern edge of Goose Lake were somewhat mixed; layers of gravel were observed within 18 inches of the ground surface. PRSW speculated that these gravel layers may reflect past gravel mining activities in the area, or possibly natural sloughing from the outwash gravel and sand hills near the lake's edge (PRSW, 2009).

Field-screening evidence of potential contamination (e.g., staining, moderate or heavy sheens, and/or elevated headspace vapors) was not observed in native soil samples collected during the RI or 2010 supplemental investigation.

9.2.2 Inactive Landfill – Analytical Results

COPCs detected at concentrations exceeding the RI soil screening levels in the landfill soil samples are shown in Figure 18. COPCs detected at concentrations exceeding the RI sediment screening levels in the landfill soil/sediment samples collected along the lake/landfill margin are shown in Figure 19.

METALS

Metals detected in soil and soil/sediment samples collected in the inactive landfill area include antimony, arsenic, cadmium, total chromium, hexavalent chromium, copper, lead, mercury, nickel, silver, and zinc (Table 8). Metals detected in soil and soil/sediment samples at concentrations exceeding the RI soil screening levels in the inactive landfill include copper in 33 samples, mercury in 29 samples, lead in 14 samples, nickel in 13 samples, zinc in 11 samples, total chromium in ten samples, antimony in three samples, and arsenic in one sample. Hexavalent chromium, cadmium, and silver were not detected at concentrations exceeding the RI soil screening levels.

Metals detected in soil/sediment samples at concentrations exceeding the RI sediment screening levels in the inactive landfill include nickel in seven samples, antimony in five samples, mercury in four samples, lead in three samples, chromium in two samples, zinc in two samples, and copper in one sample (Table 8). Arsenic, hexavalent chromium, and silver were not detected at concentrations exceeding the RI sediment screening levels.

The exceedances of RI soil and sediment screening levels were detected in samples obtained from the landfill waste horizon, with the exception of copper, lead, mercury, and/or nickel exceedances detected at three locations in the landfill cover horizon (MW-17, TP-12, and TP-18) and antimony, lead, chromium, copper, mercury, and/or nickel exceedances detected at seven locations in the native peat or glacial deposits below the waste horizon (GEI-1, GEI-3, GEI-4, GEI-5, MW-17, TP-11, and Trench-04).

DIOXINS

Twenty-four soil and soil/sediment samples obtained from the inactive landfill area were analyzed for dioxins (note: for simplicity, here and elsewhere in this report, the term “dioxins” generally refers to both dioxins and furans unless indicated otherwise). Congener-specific profiles of dioxin concentrations detected in these samples are presented in Table 9. The congener profiles were converted to total 2,3,7,8-TCDD equivalents (i.e., TEQs) for comparison to the RI screening levels protective of human health and ecological receptors (Table 10). The method used to calculate the dioxin TEQs is described in Appendix B1.

The dioxin concentrations in ten soil and soil/sediment samples exceeded the RI soil screening levels for human health, mammals, and/or birds (Table 10). With the exception of one sample obtained from the native peat horizon and one sample obtained from the landfill cover horizon, the samples that exceeded soil screening levels were obtained from the landfill waste horizon. The dioxin concentrations in 11 soil/sediment samples exceeded the RI sediment screening levels for mammals and/or birds (Table 10). The samples that exceeded sediment screening levels were obtained from the landfill waste horizon (seven samples) and the native peat horizon (four samples). Nine soil and soil/sediment samples had dioxin concentrations that were less than the respective RI screening levels.

PCBs

PCB compounds detected in the 30 landfill soil and soil/sediment samples analyzed for PCBs include Aroclor-1016, Aroclor-1248, Aroclor-1254, and Aroclor-1260 (Table 11). Eighteen soil and soil/sediment samples had PCB detections exceeding the RI soil screening level for total PCBs; nine of these samples were obtained from the landfill waste horizon, eight were obtained from the native peat horizon, and one was obtained from the landfill cover horizon. Eleven soil/sediment samples had PCB detections exceeding the RI sediment screening level for total PCBs; six of these samples were obtained from the landfill waste horizon and five were obtained from the native peat horizon.

VOCs

Six soil samples from the inactive landfill were analyzed for VOCs. Nine VOCs were detected in the samples (Table 12). None of the detected VOCs was present at concentrations exceeding the RI soil screening levels.

SVOCs

Thirty-one soil and soil/sediment samples from the inactive landfill were analyzed for SVOCs. Twenty-three SVOCs were detected in the samples (Table 13). One soil sample and one soil/sediment sample had SVOC concentrations (cPAHs) exceeding the RI soil screening levels; both samples were obtained from the landfill waste horizon. Three soil/sediment samples had SVOC concentrations (acenaphthylene, bis[2-ethylhexyl]phthalate, and/or dibenzofuran) exceeding the RI sediment screening levels; two of these samples were obtained from the landfill waste horizon and one sample was obtained from the native peat horizon.

CONVENTIONAL CHEMISTRY

Total sulfide was detected in 16 of 25 landfill soil and soil/sediment samples analyzed for this constituent (Table 14). There are no published numerical criteria for sulfide in the literature sources used to derive the RI soil screening levels. Nine of the 18 soil/sediment samples analyzed for sulfide exceeded the associated RI sediment screening level; five of these samples were obtained from the waste horizon and four were obtained from the native peat horizon.

TOC was detected at a concentration exceeding the RI sediment screening level in seven of the eight landfill soil/sediment samples analyzed for TOC. However, the TOC values were generally similar in the landfill waste and native peat horizons, suggesting that the TOC is mostly, if not entirely, naturally occurring. Consequently, TOC is not considered a COPC at the Goose Lake Site.

9.2.3 Former Disposal Lagoons – Physical Conditions

Soil encountered in the RI test pits completed outside of the former disposal lagoon boundaries (TP-21 through TP-28) generally consisted of dense silty sand overlying dense gravel. These soil units were typically brown. Soil encountered in the RI test pits completed within the former disposal lagoon boundaries (TP-29 through TP-32) generally consisted of dense gravel with varying amounts of silt and sand. Inside the former lagoon boundaries, the gravel unit was typically gray in the upper 2 to 3 feet, and brown at greater depths. Soil encountered in the disposal lagoon area explorations is likely Vashon recessional outwash. Groundwater was not encountered in the lagoon area explorations.

No evidence of material with characteristics similar to the surficial black silt in Goose Lake was observed in the former disposal lagoon area explorations. Slightly elevated headspace vapors were observed in one soil sample obtained from test pit TP-28. This sample was submitted for analysis of VOCs in addition to other constituents. No other field-screening evidence of potential contamination in disposal lagoon soils was observed.

No evidence of soil discoloration or staining was observed in the six test pits completed in the former disposal lagoon area by Floyd|Snider in 2008 (Floyd|Snider, 2009; Appendix E). Soils encountered in these test pits consisted of sand, gravel, and some silt. Cobble sizes varied from 0.5 inches to over 7 inches in diameter. A thin layer (up to 0.5 inches thick) of burnt wood and charred soil was observed on the ground surface at two test pit locations. Floyd|Snider noted that this dark layer appeared to be associated with previous forestry or land management activities, and likely resulted from the burning of forest residue associated with ground clearing after harvesting activities (Floyd|Snider, 2009; Appendix E).

9.2.4 Former Disposal Lagoons – Analytical Results

METALS

Fifteen soil samples from the former disposal lagoon area were analyzed for metals. Metals detected in these soil samples include total chromium, copper, zinc, arsenic, lead, nickel, mercury, hexavalent chromium, cadmium, antimony, and silver (Table 15). Five soil samples contained copper at concentrations exceeding the RI soil screening level protective of groundwater as surface water, and two soil samples contained mercury at concentrations exceeding the screening level protective of groundwater as surface water. Only two of the five copper exceedances also exceeds the indicator soil concentration protective of terrestrial ecological receptors. Both mercury exceedances slightly exceed the indicator soil concentration protective of terrestrial ecological receptors. None of the copper or mercury detections in soil exceed concentrations protective of human health.

DIOXINS

Seven soil samples obtained from the former disposal lagoon area were analyzed for dioxins. Congener-specific profiles of dioxin concentrations detected in these samples are presented in Table 16. The congener profiles were converted to total 2,3,7,8-TCDD equivalents (i.e., TEQs) for comparison to the RI screening levels protective of human health and ecological receptors (Table 17). The method used to calculate the dioxin TEQs is described in Appendix B1.

The dioxin concentrations detected in all disposal lagoon area soil samples are below the RI screening levels.

OTHER ANALYTES

PCBs (Table 18), VOCs (Table 19), and total sulfide (Table 20) were not detected at concentrations exceeding RI screening levels in the soil samples obtained from the former disposal lagoon area. PCBs were not detected in any of the 11 soil samples analyzed for PCBs. The only VOC detected in the one soil sample analyzed for VOCs was dichloromethane, at a concentration well below the associated RI screening level. Sulfide was detected in two of the 11 soil samples analyzed for sulfide, but there are no published numerical criteria for sulfide in the literature sources used to derive the RI soil screening levels.

9.2.5 Other Areas – Physical Conditions

Soil encountered east of the Site (MW-07 and MW-18), in the northeastern portion of the Site (MW-08), and west of Goose Lake (MW-15) generally consisted of dense to very dense gravel with varying amounts of silt and sand. Soil samples obtained from borings completed in the western portion of the Site (MW-09 and MW-10) generally consisted of dense to medium dense sand and gravel. The soil encountered in all six borings is likely Vashon recessional outwash.

Field-screening evidence of potential contamination (e.g., staining, moderate or heavy sheens, and/or elevated headspace vapors) generally was not observed in soil samples obtained from borings MW-07 through MW-10, MW-15, and MW-18. However, slightly elevated headspace vapor concentrations were detected in soil samples obtained from boring MW-07, and soil at a depth of 25 feet bgs in boring MW-15 exhibited a moderate sheen. One soil sample from each of the borings MW-07, MW-08, and MW-15 was submitted for chemical analysis to evaluate the significance of slight or moderate sheens observed in these samples.

Approximately 1 to 2 inches of organic silt and/or leaf litter/duff was present on the ground surface at shallow soil sampling locations S-2, S-4, and S-6A. Similar surficial organic material was not present at shallow soil sampling location S-5. Shallow soil at locations S-2, S-4, and S-5 consisted of silt with sand and gravel. Shallow soil at location S-6A consisted of silty gravel with sand. Groundwater was not encountered at these shallow sampling locations. Field-screening evidence of potential contamination was not observed in the soil samples collected at these locations.

9.2.6 Other Areas – Analytical Results

METALS

Chromium, copper, arsenic, lead, mercury, nickel, and/or zinc were detected in the nine soil samples analyzed for metals (Table 21). Hexavalent chromium, antimony, cadmium, and silver were not detected.

Sample S2-1, obtained from a depth of 1 foot bgs immediately southwest of Goose Lake in 1997 (PEG, 1998), contained zinc at a concentration of 748 mg/kg, which exceeds the RI soil screening level of 120 mg/kg. Samples obtained from boring MW-18 at depths of 5 feet, 7.5 feet, and 15 feet bgs contained chromium, copper, lead, and/or mercury at concentrations exceeding RI soil screening levels. The sample obtained from 20 feet bgs in boring MW-18 contained copper at a concentration exceeding the RI soil screening level.

DIOXINS

The four soil and soil/sediment samples obtained from shallow soil sampling locations S-2, S-4, S-5, and S-6A were analyzed for dioxins. Congener-specific profiles of dioxin concentrations detected in these four samples are presented in Table 22. The congener profiles were converted to total 2,3,7,8-TCDD equivalents (i.e., TEQs) for comparison to the RI screening levels protective of human health and ecological receptors (Table 23). The method used to calculate the dioxin TEQs is described in Appendix B1.

The dioxin concentration in soil sample S-5-0-0.5 (immediately southwest of Goose Lake) exceeded the RI soil screening level protective of human health (Table 23). The dioxin concentrations at locations S-2, S-4, and S-6A did not exceed the RI soil screening levels. Samples S-2-0.5-1 and

S-4-0.1-0.7 were collected at locations that may be seasonally submerged. Accordingly, the dioxin results for these samples were also compared to the RI sediment screening levels. The dioxin concentrations in sample S-4-0.1-0.7 exceeded the low-risk sediment screening level for mammals (Table 23). The dioxin concentrations at location S-2 did not exceed RI sediment screening levels. The dioxin TEQs (calculated using TEFs for humans/mammals) in the two samples with screening level exceedances are within the range of typical background values published by Ecology (1999) for forest and/or open areas in western Washington.

OTHER ANALYTES

PCBs (Table 24) were not detected in the seven samples analyzed for PCBs, with one exception: sample MW-18-7.5 had detections of Aroclor-1254 and Aroclor-1260. The concentration of total PCBs in this sample (0.3 mg/kg) slightly exceeded the RI soil screening level of 0.273 mg/kg.

SVOCs (Table 26) were not detected in the seven samples analyzed for SVOCs, with the following exceptions: bis(2-ethylhexyl)phthalate, fluoranthene, phenanthrene, and/or pyrene were detected in samples MW-18-5.0 and MW-18-7.5 at concentrations well below the RI soil screening levels.

VOCs (Table 25), gasoline-, diesel-, and heavy oil-range TPH (Table 27), and total sulfide (Table 28) were not detected in any of the soil samples analyzed for these constituents.

9.3 Site-Wide Groundwater

9.3.1 Physical Conditions

Groundwater levels were measured in ten monitoring wells (MW-01 through MW-10) during the four quarterly groundwater monitoring events performed in 2002-2003. Groundwater levels were measured in all 18 monitoring wells (MW-01 through MW-18) during the monitoring event performed in November/December 2010. Groundwater elevations calculated from the groundwater level measurements are presented in Table 29. The measured depth to groundwater in the wells ranged from 5.54 to 45.04 feet below the top of the well casings. The well casings extend approximately 3 to 4 feet above the ground surface, with the exception of well MW-12, which has a flush monument. The surface water elevation of Goose Lake was measured during three of the groundwater monitoring events (Table 29).

Groundwater and surface water elevations measured during the RI were generally lowest during the November 2002 monitoring event and highest during the May 2003 monitoring event. The Goose Lake surface water elevation in May 2003 was about 7 feet higher than in November 2002, whereas groundwater elevations in monitoring wells were about 8 to 11 feet higher in May 2003 than in November 2002. The approximate maximum and minimum groundwater table and Goose Lake surface water elevations measured at the Site are depicted on the cross-sections in Figures 5, 6, and 7.

In addition to the groundwater level data collected from wells MW-01 through MW-18 during the RI and 2010 supplemental investigation, Table 29 includes groundwater elevation data for well GMW-1, shown in Figure 24. Shelton Hills LLC installed well GMW-1 as part of a preliminary study for a proposed infiltration pond system (GeoEngineers, 2011b). Groundwater levels in wells GMW-1 and MW-14 were monitored with transducers as part of the infiltration pond study.

Table 29 shows selected transducer data (quarterly groundwater elevations) recorded in these wells at 3-month intervals between May 2009 and May 2010.

Shallow groundwater beneath the Site appears to occur under unconfined conditions, primarily in Vashon recessional outwash deposits. Groundwater contour maps for the five monitoring events are shown in Figures 20 through 24. Based on these maps, groundwater to the west, northwest, south, and southeast of Goose Lake is inferred to flow in a southerly to southeasterly direction. East of Goose Lake, the inferred groundwater flow direction is generally towards the east. In the inactive landfill area, groundwater appears to flow in an east-northeasterly direction. As shown in Figures 20 through 24, the inferred groundwater flow direction and hydraulic gradient magnitude beneath the Site are relatively consistent throughout the year. The estimated average hydraulic gradient magnitude is approximately 0.007.

Groundwater elevation measurements and regional groundwater studies indicate that the primary groundwater flow direction at the Site ranges from south to southeast to east. An east-west trending ridge composed of Vashon till is present to the south of the Site, between wells MW-04 and MW-14 (see Figure 4). This till ridge likely impedes the migration of groundwater in this area. Groundwater to the north and south of the till ridge appears to be hydraulically connected through the till, as indicated by the similar hydraulic gradients on both sides of the ridge. However, the connection is probably weak due to the expected low hydraulic conductivity/transmissivity of the Vashon till unit, which likely results in steeper hydraulic gradients within the till ridge than on either side of the ridge. This interpretation is depicted in the potentiometric map shown in Figure 25. Considering the apparent limited thickness of the Vashon till unit beneath the till ridge (approximately 20 to 30 feet thick; Kleinfelder, 2008), the advance outwash deposits beneath the till ridge may act as a transitional zone between the two groundwater regimes in the recessional outwash deposits on either side of the ridge.

Based on a comparison of groundwater elevations in monitoring wells to surface water elevations in Goose Lake, groundwater likely discharges to Goose Lake along the northwestern side of the lake. This interpretation is based on data obtained during the three monitoring events that surface water elevations were obtained (November 12, 2002; May 12, 2003; and November 30, 2010). The groundwater inferred to discharge to Goose Lake appears to originate primarily from upgradient properties (Sanderson Air Field, the industrial park, and Mason County Fairgrounds), and thus is not expected to be subject to impacts from Rayonier's historical activities at the Site. Surface water in Goose Lake appears to recharge shallow groundwater along the eastern and southern sides of Goose Lake. The existing groundwater elevation data suggest that there is a net flux of Goose Lake surface water from the lake into the inactive landfill (as groundwater), and very limited (if any) flux of groundwater from the landfill into Goose Lake.

During periods of prolonged or heavy rainfall, groundwater west and southwest of Goose Lake may daylight and manifest as impounded surface water in the drainage ravine. As the groundwater table rises, the glacial till ridge to the south of the Site likely impedes groundwater migration towards the south-southeast, causing groundwater to daylight in the drainage ravine. However, as discussed in Section 3.0, surface water in the drainage ravine does not have a significant overland flow component due to the relatively flat topography of the ravine and the presence of the four earthen dams. Although impounded surface water may appear seasonally in the drainage ravine, the primary direction of groundwater flow in the vicinity of the drainage ravine is likely towards the south-southeast, as indicated by regional groundwater flow patterns and groundwater elevation measurements in monitoring wells near the drainage ravine (Figure 24).

9.3.2 Analytical Results

There have been no exceedances of the RI groundwater screening levels protective of drinking water use in primary groundwater samples obtained from the Site monitoring wells, with one exception: arsenic was detected at a concentration (0.00632 milligrams per liter [mg/L]) slightly greater than the drinking-water-based screening level (0.005 mg/L) in the groundwater sample obtained from well MW-02 in November 2002.

COPCs with one or more exceedances of the RI groundwater screening levels protective of surface water include metals (chromium, copper, lead, and mercury), PCBs, and dioxins. COPC exceedances in groundwater are depicted in Figure 25.

METALS

The analytical results for metals in groundwater are presented in Table 30. Monitoring wells with exceedances of RI groundwater screening levels protective of surface water include:

- MW-03 – copper (November 2002 and February 2003) and lead (August 2002, November 2002, and February 2003).
- MW-05 – copper (August and November 2002) and lead (February 2003).
- MW-08 – copper and lead (August and November 2002) and chromium (August 2002).
- MW-09 – copper and lead (August 2002, November 2002, February 2003, and May 2003) and mercury (May 2003).
- MW-10 – copper (August 2002, November 2002, and February 2003) and lead (August 2002 and February 2003).
- MW-13 – copper and mercury (November/December 2010).
- MW-16 – chromium, copper, lead, and mercury (November/December 2010).
- MW-17 – chromium, copper, lead, and mercury (November/December 2010).

The data summarized in Table 30 indicate that concentrations of metals in Site groundwater are low and similar/consistent among all the monitoring wells, including wells located near or directly downgradient of past waste disposal areas (i.e., Goose Lake, the inactive landfill, and the former disposal lagoons) and wells located in areas where no known historical disposal activities occurred (e.g., wells MW-6, MW-8, and MW-13). The similar, low-level metals concentrations detected in groundwater across the Site suggest that the metals reflect area or natural background conditions rather than impacts from past waste disposal activities.

DIOXINS

Five unfiltered primary groundwater samples obtained from wells MW-12, MW-15, MW-16, MW-17, and MW-18 during the 2010 supplemental investigation were analyzed for dioxins. The congener profiles were converted to total 2,3,7,8-TCDD equivalents (i.e., TEQs) for comparison to the RI screening levels (Table 31). The dioxin TEQ concentrations detected in the groundwater samples were in the low parts-per-quadrillion range (0.618 to 4.50 picograms per liter [pg/L]), which is only slightly greater than the analytical detection limit. Despite the low concentrations detected, the dioxin TEQ concentrations in wells MW-12, MW-15, MW-16, and MW-17 exceed the RI groundwater screening level protective of surface water because the risk-based surface water criterion (0.005 pg/L) is several orders of magnitude lower than the analytical detection limit. The highest dioxin concentrations were detected upgradient of Goose Lake in well MW-15 (4.50 pg/L TEQ), whereas the lowest concentrations were detected downgradient of the landfill in well MW-18 (0.618 pg/L TEQ). The dioxin concentrations detected in well MW-18 did not exceed the RI screening levels. The similar dioxin concentrations detected in all five monitoring wells suggests that these results reflect background groundwater conditions rather than impacts from past waste disposal activities.

PCBs

Groundwater samples from all monitoring wells except MW-14 (which has not been sampled) and MW-15 have been analyzed for PCBs (Table 32). PCBs (Aroclor-1254) were detected only in the groundwater samples obtained from landfill area wells MW-16 and MW-17 in November/December 2010. The concentrations of PCB Aroclor-1254 and total PCBs detected in these wells (0.016 to 0.029 micrograms per liter, only slightly greater than the analytical PQL) exceed the RI screening levels protective of surface water. The low concentrations of a single PCB Aroclor detected slightly above the PQL in wells MW-16 and MW-17 may not be indicative of impacts from past waste disposal activities. Additional groundwater sampling for PCBs in these wells would be needed to assess whether the November/December 2010 detections of Aroclor 1254 are repeatable or whether they represent an isolated, anomalous result.

OTHER ANALYTES

VOCs (Table 33), SVOCs (Table 34), and diesel- and heavy-oil range TPH (Table 35) have not been detected in groundwater. The conventional parameter total sulfide (Table 36) was detected in groundwater samples obtained from landfill area wells MW-16 and MW-17 (November/December 2010); there are no established regulatory screening levels for sulfide in groundwater or surface water.

9.4 Surface Water – Goose Lake

9.4.1 Physical Conditions

The average depth of Goose Lake measured along the seven transects surveyed on May 24, 2001 was 5.8 feet; the maximum depth was 10.25 feet, and the minimum depth was 1.0 feet (Table 37). A fine black sediment film (likely originating from the surficial black silt layer) was observed on the depth plumb when it was retrieved at many of the survey stations. At a location along E-W Transect 1 approximately 200 feet west of the island present near the center of the lake when lake levels are low, the black sediment film appeared to produce a sheen on the water surface. These conditions appeared to persist towards the western shoreline. The black sediment film was also noted on the depth plumb approximately 80 feet from the northern shoreline (N-W Transect 3), and approximately 160 feet off the shoreline near the northern edge of a stand of deadheads in the southwestern portion of the lake (N-W Transect 6).

The six primary surface water samples submitted for laboratory analysis were collected on a cloudy day (June 4, 2002) with sporadic drizzle and air temperatures ranging from 14.8 to 18.4 °C. At the time of sampling, the three sampling locations had an average water depth of 10.0 feet. The weather on the second day of water quality sampling (June 11, 2002; field parameters only) was sunny and warm, with air temperatures ranging from 19.5 to 30.4°C. The water depth at the five locations sampled on June 11, 2002 averaged 9.3 feet.

9.4.2 Analytical Results

COPCs detected in Goose Lake surface water samples at concentrations exceeding the RI surface water screening levels include dissolved arsenic and total lead. The surface water analytical results for these constituents are presented in Figure 26.

METALS

Arsenic and copper were detected in all six primary surface water samples, and lead was detected in one sample (Table 38). The detected concentrations of arsenic and lead exceeded the RI surface water screening levels.

PCBs

PCBs were not detected in the surface water samples (Table 39).

CONVENTIONAL CHEMISTRY

Laboratory Analyses. Laboratory analytical results for conventional water quality parameters are presented in Table 40. Turbidity, pH, and conductivity were analyzed in two surface water samples: one shallow sample (SW-3-top) and one deep sample (SW-2-bottom). In these samples, pH averaged 6.69, turbidity averaged 14.5 nephelometric turbidity units (NTU), and conductivity averaged 96.5 micromhos per centimeter (µmhos/cm). Total sulfide, hardness, and alkalinity were analyzed in all of the surface water samples submitted to the laboratory. Total sulfide was not detected in any of the samples. Hardness and alkalinity averaged 50.6 mg/L and 22.4 mg/L, respectively. Of the two samples analyzed for pH, the deeper sample (SW-2-bottom) had a slightly lower (more acidic) pH; but the other parameters did not vary significantly between the shallow and deep samples.

Field Measurements. The results for conventional water quality parameters measured in the field on June 4 and June 11, 2002 are summarized in Tables 41 and 42.

- **pH** – The pH of Goose Lake surface water was slightly acidic, with shallow water pH ranging from 6.59 to 7.10, and deep water pH (1 foot above the lake bottom) ranging from 5.78 to 6.86. Data collected on June 11, 2002 showed a consistent decrease in pH (i.e., increasing acidity) with depth of approximately 0.06 pH units per foot. The pH range measured in Goose Lake is within a range supportive of fish growth and reproduction for nearly all temperate freshwater fish species (Fisher, 2000).
- **Water Temperature** – On June 4, 2002, water temperature varied by approximately 3 °C between the shallow and deep sampling depths. On June 11, 2002, water temperature varied by approximately 5 °C between the shallow and deep sampling depths. At the sampling locations where a series of water temperatures were measured at discrete depths, temperatures decreased most notably (by approximately 1 °C) near the surface and at depth, but remained relatively constant mid-column, with only a 0.2 to 0.5 °C temperature decrease for each 1-foot increase in depth.

- **Conductivity** – Conductivity measured at all sampling locations and depths on both sample collection dates ranged from 0.098 to 0.122 µmhos/cm; 0.101 µmhos/cm was the most common conductivity value measured.
- **Dissolved Oxygen** – Vertical profiles of dissolved oxygen (DO) were obtained by measuring DO at 1-foot depth increments at two locations (Gill Net 1 and Gill Net 2) on June 11, 2002. The profiles were obtained because of significant differences noted between shallow and deep DO measurements during the June 4, 2002 survey, and the concern that oxygen depletion and stratification could be partly responsible for the apparent scarcity of fish in Goose Lake. The June 11, 2002 DO measurements are summarized in Table 42. The vertical profiles showed a general trend of increasing DO with depth in the upper 2 feet of the water column, followed by a gradual decrease mid-column, and a more rapid decrease of between 1 and 4 mg/L in the lower 3 feet of the water column. Measured DO concentrations below 9 to 10 feet depth in the lake were generally less than 2 mg/L. Concentrations of DO below approximately 5 mg/L can be stressful to some fish species, and concentrations below 3 mg/L are generally considered inhospitable to the majority of freshwater fish (Fisher, 2000).

9.5 Sediment – Goose Lake

9.5.1 Physical Conditions

Organic silt and peat were generally encountered at each RI sediment sampling station in Goose Lake. A surficial layer of very soft, black organic silt (surficial black silt) was present at each station except SED-02. SED-02 was located on the flanks of a bathymetric high point, in the vicinity of the small island that is exposed near the middle of the lake when the lake level is low. The surficial black silt had a semi-solid/semi-liquid consistency and was not sufficiently competent to withstand the core extrusion process. Consequently, it was not possible to obtain accurate thickness measurements of the surficial black silt layer. However, based on sediment sampling performed using a Van Veen grab sampler, the surficial black silt layer was estimated to be approximately 3 inches thick.

Brown, soft, organic silt with varying amounts of peat was present at all sampling stations beneath the surficial black silt. This sediment unit typically contained abundant organic (plant) debris, and was encountered to a maximum depth of 13 feet below the lake bottom. Relatively thick deposits of peat were encountered in the sediment cores at five sampling stations (SED-01, SED-02, SED-03, SED-05, and SED-08). The longest sediment core collected during the RI (13 feet) was recovered at station SED-03; sediments encountered between 6.25 and 13 feet below the lake bottom at this location consisted entirely of peat. As noted previously, PRSW (2009) interpreted the brown peat deposits beneath Goose Lake to be native Mukilteo peat.

Granular material was encountered at only one RI sediment sampling station in Goose Lake. Gravel was present at a depth of 5.35 to 5.85 feet below the lake bottom in the sediment core obtained at station SED-05. Station SED-05 was located in the southeastern portion of Goose Lake near the inactive landfill. The gravel encountered in this core was most likely Vashon recessional outwash.

Along the eastern margin of Goose Lake, up to 30 feet of peat is present beneath the landfill waste horizon (see Figures 6 and 7). Similar peat deposits of comparable thickness have been documented in the surrounding region. For example, peat deposits on the order of 25 to 35 feet thick overlying glacial drift, with physical characteristics similar to the peat encountered beneath Goose Lake, are common in peat bogs and marshy areas mapped in the 1950s in the vicinity of Shelton (Logan, 2003; Rigg, 1958; USDA, 1960). The thick peat deposits encountered at the lake/landfill margin are underlain by glacial deposits, most likely Vashon recessional outwash.

As noted previously, two studies have been conducted to investigate the origin of the brown organic sediment/peat horizon beneath Goose Lake (GeoEngineers, 2008; PRSW, 2009). Both of these studies concluded that the organic sediment/peat horizon is native material consisting of alluvial silt and abundant decomposing soft plant material, rather than mill-derived waste. These two studies are described further below.

GeoEngineers collected core samples of the brown organic-rich sediment at five locations (SED-13 through SED-17) in Goose Lake in November 2007. The core samples were submitted to Econotech Services, Ltd. (Econotech) for microscopic fiber analysis. Econotech concluded that the core samples consisted of native material derived from natural processes; no evidence of anthropogenic material associated with pulp or paper mill processes was observed (GeoEngineers, 2008; Appendix D).

PRSW collected shallow sediment cores at six locations (HA-1 through HA-6) along the southeastern shoreline of Goose Lake in November 2008. These core samples consisted of 2 to 4 feet of weakly decomposed, coarse wood chips at the ground surface. Beneath this layer of coarse wood chips, PRSW observed a thin layer of finer decomposed wood chips and peat mixed with a black organic viscous material, which PRSW speculated may be a derivative of the pulp making process (PRSW, 2009; Appendix F). Below the wood chips and pulp-like materials, the PRSW cores consisted of brown organic-rich sediment, similar to the material encountered in GeoEngineers' 2007 sediment cores. PRSW concluded that this brown organic-rich sediment was native Mukilteo peat. The coarse wood chips observed at the ground surface were absent in the underlying organic sediment. Core samples obtained at locations HA-5 and HA-6 along the southern perimeter of Goose Lake suggested that the wood chip layer is concentrated next to the base of the inactive landfill and is not widespread throughout the lake. PRSW speculated that the wood chip layer may be debris associated with the inactive landfill that encroached upon the eastern portion of Goose Lake (PRSW, 2009; Appendix F). Field notes and sampling logs from PRSW's 2008 sediment study are not provided in PRSW's report (Appendix F); attempts to obtain field documentation from PRSW and Floyd|Snider (Palazzi and Massingale, personal communication, 2011) were unsuccessful.

9.5.2 Analytical Results

COPCs that exceeded screening levels in Goose Lake sediment (and drainage ravine soil/sediment) are shown in Figure 27. Figure 28 shows PCB concentrations detected in Goose Lake surficial black silt and drainage ravine shallow soil/sediment (0 to 2 feet bgs). Figure 29 shows dioxin concentrations detected in Goose Lake surficial black silt, drainage ravine shallow soil/sediment, and landfill soil. Figures 30 through 38 show concentrations of sulfide, TOC, selected metals, Aroclor-1260, total PCBs, and dioxins as a function of depth in Goose Lake sediment and drainage ravine soil/sediment. Analytical results for lake/landfill margin soil/sediment samples (locations GEI-1 through GEI-6) are discussed in Section 9.2.2.

METALS

Metals concentrations detected in Goose Lake sediment samples are summarized in Table 43. A single detection of mercury in a sample of the surficial black silt (sample SED-05-0-0.15) exceeded the RI sediment screening level; no other metals were detected in Goose Lake sediment samples at concentrations exceeding RI screening levels. In general, the metals concentrations detected in the surficial black silt layer were greater than the concentrations in the underlying native organic sediment/peat (Figures 32 through 35).

SVOCs

Several polycyclic aromatic hydrocarbons (PAHs) were detected in Goose Lake sediment samples as shown in Table 47. All of these constituents were detected in the surficial black silt layer at stations SED-01 and SED-04, with the exception of one low-level pyrene detection in the underlying native organic sediment/peat at station SED-01. None of the SVOC detections exceeded RI sediment screening levels.

PCBs

The PCB Aroclor-1260 was detected in all seven sediment samples obtained from the surficial black silt layer (Table 46). The highest concentration of Aroclor-1260 (900 ug/kg) was reported in the sample from station SED-05. No other PCB compounds were detected in Goose Lake sediment samples. All of the Aroclor-1260 detections in the surficial black silt exceeded the RI sediment screening levels for Aroclor-1260 and total PCBs. Aroclor-1260 and total PCB concentrations detected in Goose Lake sediment samples are depicted in Figures 36 and 37. A single exceedance of Aroclor-1260 occurred in a sample of the native organic sediment/peat beneath the surficial black silt layer. This sample was obtained from a depth interval of 1.7 to 4.1 feet at station SED-01 (Table 46). The Aroclor-1260 concentration reported in this sample was 85 ug/kg (estimated concentration between the PQL and MDL), which exceeds the total PCBs screening level of 62 ug/kg.

DIOXINS

Congener-specific profiles of dioxin concentrations in Goose Lake sediment samples are presented in Table 44. Dioxins were detected in samples from each of the stations (SED-04, SED-05, and SED-08) analyzed for dioxins. Station SED-05 had detectable concentrations of dioxins in the surficial black silt layer and in the underlying native organic sediment/peat, whereas the other sampling stations had detectable dioxins only in the surficial black silt. The concentration of dioxins detected in the surficial black silt at station SED-05 was roughly five times greater than the concentration in the underlying native organic sediment/peat (Figure 38).

Congener profiles were converted to total 2,3,7,8-TCDD equivalents (i.e., TEQs) for comparison to the RI screening levels for dioxins (Table 45). The method used to calculate the TEQs is described in Appendix B1. The highest dioxin TEQ calculated for Goose Lake sediment samples was 15 nanograms per kilogram (ng/kg), in surficial black silt sample SED-05-0-0.15 (calculated using TEFs for birds). The dioxin concentrations detected in the surficial black silt at stations SED-04 and SED-05 exceeded the low-risk sediment screening level for mammals. None of the dioxin concentrations in the surficial black silt layer exceeded the low-risk sediment screening levels for fish and birds or any of the high-risk sediment screening levels for ecological receptors. Furthermore, there were no dioxin exceedances in the native organic sediment/peat beneath the surficial black silt layer.

CONVENTIONAL CHEMISTRY

Conventional chemistry results for the Goose Lake RI sediment samples and the one drainage ravine soil/sediment sample (SED-09-0-0.4) analyzed for conventional chemistry parameters are discussed in this section and summarized in Table 48. The results for other drainage ravine soil/sediment analyses are discussed in Section 9.6.

Sulfide, TOC, ammonia, and pH were analyzed in all of the RI sediment samples from Goose Lake and sample SED-09-0-0.4. In these samples, sulfide averaged 11,311 mg/kg, TOC averaged 28 percent, ammonia averaged 191 mg/kg, and pH averaged 7.0. Total solids was measured in seven samples obtained from Goose Lake and sample SED-09-0-0.4, while ORP was measured in one sample from the lake and sample SED-09-0-0.4. The average value for total solids was 22 percent, confirming field observations that the sediment samples had a high moisture content. ORP values ranged from 108 to 234 millivolts.

Sulfide was detected at concentrations exceeding the RI screening level in 7 of 18 Goose Lake sediment samples. All of the sulfide exceedances occurred in the surficial black silt layer. As shown in Figure 30, the total sulfide concentrations detected in the surficial black silt layer (0 to 0.15 feet bgs) were significantly greater than the concentrations in the underlying native organic sediment/peat. Conversely, TOC values were generally lower in the surficial black silt layer than in the native organic sediment/peat (Figure 31). The other conventional parameters did not exhibit any consistent pattern of differences between the surficial black silt layer and the underlying native organic sediment/peat.

TOC was detected at a concentration exceeding the RI screening level in 16 of 18 sediment samples. However, the TOC values measured in the surficial black silt layer were less than the values measured in the underlying native organic sediment/peat, suggesting that the TOC in the sediment samples is naturally occurring. Consequently, TOC is not considered a COPC at the Goose Lake Site.

9.6 Soil/Sediment – Drainage Ravine

9.6.1 Physical Conditions

A thin (approximately 0.3- to 0.7-foot-thick) surface layer of organic silt and/or leaf litter/duff was present at the ground surface at drainage ravine sampling locations SED-09 to SED-12 (Figure 2). Fine to coarse gravel with sand (Vashon recessional outwash) was encountered directly beneath this surface layer at location SED-09. Fine to coarse sand was present between this surface layer and underlying recessional outwash at locations SED-10 through SED-12. This intervening sand horizon may represent post-glacial alluvial deposits in the drainage ravine. The lithology of the sand horizon, which ranges from about 1 to 5 feet thick, does not resemble the types of sediment observed in Goose Lake. Accordingly, the source for this sand horizon likely was not sediment transport from Goose Lake. Shallow groundwater was encountered in two of the four drainage ravine explorations, at depths of about 1 foot bgs (SED-09) and 4.5 feet bgs (SED-10). Field-screening evidence of potential contamination was not observed in the soil/sediment samples obtained from the drainage ravine.

Shallow soil sampling performed upgradient (east) of Dam #1 in 2008 by Floyd|Snider encountered gravel and cobbles; approximately 60 to 70 percent of the soil encountered during sampling in this area was composed of cobbles ranging from 1 to 5 inches in diameter. No evidence of soil staining or discoloration was observed by field personnel (Floyd|Snider, 2009; Appendix E).

9.6.2 Analytical Results

Some areas of the drainage ravine are susceptible to seasonal ponding of surface water as evidenced in historical aerial photographs, particularly those areas immediately upgradient (east) of the earthen dams. Because these areas may be submerged under shallow standing water for extended periods, analytical results for soil/sediment samples obtained from locations SED-09 through SED-12 and SH-DR-01 through SH-DR-06 were compared to both soil and sediment screening levels.

COPCs that exceeded screening levels in drainage ravine soil/sediment (and Goose Lake sediment) are shown in Figure 27. PCB concentrations detected in drainage ravine shallow soil/sediment (0 to 2 feet bgs) and Goose Lake surficial black silt are shown in Figure 28. Figure 29 shows dioxin concentrations detected in drainage ravine shallow soil/sediment, Goose Lake surficial black silt, and landfill soil. Figures 30 through 38 show concentrations of sulfide, TOC, selected metals, Aroclor-1260, total PCBs, and dioxins as a function of depth in drainage ravine soil/sediment and Goose Lake sediment.

METALS

Metals concentrations detected in drainage ravine soil/sediment samples are summarized in Table 43. With the exception of silver, all of the metals analyzed in each sample were detected in each sample. Chromium, copper, mercury, and nickel were detected in at least one sample at concentrations exceeding RI soil screening levels but not sediment screening levels. Metals were not detected at concentrations exceeding RI sediment screening levels in the drainage ravine soil/sediment samples.

SVOCs

SVOCs were analyzed in the shallow soil/sediment sample obtained from location SED-09. SVOCs were not detected in this sample (Table 47). Analytical results for several SVOCs were rejected because of data quality exceptions as described in Appendix B1; these rejected data are identified in Table 47.

PCBs

The PCB Aroclor-1260 was detected in the shallow soil/sediment sample obtained from location SED-09 (Table 46); the detected Aroclor-1260 concentration was below the RI sediment screening level but the concentration of total PCBs in this sample exceeded the RI soil screening level. No other PCB compounds were detected in the drainage ravine soil/sediment samples.

PCBs were not detected in any of the six soil/sediment samples (SH-DR-01 through SH-DR-06) submitted for PCB analysis from the area east of Dam #1 in 2008 (Floyd|Snider, 2009; Appendix E). This indicates that the PCB concentrations detected at RI location SED-09 are limited to shallow soil in the immediate vicinity of SED-09.

DIOXINS

Congener-specific profiles of dioxin concentrations in drainage ravine soil/sediment samples are presented in Table 44. Dioxins were detected in all seven samples analyzed for dioxins (two samples from location SED-10 and one sample each from locations SED-09, SED-11, SED-12, SH-DR-01, and SH-DR-06).

Congener profiles were converted to total 2,3,7,8-TCDD equivalents (i.e., TEQs) for comparison to the RI screening levels for dioxins (Table 45). The method used to calculate the TEQs is described in Appendix B1. The highest dioxin TEQ calculated for drainage ravine soil/sediment samples was 42 ng/kg in surface sample SED-09-0-0.4 (calculated using TEFs for birds). The dioxin concentrations detected in surface samples collected at locations SED-09, SED-12, and SH-DR-06 exceeded the low-risk sediment screening level for mammals. The dioxin concentrations detected in the surface sample at SED-09 also exceeded the high-risk sediment screening level for mammals and the low-risk sediment screening level for birds. Fish are not expected to live in areas of the drainage ravine that are seasonally submerged. Consequently, dioxin concentrations in the drainage ravine samples were not compared to the RI sediment screening levels for fish.

Dioxin concentrations in the drainage ravine samples were also compared to RI soil screening levels. The dioxin concentrations detected in the surface sample collected at location SED-09 exceeded the soil screening levels for humans and birds, and the dioxin concentrations detected in the surface sample collected at location SH-DR-06 exceeded the soil screening level for humans. The dioxin concentrations detected in the soil/sediment samples collected at locations SED-10, SED-11, and SH-DR-01 did not exceed RI screening levels for either soil or sediment.

CONVENTIONAL CHEMISTRY

The soil/sediment sample obtained from location SED-09 was analyzed for conventional chemistry parameters. The results are discussed in Section 9.5.2 and summarized in Table 48.

9.7 Fish Tissue – Goose Lake

Despite intensive efforts to catch fish using a variety of capture methods employed in several areas of Goose Lake, only four fish were captured for tissue analysis. This fell significantly short of the goal of capturing at least 20 fish.

All four fish captured were largemouth bass. The bass ranged from 180 to 290 millimeters in length, and weighed between 88 and 388 grams. One fish was captured from the gill net positioned off the inactive landfill, and the other three were captured from the baited long lines. In addition to these four fish, eight rough-skinned newts were captured (unintentionally) with the gill nets and long lines. Both fillet and whole-body fish tissue samples were analyzed for metals, congener-specific PCBs, and dioxins. The results of the fish tissue analyses are summarized below and in Tables 49 and 50.

As discussed in Section 6.5, due to the small number of fish captured and the availability of Washington State draft freshwater sediment quality values protective of aquatic life (Ecology, 2003), as well as the availability of numerical surface water criteria (included in Table 6) for human health protection based on fish consumption, the analytical results for fish tissue samples are not compared to numerical screening criteria in this RI. The limited fish tissue data obtained during the RI are presented to provide general information regarding COPC concentrations in fish living in

Goose Lake. Where possible, the Goose Lake fish tissue data are compared to similar freshwater fish tissue data for western Washington collected in 2004-05 as part of Ecology's Washington State Toxics Monitoring Program.

METALS

Metals results for the fish tissue samples are presented in Table 49. Arsenic was not detected in any of the fish tissue samples. Cadmium was detected in only one tissue sample, while lead was detected in all but one of the tissue samples. Copper, mercury, nickel, and zinc were detected in all of the tissue samples. In general, the metals concentrations in the fillet samples were slightly lower than the concentrations in the whole-body samples, with the exception of copper and mercury. The detected concentrations of mercury in the fillet samples (0.05 to 0.06 mg/kg) are within the range of mean mercury concentrations detected in freshwater fish fillet samples collected from 19 western Washington lakes and rivers (0.03 to 0.54 mg/kg; median = 0.23 mg/kg). The referenced mean mercury concentrations were derived from a 2004-2005 Ecology study of contaminants in freshwater fish tissue (Seiders et al., 2007). Mercury was the only metal analyzed in the 2004-2005 Ecology study.

DIOXINS AND PCBs

Several dioxin congeners and PCB congeners were detected in the fish tissue samples (Table 50). The dioxin and PCB concentrations in the fillet samples were significantly lower than the concentrations in the whole-body samples. The detected concentrations of total dioxins in the fillet samples (0.00008240 to 0.0001048 ng/kg TEQ) are less than the mean total dioxin concentrations detected in freshwater fish fillet samples collected from 19 western Washington lakes and rivers (0.009 to 6.79 ng/kg TEQ; median = 0.218 ng/kg TEQ). The detected concentrations of total PCB congeners in the fillet samples (8.1 to 62 ug/kg) are within the range of mean total PCB congener concentrations detected in freshwater fish fillet samples collected from 19 western Washington lakes and rivers (0.9 to 382 ug/kg; median = 10 ug/kg). The mean dioxin and PCB concentrations referenced above were derived from an Ecology study of contaminants in freshwater fish tissue conducted in 2004-2005 (Seiders et al., 2007).

In addition to the tissue analyses, qualitative visual health assessments of each of the captured fish were conducted immediately after the fish were euthanized. In general, the captured fish appeared to be healthy, with minimal or no indications of disease or other physical impairments. One bass had a small focal area of gill necrosis caused by an active infection of gill fluke (*Gyrodactilus sp.*). A second bass had a small focal area of fin erosion on the dorsal lobe of the caudal fin. The cause of the fin erosion could not be determined, but it was not consistent with "fin rot," as it did not have associated opportunistic infection with typical fish parasites such as skin fluke or "Ich" (*Ichthiopthirius multifilis*). The eroded area of the fin appeared to be more consistent with either a predatory encounter or erosion from spawning behavior. Internal examination of organ integrity did not reveal any significant abnormalities in the fish.

10.0 SUMMARY AND CONCLUSIONS

Details regarding the nature and extent of constituents detected in various media at the Site are discussed in Section 9.0. Potential risks associated with COPCs detected in soil, groundwater, surface water, and sediment were assessed by comparing the analytical data from the RI and previous and subsequent investigations to conservative, published or calculated chemical-specific screening levels derived from published numerical criteria (i.e., promulgated regulatory criteria, risk-based screening concentrations, and natural background concentrations). The results and conclusions for each of the areas and media evaluated are summarized in Sections 10.1 through 10.5 below.

Two supplemental studies were conducted after the RI to investigate the origin of the brown organic sediment/peat horizon beneath the surficial black silt layer on the bottom of Goose Lake (GeoEngineers, 2008; PRSW, 2009). Both studies concluded that this sediment horizon is composed of native sediment and peat – alluvial silt with abundant decomposing soft plant material – rather than mill-derived waste. PRSW (2009) interpreted this material as Mukilteo peat, which is known to occur in the surrounding region based on a previous survey of peat deposits in Mason County (Rigg, 1958). Additionally, samples of the brown organic sediment/peat recovered from borings completed in the inactive landfill area during the 2010 supplemental investigation (GeoEngineers, 2011a) were visually examined by GeoEngineers wetland scientists, who deemed the physical characteristics of the samples to be consistent with natural silt and peat deposits.

10.1 Former Disposal Lagoons

Three soil samples collected in the disposal lagoon area during previous investigations (SAIC, 1997; PEG, 1998) contained concentrations of copper and/or mercury that exceed RI soil screening levels protective of groundwater as surface water. The copper and mercury concentrations detected in two of these samples also exceed indicator soil concentrations protective of terrestrial ecological receptors (plants and/or soil biota). Neither of these metals exceed soil concentrations protective of human health.

The 2002 RI analytical data indicate no impacts to soil (metals, PCBs, and VOCs) in the former disposal lagoon area at concentrations exceeding RI screening levels, with the exception of copper in shallow soil at two locations (samples TP-22-0.3 and TP-24-1.0). The copper concentrations detected in these two samples exceed the RI soil screening level protective of groundwater as surface water, but do not exceed concentrations protective of terrestrial ecological receptors and human health. Additional soil sampling and analysis for PCBs and dioxins in the disposal lagoon area in 2008 (Floyd|Snider, 2009; Appendix E) showed no detections of PCBs and no exceedances of the RI screening levels for dioxins.

10.2 Site-Wide Groundwater

Four quarterly groundwater monitoring events were conducted during the RI (August 2002–May 2003). Two additional monitoring events were conducted in 2005 (Kleinfelder, 2006; Appendix C) and in 2010 during the supplemental investigation (GeoEngineers, 2011a).

Groundwater sampling results for wells MW-03, MW-05, MW-06, MW-08, MW-09, MW-10, MW-13, MW-15, MW-16, and MW-17 were compared to screening levels protective of drinking water use and screening levels protective of surface water due to the proximity or upgradient location of these wells relative to Goose Lake, the drainage ravine, or the seasonal pond to the northeast of Goose Lake. Sampling results for wells MW-01, MW-02, MW-04, MW-07, MW-11, MW-12, and MW-18 were compared only to groundwater screening levels protective of drinking water use due to the downgradient location of these wells relative to Goose Lake and the drainage ravine. Well

MW-14 was installed by Shelton Hills LLC as part of a geotechnical and stormwater infiltration evaluation and has not been sampled.

Seven COPCs (arsenic, lead, mercury, chromium, copper, PCBs, and dioxins) have been detected in groundwater at concentrations exceeding the RI screening levels protective of surface water. There have been no confirmed exceedances of the RI groundwater screening levels protective of drinking water use in primary groundwater samples obtained from the Site monitoring wells. Although total arsenic was detected once in well MW-02 at a concentration (0.00632 mg/L) slightly greater than the RI screening level of 0.005 mg/L (November 2002), there were no arsenic exceedances in the other four groundwater samples collected from this well (August 2002, February 2003, May 2003, and November/December 2010).

Overall, the groundwater monitoring results indicate that low-level concentrations of metals and dioxins were detected in groundwater in all monitoring wells sampled for these constituents. The detected concentrations of metals and dioxins in and downgradient of former waste disposal areas (i.e., Goose Lake, the inactive landfill, and the former disposal lagoons) were similar to the concentrations detected in areas with no history of past waste disposal. These findings suggest that the metals and dioxins detected in groundwater reflect natural or area background conditions rather than impacts from historical waste disposal activities at the Site.

The low-level detections of the PCB Aroclor-1254 slightly above the analytical PQL in wells MW-16 and MW-17 in November/December 2010 may not be indicative of impacts from past waste disposal activities. Additional groundwater sampling for PCBs in wells MW-16 and MW-17 would be needed to assess whether these detections are repeatable or whether they are an isolated, anomalous result.

10.3 Inactive Landfill

COPCs detected at concentrations exceeding RI soil screening levels in the inactive landfill include antimony, arsenic, chromium, copper, lead, mercury, nickel, zinc, cPAHs, PCBs, and dioxins. The majority of these exceedances occurred in the landfill waste horizon. However, several COPCs were detected above soil screening levels in the landfill cover horizon, including metals (copper, lead, mercury, and/or nickel) at three locations (MW-17, TP-12, and TP-18) and PCBs and dioxins at one location (MW-17). COPCs also were detected at concentrations exceeding soil screening levels in native peat or glacial deposits below the landfill waste horizon, including metals (lead, chromium, copper, mercury, and/or nickel) at seven locations (GEI-1, GEI-3, GEI-4, GEI-5, MW-17, TP-11, and Trench-04), PCBs at eight locations (GEI-1 through GEI-6, MW-16, and MW-17), and dioxins at one location (GEI-3).

COPCs detected at concentrations exceeding RI sediment screening levels in borings GEI-1 through GEI-6 along the lake/landfill margin include metals (antimony, chromium, copper, lead, mercury, nickel, and zinc), sulfide, PCBs, dioxins, and SVOCs (acenaphthylene, bis[2-ethylhexyl]phthalate, and dibenzofuran). Most of these sediment screening level exceedances occurred in the landfill waste horizon; however, there were also exceedances of metals and organic COPCs in the native peat horizon below the waste horizon. With the exception of dioxins at several locations, the exceedances in the peat horizon are vertically bounded and are generally limited to the upper 8 feet of this horizon.

The COPC detections in the inactive landfill do not exhibit any clear spatial patterns. There also is no apparent correlation between the type or magnitude of COPC detections in the landfill waste horizon and the physical characteristics of the waste material.

The estimated extent of the submerged portion of the inactive landfill in Goose Lake is shown in Figures 6 and 7. The exact point at which the landfill waste horizon pinches out on the lake bottom is uncertain. Since native peat was encountered within 1 foot of the sediment surface at lake-bottom sediment sampling stations SED-01, SED-05, and SED-08, the landfill waste horizon is assumed to pinch out between these sampling stations and the upland portion of the landfill.

10.4 Goose Lake and Drainage Ravine

10.4.1 Surface Water

Arsenic and lead were detected in Goose Lake surface water samples at concentrations exceeding the RI surface water screening levels. Total lead was detected at a concentration slightly exceeding the associated screening level in one of the six primary surface water samples collected. Dissolved arsenic concentrations detected in all six surface water samples slightly exceeded the associated screening level. As discussed in Section 9.3, groundwater upgradient (west and northwest) of Goose Lake likely discharges to the lake along the northwestern side of the lake. The arsenic concentrations detected in Goose Lake surface water are at least an order of magnitude less than the groundwater screening level of 0.005 mg/L, which is based on Washington state background arsenic concentrations in groundwater. The arsenic concentrations detected in Goose Lake surface water are also at least an order of magnitude less than the majority of the arsenic concentrations detected in Site groundwater. As discussed in Section 10.2, the groundwater monitoring results suggest that the metals detected in Site groundwater reflect natural or area background conditions rather than impacts from historical waste disposal activities. The arsenic concentrations detected in Goose Lake surface water are thus consistent a conceptual model in which upgradient groundwater containing background concentrations of arsenic discharges to the lake, followed by attenuation of the arsenic concentrations in surface water by dilution, oxidation, or other natural processes.

10.4.2 Soil/Sediment

During the RI, several metals (chromium, copper, nickel, and mercury), PCBs, dioxins, and sulfide were detected at concentrations exceeding soil and/or sediment screening levels in selected sediment and soil/sediment samples obtained from Goose Lake and the drainage ravine. With one exception, the COPC exceedances in lake-bottom sediments occurred entirely in the thin surficial black silt layer on the bottom of Goose Lake. COPC concentrations in the underlying brown organic (native) sediment/peat were generally much lower or non-detectable. The exception was a single exceedance of the PCB Aroclor-1260 in the sediment sample obtained from a depth interval of 1.7 to 4.1 feet at sampling station SED-01. The estimated Aroclor-1260 concentration in this sample was 85 ug/kg, which slightly exceeds the total PCBs screening level of 62 ug/kg. The highest COPC concentrations detected in the surficial black silt layer generally occurred at the sampling station closest to the inactive landfill (station SED-05).

In the drainage ravine, the highest concentrations of COPCs were generally detected at location SED-09, which is immediately upgradient (east) of Dam #1. Dam #1 is the closest dam to Goose

Lake. In general, the COPC exceedances in drainage ravine soil/sediment samples collected during the RI were only slightly greater than screening levels and/or were consistent with natural background concentrations.

Additional sampling performed in the drainage ravine immediately upgradient of Dam #1 in 2008 (Floyd|Snider, 2009; Appendix E) identified slight exceedances of soil and sediment screening levels for dioxin in one sample obtained from approximately 0.5 feet bgs. This sample (SH-DR-06) was obtained from a location approximately 300 feet northeast of RI sampling location SED-09. The dioxin TEQs calculated for the samples collected in 2008 (using human/mammal TEFs) are within the range of typical background values for forest and/or open areas in western Washington (Floyd|Snider, 2009). PCBs were not detected in any of the soil samples collected in the drainage ravine in 2008.

10.4.3 Fish

The primary intent of the fish sampling and analysis was to document the concentrations of COPCs in the tissue of the Goose Lake fish species most likely to be consumed by humans or wildlife. Several metals, PCBs, and dioxins were detected in the fish tissue samples analyzed during the RI. The detected concentrations of mercury, PCBs, and dioxins in the Goose Lake fish tissue samples are less than, or within the range of, mean concentrations of these constituents detected in fish tissue samples collected from 19 western Washington lakes and rivers in 2004-2005 (Seiders et al., 2007).

It was originally intended that the analytical results for fish tissue samples would be compared to tissue residue-based lowest observable effect concentrations. However, due to uncertainty associated with the small number of fish (four) captured for tissue analysis, and also because Washington State draft freshwater sediment quality values became available after the RI work plan was published (Ecology, 2003), the fish tissue data were not compared to numerical screening criteria. This is appropriate because the Ecology (2003) freshwater sediment quality values provide conservative screening criteria that can be used to directly assess potential risks to aquatic life from COPCs present in sediment. Direct comparison of sediment data to these conservative screening criteria provides a more robust means of assessing potential risks to aquatic life associated with Goose Lake sediment than inferences drawn from a limited screening evaluation of four fish samples. Accordingly, the fish tissue analytical data presented in this RI are provided for information only, without comparison to numerical screening criteria. Potential risks to fish, as well as associated risks to wildlife and humans from fish consumption, were assessed by comparing the sediment and surface water analytical data to the screening levels developed for these media.

10.5 Other Areas

Dioxins, metals (chromium, copper, lead, mercury, and zinc), and/or PCBs were detected at concentrations exceeding soil and/or sediment screening levels in the soil and soil/sediment samples obtained from areas outside of the inactive landfill boundary, the former disposal lagoon area, and locations immediately upgradient of the earthen dams in the drainage ravine.

- Dioxins: Two samples of shallow soil and soil/sediment obtained in 2002 at locations S-4 and S-5 contained dioxins at concentrations slightly exceeding RI sediment screening levels protective of ecological receptors (location S-4) or the RI soil screening level protective of human health (location S-5). The dioxin TEQs in these samples (calculated using TEFs for humans/mammals) are within the range of typical background values published in Ecology (1999) for forest and/or open areas in western Washington.

- Metals: Sample S2-1, obtained from a depth of 1 foot bgs, contained zinc at a concentration that exceeds the RI soil screening level. Samples obtained from 5 feet, 7.5 feet, 15 feet, and 20 feet bgs in boring MW-18 contained chromium, copper, lead, and/or mercury at concentrations exceeding the RI soil screening levels.
- PCBs: The concentration of total PCBs detected in sample MW-18-7.5 slightly exceeds the RI soil screening level.

10.6 Areal and Vertical Extent of Contamination

The primary areas and depths of soil and sediment impacts that exceed RI screening levels and will likely require future cleanup action are shown in Figure 39. The impacted areas and depths include:

- Inactive landfill soil and sediment (approximate depth = 20 feet bgs) – COPCs exceeding RI screening levels include metals (antimony, arsenic, chromium, copper, lead, mercury, nickel, and zinc), PCBs, cPAHs, SVOCs (acenaphthylene, bis[2-ethylhexyl]phthalate, and dibenzofuran), dioxins, and sulfide.
- Goose Lake surface sediments/surficial black silt (approximate depth = 3 inches) – COPCs exceeding RI screening levels include mercury, PCBs, dioxins, and sulfide.
- Soil/sediment in drainage ravine immediately east of Dam #1 (approximate depth = 0.5 feet bgs) – COPCs exceeding RI screening levels include metals (copper and mercury), PCBs, and dioxins.

The groundwater monitoring results for the Site suggest that the low concentrations of metals and dioxins detected in groundwater reflect natural or area background conditions rather than impacts from historical waste disposal activities. The low-level detections of a single PCB Aroclor in monitoring wells MW-16 and MW-17 near the lake/landfill margin in November/December 2010 also may not be indicative of impacts from historical waste disposal. Additional groundwater sampling for PCBs in wells MW-16 and MW-17 would be needed to assess whether these detections are repeatable or whether they are an isolated, anomalous result.

11.0 REFERENCES

California Environmental Protection Agency (Cal-EPA). 2005. Air Toxics Hot Spots Program Risk Assessment Guidelines, Part II – Technical Support Document for Describing Available Cancer Potency Factors.

Fisher, J.P. 2000. Facilities and Husbandry (Large Fish Models). In: The Lab Fish. Academic Press, London, pp. 13-39.

Floyd|Snider. 2009. Remedial Investigation Addendum Report – Additional Sampling Program, Drainage Ravine and Former Disposal Lagoons, Goose Lake Project Site. Prepared for Hall Equities Group, January 29, 2009.

GeoEngineers. 2002. Remedial Investigation Work Plan, Goose Lake Site, Shelton, Washington.

GeoEngineers. 2003. Supplemental Sampling, Remedial Investigation, Goose Lake Site, Shelton, Washington.

GeoEngineers. 2008. Supplemental Sediment Sampling, Goose Lake Site, Shelton, Washington. Letter report prepared for Rayonier Inc., January 14, 2008.

GeoEngineers. 2009a. Draft Final Remedial Investigation Report, Goose Lake Site, Shelton, Washington. May 8, 2009.

GeoEngineers. 2009b. Revised Draft Remedial Investigation/Feasibility Study Report, Irondale Iron and Steel Plant, Irondale, Washington. Ecology Facility/Site No. 95275518. August 13, 2009.

GeoEngineers. 2010. Proposed Technical Approach to Complete Remedial Investigation, Goose Lake Site, Shelton, Washington. September 3, 2010.

GeoEngineers. 2011a. Supplemental Investigation Technical Memorandum, Goose Lake Site, Shelton, Washington. April 11, 2011.

GeoEngineers. 2011b. Hydrogeologic and Geotechnical Services, Proposed Infiltration Pond System, West Wallace-Kneeland Boulevard Interchange Project, Shelton, Washington, MP 343.44 to 346.52. Prepared for Hall Equities Group, June 9, 2011.

Kleinfelder. 2006. Limited Environmental Assessment and Phase II Groundwater Characterization, Proposed 672-Acres Mixed-Use Development, Southwest of Highway 101 and West Wallace-Kneeland Blvd., Shelton, Washington. Letter report prepared for Hall Equities Group, January 26, 2006.

Kleinfelder West., 2008. Preliminary Geotechnical and Stormwater Infiltration Evaluation, Proposed Shelton Hills Mix-Use Development, Shelton, Washington. Prepared for Hall Equities, April 15, 2008.

Logan, Robert L. 2003. Geologic Map of the Shelton 1:100,000 Quadrangle, Washington. Washington Dept of Natural Resources OFR 2003-15 (http://www.dnr.wa.gov/Publications/ger_ofr2003-15_geol_map_shelton_100k.pdf).

Pacific Environmental Group (PEG). 1998. Environmental Investigation Report, Rayonier Inc., Goose Lake, Shelton, Washington.

Pacific Rim Soil & Water (PRSW). 2009. Evaluation of Goose Lake Organic Matter and Geomorphic History, Goose Lake Area, Shelton, Washington. Prepared for Floyd|Snider, February 27, 2009.

Palazzi, Lisa (PRSW) and Jessi Massingale (Floyd|Snider). 2011. Email communication with Zanna Satterwhite re: PRSW field notes and photographs. January 10, 2011.

Rigg, G.B. 1958. Peat Deposits in Mason County. In: Peat Resources of Washington. Washington Division of Mines and Geology Bulletin 44, pp. 110-121, 1958. (http://www.dnr.wa.gov/Publications/ger_b44_peat_reasources_wa_2.pdf).

Sample, B.E., J.J. Beauchamp, R.A. Efroymson, G.W. Suter, II, and T.L. Ashwood. 1998. Development and Validation of Bioaccumulation Models for Earthworms. Oak Ridge National Laboratory ES/ER/TM-220. Lockheed Martin Energy Systems Environmental Restoration Program.

Sample, B.E., J.J. Beauchamp, R.A. Efroymson, and G.W. Suter, II. 1999. Literature-Derived Bioaccumulation Models for Earthworms: Development and Validation. Environmental Toxicology and Chemistry, 18: 2110-2120.

Science Applications International Corporation (SAIC). 1997. Final Sediment, Soil, and Groundwater Investigation Report, Goose Lake, Shelton, Washington.

Seiders, K., C. Deligeannis, and P. Sandvik. 2007. Washington State Toxics Monitoring Program: Contaminants in Fish Tissue from Freshwater Environments in 2004 and 2005. Washington State Department of Ecology, Olympia, WA. Publication No. 07-03-024.

United States Department of Agriculture (USDA). 1960. Soil Survey of Mason County, Washington.

United States Environmental Protection Agency (USEPA). 1983. Methods for Chemical Analysis of Water and Wastes.

USEPA. 1986. Test Methods for Evaluating Solid Waste, SW-846, 3rd Edition.

USEPA. 1993. Interim Report on the Data and Methods for Assessment of 2,3,7,8-Tetrachlorodibenzo-p-dioxin Risks to Aquatic Life and Associated Wildlife. EPA/600/R-93/055.

USEPA. 1994. National Functional Guidelines for Inorganic Data Review.

USEPA. 1999. National Functional Guidelines for Organic Data Review.

USEPA. 2003. Framework for Application of the Toxicity Equivalence Methodology for Polychlorinated Dioxins, Furans, and Biphenyls in Ecological Risk Assessment.

USEPA.. 2005a. Guidance for Developing Ecological Soil Screening Levels. OSWER Directive 9285.7-55. November 2003, Revised February 2005.

USEPA. 2005b. Ecological Soil Screening Levels for Arsenic, Interim Final. OSWER Directive 9285.7-62. March 2005.

USEPA. 2005c. Ecological Soil Screening Levels for Cadmium, Interim Final. OSWER Directive 9285.7-65. March 2005.

USEPA. 2005d. Ecological Soil Screening Levels for Lead, Interim Final. OSWER Directive 9285.7-70. March 2005.

USEPA. 2007a. Ecological Soil Screening Levels for Copper, Interim Final. OSWER Directive 9285.7-68. July 2006, Revised February 2007.

USEPA. 2007b. Ecological Soil Screening Levels for Nickel, Interim Final. OSWER Directive 9285.7-76. March 2005.

USEPA. 2007c. Ecological Soil Screening Levels for Zinc, Interim Final. OSWER Directive 9285.7-73. June 2007.

USEPA. 2008. Ecological Soil Screening Levels for Chromium, Interim Final. OSWER Directive 9285.7-66. March 2005, Revised April 2008.

Van den Berg et al. 2006. The 2005 World Health Organization Reevaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds. Toxicological Sciences 2006 93(2):223-241; doi:10.1093/toxsci/kfl055.

Washington State Department of Ecology (Ecology). 1994. Natural Background Soil Metals Concentrations in Washington State. October 1994.

Ecology. 1999. Screening Survey for Metals and Dioxins in Fertilizer Products and Soils in Washington State. Publication No. 99-309.

Ecology. 2003. Development of Freshwater Sediment Quality Values for Use in Washington State, Phase II Report: Development and Recommendation of SQVs for Freshwater Sediments in Washington State, September 2003, Publication No. 03-09-088.

Ecology. 2007. Model Toxics Control Act (MTCA) Cleanup Regulation, Chapter 173-340 WAC. Updated November 2007.

Ecology. 2008a. DRAFT Revised Amendment No. 1 to Agreed Order No. DE 99TC-S260 between Rayonier Properties, LLC and Shelton Hills Investors, LLC. February 2008.

Ecology. 2008b. Sediment Sampling and Analysis Plan Appendix (SAPA). Guidance on the Development of Sediment Sampling and Analysis Plans Meeting the Requirements of the Sediment Management Standards (Chapter 173-204 WAC). Ecology Publication No. 03-09-043. February 2008.

Ecology. 2010. Natural Background for Dioxins/Furans in WA Soils, Technical Memorandum #8. Publication No. 10-09-053. August 9, 2010.

Ecology. 2012a. Letter from Ms. Connie Groven to Mr. Warren Snyder, Rayonier Inc. re: Response to Questions Related to Ecology's Goose Lake Supplemental Investigation Technical Memorandum Comments, March 21, 2012.

Ecology. 2012b. Cleanup Levels and Risk Calculations (CLARC) Website. Accessed June 2012.

Washington State Department of Natural Resources. 1987. Geologic Map of the South Half of the Shelton and South Half of the Copalis Beach Quadrangles, Washington.

Washington State Department of Water Resources. 1970. Geology and Related Ground-Water Occurrence, Southeastern Mason County, Washington (Water Supply Bulletin No. 29).

TABLES

GeoEngineers

TABLE 1
SUMMARY OF SAMPLING METHODOLOGY
FISH AND SURFACE WATER
GOOSE LAKE SITE
SHELTON, WASHINGTON

Date	Start	Finish	Activity	Result
6/6/2002	11:30	14:00	Set bait lines with power bait	
6/6/2002	15:00	17:00	2 beach seines	
6/6/2002	18:00	18:30	Check bait lines	No fish, inoculate bait with power-scent
6/7/2002	9:00	9:10	Check bait line 1	No fish, rebait with rubber worms, minnows and inoculate bait with power-scent
6/7/2002	9:30	9:40	Check bait line 2	No fish, rebait with rubber worms, minnows and inoculate bait with power-scent
6/7/2002	14:00	14:10	Check bait line 1	No fish, inoculate bait with power-scent
6/7/2002	14:15	14:25	Check bait line 2	No fish, inoculate bait with power-scent
6/10/2002	13:30	13:40	Check bait line 1and rebait	No fish, inoculate bait with power-scent
6/10/2002	14:00	14:10	Check bait line 2 and rebait	No fish, inoculate bait with power-scent
6/10/2002	13:30	13:50	Set gillnet 1(south) off dead-head cove (parallel)	West end = WP 052: N 47 13'48.0" W 123 08'11.5" East end = WP 053: N 47 13'48.8" W 123 08'08.7"
6/10/2002	15:00	15:20	Set gillnet 2 (north)	West end = WP 055: N 47 13'52.2" W 123 08'06.5" East end = WP 056: N 47 13'52.8" W 123 08'03.8"
6/10/2002	16:00	16:30	Beach seine in east cove (too slow)	Larval fish entrained, no adult fish, excessive algae slows seine rate, sample put in 10% non-buffered formalin
6/11/2002	11:25	11:38	Moved bait line 1 (south) closer to shore	West end = WP 049: N 47 13'46.5" W 123 08'10.4" East end = WP 050: N 47 13'46.5" W 123 08'09.6"
6/11/2002	11:40	11:50	Check bait line 1 (south) and rebait	No fish, inoculate bait with power-scent
6/11/2002	12:05	12:16	WQ sampling for bait line 1 (south) for conventional parameters	WP 051: N 47 13'46.3" W123 08'09.9" see spreadsheet
6/11/2002	12:23	13:00	Check gillnet 1 (south)	No fish
6/11/2002	13:02	13:12	WQ sampling for gill net 1 (south) for conventional parameters	WP 054: N 47 13'48.1" W 123 08'09.7" see spreadsheet
6/11/2002	13:50	14:38	WQ sampling at SW-1 for conventional parameters	See spreadsheet
6/11/2002	14:00	14:22	Check gill net 2 (north)	Bass (fish 1) caught live at 14:15 (first 1/4 net from W end) and put in live box

Date	Start	Finish	Activity	Result
6/11/2002	14:24	14:32	Check bait line 2 and rebait	No fish, inoculate bait with power-scent
6/11/2002	14:50	14:58	WQ sampling for bait line 2 (north) for conventional parameters	WP 058: N 47 13'55.1" W 123 08'07.2" see spreadsheet
6/11/2002	15:00	15:03	WQ sampling at SW-2 for conventional parameters	See spreadsheet
6/11/2002	15:05	15:22	WQ sampling for gill net 2 (north) for conventional parameters	WP 059: N 47 13'52.8" W 123 08'05.6" see spreadsheet
6/11/2002	15:26	15:36	WQ sampling at SW-3 for conventional parameters	See spreadsheet
6/12/2002	9:54	10:05	Check bait line 1 (south) and rebait with live worms	Newt (1) caught live at 9:58 (midline) and put in live box
6/12/2002	10:10	10:21	Check gillnet 1 (south)	No fish
6/12/2002	10:25	10:35	Check gillnet 2 (north)	No fish
6/12/2002	10:38	10:48	Check bait line 2 (north) and rebait with live worms	No fish
6/12/2002	10:55	11:18	Remove and reset bait line 2 (north) in east cove	South end = WP 104: N 47 13'49.4" W 123 07'57.3" North end = WP 103: N 47 13'49.7" W 123 07"57.5"
6/12/2002	11:38	12:07	Remove and reset gillnet 2 (north) in east cove	
6/12/2002	17:00	18:00	Exam fish 1 and put on ice	Tissues archived frozen
6/12/2002	17:00		Newt 1 put on ice	Archived frozen
6/13/2002	13:55	14:05	Check gill net 1 (south)	No fish
6/13/2002	13:45	13:51	Check bait line 1 (south) and rebait	Newt (2) caught live at 13:48 (midline) and put in live box
6/13/2002	14:08	14:18	Check gill net 2 (east cove)	No fish
6/13/2002	14:20	14:25	Check bait line 2 (east cove) and rebait	No fish
6/13/2002	16:00		Newt 2 put on ice	Archived frozen
6/14/2002	13:10	13:22	Check bait line 1 (south) and rebait	Newts (3 and 4) caught live at 13:15 and 13:17 (midline) and put in live box
6/14/2002	13:26	13:37	Check gill net 1 (south)	5 newts seen, but escape
6/14/2002	13:41	13:51	Check gill net 2 (east cove)	No fish
6/14/2002	13:52	14:04	Check bait line 2 (east cove) and rebait	Bass (fish 2) caught live at 13:55 (south end)
6/14/2002	15:00		Newt 3 and 4 put on ice	Archived frozen
6/14/2002	17:00	18:00	Exam fish 2 and put on ice	Tissues archived frozen

Date	Start	Finish	Activity	Result
6/17/2002	9:38	9:42	Check bait line 1 (south) and rebait	Newts (5 and 6) caught live at 9:40 and dead at 9:42 (midline) and put in live box
6/17/2002	9:44	10:03	Check gill net 1 (south)	Newt (7) caught live at 9:48 (midline) and put in live box, others seen but escape
6/17/2002	10:06	10:16	Check bait line 2 (east cove) and rebait	Bass caught live (fish 3) at 10:08 (midline) and dead (fish 4) at 10:11 (midline) and put into live box
6/17/2002	10:18	10:22	Move south side of gill net 2 (east cove) about 20ft west	South side = WP 105: N 47 13'48.7" W 123 07'59.2"
6/17/2002	10:23	10:34	Check gill net 2 (east cove)	No fish
6/17/2002	10:36	10:50	Move north side of gillnet 2 (east cove) about 30ft east	North side = WP 106: N 47 13'50.6" W 123 07'59.5"
6/17/2002	12:00		Newt 5, 6 and 7 put on ice	Archived frozen
6/17/2002	17:00	18:00	Exam fish 3 and put on ice	Tissues archived frozen
6/18/2002	13:12	13:22	Remove and check bait line 1 (south)	Newt (8) caught live at 13:15 (midline) and put in live box
6/18/2002	13:25	13:36	Remove and check gillnet 1 (south)	No fish
6/18/2002	13:56	14:00	Remove and check bait line 2 (east cove)	No fish
6/18/2002	14:03	14:12	Remove and check gillnet 2 (east cove)	No fish
6/18/2002	16:00		Newt 8 put on ice	Archived frozen
6/18/2002	17:00	18:00	Exam fish 4	Tissues archived frozen

TABLE 2
SUMMARY OF ANALYTICAL TESTING PROGRAM
GOOSE LAKE SITE
SHELTON, WASHINGTON

Matrix	Location/Area	Metals	Dioxins/ Furans	PCBs	VOCs	SVOCs	TPH	Sulfide	pH	Ammonia	TOC	Total Solids	ORP	Hardness	Turbidity	Conductivity	Alkalinity
Soil	Inactive Landfill	x	x	x	x	x		x									
	Former Disposal Lagoons	x		x	x			x									
	MW-07 and MW-08	x		x	x	x	x	x									
	S-5 and S-6A		x														
Soil/Sediment	S-2 and S-4		x														
	Drainage Ravine (SED-09 to SED-12)	x	x	x		x		x	x	x	x	x	x				
Groundwater	Monitoring Wells	x		x				x									
Surface Water	Goose Lake	x		x				x	x					x	x	x	x
Sediment	Goose Lake	x	x	x		x		x	x	x	x	x	x				
Fish Tissue	Goose Lake	x	x	x													

Notes:

PCBs = Polychlorinated biphenyls
SVOCs = Semivolatile organic compounds
VOCs = Volatile organic compounds
TPH = Total petroleum hydrocarbons
TOC = Total organic carbon
ORP = Oxidation-reduction potential
Metals analyzed include chromium, copper, arsenic, lead, hexavalent chromium, mercury, cadmium, antimony, nickel, silver, and/or zinc.
This table includes only the 2002-2003 RI analytical testing program; it does not include previous or subsequent studies

Table 3

Soil Screening Levels

Goose Lake Site
Shelton, Washington

Analyte	MTCA Method B Formula Value - Human Health Protection (a)	MTCA Method B (Soil Protective of Groundwater as Surface Water) (Saturated/Unsaturated)(b)	MTCA Method B (Soil Protective of Groundwater as Drinking Water) (Saturated/Unsaturated)(b)	Ecological Indicator Concentration (c)	Natural Background Concentration	Lab (ARI) PQL (d)	Soil Screening Level (Near or Upgradient of Local Surface Water Body) (Saturated/Unsaturated) (e)	Soil Screening Level (Not Near or Upgradient of Local Surface Water Body) (Saturated/Unsaturated) (e)
Conventionals (mg/kg)								
Ammonia	--	--	--	--	--	--	--	--
Oxidation-Reduction Potential (ORP)	--	--	--	--	--	--	--	--
pH	--	--	--	--	--	--	--	--
Sulfide	--	--	--	--	--	--	--	--
Total Organic Carbon (%)	--	--	--	--	--	--	--	--
Dioxins and Furans (ng/kg)								
2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN (TCDD)	11	0.0012/0.025	7.5/150	20 (o)	–	–	*see TEQ*	*see TEQ*
TOTAL DIOXINS/FURANS - HUMAN HEALTH TEQ	11 (f)	0.0012/0.025 (f)	7.5/150	–	5.2 (g)	0.57	5.2	7.5/11
TOTAL DIOXINS - ECOLOGICAL TEQ (mammals)	–	–	–	20 (o)	4.0 (g)	–	20	20
TOTAL DIOXINS - ECOLOGICAL TEQ (birds)	–	–	–	20 (o)	2.8 (g)	–	20	20
TOTAL FURANS - ECOLOGICAL TEQ (mammals)	–	–	–	20 (o)	1.2 (g)	–	20	20
TOTAL FURANS - ECOLOGICAL TEQ (birds)	–	–	–	20 (o)	3.9 (g)	–	20	20
Metals (mg/kg)								
ANTIMONY	32	–	–	5 (n)	5 (h)	0.2	5	5
ARSENIC	0.67	0.15/2.9	0.15/2.9	18 (o)	20 (m)	0.2	20	20
CADMIUM	80	–	–	14 (o)	1 (i)	0.2	14	14
TRIVALENT CHROMIUM	120,000	–	–	–	–	2	120,000	120,000
HEXAVALENT CHROMIUM	240	–	–	–	–	5	240	240
TOTAL CHROMIUM	–	57/1,100 (p)	100/2,000	42 (n)	48 (i)	2	48	48
COPPER	2,960	0.078/1.6	13/260	70 (o)	36 (i)	0.2	36	36/70
LEAD	250 (j)	5.4/110	150/3,000	120 (o)	24 (i)	1	24/110	120
MERCURY	24	0.00063/0.013	0.1/2.1	0.1 (n)	0.07 (i)	0.02	0.07	0.1
NICKEL	1,600	–	–	38 (o)	48 (i)	0.5	48	48
SILVER	400	–	–	560 (o)	0.61 (h)	0.2	400	400
ZINC	24,000	–	–	120 (o)	85 (i)	1	120	120
TPH (mg/kg)								
GASOLINE-RANGE	100/30 (j)(k)	–	–	100 (n)	–	5	100	100
DIESEL-RANGE	2,000 (j)	–	–	200 (n)	–	5	200	200
MOTOR OIL-RANGE	2,000 (j)	–	–	–	–	10	2,000 (j)	2,000 (j)
PCBs (µg/kg)								
AROCLOR-1016	5,600	–	–	–	–	4	5,600	5,600
AROCLOR-1221	–	–	–	–	–	4	–	–
AROCLOR-1232	–	–	–	–	–	4	–	–
AROCLOR-1242	–	–	–	–	–	4	–	–
AROCLOR-1248	–	–	–	–	–	4	–	–
AROCLOR-1254	1,600	– (l)	– (l)	–	–	4	1,600 (l)	1,600 (l)
AROCLOR-1260	–	–	–	–	–	4	–	–
TOTAL PCBs	500	0.0199/0.397	13.7/273	650 (n)	–	4	4	13.7/273
SVOCs (µg/kg)								
ACENAPHTHENE	4,800,000	–	–	20,000 (n)	–	5	20,000	20,000
ACENAPHTHYLENE	–	–	–	–	–	5	–	–
ANILINE	180,000	–	–	–	–	20	180,000	180,000
ANTHRACENE	24,000,000	–	–	–	–	5	24,000,000	24,000,000
AZOBENZENE	9,100	–	–		–	20	9,100	9,100
BENZIDINE	4.3	–	–	–	–	200	200	200
BENZO(G,H,I)PERYLENE	–	–	–	–	–	5	–	–

Analyte	MTCA Method B Formula Value - Human Health Protection (a)	MTCA Method B (Soil Protective of Groundwater as Surface Water) (Saturated/Unsaturated)(b)	MTCA Method B (Soil Protective of Groundwater as Drinking Water) (Saturated/Unsaturated)(b)	Ecological Indicator Concentration (c)	Natural Background Concentration	Lab (ARI) PQL (d)	Soil Screening Level (Near or Upgradient of Local Surface Water Body) (Saturated/Unsaturated) (e)	Soil Screening Level (Not Near or Upgradient of Local Surface Water Body) (Saturated/Unsaturated) (e)
BENZOIC ACID	320,000,000	--	--	--	--	200	320,000,000	320,000,000
BENZYL ALCOHOL	24,000,000	--	--	--	--	20	24,000,000	24,000,000
BENZYL BUTYL PHTHALATE	16,000,000	--	--	--	--	20	16,000,000	16,000,000
BIS(2-CHLOROETHOXY)METHANE	--	--	--	--	--	20	--	--
BIS(2-CHLOROETHYL)ETHER	910	--	--	--	--	20	910	910
BIS(2-CHLOROISOPROPYL)ETHER	3,200,000	--	--	--	--	20	3,200,000	3,200,000
BIS(2-ETHYLHEXYL)ETHER	--	--	--	--	--	--	--	--
BIS(2-ETHYLHEXYL)PHTHALATE	71,000	--	--	--	--	20	71,000	71,000
BROMOPHENYL PHENYL ETHER; 4-	--	--	--	--	--	20	--	--
CARBAZOLE	50,000	--	--	--	--	20	50,000	50,000
CHLORO-3-METHYLPHENOL; 4-	--	--	--	--	--	100	--	--
CHLOROANILINE; P-	320,000	--	--	--	--	100	320,000	320,000
CHLORONAPHTHALENE; 2-	6,400,000	--	--	--	--	20	6,400,000	6,400,000
CHLOROPHENOL; 2-	400,000	--	--	--	--	20	400,000	400,000
CHLOROPHENYL METHYL SULFONE; 4-	--	--	--	--	--	--	--	--
CHLOROPHENYL PHENYL ETHER; 4-	--	--	--	--	--	20	--	--
CRESOL; M,P- (4-METHYLPHENOL)	400,000	--	--	--	--	20	400,000	400,000
CYCLOHEXANONE	400,000,000	--	--	--	--	--	400,000,000	400,000,000
DIBENZOFURAN	160,000	--	--	--	--	5	160,000	160,000
DICHLOROBENZENE; 1,2-	7,200,000	--	--	--	--	20	7,200,000	7,200,000
DICHLOROBENZENE; 1,3-	--	--	--	--	--	20	--	--
DICHLOROBENZENE; 1,4-	42,000	--	--	20,000 (n)	--	20	20,000	20,000
DICHLOROBENZIDINE; 3,3-	2,200	--	--	--	--	100	2,200	2,200
DICHLOROPHENOL; 2,4-	240,000	--	--	--	--	100	240,000	240,000
DICHLOROPHENOL; 2,6-	--	--	--	--	--	--	--	--
DIETHYL PHTHALATE	64,000,000	--	--	100,000 (n)	--	20	100,000	100,000
DIMETHYL PHTHALATE	80,000,000	--	--	200,000 (n)	--	20	200,000	200,000
DIMETHYLPHENOL; 2,4-	1,600,000	--	--	--	--	20	1,600,000	1,600,000
DI-N-BUTYLPHTHALATE	8,000,000	--	--	200,000 (n)	--	20	200,000	200,000
DINITRO-2-METHYLPHENOL; 4,6-	--	--	--	--	--	200	--	--
DINITROPHENOL; 2,4-	160,000	--	--	20,000 (n)	--	200	20,000	20,000
DINITROTOLUENE; 2,4-	160,000	--	--	--	--	100	160,000	160,000
DINITROTOLUENE; 2,6-	80,000	--	--	--	--	100	80,000	80,000
DI-N-OCTYLPHTHALATE	1,600,000	--	--	--	--	20	1,600,000	1,600,000
DIPHENYLHYDRAZINE; 1,2-	1,300	--	--	--	--	20	1,300	1,300
FLUORANTHENE	3,200,000	--	--	--	--	5	3,200,000	3,200,000
FLUORENE	3,200,000	--	--	30,000 (n)	--	5	30,000	30,000
HEXACHLORO-1,3-BUTADIENE	13,000	--	--	--	--	20	13,000	13,000
HEXACHLOROBENZENE	630	--	--	--	--	20	630	630
HEXACHLOROCYCLOPENTADIENE	480,000	--	--	10,000 (n)	--	100	10,000	10,000
HEXACHLOROETHANE	71,000	--	--	--	--	20	71,000	71,000
METHANAMINE, N-METHYL-N-NITROSO (N-NITROSODIMETHYLAMINE)	--	--	--	--	--	100	--	--
METHYLNAPHTHALENE; 2-	320,000	--	--	--	--	5	320,000	320,000
METHYLPHENOL; 2- /CRESOL; O-	4,000,000	--	--	--	--	20	4,000,000	4,000,000
NITROANILINE; 2-	--	--	--	--	--	100	--	--
NITROANILINE; 3-	--	--	--	--	--	100	--	--
NITROANILINE; P-	--	--	--	--	--	100	--	--
NITROPHENOL; 2-	--	--	--	--	--	20	--	--
NITROPHENOL; 4-	--	--	--	7,000 (n)	--	100	7,000	7,000
NITROSO-DI-N-PROPYLAMINE; N-	140	--	--	--	--	100	140	140
NITROSODIPHENYLAMINE; N-	200,000	--	--	20,000 (n)	--	20	20,000	20,000
PENTACHLOROPHENOL	8,300	--	--	--	--	6.25	8,300	8,300
PHENANTHRENE	--	--	--	--	--	5	--	--

Analyte	MTCA Method B Formula Value - Human Health Protection (a)	MTCA Method B (Soil Protective of Groundwater as Surface Water) (Saturated/Unsaturated)(b)	MTCA Method B (Soil Protective of Groundwater as Drinking Water) (Saturated/Unsaturated)(b)	Ecological Indicator Concentration (c)	Natural Background Concentration	Lab (ARI) PQL (d)	Soil Screening Level (Near or Upgradient of Local Surface Water Body) (Saturated/Unsaturated) (e)	Soil Screening Level (Not Near or Upgradient of Local Surface Water Body) (Saturated/Unsaturated) (e)
PHENOL	48,000,000	–	–	30,000 (n)	–	20	30,000	30,000
PYRENE	2,400,000	–	–	–	–	5	2,400,000	2,400,000
PYRIDINE	80,000	–	–	–	–	100	80,000	80,000
TETRACHLOROPHENOL; 2,3,4,6-	2,400,000	–	–	–	–	20	2,400,000	2,400,000
TRIBROMOPHENOL; 2,4,6-	–	–	–	–	–	–	–	–
TRICHLOROPHENOL; 2,4,5-	8,000,000	–	–	4,000 (n)	–	100	4,000	4,000
TRICHLOROPHENOL; 2,4,6-	91,000	–	–	10,000 (n)	–	6.25	10,000	10,000
TRIMETHYL-2-CYCLOHEXENE-1-ONE; 3,5,5-/ISOPHORONE	1,100,000	–	–	–	–	20	1,100,000	1,100,000
cPAHs (µg/kg)								
BENZO(A)PYRENE (cPAH)	140	–	–	12,000 (n)	–	5	*see TEQ*	*see TEQ*
TOTAL cPAHs TEQ	140	–	–	–	–	5	140	140
VOCs (µg/kg)								
BENZENE	18,000	–	–	–	–	1	18,000	18,000
BENZENE, (1,1-DIMETHYLETHYL)- (TERT-BUTYLBENZENE)	–	–	–	–	–	1	–	–
BROMOBENZENE	–	–	–	–	–	1	–	–
BROMODICHLOROMETHANE	16,000	–	–	–	–	1	16,000	16,000
BROMOMETHANE	110,000	–	–	–	–	1	110,000	110,000
BUTYLBENZENE; N-	–	–	–	–	–	1	–	–
CARBON TETRACHLORIDE	7,700	–	–	–	–	1	7,700	7,700
TRICHLOROFLUOROMETHANE (CFC-11)	24,000,000	–	–	–	–	1	24,000,000	24,000,000
DICHLORODIFLUOROMETHANE (CFC-12)	16,000,000	–	–	–	–	1	16,000,000	16,000,000
CHLOROBENZENE	1,600,000	–	–	40,000 (n)	–	1	40,000	40,000
CHLOROBROMOMETHANE	–	–	–	–	–	1	–	–
CHLORODIBROMOMETHANE (DIBROMOCHLOROMETHANE)	12,000	–	–	–	–	1	12,000	12,000
CHLOROETHANE (ETHYL CHLORIDE)	350,000	–	–	–	–	1	350,000	350,000
CHLOROFORM	160,000	–	–	–	–	1	160,000	160,000
CHLOROMETHANE	77,000	–	–	–	–	1	77,000	77,000
CHLOROTOLUENE; 2-	–	–	–	–	–	1	–	–
CHLOROTOLUENE; 4-	–	–	–	–	–	1	–	–
CIS-1,2-DICHLOROETHENE	800,000	–	–	–	–	1	800,000	800,000
CIS-1,3-DICHLOROPROPENE	–	–	–	–	–	1	–	–
ISOPROPYLBENZENE (CUMENE)	8,000,000	–	–	–	–	1	8,000,000	8,000,000
CYMENE	–	–	–	–	–	–	–	–
DIBROMO-3-CHLOROPROPANE (DBCP); 1,2-	710	–	–	–	–	5	710	710
DIBROMOMETHANE (METHYLENE BROMIDE)	800,000	–	–	–	–	1	800,000	800,000
DICHLOROETHANE; 1,1-	16,000,000	–	–	–	–	1	16,000,000	16,000,000
DICHLOROETHANE; 1,2-	11,000	–	–	–	–	1	11,000	11,000
DICHLOROETHYLENE; 1,1-	4,000,000	–	–	–	–	1	4,000,000	4,000,000
DICHLOROMETHANE (METHYLENE CHLORIDE)	130,000	–	–	–	–	2	130,000	130,000
DICHLOROPROPANE; 1,2-	15,000	–	–	700,000 (n)	–	1	15,000	15,000
DICHLOROPROPANE; 1,3-	–	–	–	–	–	1	–	–
DICHLOROPROPANE; 2,2-	–	–	–	–	–	1	–	–
DICHLOROPROPENE; 1,1-	–	–	–	–	–	1	–	–
ETHYLENE DIBROMIDE (1,2-DIBROMOETHANE)(EDB)	12	–	–	–	–	1	12	12
NAPHTHALENES	1,600,000	–	–	–	–	5	1,600,000	1,600,000
PHENYLBUTANE; 2- (sec-butylbenzene)	–	–	–	–	–	1	–	–
PROPYLBENZENE; N-	–	–	–	–	–	1	–	–
STYRENE (MONOMER)	33,000	–	–	300,000 (n)	–	1	33,000	33,000
TETRACHLOROETHANE; 1,1,1,2-	38,000	–	–	–	–	1	38,000	38,000
TETRACHLOROETHANE; 1,1,2,2-	5,000	–	–	–	–	1	5,000	5,000
TETRACHLOROETHENE	1,900	–	–	–	–	1	1,900	1,900
TOLUENE	6,400,000	–	–	200,000 (n)	–	1	200,000	200,000
TOTAL XYLENES	16,000,000	–	–	–	–	1	16,000,000	16,000,000

Analyte	MTCA Method B Formula Value - Human Health Protection (a)	MTCA Method B (Soil Protective of Groundwater as Surface Water) (Saturated/Unsaturated)(b)	MTCA Method B (Soil Protective of Groundwater as Drinking Water) (Saturated/Unsaturated)(b)	Ecological Indicator Concentration (c)	Natural Background Concentration	Lab (ARI) PQL (d)	Soil Screening Level (Near or Upgradient of Local Surface Water Body) (Saturated/Unsaturated) (e)	Soil Screening Level (Not Near or Upgradient of Local Surface Water Body) (Saturated/Unsaturated) (e)
TRANS-1,2-DICHLOROETHENE	1,600,000	--	--	--	--	1	1,600,000	1,600,000
TRANS-1,3-DICHLOROPROPENE	--	--	--	--	--	1	--	--
TRIBROMOMETHANE (BROMOFORM)	130,000	--	--	--	--	1	130,000	130,000
TRICHLOROBENZENE; 1,2,3-	--	--	--	20,000 (n)	--	5	20,000	20,000
TRICHLOROBENZENE; 1,2,4-	800,000	--	--	20,000 (n)	--	5	20,000	20,000
TRICHLOROETHANE; 1,1,1-	72,000,000	--	--	--	--	1	72,000,000	72,000,000
TRICHLOROETHANE; 1,1,2-	18,000	--	--	--	--	1	18,000	18,000
TRICHLOROETHYLENE	11,000	--	--	--	--	1	11,000	11,000
TRICHLOROPROPANE; 1,2,3-	140	--	--	--	--	2	140	140
TRIMETHYLBENZENE; 1,2,4-	4,000,000	--	--	--	--	1	4,000,000	4,000,000
TRIMETHYLBENZENE; 1,3,5-	4,000,000	--	--	--	--	1	4,000,000	4,000,000
VINYL CHLORIDE	670	--	--	--	--	1	670	670
XYLENE; O-	160,000,000	--	--	--	--	1	160,000,000	160,000,000
XYLENE; P-, M-	160,000,000	--	--	--	--	1	160,000,000	160,000,000

Notes:

MTCA = Washington State Model Toxics Control Act

MDL = Method detection limit

PQL = Practical quantitation limit

cPAHs = Carcinogenic polycyclic aromatic hydrocarbons

TPH = Total petroleum hydrocarbons

VOCs = Volatile organic compounds

PCBs = Polychlorinated biphenyls

SVOCs = Semivolatile organic compounds

TEQ = Toxicity equivalency quotient

TEF = Toxicity equivalency factor

mg/kg = Milligrams per kilogram

ug/kg = Micrograms per kilogram

ng/kg = Nanograms per kilogram

-- = Not established; no value available; not applicable.

(a) Washington State Department of Ecology Cleanup Levels and Risk Calculations (CLARC) Method B standard formula values (ingestion). Where both carcinogenic and non-carcinogenic values are available, the lower value is used.

(b) MTCA Method B soil concentrations protective of groundwater are shown only for constituents that had exceedances in groundwater. Values were calculated using MTCA fixed parameter three-phase partitioning model.

(c) Ecological indicator soil concentrations based on site-specific terrestrial ecological evaluation (WAC 173-340-7493).

(d) In some cases, the SL is based on the PQL, however, the sample-specific MRL will vary from sample to sample. Any positive detection above the lowest of the screening criteria is considered an exceedance.

(e) Where only a single value is shown, the screening level is the same for saturated and unsaturated soils.

(f) Listed value is for 2,3,7,8-TCDD.

(g) Source: *Final Report, Screening Survey for Metals and Dioxins in Fertilizer Products and Soils in Washington State;* Ecology 1999. Background concentrations were calculated in accordance with Ecology's 2010 Technical Memorandum #8 (Ecology, 2010). Listed value is the lowest of either 4x50th percentile or 90th percentile TEQ (as calculated by MTCAStat97) in 16 samples collected statewide (open and forested samples; urban samples not included). One-half the MDL was assumed for non-detects in the calculations. TEQs were calculated using the 2007 MTCA TEFs (2005 World Health Organization TEFs) for humans and mammals and the 2003 USEPA TEFs for birds.

(h) Source: *Natural Background Soil Metals Concentrations in Washington State;* Ecology 1994. Listed value is the state-wide 90th percentile background value.

(i) Source: *Natural Background Soil Metals Concentrations in Washington State;* Ecology 1994. Listed value is the Puget Sound Basin 90th percentile background value.

(j) MTCA Method B value not established; listed value is the MTCA Method A cleanup level for unrestricted land use; WAC 173-340-900, Table 740-1.

(k) Screening level is 100 mg/kg when benzene is not present and 30 mg/kg when benzene is present. Benzene has been detected in only one soil sample at the Goose Lake site, obtained from the inactive landfill, at a concentration of 0.097 mg/kg.

(l) Aroclor 1254 had exceedances in groundwater; however, MTCA Method B soil concentrations protective of groundwater were not calculated because Koc and S values for Aroclor-1254 are not available in CLARC database.

(m) Regulatory background (MTCA Method A) value.

(n) Default value from MTCA Table 749-3 (WAC 173-340-900); listed value represents the lowest value for plants, soil biota, and wildlife listed in Table 749-3.

(o) Value derived from site-specific terrestrial ecological evaluation - see Section 8.0 of RI report.

(p) Total chromium concentrations protective of groundwater as surface water were calculated using lowest surface water criterion for trivalent chromium, since surface water criteria have not been established for total chromium and hexavalent chromium has not been detected in Site groundwater.

Shaded cells indicate basis for a screening level.

Table 4

Groundwater Screening Levels Protective of Drinking Water Use

Goose Lake Site
Shelton, Washington

Analyte	MTCA Method B Formula Value - Human Health Protection (a)	Federal and State Maximum Contaminant Level (MCL) (40 C.F.R. 141; WAC 246-290)	Lab (ARI/Frontier Global) PQL (f)	Groundwater Screening Level (Protective of Drinking Water Use)
TPH (mg/L)				
KEROSENE-/JET FUEL-RANGE	--	--	0.25	--
DIESEL-/FUEL-OIL-RANGE	0.5 (b)	--	0.25	0.5
HEAVY-OIL RANGE	0.5 (b)	--	0.4	0.5
Conventionals (mg/L)				
SULFIDE	--	--	--	--
Metals (mg/L)				
ANTIMONY	0.0064	0.006	0.0002 (0.00002)	0.006
ARSENIC	0.000058	0.01	0.0002 (0.00001)	0.005 (b)(c)
CADMIUM	0.016	0.005	0.0002 (0.00002)	0.005
TRIVALENT CHROMIUM	24	0.1	0.0005 (0.001)	0.1
HEXAVALENT CHROMIUM	0.048	0.1 (d)	0.02 (0.001)	0.048
TOTAL CHROMIUM	--	0.1	0.0005 (0.0001)	0.1
COPPER	0.59	1.3	0.0005 (0.0001)	0.59
LEAD	--	0.015	0.001 (0.00004)	0.015
MERCURY	0.0048	0.002	0.00002 (0.0000005)	0.002
NICKEL	0.32	0.1	0.0005 (0.0001)	0.1
SILVER	0.08	--	0.0002 (0.00002)	0.08
ZINC	4.8	--	0.004 (0.0002)	4.8
PCBs (µg/L)				
AROCLOR-1016	1.1	--	0.01	1.1
AROCLOR-1221	--	--	0.01	--
AROCLOR-1232	--	--	0.01	--
AROCLOR-1242	--	--	0.01	--
AROCLOR-1248	--	--	0.01	--
AROCLOR-1254	0.32	--	0.01	0.32
AROCLOR-1260	--	--	0.01	--
TOTAL PCBs	0.044	0.5	0.01	0.044
VOCs (µg/L)				
BENZENE	0.8	5	0.45	0.8
BROMOBENZENE	--	--	0.2	--
BROMODICHLOROMETHANE	0.71	80	0.2	0.71
BROMOFORM (TRIBROMOMETHANE)	5.5	80	0.2	5.5
BROMOMETHANE	11	--	0.5	11
BUTYLBENZENE; N-	--	--	0.2	--
CARBON TETRACHLORIDE	0.63	5	0.2	0.63
CHLOROBENZENE	160	100	0.2	100
CHLOROETHANE	--	--	0.2	--
CHLOROFORM	80	80	0.2	80
CHLOROMETHANE	--	--	0.5	--
CHLOROTOLUENE; 2-	160	--	0.2	160
CHLOROTOLUENE; 4-	--	--	0.2	--
CIS-1,2-DICHLOROETHENE	16	70	0.2	16
CIS-1,3-DICHLOROPROPENE	--	--	0.2	--
DIBROMO-3-CHLOROPROPANE; 1,2-	--	--	0.5	--
DIBROMOCHLOROMETHANE	0.52	80	0.2	0.52
DIBROMOETHANE; 1,2- (EDB)	0.022	0.05	0.2	0.2
DIBROMOMETHANE	80	--	0.2	80
DICHLOROBENZENE;1,2-	720	600	0.2	600
DICHLOROBENZENE;1,3-	--	--	0.2	--
DICHLOROBENZENE;1,4-	--	75	0.2	75
DICHLORODIFLUOROMETHANE (CFC-12)	1600	--	0.2	1600
DICHLOROETHANE; 1,1-	1600	--	0.2	1600
DICHLOROETHANE; 1,2- (EDC)	0.48	5	0.2	0.48
DICHLOROETHENE; 1,1-	400	7	0.2	7
DICHLOROPROPANE; 1,2-	--	5	0.2	5
DICHLOROPROPANE; 1,3-	--	--	0.2	--
DICHLOROPROPANE; 2,2-	--	--	0.2	--
DICHLOROPROPENE; 1,1-	--	--	0.2	--
ETHYLBENZENE	800	700	0.42	700
HEXACHLOROBUTADIENE	0.56	--	0.5	0.56
ISOPROPYLBENZENE (CUMENE)	800	--	0.2	800
ISOPROPYLTOLUENE; P-	--	--	0.2	--
METHYLENE CHLORIDE	5.8	5	0.5	5
NAPHTHALENE	160	--	0.5	160
PROPYLBENZENE; N-	800	--	0.2	800
SEC-BUTYLBENZENE	--	--	0.2	--
STYRENE	1600	100	0.2	100
TERT-BUTYLBENZENE	--	--	0.2	--
TETRACHLOROETHANE; 1,1,1,2-	1.7	--	0.2	1.7
TETRACHLOROETHANE; 1,1,2,2-	0.22	--	0.2	0.22
TETRACHLOROETHENE	80	5	0.2	5
TOLUENE	640	1000	0.48	640
TOTAL XYLENES	1600	--	0.78	1600
TRANS-1,2-DICHLOROETHENE	--	--	0.2	--
TRANS-1,3-DICHLOROPROPENE	--	--	0.2	--
TRICHLOROBENZENE; 1,2,3-	--	--	0.5	--
TRICHLOROBENZENE;1,2,4-	1.5	70	0.5	1.5
TRICHLOROETHANE; 1,1,1-	16000	200	0.2	200
TRICHLOROETHANE; 1,1,2-	0.77	5	0.2	0.77
TRICHLOROETHENE (TCE)	--	5	0.2	5
TRICHLOROFLUOROMETHANE (CFC-11)	--	--	0.2	--
TRICHLOROPROPANE; 1,2,3-	0.0015	--	0.5	0.5
TRIMETHYLBENZENE; 1,2,4-	--	--	0.2	--
TRIMETHYLBENZENE; 1,3,5-	80	--	0.2	80
VINYL CHLORIDE	0.061	2	0.2	0.2
cPAHs (µg/L)				
BENZO(A)PYRENE	0.012	0.2	0.01	0.012
TOTAL cPAHs TEQ	0.012	0.2	0.01	0.012
SVOCs (µg/L)				
ACENAPHTHENE	960	--	1	960
ACENAPHTHYLENE	--	--	1	--
ANILINE	7.7	--	1	7.7
ANTHRACENE	4800	--	1	4800
AZOBENZENE	0.8	--	1	1
BENZIDINE	0.00038	--	10	10
BENZO(GHI)PERYLENE	--	--	1	--
BENZOIC ACID	64000	--	10	64000
BENZYL ALCOHOL	2400	--	5	2400
BIS(2-CHLOROETHOXY)METHANE	--	--	1	--
BIS(2-CHLOROETHYL)ETHER	0.04	--	1	1

Analyte	MTCA Method B Formula Value - Human Health Protection (a)	Federal and State Maximum Contaminant Level (MCL) (40 C.F.R. 141; WAC 246-290)	Lab (ARI/Frontier Global) PQL (f)	Groundwater Screening Level (Protective of Drinking Water Use)
BIS(2-CHLOROISOPROPYL) ETHER (2,2-OXYBIS(1-CHLOROPROPANE))	320	--	1	320
BIS(2-ETHYLHEXYL) PHTHALATE	6.3	6	1	6
BIS(2-ETHYLHEXYL)ETHER	--	--	--	--
BROMOPHENYL PHENYL ETHER; 4-	--	--	1	--
BUTYL BENZYL PHTHALATE	3200	--	1	3200
CAPROLACTAM	8000	--	1	8000
CARBAZOLE	4.4	--	1	4.4
CHLORO-3-METHYLPHENOL; 4-	--	--	5	--
CHLOROANILINE;P-	32	--	5	32
CHLORONAPHTHALENE; 2-	640	--	1	640
CHLOROPHENOL;2-	40	--	1	40
CHLOROPHENYL-PHENYL ETHER; 4-	--	--	1	--
CRESOL; M,P- (4-METHYLPHENOL)	400	--	1	400
CRESOL; O- (2-METHYLPHENOL)	400	--	1	400
DIBENZOFURAN	32	--	1	32
DI-BUTYL PHTHALATE	1600	--	1	1600
DICHLOROBENZENE;1,2-	720	600	1	600
DICHLOROBENZENE;1,3-	--	--	1	--
DICHLOROBENZENE;1,4-	--	75	1	75
DICHLOROBENZIDINE;3,3'-	0.19	--	5	5
DICHLOROPHENOL; 2,6-	--	--	--	--
DICHLOROPHENOL;2,4-	24	--	5	24
DIETHYL PHTHALATE	13,000	--	1	13,000
DIMETHYL PHTHALATE	16,000	--	1	16,000
DIMETHYLPHENOL;2,4-	160	--	1	160
DINITROPHENOL;2,4-	32	--	10	32
DINITROTOLUENE;2,4-	32	--	5	32
DINITROTOLUENE;2,6-	16	--	5	16
DI-N-OCTYL PHTHALATE	320	--	1	320
DIPHENYLHYDRAZINE;1,2-	0.11	--	1	1
FLUORANTHENE	640	--	1	640
FLUORENE	640	--	1	640
HEXACHLOROBENZENE	0.055	1	1	1
HEXACHLOROBUTADIENE	0.56	--	1	1
HEXACHLOROCYCLOPENTADIENE	48	50	5	48
HEXACHLOROETHANE	3.1	--	1	3.1
HEXACHLOROPROPENE	--	--	--	--
ISOPHORONE	46	--	1	46
METHYL NAPHTHALENE;2-	32	--	1	32
NAPHTHALENE	160	--	1	160
NITROBENZENE	4	--	1	4
NITROPHENOL; 2-	--	--	5	--
NITROPHENOL; 4- (P-NITROPHENOL)	--	--	5	--
NITROSO-DI-N-PROPYLAMINE;N-	--	--	1	--
NITROSODIPHENYLAMINE;N-	--	--	1	--
PENTACHLOROBENZENE	13	--	1	13
PENTACHLOROETHANE	--	--	--	--
PENTACHLOROPHENOL	0.73	1	5	5
PHENANTHRENE	--	--	1	--
PHENOL	4800	--	1	4800
PYRENE	480	--	1	480
PYRIDINE	8	--	5	8
SEC-BUTYL-4,6-DINITROPHENOL; 2-	--	--	--	--
TETRACHLOROBENZENE; 1,2,4,5-	4.8	--	1	4.8
TETRACHLOROPHENOL; 2,3,4,6-	480	--	1	480
TRICHLOROBENZENE;1,2,4-	1.5	70	1	1.5
TRICHLOROPHENOL;2,4,5-	800	--	5	800
TRICHLOROPHENOL;2,4,6-	4	--	5	5
Dioxins and Furans (µg/L)				
TOTAL DIOXINS/FURANS TEQ	--	0.00003 (e)	0.000001 to 0.000004	0.00003

Notes:

C.F.R. = Code of Federal Regulations

MTCA = Washington State Model Toxics Control Act

TPH = Total petroleum hydrocarbons

PCBs = Polychlorinated biphenyls

VOCs = Volatile organic compounds

SVOCs = Semivolatile organic compounds

cPAHs = Carcinogenic polycyclic aromatic hydrocarbons

WAC = Washington Administrative Code

TEQ = Toxicity equivalency quotient

mg/L = Milligrams per liter

µg/L = Micrograms per liter

-- = Not established; no value available; not applicable.

(a) Washington State Department of Ecology Cleanup Levels and Risk Calculations (CLARC) Method B standard formula values (ingestion and inhalation). Where both carcinogenic and non-carcinogenic values are available, the lower value is used.

(b) MTCA Method A cleanup level; WAC 173-340-900, Table 720-1.

(c) Value based on background concentrations for state of Washington.

(d) State Maximum Contaminant Level (MCL); a Federal MCL for chromium(VI) has not been established.

(e) Listed value is for 2,3,7,8-TCDD.

(f) In some cases, the SL is based on the PQL, however, the sample-specific MRL will vary from sample to sample. Any positive detection above the lowest of the screening criter

Grey-shaded cells indicate basis for screening level.

TABLE 5

Groundwater Screening Levels Protective of Surface Water

Goose Lake Site
Shelton, Washington

Analyte	MTCA Method B Formula Value - Human Health Protection (Fish Consumption) (a)	Federal Water Quality Criteria - Human Health Protection (Fish Consumption) (CWA Section 304) (b)	Federal Water Quality Criteria - Human Health Protection (Fish Consumption) (40 C.F.R. 131) (c)	State Water Quality Criteria - Aquatic Organism Protection (Chronic) (WAC 173-201A) (d)	Federal Water Quality Criteria - Aquatic Organism Protection (Chronic) (CWA Section 304) (b)	Federal Water Quality Criteria - Aquatic Organism Protection (Chronic) (40 C.F.R. 131) (c)	Lab (ARI/Frontier Global) PQL (e)	Groundwater Screening Level (Protective of Surface Water)
TPH (mg/L)								
KEROSENE-/JET FUEL-RANGE	--	--	--	--	--	--	**0.25**	--
DIESEL-/FUEL-OIL-RANGE	--	--	--	--	--	--	**0.25**	--
HEAVY-OIL RANGE	--	--	--	--	--	--	**0.4**	--
Conventionals (mg/L)								
ALKALINITY as CaCO3	--	--	--	--	--	--	--	--
CONDUCTIVITY	--	--	--	--	--	--	--	--
HARDNESS as CaCO3	--	--	--	--	--	--	--	--
pH	--	--	--	--	--	--	--	--
SULFIDE	--	--	--	--	--	--	--	--
TURBIDITY	--	--	--	--	--	--	--	--
Metals (mg/L)								
ANTIMONY	1	0.0056	0.014	--	--	--	0.0002 (0.00002)	0.0056
ARSENIC	0.000098	0.00014	0.00014	0.19	0.15	0.19	0.0002 (0.00001)	0.005(f)
CADMIUM	0.02	--	--	0.00037	0.00025	0.001	0.0002 (0.00002)	0.00025
TRIVALENT CHROMIUM	240	--	--	0.057	0.074	0.18	0.0005 (0.001)	0.057
HEXAVALENT CHROMIUM	0.49	--	--	0.01	0.011	0.01	0.02 (0.001)	0.01
TOTAL CHROMIUM	--	--	--	--	--	--	0.0005 (0.0001)	-- (g)
COPPER	2.7	--	--	0.0035	0.009	0.011	0.0005 (0.0001)	0.0035
LEAD	--	--	--	0.00054	0.0025	0.0025	0.001 (0.00004)	0.00054
MERCURY	--	--	0.00015	0.000012	0.00077	0.000012	0.00002 (0.0000005)	0.000012
NICKEL	1.1	0.61	0.61	0.049	0.052	0.16	0.0005 (0.0001)	0.049
SILVER	26	--	--	--	--	--	0.0002 (0.00002)	26
ZINC	17	7.4	--	0.032	0.12	0.1	0.004 (0.0002)	0.032
PCBs (µg/L)								
AROCLOR-1016	0.0058	--	--	--	--	0.014	0.01	0.01
AROCLOR-1221	--	--	--	--	--	--	0.01	--
AROCLOR-1232	--	--	--	--	--	--	0.01	--
AROCLOR-1242	--	--	--	--	--	--	0.01	--
AROCLOR-1248	--	--	--	--	--	--	0.01	--
AROCLOR-1254	0.0017	--	--	--	--	0.014	0.01	0.01
AROCLOR-1260	--	--	--	--	--	0.014	0.01	0.014
TOTAL PCBs	0.00011	0.000064	0.00017	0.014	0.014	0.14	0.01	0.01
VOCs (µg/L)								
BENZENE	23	2.2	1.2	--	--	--	0.45	1.2
BROMOBENZENE	--	--	--	--	--	--	0.2	--
BROMODICHLOROMETHANE	28	0.55	0.27	--	--	--	0.2	0.27
BROMOFORM (TRIBROMOMETHANE)	220	4.3	4.3	--	--	--	0.2	4.3
BROMOMETHANE	970	47	48	--	--	--	0.5	47
BUTYLBENZENE; N-	--	--	--	--	--	--	0.2	--
CARBON TETRACHLORIDE	4.9	0.23	0.25	--	--	--	0.2	0.23
CHLOROBENZENE	5,000	130	680	--	--	--	0.2	130
CHLOROETHANE	--	--	--	--	--	--	0.2	--
CHLOROFORM	6,900	5.7	5.7	--	--	--	0.2	5.7
CHLOROMETHANE	--	--	--	--	--	--	0.5	--
CHLOROTOLUENE; 2-	--	--	--	--	--	--	0.2	--
CHLOROTOLUENE; 4-	--	--	--	--	--	--	0.2	--
CIS-1,2-DICHLOROETHENE	--	--	--	--	--	--	0.2	--
CIS-1,3-DICHLOROPROPENE	--	--	--	--	--	--	0.2	--

Analyte	MTCA Method B Formula Value - Human Health Protection (Fish Consumption) (a)	Federal Water Quality Criteria - Human Health Protection (Fish Consumption) (CWA Section 304) (b)	Federal Water Quality Criteria - Human Health Protection (Fish Consumption) (40 C.F.R. 131) (c)	State Water Quality Criteria - Aquatic Organism Protection (Chronic) (WAC 173-201A) (d)	Federal Water Quality Criteria - Aquatic Organism Protection (Chronic) (CWA Section 304) (b)	Federal Water Quality Criteria - Aquatic Organism Protection (Chronic) (40 C.F.R. 131) (c)	Lab (ARI/Frontier Global) PQL (e)	Groundwater Screening Level (Protective of Surface Water)
DIBROMO-3-CHLOROPROPANE; 1,2-	--	--	--	--	--	--	0.5	--
DIBROMOCHLOROMETHANE	21	0.4	0.41	--	--	--	0.2	0.4
DIBROMOETHANE; 1,2- (EDB)	--	--	--	--	--	--	0.2	--
DIBROMOMETHANE	--	--	48	--	--	--	0.2	48
DICHLOROBENZENE; 1,2-	4,200	420	2700	--	--	--	0.2	420
DICHLOROBENZENE; 1,3-	--	320	400	--	--	--	0.2	320
DICHLOROBENZENE;1,4-	--	63	400	--	--	--	0.2	63
DICHLORODIFLUOROMETHANE (CFC-12)	--	--	--	--	--	--	0.2	--
DICHLOROETHANE; 1,1-	--	--	--	--	--	--	0.2	--
DICHLOROETHANE; 1,2- (EDC)	59	0.38	0.38	--	--	--	0.2	0.38
DICHLOROETHENE; 1,1-	23,000	330	0.057	--	--	--	0.2	0.2
DICHLOROPROPANE; 1,2-	--	0.5	--	--	--	--	0.2	0.5
DICHLOROPROPANE; 1,3-	--	--	--	--	--	--	0.2	--
DICHLOROPROPANE; 2,2-	--	--	--	--	--	--	0.2	--
DICHLOROPROPENE; 1,1-	--	--	--	--	--	--	0.2	--
ETHYLBENZENE	6900	530	3100	--	--	--	0.42	530
HEXACHLOROBUTADIENE	30	0.44	0.44	--	--	--	0.5	0.5
ISOPROPYLBENZENE (CUMENE)	--	--	--	--	--	--	0.2	--
ISOPROPYLTOLUENE; P-	--	--	--	--	--	--	0.2	--
METHYLENE CHLORIDE	960	4.6	4.7	--	--	--	0.5	17
NAPHTHALENE	4,900	--	--	--	--	--	0.5	4,900
PROPYLBENZENE; N-	--	--	--	--	--	--	0.2	--
SEC-BUTYLBENZENE	--	--	--	--	--	--	0.2	--
STYRENE	--	--	--	--	--	--	0.2	--
TERT-BUTYLBENZENE	--	--	--	--	--	--	0.2	--
TETRACHLOROETHANE; 1,1,1,2-	--	--	--	--	--	--	0.2	--
TETRACHLOROETHANE; 1,1,2,2-	6.5	0.17	0.17	--	--	--	0.2	0.2
TETRACHLOROETHENE	840	0.69	0.8	--	--	--	0.2	16
TOLUENE	19,000	1,300	6,800	--	--	--	0.48	1,300
TOTAL XYLENES	--	--	--	--	--	--	0.78	--
TRANS-1,2-DICHLOROETHENE	--	--	--	--	--	--	0.2	--
TRANS-1,3-DICHLOROPROPENE	--	--	--	--	--	--	0.2	--
TRICHLOROBENZENE; 1,2,3-	--	--	--	--	--	--	0.5	--
TRICHLOROBENZENE;1,2,4-	2	35	--	--	--	--	0.5	2
TRICHLOROETHANE; 1,1,1-	930,000	--	--	--	--	--	0.2	930,000
TRICHLOROETHANE; 1,1,2-	25	0.59	0.6	--	--	--	0.2	0.59
TRICHLOROETHENE (TCE)	--	2.5	2.7	--	--	--	0.2	4.3
TRICHLOROFLUOROMETHANE (CFC-11)	--	--	--	--	--	--	0.2	--
TRICHLOROPROPANE; 1,2,3-	--	--	--	--	--	--	0.5	--
TRIMETHYLBENZENE; 1,2,4-	--	--	--	--	--	--	0.2	--
TRIMETHYLBENZENE; 1,3,5-	--	--	--	--	--	--	0.2	--
VINYL CHLORIDE	7.7	0.025	2	--	--	--	0.2	0.2
cPAHs (µg/L)								
BENZO(A)PYRENE	0.03	0.0038	0.0028	--	--	--	0.01	0.01
TOTAL cPAHs TEQ	0.03	0.0038	0.0028	--	--	--	0.01	0.01
SVOCs (µg/L)								
ACENAPHTHENE	640	670	--	--	--	--	1	640
ANTHRACENE	26,000	8,300	9,600	--	--	--	1	8,300
BENZIDINE	0.00032	0.000086	0.00012	--	--	--	10	10
BIS(2-CHLOROETHYL)ETHER	0.85	0.03	0.031	--	--	--	1	1
BIS(2-CHLOROISOPROPYL) ETHER (2,2-OXYBIS(1-CHLOROPROPANE))	42,000	1,400	1400	--	--	--	1	1,400
BIS(2-ETHYLHEXYL) PHTHALATE	3.6	1.2	1.8	--	--	--	1	1.2

Analyte	MTCA Method B Formula Value - Human Health Protection (Fish Consumption) (a)	Federal Water Quality Criteria - Human Health Protection (Fish Consumption) (CWA Section 304) (b)	Federal Water Quality Criteria - Human Health Protection (Fish Consumption) (40 C.F.R. 131) (c)	State Water Quality Criteria - Aquatic Organism Protection (Chronic) (WAC 173-201A) (d)	Federal Water Quality Criteria - Aquatic Organism Protection (Chronic) (CWA Section 304) (b)	Federal Water Quality Criteria - Aquatic Organism Protection (Chronic) (40 C.F.R. 131) (c)	Lab (ARI/Frontier Global) PQL (e)	Groundwater Screening Level (Protective of Surface Water)
CHLORONAPHTHALENE; 2-	1,000	1000	--	--	--	--	1	1,000
CHLOROPHENOL; 2-	97	--	--	--	--	--	1	97
DI-BUTYL PHTHALATE	2,900	2,000	2,700	--	--	--	1	2,000
DICHLOROBENZENE; 1,2-	4,200	420	2,700	--	--	--	1	420
DICHLOROBENZENE; 1,3-	--	320	400	--	--	--	1	320
DICHLOROBENZENE;1,4-	--	63	400	--	--	--	1	63
DICHLOROBENZIDINE;3,3'-	0.046	0.021	0.04	--	--	--	5	5
DICHLOROPHENOL;2,4-	190	77	93	--	--	--	5	77
DIETHYL PHTHALATE	28,000	17,000	23,000	--	--	--	1	17,000
DIMETHYL PHTHALATE	72,000	270,000	313,000	--	--	--	1	72,000
DIMETHYLPHENOL;2,4-	550	380	--	--	--	--	1	380
DINITROPHENOL;2,4-	3,500	69	70	--	--	--	10	69
DINITROTOLUENE;2,4-	1,400	0.11	0.11	--	--	--	5	5
DIPHENYLHYDRAZINE;1,2-	0.33	0.036	0.04	--	--	--	1	1
FLUORANTHENE	90	130	300	--	--	--	1	90
FLUORENE	3,500	1,100	1300	--	--	--	1	1,100
HEXACHLOROBENZENE	0.00047	0.00028	0.00075	--	--	--	1	1
HEXACHLOROBUTADIENE	30	0.44	0.44	--	--	--	1	1
HEXACHLOROCYCLOPENTADIENE	3,600	40	240	--	--	--	5	40
HEXACHLOROETHANE	5.3	1.4	1.9	--	--	--	1	1.4
HEXACHLOROPROPENE	--	--	--	--	--	--	--	--
ISOPHORONE	1,600	35	8.4	--	--	--	1	8.4
METHYL NAPHTHALENE;2-	--	--	--	--	--	--	1	--
NAPHTHALENE	4,900	--	--	--	--	--	1	4,900
NITROBENZENE	450	17	17	--	--	--	1	17
NITROSO-DI-N-PROPYLAMINE;N-	0.82	0.005	--	--	--	--	1	1
NITROSODIPHENYLAMINE;N-	9.7	3.3	5	--	--	--	1	3.3
PENTACHLOROPHENOL	4.9	0.27	0.28	12.79	15	13	5	5
PHENOL	1,100,000	21,000	21,000	--	--	--	1	21,000
TRICHLOROBENZENE;1,2,4-	2	35	--	--	--	--	1	2
TRICHLOROPHENOL;2,4,5-	--	1,800	--	--	--	--	5	1,800
TRICHLOROPHENOL;2,4,6-	3.9	1.4	2.1	--	--	--	5	5
Dioxins/Furans (µg/L)								
TOTAL DIOXINS/FURANS TEQ	0.0000000086 (h)	0.000000005 (h)	0.000000013 (h)	--	--	--	0.000001 to 0.000004 (i)	0.000001 to 000004 (i)

Notes:

C.F.R. = Code of Federal Regulations

CWA = Clean Water Act

MTCA = Washington State Model Toxics Control Act

PCBs = Polychlorinated biphenyls

VOCs = volatile organic compounds

SVOCs = Semivolatile organic compounds

cPAHs = Carcinogenic polycyclic aromatic hydrocarbons

PQL = Practical quantitation limit

WAC = Washington Administrative Code

TEQ = Toxicity equivalency quotient

mg/L = Milligrams per liter

µg/L = Micrograms per liter

-- = Not established; no value available; not applicable.

(a) Washington State Department of Ecology Cleanup Levels and Risk Calculations (CLARC) Method B standard formula values (fish consumption). Where both carcinogenic and non-carcinogenic values are available, the lower value is used.

(b) National Recommended Water Quality Criteria

(c) National Toxics Rule criteria

(d) Water Quality Standards for Surface Waters of the State of Washington

(e) In some cases, the SL is based on the PQL, however, the sample-specific MRL will vary from sample to sample. Any positive detection above the lowest of the screening criteria is considered an exceedance.

(f) GW background - MTCA A

(g) No screening level is listed since there are no regulatory criteria for total chromium.

(h) Listed value is for 2,3,7,8-TCDD.

(i) Sample-specific EDL will vary from sample to sample, and any positive D/F TEC detection above the EDL is considered an exceedance.

Grey-shaded cells indicate basis for screening level.

Table 6

Surface Water Screening Levels

Goose Lake Site
Shelton, Washington

Analyte	MTCA Method B Formula Value - Human Health Protection (Fish Consumption) (a)	Federal Water Quality Criteria - Human Health Protection (Fish Consumption) (CWA Section 304) (b)	Federal Water Quality Criteria - Human Health Protection (Fish Consumption) (40 C.F.R. 131) (c)	State Water Quality Criteria - Aquatic Organism Protection (Chronic) (WAC 173-201A) (d)	Federal Water Quality Criteria - Aquatic Organism Protection (Chronic) (CWA Section 304) (b)	Federal Water Quality Criteria - Aquatic Organism Protection (Chronic) (40 C.F.R. 131) (c)	Laboratory (ARI/Frontier Global) PQL (e)	Surface Water Screening Level
Conventionals (mg/L)								
ALKALINITY as CaCO3	–	–	–	–	–	–	–	–
CONDUCTIVITY	–	–	–	–	–	–	–	–
HARDNESS as CaCO3	–	–	–	–	–	–	–	–
pH	–	–	–	–	–	–	–	–
SULFIDE	–	–	–	–	–	–	–	–
TURBIDITY	–	–	–	–	–	–	–	–
Metals (mg/L)								
ANTIMONY	1	0.0056	0.014	–	–	–	0.0002 (0.00002)	0.0056
ARSENIC	0.000098	0.00014	0.00014	0.19	0.15	0.19	0.0002 (0.00001)	0.000098
CADMIUM	0.02	–	–	0.00037	0.00025	0.001	0.0002 (0.00002)	0.00025
TRIVALENT CHROMIUM	240	–	–	0.057	0.074	0.18	0.0005 (0.001)	0.057
HEXAVALENT CHROMIUM	0.49	–	–	0.01	0.011	0.01	0.02 (0.001)	0.01
TOTAL CHROMIUM	–	–	–	–	–	–	0.0005 (0.0001)	–
COPPER	2.7	–	–	0.0035	0.009	0.011	0.0005 (0.0001)	0.0035
LEAD	–	–	–	0.00054	0.0025	0.0025	0.001 (0.00004)	0.00054
MERCURY	–	–	0.00015	0.000012	0.00077	0.000012	0.00002 (0.0000005)	0.000012
NICKEL	1.1	0.61	0.61	0.049	0.052	0.16	0.0005 (0.0001)	0.049
SILVER	26	–	–	–	–	–	0.0002 (0.00002)	26
ZINC	17	7.4	–	0.032	0.12	0.1	0.004 (0.0002)	0.032
PCBs (µg/L)								
AROCLOR-1016	0.0058	–	–	–	–	0.014	0.01	0.01
AROCLOR-1221	–	–	–	–	–	–	0.01	–
AROCLOR-1232	–	–	–	–	–	–	0.01	–
AROCLOR-1242	–	–	–	–	–	–	0.01	–
AROCLOR-1248	–	–	–	–	–	–	0.01	–
AROCLOR-1254	0.0017	–	–	–	–	0.014	0.01	0.01
AROCLOR-1260	–	–	–	–	–	0.014	0.01	0.014
TOTAL PCBs	0.00011	0.000064	0.00017	0.014	0.014	0.14	0.01	0.01
cPAHs (µg/L)								
BENZO(A)PYRENE	0.03	0.0038	0.0028	–	–	–	0.01	0.01
TOTAL cPAHs TEQ	0.03	0.0038	0.0028	–	–	–	0.01	0.01
SVOCs (µg/L)								
ACENAPHTHENE	640	670	–	–	–	–	1	640
ANTHRACENE	26000	8300	9600	–	–	–	1	8300
BENZIDINE	0.00032	0.000086	0.00012	–	–	–	10	10
BIS(2-CHLOROETHYL)ETHER	0.85	0.03	0.031	–	–	–	1	1
BIS(2-CHLOROISOPROPYL) ETHER (2,2-OXYBIS(1-CHLOROPROPANE))	42000	1400	1400	–	–	–	1	1400
BIS(2-ETHYLHEXYL) PHTHALATE	4	1.2	1.8	–	–	–	1	1.2
BUTYL BENZYL PHTHALATE	1300	1500	–	–	–	–	1	1300
CHLORONAPHTHALENE; 2-	1000	1000	–	–	–	–	1	1000
CHLOROPHENOL; 2-	97	–	–	–	–	–	1	97
DI-BUTYL PHTHALATE	2900	2000	2700	–	–	–	1	2000

Analyte	MTCA Method B Formula Value - Human Health Protection (Fish Consumption) (a)	Federal Water Quality Criteria - Human Health Protection (Fish Consumption) (CWA Section 304) (b)	Federal Water Quality Criteria - Human Health Protection (Fish Consumption) (40 C.F.R. 131) (c)	State Water Quality Criteria - Aquatic Organism Protection (Chronic) (WAC 173-201A) (d)	Federal Water Quality Criteria - Aquatic Organism Protection (Chronic) (CWA Section 304) (b)	Federal Water Quality Criteria - Aquatic Organism Protection (Chronic) (40 C.F.R. 131) (c)	Laboratory (ARI/Frontier Global) PQL (e)	Surface Water Screening Level
DICHLOROBENZENE; 1,2-	4200	420	2700	--	--	--	1	420
DICHLOROBENZENE; 1,3-	--	320	400	--	--	--	1	320
DICHLOROBENZENE;1,4-	--	63	400	--	--	--	1	63
DICHLOROBENZIDINE;3,3'-	0.046	0.021	0.04	--	--	--	5	5
DICHLOROPHENOL;2,4-	190	77	93	--	--	--	5	77
DIETHYL PHTHALATE	28000	17000	23000	--	--	--	1	17000
DIMETHYL PHTHALATE	72000	270000	313000	--	--	--	1	72000
DIMETHYLPHENOL;2,4-	550	380	--	--	--	--	1	380
DINITROPHENOL;2,4-	3500	69	70	--	--	--	10	69
DINITROTOLUENE;2,4-	1400	0.11	0.11	--	--	--	5	5
DIPHENYLHYDRAZINE;1,2-	0.33	0.036	0.04	--	--	--	1	1
FLUORANTHENE	90	130	300	--	--	--	1	90
FLUORENE	3500	1100	1300	--	--	--	1	1100
HEXACHLOROBENZENE	0.00047	0.00028	0.00075	--	--	--	1	1
HEXACHLOROBUTADIENE	30	0.44	0.44	--	--	--	1	1
HEXACHLOROCYCLOPENTADIENE	3600	40	240	--	--	--	5	40
HEXACHLOROETHANE	5.3	1.4	1.9	--	--	--	1	1.4
ISOPHORONE	1600	35	8.4	--	--	--	1	8.4
NAPHTHALENE	4900	--	--	--	--	--	1	4900
NITROBENZENE	450	17	17	--	--	--	1	17
NITROSO-DI-N-PROPYLAMINE;N-	0.82	0.005	--	--	--	--	1	1
NITROSODIPHENYLAMINE;N-	9.7	3.3	5	--	--	--	1	3.3
PENTACHLOROPHENOL	4.9	0.27	0.28	12.79	15	13	5	5
PHENOL	1100000	21000	21000	--	--	--	1	21000
PYRENE	2600	830	960	--	--	--	1	830
TRICHLOROBENZENE;1,2,4-	230	35	--	--	--	--	1	35
TRICHLOROPHENOL;2,4,5-	--	1800	--	--	--	--	5	1800
TRICHLOROPHENOL;2,4,6-	4	1.4	2.1	--	--	--	5	5
Dioxins/Furans (µg/L)								
TOTAL DIOXINS/FURANS TEQ	0.0000000086 (f)	0.000000005 (f)	0.000000013 (f)	--	--	--	0.000001 to 0.000004 (g)	0.000001 to 0.000004 (g)

Notes:

C.F.R. = Code of Federal Regulations

CWA = Clean Water Act

MTCA = Washington State Model Toxics Control Act

PCBs = Polychlorinated biphenyls

SVOCs = Semivolatile organic compounds

cPAHs = Carcinogenic polycyclic aromatic hydrocarbons

PQL = Practical quantitation limit

WAC = Washington Administrative Code

TEQ = Toxicity equivalency quotient

mg/L = Milligrams per liter

µg/L = Micrograms per liter

-- = Not established; no value available; not applicable.

(a) Washington State Department of Ecology Cleanup Levels and Risk Calculations (CLARC) Method B standard formula values (fish consumption). Where both carcinogenic and non-carcinogenic values are available, the lower value is used.

(b) National Recommended Water Quality Criteria

(c) National Toxics Rule criteria

(d) Water Quality Standards for Surface Waters of the State of Washington

(e) In some cases, the SL is based on the PQL, however, the sample-specific MRL will vary from sample to sample. Any positive detection above the lowest of the screening criteria is considered an exceedance.

(f) Listed value is for 2,3,7,8-TCDD.

(g) Sample-specific EDL will vary from sample to sample, and any positive D/F TEC detection above the EDL is considered an exceedance.

Grey-shaded cells indicate basis for screening level.

Table 7

Sediment Screening Levels

Goose Lake Site
Shelton, Washington

Analyte	2003 Freshwater Sediment AETs (a)		Lab (ARI) PQL (d)	Sediment Screening Level
	LAET	2LAET		
Conventionals (mg/kg)				
AMMONIA	--	--	--	--
OXIDATION-REDUCTION POTENTIAL (ORP)	--	--	--	--
pH	--	--	--	--
SULFIDE	702	941	--	702
TOTAL ORGANIC CARBON (%)	9.82	--	--	9.82
Dioxins and Furans (ng/kg)				
TOTAL DIOXINS/FURANS - FISH (TEQ)	60 (b)	100 (c)	--	60 to 100
TOTAL DIOXINS/FURANS - MAMMALIAN WILDLIFE (TEQ)	2.5 (b)	25 (c)	0.57	2.5 to 25
TOTAL DIOXINS/FURANS - AVIAN WILDLIFE (TEQ)	21 (b)	210 (c)	--	21 to 210
Metals (mg/kg)				
ANTIMONY	0.6	1.9	0.2	0.6
ARSENIC	31.4	50.9	0.2	31.4
CADMIUM	2.39	2.9	0.2	2.39
TRIVALENT CHROMIUM	--	--	2	--
HEXAVALENT CHROMIUM	--	--	5	--
TOTAL CHROMIUM	95	133	2	95
COPPER	619	829	0.2	619
LEAD	335	431	1	335
MERCURY	0.8	3.04	0.02	0.8
NICKEL	53.1	113	0.5	53.1
SILVER	0.545	3.5	0.2	0.545
ZINC	683	1,080	1	683
PCBs (µg/kg)				
AROCLOR-1016	--	--	4	--
AROCLOR-1221	--	--	4	--
AROCLOR-1232	--	--	4	--
AROCLOR-1242	--	--	4	--
AROCLOR-1248	--	--	4	--
AROCLOR-1254	230	294	4	230
AROCLOR-1260	138	140	4	138
TOTAL PCBs	62	354	4	62
SVOCs (µg/kg)				
1,2-DICHLOROBENZENE	--	--	--	--
1,3-DICHLOROBENZENE	--	--	--	--
1,4-DICHLOROBENZENE	--	--	--	--
2,4-DIMETHYLPHENOL	--	--	--	--
2-METHYLNAPHTHALENE	469	555	5	469
2-METHYLPHENOL	--	--	--	--
ACENAPHTHENE	1,060	1,320	5	1,060
ACENAPHTHYLENE	470	640	5	470
ANTHRACENE	1,230	1,580	5	1,230
BENZO(G,H,I)PERYLENE	4,020	5,200	5	4,020
BENZOIC ACID	2,910	3,790	200	2,910
BENZYL ALCOHOL	--	--	--	--
BENZYL BUTYL PHTHALATE	260	366	20	260
BIS(2-ETHYLHEXYL)PHTHALATE	2,520	6,380	20	2,520
DIBENZOFURAN	399	443	5	399
DIETHYL PHTHALATE	--	--	20	--
DIMETHYL PHTHALATE	311	436	20	311
DI-N-BUTYLPHTHALATE	103	--	20	103
DI-N-OCTYLPHTHALATE	11	201	20	20
FLUORANTHENE	11,100	15,000	5	11,100

Analyte	2003 Freshwater Sediment AETs (a)		Lab (ARI) PQL (d)	Sediment Screening Level
	LAET	2LAET		
SVOCs (µg/kg) (cont.)				
HEXACHLORO-1,3-BUTADIENE	--	--	20	--
HEXACHLOROBENZENE	--	--	20	--
HEXACHLOROETHANE	--	--	20	--
PENTACHLOROPHENOL	--	--	6.25	--
PHENANTHRENE	6,100	7,570	5	6,100
PHENOL	--	--	20	--
PYRENE	8,790	16,000	5	8,790
BENZO(A)ANTHRACENE (cPAH)	4,260	5,800	--	4,260
BENZO(A)PYRENE (cPAH)	3,300	4,810	5	3,300
BENZO(B)FLUORANTHENE (cPAH)	--	--	--	--
BENZO(K)FLUORANTHENE (cPAH)	--	--	--	--
TOTAL BENZOFLUORANTHENES (cPAH)	11,000	13,800	--	11,000
CHRYSENE (cPAH)	5,940	6,400	--	5,940
DIBENZ(A,H)ANTHRACENE (cPAH)	800	839	--	800
INDENO(1,2,3-CD)PYRENE (cPAH)	4,120	5,300	--	4,120
VOCs (µg/kg)				
1,2,4-TRICHLOROBENZENE	--	--	5	--
NAPHTHALENE	529	1,310	5	529

Notes:

AET = Apparent Effects Threshold

cPAH = Carcinogenic polycyclic aromatic hydrocarbon

LAET = Lowest Apparent Effects Threshold

2LAET = Second Lowest Apparent Effects Threshold

PCBs = Polychlorinated biphenyls

PQL = Practical quantitation limit

SVOCs = Semivolatile organic compounds

TEQ = Toxicity Equivalency Quotient

VOCs = Volatile organic compounds

mg/kg = Milligrams per kilogram

µg/kg = Micrograms per kilogram

ng/kg = Nanograms per kilogram

-- = Not established; no value available; not applicable.

(a) Source (with the exception of dioxins/furans): *Development of Freshwater Sediment Quality Values for Use in Washington State* (Ecology, 2003), Table 3-3. LAET and 2LAET values derived from four bioassay endpoints (Hyalella Mortality, Chironomus Growth, Chironomus Mortality, and Microtox Lumin).

(b) Concentration associated with low TCDD risk to aquatic organisms and associated wildlife. Source: Table E-1, *Interim Report on Data and Methods for Assessment of 2,3,7,8-Tetrachlorodibenzo-p-dioxin Risks to Aquatic Life and Associated Wildlife (USEPA, 1993).*

(c) Concentration associated with high TCDD risk to aquatic organisms and associated wildlife. Source: Table E-1, *Interim Report on Data and Methods for Assessment of 2,3,7,8-Tetrachlorodibenzo-p-dioxin Risks to Aquatic Life and Associated Wildlife (USEPA, 1993).*

(d) In some cases, the SL is based on the PQL, however, the sample-specific MRL will vary from sample to sample. Any positive detection above the lowest of the screening criteria is considered an exceedance.

Grey-shaded cells indicate basis for screening level.

TABLE 8
SUMMARY OF SOIL/SEDIMENT ANALYTICAL RESULTS
METALS[1] - INACTIVE LANDFILL AREA
GOOSE LAKE SITE
SHELTON, WASHINGTON

Sample ID	TP-02-1.0	TP-02-11.5	TP-02-22.0	TP-03-9.5	TP-04-22.0	TP-05-13	TP-06-24.5	TP-07-9.5	TP-08-8.0	TP-09-12.5	TP-11-24.0	TP-12-1.0	TP-12-7.0	TP-13-5.0	TP-13-24.5	TP-16-10	TP-18-2.0	TP-19-25.0	TP-20-4.0	TP-20-24.5	Soil Screening Level (Near or Upgradient of Local Surface Water Body) (Saturated/ Unsaturated) [3]	Soil Screening Level (Not Near or Upgradient of Local Surface Water Body) (Saturated/ Unsaturated) [3]	Sediment Screening Level
Sample Date	07/08/02	07/08/02	07/08/02	07/09/02	07/11/02	07/08/02	07/09/02	07/08/02	07/11/02	07/08/02	07/10/02	07/11/02	07/11/02	07/08/02	07/08/02	07/08/02	07/10/02	07/10/02	07/10/02	07/10/02			
Depth (ft bgs)	1	11.5	22	9.5	22	13	24.5	9.5	8	12.5	24	1	7	5	24.5	10	2	25	4	24.5			
Sampled Horizon[2]	Cover	Waste	Glacial	Waste	Waste	Waste	Glacial	Waste	Waste	Waste	Glacial	Cover	Waste	Waste	Waste	Waste	Cover	Peat	Waste	Glacial			
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Applicable Screening Levels	A	B	B	A	D	A	B	B	C	B	B	C	C	A	B	D	A	D	C	D			
Chromium	17.3	22.7	21.1	11.8	15	29.5	16.9	12	15	30.6	23.8	28.8	21.3	16.2	42	59.3	14.6	25.7	44.6	43	48	48	95
Hexavalent chromium	0.0914 U	0.265 U	0.12 UJ	0.383 U	0.261	0.345 U	0.0983 U	0.236 J	0.407 U	0.315 U	0.166	0.111 U	0.384 U	0.0992 U	0.838	1.32R	0.143	0.771	0.182	0.151	240	240	--
Copper	34.3	134	27.2	168	47.1	401	34	229	51.4	91.5	37.8	37.2	92.3	18.3	1180	38.7	22.2	15.3	77.7	24.1	36	36/70	619
Arsenic	2.48	2.63 U	1.3	3.77 U	2.04 U	3.84	1.17	4.43 U	4.22 U	3.48 U	1.8	2.48	3.76 U	1.01 U	3.32 U	0.921 J	3.94	2.66 U	2.42	2.65	20[4]	20[4]	31.4
Lead	21.6	81.2	1.69	98.8	22.2	599	1.35	89.6	13.7	93.8	12.8	32.2	25.3	5.15	68	14.1	290	2.95	99.6	3.17	24/110	120	335
Mercury	0.0202 U	0.562	0.0218 U	0.0699	0.264	63.8	0.0173 U	0.0812 J	0.0862 U	0.416	0.0745	0.0523	0.914	0.236	0.0609 U	0.412	0.406	0.0575 U	1.27	0.0221 U	0.07	0.1	0.8
Cadmium	--	--	--	--	--	--	--	5.07 U	--	--	--	--	--	--	--	--	--	--	--	--	14	14	2.39
Antimony	--	--	--	--	--	--	--	93.1	--	--	--	--	--	--	--	--	--	--	--	--	5	5	0.6
Nickel	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	48	48	53.1
Silver	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	400	400	0.545
Zinc	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	120	120	683

Notes:

[1] Metals analyzed by USEPA 6000/7000 Series methods.

[2] The soil/sediment samples from the inactive landfill were obtained from either the landfill cover, waste horizon, or native (peat or glacial) soil beneath the waste horizon.

[3] Where only a single value is shown, the screening level is the same for saturated and unsaturated soils.

[4] Regulatory background (MTCA Method A) value.

mg/kg = Milligrams per kilogram

U = The analyte was not detected at the value reported. Value reported represents the practical quantitation limit (PQL).

UJ = The analyte was not detected at the value reported. Value reported represents the estimated practical quantitation limit (PQL).

J = Estimated concentration.

ft bgs = Feet below ground surface

MDL = Method detection limit

PQL = Practical quantitation limit

🟪 = Value rejected ("R" flag) based on data quality assessment.

🟨 = Value exceeds soil screening level when rounded to same number of significant figures as soil screening level.

🟥 = Value exceeds sediment screening level when rounded to same number of significant figures as sediment screening level.

🟩= PQL exceeds screening level when rounded to same number of significant figures as screening level.

'-- = Not applicable or not established.

Applicable Screening Levels

- A - Not near or upgradient of local surface water body and unsaturated.
- B - Not near or upgradient of local surface water body and saturated.
- C - Near or upgradient of local surface water body and unsaturated.
- D - Near or upgradient of local surface water body and saturated.
- E - Seasonally submerged; results compared to both soil and sediment screening levels.

TABLE 8
SUMMARY OF SOIL/SEDIMENT ANALYTICAL RESULTS
METALS[1] - INACTIVE LANDFILL AREA
GOOSE LAKE SITE
SHELTON, WASHINGTON

Sample ID	Trench-04-0.5	Trench-04-8.0	TP1-10	TP1-5	TP2-4	TP2-6.5	TP3-4	TP3-7	TP22-7 (dup of TP3-7)	TP4-3	TP5-10	GEI-1-2.0-3.0	GEI-1-8.0-9.0	GEI-1-19.0-20.0	GEI-1-26.0-27.0	GEI-2-4.0-5.0	GEI-2-12.0-13.0	GEI-2-24.0-25.0	GEI-3-4.0-5.0	GEI-3-16.0-17.0	Soil Screening Level (Near or Upgradient of Local Surface Water Body) (Saturated/ Unsaturated) [3]	Soil Screening Level (Not Near or Upgradient of Local Surface Water Body) (Saturated/ Unsaturated) [3]	Sediment Screening Level
Sample Date	08/13/02	08/13/02	12/16/97	12/16/97	12/16/97	12/16/97	12/16/97	12/16/97	12/16/97	12/16/97	12/16/97	10/19/10	10/19/10	10/19/10	10/19/10	10/19/10	10/19/10	10/19/10	10/18/10	10/18/10			
Depth (ft bgs)	0.5	8	10	5	4	6.5	4	7	7	3	10	2-3	8-9	19-20	26-27	4-5	12-13	24-25	4-5	16-17			
Sampled Horizon[2]	Waste	Glacial	Waste	Waste	Waste	Waste	Waste	Waste	Waste	Waste	Waste	Waste	Peat	Peat	Glacial	Waste	Peat	Peat	Waste	Peat			
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Applicable Screening Levels	A	A	A	A	A	A	C	C	C	C	A	C / E	D / E	D / E	D / E	C / E	D / E	D / E	C / E	D / E			
Chromium	47.2	82.5	13.7	7.37	32.6	36.3	89.1	46	23.3	42.6	74.7	18 J	20 J	24 J	--	25 J	19 J	32 J	3410	25	48	48	95
Hexavalent chromium	0.114 U	0.325	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	240	240	--
Copper	116	173	7.62	18.9	77.5	177	152	258	104	339	176	52	20	6	--	41.3	9	9	1100 J	153 J	36	36/70	619
Arsenic	9.8	5.34	1 U	1 U	1.26	1.26	26.5	7.68	5.39	1.97	4.1	20 U	30 U	30 U	--	20 U	30 U	30 U	50 U	20 U	20[4]	20[4]	31.4
Lead	133	170	10 U	10 U	54.2	124	27.6	704	725	121	51.8	50	60	10 U	--	19	10 U	10 U	1010	18	24/110	120	335
Mercury	1.96	0.426	0.05 U	0.05 U	0.413	1.06	0.348	38.4	19.6	0.98	1.07	0.3	0.2 U	0.1 U	--	0.12	0.1 U	0.2 U	0.85	0.4	0.07	0.1	0.8
Cadmium	--	--	0.25 U	0.25 U	1.61	1.2	0.25 U	1.57	1.61	1.08	0.5 U	--	--	--	--	--	--	--	--	--	14	14	2.39
Antimony	--	--	5 U	5 U	0.6 U	0.861	5 U	22.8	5 U	1.07	3.03	1 UJ	1 UJ	1 UJ	--	0.8 UJ	1 UJ	1 UJ	23 J	0.9 UJ	5	5	0.6
Nickel	--	--	32.9	83.3	13.3	24.9	48.6	44.5	50.4	28	699	58	23	7 U	--	66	11	7 U	2310 J	63 J	48	48	53.1
Silver	--	--	2.5 U	2.5 U	0.5 U	62.2	2.5 U	2.5 U	2.5 U	1.41	0.5 U	1 U	2 U	2 U	--	1 U	2 U	2 U	3 U	1 U	400	400	0.545
Zinc	--	--	10.3	8.67	47.5	1020	113	319	337	373	168	124	20	33	--	69	12	23	870	95	120	120	683

Notes:

[1] Metals analyzed by USEPA 6000/7000 Series methods.

[2] The soil/sediment samples from the inactive landfill were obtained from either the landfill cover, waste horizon, or native (peat or glacial) soil beneath the waste horizon.

[3] Where only a single value is shown, the screening level is the same for saturated and unsaturated soils.

[4] Regulatory background (MTCA Method A) value.

mg/kg = Milligrams per kilogram

U = The analyte was not detected at the value reported. Value reported represents the practical quantitation limit (PQL).

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Applicable Screening Levels

- A - Not near or upgradient of local surface water body and unsaturated.
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- E - Seasonally submerged; results compared to both soil and sediment screening levels.

TABLE 8
SUMMARY OF SOIL/SEDIMENT ANALYTICAL RESULTS
METALS[1] - INACTIVE LANDFILL AREA
GOOSE LAKE SITE
SHELTON, WASHINGTON

Sample ID	GEI-3-29.0-30.0	GEI-4-3.5-4.0	GEI-4-7.0-8.0	GEI-4-19.0-20.0	GEI-4-30.0-32.0	GEI-5-2.5-3.5	GEI-5-6.0-7.0	GEI-5-19.0-20.0	GEI-6-1.0-2.0	GEI-6-7.0-8.0	GEI-6-14.0-15.0	GEI-6-19.0-20.0	MW-16-4.0-5.0	MW-16-9.0-10.0	MW-16-19.0-20.0	MW-17-3.0-4.0	MW-17-9.0-10.0	MW-17-18.0-19.0	MW-17-23.0-24.0	Soil Screening Level (Near or Upgradient of Local Surface Water Body) (Saturated/ Unsaturated) [3]	Soil Screening Level (Not Near or Upgradient of Local Surface Water Body) (Saturated/ Unsaturated) [3]	Sediment Screening Level
Sample Date	10/18/10	10/18/10	10/18/10	10/18/10	10/18/10	10/18/10	10/18/10	10/18/10	10/19/10	10/19/10	10/19/10	10/19/10	10/19/10	10/19/10	10/19/10	10/19/10	10/19/10	10/19/10	10/19/10			
Depth (ft bgs)	29-30	3.5-4	7-8	19-20	30-32	2.5-3.5	6-7	19-20	1-2	7-8	14-15	19-20	4-5	9-10	19-20	3-4	9-10	18-19	23-24			
Sampled Horizon[2]	Peat	Waste	Peat	Peat	Glacial	Waste	Peat	Peat	Waste	Waste	Peat	Glacial	Waste	Waste	Peat	Cover	Waste	Peat	Peat			
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Applicable Screening Levels	D / E	C / E	D / E	D / E	D / E	C / E	D / E	D / E	C / E	D / E	D / E	D / E	C	D	D	C	D	D	D			
Chromium	25	58	23	22	--	64	42	31	169 J	49 J	40 J	--	8 J	9 J	19 J	40 J	57 J	18 J	--	48	48	95
Hexavalent chromium	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	240	240	--
Copper	6 J	104 J	28.6 J	5 J	--	110 J	250 J	9 J	109	349	13.6	--	14.6	16.1	8.4	47	130	62.2	12	36	36/70	619
Arsenic	40 U	20 U	20 U	40 U	--	20 U	40 U	40 U	6 U	10 U	20 U	--	20 U	20 U	20 U	10 U	7 U	20 U	7	20[4]	20[4]	31.4
Lead	10 U	339	11	20 U	--	185	20	20 U	102	512	7 U	--	8 U	9 U	8 U	46	125	45	--	24/110	120	335
Mercury	0.2 U	4.97	0.1	0.2 U	--	1.27	0.23	0.2 U	0.98	0.28	0.08 U	--	0.08 U	0.1 U	0.09 U	0.08	15	0.1 U	--	0.07	0.1	0.8
Cadmium	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	14	14	2.39
Antimony	1 UJ	3.9 J	0.9 UJ	2 UJ	--	2 J	3.6 J	2 UJ	0.6 J	0.9 J	0.7 UJ	--	0.8 UJ	0.9 UJ	0.8 UJ	0.2 UJ	0.6 J	1.1 J	--	5	5	0.6
Nickel	7 U	36 J	53 J	9 U	--	56 J	127 J	12 J	54	40	6	--	25	26	13	54	45	139	9	48	48	53.1
Silver	2 U	1 U	1 U	3 U	--	1 U	2 U	3 U	0.4 U	0.7 U	1 U	--	1 U	1 U	1 U	0.8 U	0.4 U	1 U	--	400	400	0.545
Zinc	8	243	51	9 U	--	5370	109	9	274	140	7	--	35	22	10	55	133	107	8	120	120	683

Notes:

[1] Metals analyzed by USEPA 6000/7000 Series methods.

[2] The soil/sediment samples from the inactive landfill were obtained from either the landfill cover, waste horizon, or native (peat or glacial) soil beneath the waste horizon.

[3] Where only a single value is shown, the screening level is the same for saturated and unsaturated soils.

[4] Regulatory background (MTCA Method A) value.

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U = The analyte was not detected at the value reported. Value reported represents the practical quantitation limit (PQL).

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Applicable Screening Levels

- A - Not near or upgradient of local surface water body and unsaturated.
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- D - Near or upgradient of local surface water body and saturated.
- E - Seasonally submerged; results compared to both soil and sediment screening levels.

TABLE 9
SUMMARY OF SOIL/SEDIMENT ANALYTICAL RESULTS[1]
DIOXIN CONGENERS[2] - INACTIVE LANDFILL AREA
GOOSE LAKE SITE
SHELTON, WASHINGTON

Congeners and TEFs	Sample ID	Sample Depth (ft bgs)	Sampled Horizon[5]	Concentration (ng/kg)
1,2,3,4,6,7,8-HpCDF **WHO TEF[3] for:** **Humans/Mammals = 0.01** **EPA TEF[4] for:** **Birds = 0.01** **Fish = 0.01**	TP-33-8	8	Waste	8.957 J
	TP-34-5	5	Waste	125.374
	TP-35-15	15	Waste	1331.205
	TP-36-20	20	Waste	15.296
	TP-37-12	12	Waste	7.315 J
	GEI-1-2.0-3.0-10192010	2-3	Waste	34.4
	GEI-1-8.0-9.0-10192010	8-9	Peat	24.6
	GEI-1-26.0-27.0-10192010	26-27	Glacial	0.478 J
	GEI-2-4.0-5.0-10192010	4-5	Waste	23.1
	GEI-2-12.0-13.0-10192010	12-13	Peat	5.05
	GEI-3-4.0-5.0-10182010	4-5	Waste	18.6
	GEI-3-16.0-17.0-10182010	16-17	Peat	84.6
	GEI-3-29.0-30.0-10182010	29-30	Peat	0.169 U
	GEI-4-3.5-4.0-10182010	3.5-4	Waste	32
	GEI-4-7.0-8.0-10182010	7-8	Peat	18.1
	GEI-5-2.5-3.5-10182010	2.5-3.5	Waste	25.9
	GEI-5-6.0-7.0-10182010	6-7	Peat	32.9
	GEI-6-1.0-2.0-10192010	1-2	Waste	103
	GEI-6-7.0-8.0-10192010	7-8	Waste	12.8
	GEI-6-19.0-20.0-10192010	19-20	Glacial	0.0376 U
	MW-16-4.0-5.0-10192010	4-5	Waste	3.82 J
	MW-16-9.0-10.0-10192010	9-10	Waste	56.8
	MW-17-3.0-4.0-10192010	3-4	Cover	24.8
	MW-17-9.0-10.0-10192010	9-10	Waste	128
1,2,3,4,7,8,9-HpCDF **WHO TEF for:** **Humans/Mammals = 0.01** **EPA TEF for:** **Birds = 0.01** **Fish = 0.01**	TP-33-8	8	Waste	1.57 U
	TP-34-5	5	Waste	19.614 J
	TP-35-15	15	Waste	46.755
	TP-36-20	20	Waste	1.019 U
	TP-37-12	12	Waste	1.137 U
	GEI-1-2.0-3.0-10192010	2-3	Waste	2.72 J
	GEI-1-8.0-9.0-10192010	8-9	Peat	0.829 J
	GEI-1-26.0-27.0-10192010	26-27	Glacial	0.0593 U
	GEI-2-4.0-5.0-10192010	4-5	Waste	0.796 J
	GEI-2-12.0-13.0-10192010	12-13	Peat	0.184 J
	GEI-3-4.0-5.0-10182010	4-5	Waste	1.19 U
	GEI-3-16.0-17.0-10182010	16-17	Peat	5.3
	GEI-3-29.0-30.0-10182010	29-30	Peat	0.313 U
	GEI-4-3.5-4.0-10182010	3.5-4	Waste	2.48 J
	GEI-4-7.0-8.0-10182010	7-8	Peat	1.2 J
	GEI-5-2.5-3.5-10182010	2.5-3.5	Waste	1.72 J
	GEI-5-6.0-7.0-10182010	6-7	Peat	1.5 J
	GEI-6-1.0-2.0-10192010	1-2	Waste	11
	GEI-6-7.0-8.0-10192010	7-8	Waste	0.954 J
	GEI-6-19.0-20.0-10192010	19-20	Glacial	0.0416 U
	MW-16-4.0-5.0-10192010	4-5	Waste	0.203 J
	MW-16-9.0-10.0-10192010	9-10	Waste	1.25 J
	MW-17-3.0-4.0-10192010	3-4	Cover	2.55 J
	MW-17-9.0-10.0-10192010	9-10	Waste	10.2
1,2,3,4,6,7,8-HpCDD **WHO TEF for:** **Humans/Mammals = 0.01** **EPA TEF for:** **Birds = <0.001** **Fish = 0.001**	TP-33-8	8	Waste	22.044
	TP-34-5	5	Waste	709.779
	TP-35-15	15	Waste	3742.07 J
	TP-36-20	20	Waste	60.792
	TP-37-12	12	Waste	30.678
	GEI-1-2.0-3.0-10192010	2-3	Waste	93.2
	GEI-1-8.0-9.0-10192010	8-9	Peat	62.6
	GEI-1-26.0-27.0-10192010	26-27	Glacial	0.791 U
	GEI-2-4.0-5.0-10192010	4-5	Waste	63.9
	GEI-2-12.0-13.0-10192010	12-13	Peat	12.5
	GEI-3-4.0-5.0-10182010	4-5	Waste	64.3
	GEI-3-16.0-17.0-10182010	16-17	Peat	312
	GEI-3-29.0-30.0-10182010	29-30	Peat	0.313 U
	GEI-4-3.5-4.0-10182010	3.5-4	Waste	192
	GEI-4-7.0-8.0-10182010	7-8	Peat	85.2
	GEI-5-2.5-3.5-10182010	2.5-3.5	Waste	99
	GEI-5-6.0-7.0-10182010	6-7	Peat	89.3
	GEI-6-1.0-2.0-10192010	1-2	Waste	388
	GEI-6-7.0-8.0-10192010	7-8	Waste	46.4
	GEI-6-19.0-20.0-10192010	19-20	Glacial	0.255 U
	MW-16-4.0-5.0-10192010	4-5	Waste	25.8
	MW-16-9.0-10.0-10192010	9-10	Waste	149
	MW-17-3.0-4.0-10192010	3-4	Cover	264
	MW-17-9.0-10.0-10192010	9-10	Waste	341

TABLE 9
SUMMARY OF SOIL/SEDIMENT ANALYTICAL RESULTS[1]
DIOXIN CONGENERS[2] - INACTIVE LANDFILL AREA
GOOSE LAKE SITE
SHELTON, WASHINGTON

Congeners and TEFs	Sample ID	Sample Depth (ft bgs)	Sampled Horizon[5]	Concentration (ng/kg)
1,2,3,6,7,8-HxCDD WHO TEF for: Humans/Mammals = 0.1 EPA TEF for: Birds = 0.01 Fish = 0.01	TP-33-8	8	Waste	0.952 U
	TP-34-5	5	Waste	222.36
	TP-35-15	15	Waste	140.813
	TP-36-20	20	Waste	1.668 J
	TP-37-12	12	Waste	1.606 J
	GEI-1-2.0-3.0-10192010	2-3	Waste	4 J
	GEI-1-8.0-9.0-10192010	8-9	Peat	3 J
	GEI-1-26.0-27.0-10192010	26-27	Glacial	0.0435 U
	GEI-2-4.0-5.0-10192010	4-5	Waste	3.09 J
	GEI-2-12.0-13.0-10192010	12-13	Peat	0.755 U
	GEI-3-4.0-5.0-10182010	4-5	Waste	3.08 J
	GEI-3-16.0-17.0-10182010	16-17	Peat	12.3
	GEI-3-29.0-30.0-10182010	29-30	Peat	0.187 U
	GEI-4-3.5-4.0-10182010	3.5-4	Waste	7.24
	GEI-4-7.0-8.0-10182010	7-8	Peat	3.38 J
	GEI-5-2.5-3.5-10182010	2.5-3.5	Waste	5.18
	GEI-5-6.0-7.0-10182010	6-7	Peat	4.36 J
	GEI-6-1.0-2.0-10192010	1-2	Waste	29.9
	GEI-6-7.0-8.0-10192010	7-8	Waste	3 J
	GEI-6-19.0-20.0-10192010	19-20	Glacial	0.0314 U
	MW-16-4.0-5.0-10192010	4-5	Waste	1.16 J
	MW-16-9.0-10.0-10192010	9-10	Waste	4.39 J
	MW-17-3.0-4.0-10192010	3-4	Cover	27.5
	MW-17-9.0-10.0-10192010	9-10	Waste	15.8
1,2,3,7,8,9-HxCDD WHO TEF for: Humans/Mammals = 0.1 EPA TEF for: Birds = 0.1 Fish = 0.01	TP-33-8	8	Waste	1.02 U
	TP-34-5	5	Waste	233.147
	TP-35-15	15	Waste	25.892
	TP-36-20	20	Waste	0.415 U
	TP-37-12	12	Waste	0.62 U
	GEI-1-2.0-3.0-10192010	2-3	Waste	1.81 J
	GEI-1-8.0-9.0-10192010	8-9	Peat	1.33 J
	GEI-1-26.0-27.0-10192010	26-27	Glacial	0.0488 U
	GEI-2-4.0-5.0-10192010	4-5	Waste	1.62 J
	GEI-2-12.0-13.0-10192010	12-13	Peat	0.595 J
	GEI-3-4.0-5.0-10182010	4-5	Waste	1.69 J
	GEI-3-16.0-17.0-10182010	16-17	Peat	5.47
	GEI-3-29.0-30.0-10182010	29-30	Peat	0.21 U
	GEI-4-3.5-4.0-10182010	3.5-4	Waste	3.72 J
	GEI-4-7.0-8.0-10182010	7-8	Peat	1.13 J
	GEI-5-2.5-3.5-10182010	2.5-3.5	Waste	2.6 J
	GEI-5-6.0-7.0-10182010	6-7	Peat	1.4 J
	GEI-6-1.0-2.0-10192010	1-2	Waste	20.4
	GEI-6-7.0-8.0-10192010	7-8	Waste	1.77 J
	GEI-6-19.0-20.0-10192010	19-20	Glacial	0.0353 U
	MW-16-4.0-5.0-10192010	4-5	Waste	0.72 J
	MW-16-9.0-10.0-10192010	9-10	Waste	1.19 J
	MW-17-3.0-4.0-10192010	3-4	Cover	20
	MW-17-9.0-10.0-10192010	9-10	Waste	9.97
1,2,3,4,7,8-HxCDD WHO TEF for: Humans/Mammals = 0.1 EPA TEF for: Birds = 0.05 Fish = 0.5	TP-33-8	8	Waste	1.127 U
	TP-34-5	5	Waste	133.922 J
	TP-35-15	15	Waste	5.011 J
	TP-36-20	20	Waste	0.487 U
	TP-37-12	12	Waste	0.727 U
	GEI-1-2.0-3.0-10192010	2-3	Waste	0.976 J
	GEI-1-8.0-9.0-10192010	8-9	Peat	0.744 J
	GEI-1-26.0-27.0-10192010	26-27	Glacial	0.0358 U
	GEI-2-4.0-5.0-10192010	4-5	Waste	0.807 J
	GEI-2-12.0-13.0-10192010	12-13	Peat	0.0894 U
	GEI-3-4.0-5.0-10182010	4-5	Waste	1.09 J
	GEI-3-16.0-17.0-10182010	16-17	Peat	2.57 J
	GEI-3-29.0-30.0-10182010	29-30	Peat	0.185 U
	GEI-4-3.5-4.0-10182010	3.5-4	Waste	1.95 J
	GEI-4-7.0-8.0-10182010	7-8	Peat	0.458 J
	GEI-5-2.5-3.5-10182010	2.5-3.5	Waste	1.09 J
	GEI-5-6.0-7.0-10182010	6-7	Peat	0.751 J
	GEI-6-1.0-2.0-10192010	1-2	Waste	13.1
	GEI-6-7.0-8.0-10192010	7-8	Waste	1.06 U
	GEI-6-19.0-20.0-10192010	19-20	Glacial	0.0288 U
	MW-16-4.0-5.0-10192010	4-5	Waste	0.261 U
	MW-16-9.0-10.0-10192010	9-10	Waste	0.541 J
	MW-17-3.0-4.0-10192010	3-4	Cover	12.3
	MW-17-9.0-10.0-10192010	9-10	Waste	4.8

TABLE 9
SUMMARY OF SOIL/SEDIMENT ANALYTICAL RESULTS[1]
DIOXIN CONGENERS[2] - INACTIVE LANDFILL AREA
GOOSE LAKE SITE
SHELTON, WASHINGTON

Congeners and TEFs	Sample ID	Sample Depth (ft bgs)	Sampled Horizon[5]	Concentration (ng/kg)
1,2,3,4,7,8-HxCDF **WHO TEF for:** **Humans/Mammals = 0.1** **EPA TEF for:** **Birds = 0.1** **Fish = 0.1**	TP-33-8	8	Waste	0.702 U
	TP-34-5	5	Waste	236.7 J
	TP-35-15	15	Waste	19.774
	TP-36-20	20	Waste	0.931 J
	TP-37-12	12	Waste	2.421 J
	GEI-1-2.0-3.0-10192010	2-3	Waste	3.59 J
	GEI-1-8.0-9.0-10192010	8-9	Peat	0.96 J
	GEI-1-26.0-27.0-10192010	26-27	Glacial	0.0287 U
	GEI-2-4.0-5.0-10192010	4-5	Waste	1.3 J
	GEI-2-12.0-13.0-10192010	12-13	Peat	0.372 J
	GEI-3-4.0-5.0-10182010	4-5	Waste	2.04 J
	GEI-3-16.0-17.0-10182010	16-17	Peat	4.94
	GEI-3-29.0-30.0-10182010	29-30	Peat	0.151 U
	GEI-4-3.5-4.0-10182010	3.5-4	Waste	3.87 J
	GEI-4-7.0-8.0-10182010	7-8	Peat	1.64 J
	GEI-5-2.5-3.5-10182010	2.5-3.5	Waste	2.05 J
	GEI-5-6.0-7.0-10182010	6-7	Peat	1.74 J
	GEI-6-1.0-2.0-10192010	1-2	Waste	18.7
	GEI-6-7.0-8.0-10192010	7-8	Waste	2.09 J
	GEI-6-19.0-20.0-10192010	19-20	Glacial	0.0202 U
	MW-16-4.0-5.0-10192010	4-5	Waste	0.401 J
	MW-16-9.0-10.0-10192010	9-10	Waste	2.08 J
	MW-17-3.0-4.0-10192010	3-4	Cover	5.14
	MW-17-9.0-10.0-10192010	9-10	Waste	17.5
1,2,3,6,7,8-HxCDF **WHO TEF for:** **Humans/Mammals = 0.1** **EPA TEF for:** **Birds = 0.1** **Fish = 0.1**	TP-33-8	8	Waste	0.65 U
	TP-34-5	5	Waste	147.825
	TP-35-15	15	Waste	6.076 J
	TP-36-20	20	Waste	0.473 U
	TP-37-12	12	Waste	0.398 U
	GEI-1-2.0-3.0-10192010	2-3	Waste	1.68 J
	GEI-1-8.0-9.0-10192010	8-9	Peat	0.616 J
	GEI-1-26.0-27.0-10192010	26-27	Glacial	0.0243 U
	GEI-2-4.0-5.0-10192010	4-5	Waste	0.986 J
	GEI-2-12.0-13.0-10192010	12-13	Peat	0.266 J
	GEI-3-4.0-5.0-10182010	4-5	Waste	1.52 J
	GEI-3-16.0-17.0-10182010	16-17	Peat	3.59 J
	GEI-3-29.0-30.0-10182010	29-30	Peat	0.143 U
	GEI-4-3.5-4.0-10182010	3.5-4	Waste	2.04 J
	GEI-4-7.0-8.0-10182010	7-8	Peat	0.781 J
	GEI-5-2.5-3.5-10182010	2.5-3.5	Waste	1.41 J
	GEI-5-6.0-7.0-10182010	6-7	Peat	1.13 J
	GEI-6-1.0-2.0-10192010	1-2	Waste	12.3
	GEI-6-7.0-8.0-10192010	7-8	Waste	1.42 J
	GEI-6-19.0-20.0-10192010	19-20	Glacial	0.0192 U
	MW-16-4.0-5.0-10192010	4-5	Waste	0.166 U
	MW-16-9.0-10.0-10192010	9-10	Waste	1.12 J
	MW-17-3.0-4.0-10192010	3-4	Cover	5.13
	MW-17-9.0-10.0-10192010	9-10	Waste	15.4
1,2,3,7,8,9-HxCDF **WHO TEF for:** **Humans/Mammals = 0.1** **EPA TEF for:** **Birds = 0.1** **Fish = 0.1**	TP-33-8	8	Waste	0.881 U
	TP-34-5	5	Waste	2.424 U
	TP-35-15	15	Waste	6.463 U
	TP-36-20	20	Waste	0.6 U
	TP-37-12	12	Waste	0.506 U
	GEI-1-2.0-3.0-10192010	2-3	Waste	0.7 U
	GEI-1-8.0-9.0-10192010	8-9	Peat	0.159 U
	GEI-1-26.0-27.0-10192010	26-27	Glacial	0.0334 U
	GEI-2-4.0-5.0-10192010	4-5	Waste	0.269 U
	GEI-2-12.0-13.0-10192010	12-13	Peat	0.0912 U
	GEI-3-4.0-5.0-10182010	4-5	Waste	0.497 J
	GEI-3-16.0-17.0-10182010	16-17	Peat	1.28 J
	GEI-3-29.0-30.0-10182010	29-30	Peat	0.201 U
	GEI-4-3.5-4.0-10182010	3.5-4	Waste	1.06 J
	GEI-4-7.0-8.0-10182010	7-8	Peat	0.351 J
	GEI-5-2.5-3.5-10182010	2.5-3.5	Waste	0.518 J
	GEI-5-6.0-7.0-10182010	6-7	Peat	0.348 J
	GEI-6-1.0-2.0-10192010	1-2	Waste	4.27 J
	GEI-6-7.0-8.0-10192010	7-8	Waste	0.565 J
	GEI-6-19.0-20.0-10192010	19-20	Glacial	0.0265 U
	MW-16-4.0-5.0-10192010	4-5	Waste	0.0785 U
	MW-16-9.0-10.0-10192010	9-10	Waste	0.381 U
	MW-17-3.0-4.0-10192010	3-4	Cover	1.65 J
	MW-17-9.0-10.0-10192010	9-10	Waste	4.67 J

TABLE 9
SUMMARY OF SOIL/SEDIMENT ANALYTICAL RESULTS^1
DIOXIN CONGENERS^2 - INACTIVE LANDFILL AREA
GOOSE LAKE SITE
SHELTON, WASHINGTON

Congeners and TEFs	Sample ID	Sample Depth (ft bgs)	Sampled Horizon^5	Concentration (ng/kg)
2,3,4,6,7,8-HxCDF **WHO TEF for:** **Humans/Mammals = 0.1** **EPA TEF for:** **Birds = 0.1** **Fish = 0.1**	TP-33-8	8	Waste	0.766 U
	TP-34-5	5	Waste	153.051 J
	TP-35-15	15	Waste	42.254
	TP-36-20	20	Waste	0.533 U
	TP-37-12	12	Waste	0.449 U
	GEI-1-2.0-3.0-10192010	2-3	Waste	1.92 J
	GEI-1-8.0-9.0-10192010	8-9	Peat	0.777 U
	GEI-1-26.0-27.0-10192010	26-27	Glacial	0.0275 U
	GEI-2-4.0-5.0-10192010	4-5	Waste	1.15 J
	GEI-2-12.0-13.0-10192010	12-13	Peat	0.328 J
	GEI-3-4.0-5.0-10182010	4-5	Waste	1.5 J
	GEI-3-16.0-17.0-10182010	16-17	Peat	4.59 J
	GEI-3-29.0-30.0-10182010	29-30	Peat	0.159 U
	GEI-4-3.5-4.0-10182010	3.5-4	Waste	2.88 J
	GEI-4-7.0-8.0-10182010	7-8	Peat	1.37 J
	GEI-5-2.5-3.5-10182010	2.5-3.5	Waste	2.01 J
	GEI-5-6.0-7.0-10182010	6-7	Peat	1.55 J
	GEI-6-1.0-2.0-10192010	1-2	Waste	12.9
	GEI-6-7.0-8.0-10192010	7-8	Waste	1.63 J
	GEI-6-19.0-20.0-10192010	19-20	Glacial	0.0221 U
	MW-16-4.0-5.0-10192010	4-5	Waste	0.0738 U
	MW-16-9.0-10.0-10192010	9-10	Waste	1.34 J
	MW-17-3.0-4.0-10192010	3-4	Cover	5.89
	MW-17-9.0-10.0-10192010	9-10	Waste	18.4
1,2,3,7,8-PeCDF **WHO TEF for:** **Humans/Mammals = 0.03** **EPA TEF for:** **Birds = 0.1** **Fish = 0.05**	TP-33-8	8	Waste	0.967 U
	TP-34-5	5	Waste	384.271 J
	TP-35-15	15	Waste	8.579 J
	TP-36-20	20	Waste	0.492 U
	TP-37-12	12	Waste	0.541 U
	GEI-1-2.0-3.0-10192010	2-3	Waste	1.15 J
	GEI-1-8.0-9.0-10192010	8-9	Peat	0.539 J
	GEI-1-26.0-27.0-10192010	26-27	Glacial	0.0276 U
	GEI-2-4.0-5.0-10192010	4-5	Waste	1.13 J
	GEI-2-12.0-13.0-10192010	12-13	Peat	0.334 U
	GEI-3-4.0-5.0-10182010	4-5	Waste	1.08 J
	GEI-3-16.0-17.0-10182010	16-17	Peat	2.7 J
	GEI-3-29.0-30.0-10182010	29-30	Peat	0.125 U
	GEI-4-3.5-4.0-10182010	3.5-4	Waste	1.45 J
	GEI-4-7.0-8.0-10182010	7-8	Peat	0.438 J
	GEI-5-2.5-3.5-10182010	2.5-3.5	Waste	1.08 J
	GEI-5-6.0-7.0-10182010	6-7	Peat	0.773 J
	GEI-6-1.0-2.0-10192010	1-2	Waste	13.4
	GEI-6-7.0-8.0-10192010	7-8	Waste	2.08 J
	GEI-6-19.0-20.0-10192010	19-20	Glacial	0.0141 U
	MW-16-4.0-5.0-10192010	4-5	Waste	0.187 J
	MW-16-9.0-10.0-10192010	9-10	Waste	0.623 J
	MW-17-3.0-4.0-10192010	3-4	Cover	6.48
	MW-17-9.0-10.0-10192010	9-10	Waste	9.27
2,3,4,7,8-PeCDF **WHO TEF for:** **Humans/Mammals = 0.3** **EPA TEF for:** **Birds = 1** **Fish = 0.5**	TP-33-8	8	Waste	0.972 U
	TP-34-5	5	Waste	613.957
	TP-35-15	15	Waste	9.306 J
	TP-36-20	20	Waste	0.454 U
	TP-37-12	12	Waste	0.5 U
	GEI-1-2.0-3.0-10192010	2-3	Waste	1.21 J
	GEI-1-8.0-9.0-10192010	8-9	Peat	0.781 J
	GEI-1-26.0-27.0-10192010	26-27	Glacial	0.0576 U
	GEI-2-4.0-5.0-10192010	4-5	Waste	1.53 J
	GEI-2-12.0-13.0-10192010	12-13	Peat	0.338 U
	GEI-3-4.0-5.0-10182010	4-5	Waste	1.37 J
	GEI-3-16.0-17.0-10182010	16-17	Peat	3.78 J
	GEI-3-29.0-30.0-10182010	29-30	Peat	0.124 U
	GEI-4-3.5-4.0-10182010	3.5-4	Waste	2.55 J
	GEI-4-7.0-8.0-10182010	7-8	Peat	0.809 J
	GEI-5-2.5-3.5-10182010	2.5-3.5	Waste	2.27 J
	GEI-5-6.0-7.0-10182010	6-7	Peat	0.984 J
	GEI-6-1.0-2.0-10192010	1-2	Waste	14.4
	GEI-6-7.0-8.0-10192010	7-8	Waste	2.48 J
	GEI-6-19.0-20.0-10192010	19-20	Glacial	0.0172 U
	MW-16-4.0-5.0-10192010	4-5	Waste	0.193 J
	MW-16-9.0-10.0-10192010	9-10	Waste	0.874 J
	MW-17-3.0-4.0-10192010	3-4	Cover	7.74
	MW-17-9.0-10.0-10192010	9-10	Waste	13.8

TABLE 9

SUMMARY OF SOIL/SEDIMENT ANALYTICAL RESULTS[1]

DIOXIN CONGENERS[2] - INACTIVE LANDFILL AREA

GOOSE LAKE SITE

SHELTON, WASHINGTON

Congeners and TEFs	Sample ID	Sample Depth (ft bgs)	Sampled Horizon[5]	Concentration (ng/kg)
1,2,3,7,8-PeCDD WHO TEF for: Humans/Mammals = 1 EPA TEF for: Birds = 1 Fish = 1	TP-33-8	8	Waste	1.012 U
	TP-34-5	5	Waste	215.575 J
	TP-35-15	15	Waste	4.386 J
	TP-36-20	20	Waste	0.332 U
	TP-37-12	12	Waste	0.608 U
	GEI-1-2.0-3.0-10192010	2-3	Waste	1.16 J
	GEI-1-8.0-9.0-10192010	8-9	Peat	0.942 J
	GEI-1-26.0-27.0-10192010	26-27	Glacial	0.0281 U
	GEI-2-4.0-5.0-10192010	4-5	Waste	1.49 J
	GEI-2-12.0-13.0-10192010	12-13	Peat	0.472 J
	GEI-3-4.0-5.0-10182010	4-5	Waste	0.983 J
	GEI-3-16.0-17.0-10182010	16-17	Peat	3.55 J
	GEI-3-29.0-30.0-10182010	29-30	Peat	0.185 U
	GEI-4-3.5-4.0-10182010	3.5-4	Waste	2.36 J
	GEI-4-7.0-8.0-10182010	7-8	Peat	0.638 J
	GEI-5-2.5-3.5-10182010	2.5-3.5	Waste	1.55 J
	GEI-5-6.0-7.0-10182010	6-7	Peat	1.02 J
	GEI-6-1.0-2.0-10192010	1-2	Waste	16.1
	GEI-6-7.0-8.0-10192010	7-8	Waste	2.12 J
	GEI-6-19.0-20.0-10192010	19-20	Glacial	0.0238 U
	MW-16-4.0-5.0-10192010	4-5	Waste	0.437 U
	MW-16-9.0-10.0-10192010	9-10	Waste	0.521 J
	MW-17-3.0-4.0-10192010	3-4	Cover	11
	MW-17-9.0-10.0-10192010	9-10	Waste	6.89
2,3,7,8-TCDF WHO TEF for: Humans/Mammals = 0.1 EPA TEF for: Birds = 1 Fish = 0.05	TP-33-8	8	Waste	1.044 U
	TP-34-5	5	Waste	1034.60 J
	TP-35-15	15	Waste	11.006
	TP-36-20	20	Waste	0.392 U
	TP-37-12	12	Waste	1.418 U
	GEI-1-2.0-3.0-10192010	2-3	Waste	1.96
	GEI-1-8.0-9.0-10192010	8-9	Peat	0.956 J
	GEI-1-26.0-27.0-10192010	26-27	Glacial	0.0142 U
	GEI-2-4.0-5.0-10192010	4-5	Waste	1.86 U
	GEI-2-12.0-13.0-10192010	12-13	Peat	0.488 J
	GEI-3-4.0-5.0-10182010	4-5	Waste	1.71
	GEI-3-16.0-17.0-10182010	16-17	Peat	4.88
	GEI-3-29.0-30.0-10182010	29-30	Peat	0.095 U
	GEI-4-3.5-4.0-10182010	3.5-4	Waste	3.06
	GEI-4-7.0-8.0-10182010	7-8	Peat	0.894 J
	GEI-5-2.5-3.5-10182010	2.5-3.5	Waste	2.67
	GEI-5-6.0-7.0-10182010	6-7	Peat	1.47
	GEI-6-1.0-2.0-10192010	1-2	Waste	20.9
	GEI-6-7.0-8.0-10192010	7-8	Waste	3.39
	GEI-6-19.0-20.0-10192010	19-20	Glacial	0.0183 U
	MW-16-4.0-5.0-10192010	4-5	Waste	0.327 J
	MW-16-9.0-10.0-10192010	9-10	Waste	1.77
	MW-17-3.0-4.0-10192010	3-4	Cover	9.06
	MW-17-9.0-10.0-10192010	9-10	Waste	17.8
2,3,7,8-TCDD WHO TEF for: Humans/Mammals = 1 EPA TEF for: Birds = 1 Fish = 1	TP-33-8	8	Waste	0.839 U
	TP-34-5	5	Waste	159.677
	TP-35-15	15	Waste	9.957 J
	TP-36-20	20	Waste	0.429 U
	TP-37-12	12	Waste	0.605 U
	GEI-1-2.0-3.0-10192010	2-3	Waste	0.506 U
	GEI-1-8.0-9.0-10192010	8-9	Peat	0.233 U
	GEI-1-26.0-27.0-10192010	26-27	Glacial	0.036 U
	GEI-2-4.0-5.0-10192010	4-5	Waste	0.428 U
	GEI-2-12.0-13.0-10192010	12-13	Peat	0.15 U
	GEI-3-4.0-5.0-10182010	4-5	Waste	0.4 U
	GEI-3-16.0-17.0-10182010	16-17	Peat	1.25 U
	GEI-3-29.0-30.0-10182010	29-30	Peat	0.131 U
	GEI-4-3.5-4.0-10182010	3.5-4	Waste	0.762 U
	GEI-4-7.0-8.0-10182010	7-8	Peat	0.329 U
	GEI-5-2.5-3.5-10182010	2.5-3.5	Waste	0.466 U
	GEI-5-6.0-7.0-10182010	6-7	Peat	0.269 U
	GEI-6-1.0-2.0-10192010	1-2	Waste	4.91
	GEI-6-7.0-8.0-10192010	7-8	Waste	0.648 U
	GEI-6-19.0-20.0-10192010	19-20	Glacial	0.0292 U
	MW-16-4.0-5.0-10192010	4-5	Waste	0.0525 U
	MW-16-9.0-10.0-10192010	9-10	Waste	0.134 U
	MW-17-3.0-4.0-10192010	3-4	Cover	3.78
	MW-17-9.0-10.0-10192010	9-10	Waste	2.06

TABLE 9
SUMMARY OF SOIL/SEDIMENT ANALYTICAL RESULTS[1]
DIOXIN CONGENERS[2] - INACTIVE LANDFILL AREA
GOOSE LAKE SITE
SHELTON, WASHINGTON

Congeners and TEFs	Sample ID	Sample Depth (ft bgs)	Sampled Horizon[5]	Concentration (ng/kg)
OCDF **WHO TEF for:** **Humans/Mammals = 0.0003** **EPA TEF for:** **Birds = 0.0001** **Fish = <0.0001**	TP-33-8	8	Waste	45.432
	TP-34-5	5	Waste	54.785 J
	TP-35-15	15	Waste	2642.419
	TP-36-20	20	Waste	26.07
	TP-37-12	12	Waste	9.34 J
	GEI-1-2.0-3.0-10192010	2-3	Waste	53.4
	GEI-1-8.0-9.0-10192010	8-9	Peat	20.1
	GEI-1-26.0-27.0-10192010	26-27	Glacial	2.9 J
	GEI-2-4.0-5.0-10192010	4-5	Waste	24.5
	GEI-2-12.0-13.0-10192010	12-13	Peat	4.52 J
	GEI-3-4.0-5.0-10182010	4-5	Waste	37.2
	GEI-3-16.0-17.0-10182010	16-17	Peat	266
	GEI-3-29.0-30.0-10182010	29-30	Peat	0.539 U
	GEI-4-3.5-4.0-10182010	3.5-4	Waste	75
	GEI-4-7.0-8.0-10182010	7-8	Peat	36.2
	GEI-5-2.5-3.5-10182010	2.5-3.5	Waste	50.7
	GEI-5-6.0-7.0-10182010	6-7	Peat	43
	GEI-6-1.0-2.0-10192010	1-2	Waste	220
	GEI-6-7.0-8.0-10192010	7-8	Waste	21.8
	GEI-6-19.0-20.0-10192010	19-20	Glacial	0.0807 U
	MW-16-4.0-5.0-10192010	4-5	Waste	5.89 J
	MW-16-9.0-10.0-10192010	9-10	Waste	37.3
	MW-17-3.0-4.0-10192010	3-4	Cover	40.5
	MW-17-9.0-10.0-10192010	9-10	Waste	162
OCDD **WHO TEF for:** **Humans/Mammals = 0.0003** **EPA TEF for:** **Birds = 0.0001** **Fish = <0.0001**	TP-33-8	8	Waste	244.951
	TP-34-5	5	Waste	611.985
	TP-35-15	15	Waste	66387.236 J
	TP-36-20	20	Waste	682.356
	TP-37-12	12	Waste	279.128
	GEI-1-2.0-3.0-10192010	2-3	Waste	950
	GEI-1-8.0-9.0-10192010	8-9	Peat	987
	GEI-1-26.0-27.0-10192010	26-27	Glacial	4.69 J
	GEI-2-4.0-5.0-10192010	4-5	Waste	815
	GEI-2-12.0-13.0-10192010	12-13	Peat	190
	GEI-3-4.0-5.0-10182010	4-5	Waste	592
	GEI-3-16.0-17.0-10182010	16-17	Peat	2920
	GEI-3-29.0-30.0-10182010	29-30	Peat	0.659 U
	GEI-4-3.5-4.0-10182010	3.5-4	Waste	1950
	GEI-4-7.0-8.0-10182010	7-8	Peat	736
	GEI-5-2.5-3.5-10182010	2.5-3.5	Waste	1020
	GEI-5-6.0-7.0-10182010	6-7	Peat	1140
	GEI-6-1.0-2.0-10192010	1-2	Waste	3060
	GEI-6-7.0-8.0-10192010	7-8	Waste	439
	GEI-6-19.0-20.0-10192010	19-20	Glacial	1.72 J
	MW-16-4.0-5.0-10192010	4-5	Waste	159
	MW-16-9.0-10.0-10192010	9-10	Waste	1170
	MW-17-3.0-4.0-10192010	3-4	Cover	1040
	MW-17-9.0-10.0-10192010	9-10	Waste	2850

Notes:

[1] Chemical analyses conducted by Columbia Analytical Services of Kelso, Washington or Analytical Resources, Inc., Tukwila, Washington.

[2] Dioxins and furans analyzed by USEPA Method 8290 or USEPA Method 1613B.

[3] WHO TEF Source: World Health Organization 2005 Reevaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-Like Compounds (Van den Berg et al., 2006). Human and mammal dioxin/furan TEFs based on MTCA 2007 TEFs (World Health Organization 2005 Reevaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-Like Compounds (Van den Berg et al., 2006).

[4] EPA TEF Source: Framework for Application of the Toxicity Equivalence Methodology for Polychlorinated Dioxins, Furans, and Biphenyls in Ecological Risk Assessment (USEPA, 2003) . Bird and fish dioxin/furan TEFs based on USEPA 2003 Framework for Application of the Toxicity Equivalence Methodology for Polychlorinated Dioxins, Furans, and Biphenyls in Ecological Risk Assessment.

[5] The soil/sediment samples from the inactive landfill were obtained from either the landfill cover, waste horizon, or native (peat or glacial) soil beneath the waste horizon.

ng/kg = Nanograms per kilogram
U = Congener was not detected at a concentration exceeding the value reported. Value reported represents method detection limit (MDL).
J = Congener was detected at the reported value but is considered to be estimated.
HpCDF = Heptachlorodibenzofuran
HpCDD = Heptachlorodibenzo-p-dioxin
HxCDD = Hexachlorodibenzo-p-dioxin
HxCDF = Hexachlorodibenzofuran
PeCDF = Pentachlorodibenzofuran
PeCDD = Pentachlorodibenzo-p-dioxin
TCDF = Tetrachlorodibenzofuran
TCDD = Tetrachlorodibenzo-p-dioxin
OCDF = Octachlorodibenzofuran
OCDD = Octachlorodibenzo-p-dioxin
TEF = Toxicity equivalency factor
ft bgs = Feet below ground surface
MDL = Method detection limit

TABLE 10
SUMMARY OF SOIL/SEDIMENT ANALYTICAL RESULTS
DIOXIN TEQ VALUES - INACTIVE LANDFILL AREA
GOOSE LAKE SITE
SHELTON, WASHINGTON

TEQ/Screening Level Categories (ng/kg)	Sample Identification															
	TP-33-8		TP-34-5		TP-35-15		TP-36-20		TP-37-12		GEI-1-2.0-3.0-10192010			GEI-1-8.0-9.0-10192010		
	Waste[1]		Waste		Waste		Waste		Waste		Waste			Peat		
	TEQ (h)(m)	TEQ (b)	TEQ (h)(m)	TEQ (b)	TEQ (h)(m)	TEQ (b)	TEQ (h)(m)	TEQ (b)	TEQ (h)(m)	TEQ (b)	TEQ (h)(m)	TEQ (b)	TEQ (f)	TEQ (h)(m)	TEQ (b)	TEQ (f)
Applicable Screening Levels:	C		A		A		B		A		C / E			D / E		
Total Dioxins TEQ (ND=0.5MDL)	1.4	1.1	440	410	89	40	1.4	0.69	1.2	0.84	3.3 J	2.1 J	--	2.5 J	1.6 J	--
Total Furans TEQ (ND=0.5MDL)	0.5	1.3	400	1700	30	42	0.4	0.78	0.5	1.4	2 J	4.4 J	--	0.8 J	2.3 J	--
Total D/F TEQ (ND=0.5MDL)	1.8	--	800	--	110	--	1.8	--	1.8	--	5.3 J	6.5 J	4 J	3.5 J	3.9 J	3 J
Soil Screening Level (Total Dioxins TEQ - Ecological)(Near/Not Near or Upgradient of Local Surface Water Body) (Saturated/Unsaturated) [2, 3]	20	20	20	20	20	20	20	20	20	20	20	20	--	20	20	--
Soil Screening Level (Total Furans TEQ - Ecological)(Near/Not Near or Upgradient of Local Surface Water Body) (Saturated/Unsaturated) [2, 3]	20	20	20	20	20	20	20	20	20	20	20	20	--	20	20	--
Soil Screening Level (Total D/F TEQ - Human Health)(Near or Upgradient of Local Surface Water Body) (Saturated/Unsaturated) [2]	5.2 (a)	--	5.2 (a)	--	5.2 (a)	--	5.2 (a)	--	5.2 (a)	--	5.2 (a)	--	--	5.2 (a)	--	--
Soil Screening Level (Total D/F TEQ - Human Health)(Not Near or Upgradient of Local Surface Water Body) (Saturated/Unsaturated) [2]	7.5 (a) / 11 (a)	--	7.5 (a) / 11 (a)	--	7.5 (a) / 11 (a)	--	7.5 (a) / 11 (a)	--	7.5 (a) / 11 (a)	--	7.5 (a) / 11 (a)	--	--	7.5 (a) / 11 (a)	--	--
Sediment Screening Level (Total D/F TEQ - Low-Risk Ecological)	--	--	--	--	--	--	--	--	--	--	2.5 (b)	21	60	2.5 (b)	21	60
Sediment Screening Level (Total D/F TEQ - High-Risk Ecological)	--	--	--	--	--	--	--	--	--	--	25 (b)	210	100	25 (b)	210	100

TEQ/Screening Level Categories (ng/kg)	Sample Identification														
	GEI-4-3.5-4.0-10182010			GEI-4-7.0-8.0-10182010			GEI-5-2.5-3.5-10182010			GEI-5-6.0-7.0-10182010			GEI-6-1.0-2.0-10192010		
	Waste			Peat			Waste			Peat			Waste		
	TEQ (h)(m)	TEQ (b)	TEQ (f)	TEQ (h)(m)	TEQ (b)	TEQ (f)	TEQ (h)(m)	TEQ (b)	TEQ (f)	TEQ (h)(m)	TEQ (b)	TEQ (f)	TEQ (h)(m)	TEQ (b)	TEQ (f)
Applicable Screening Levels:	C / E			D / E			C / E			D / E			C / E		
Total Dioxins TEQ (ND=0.5MDL)	6.5 J	4.1 J	--	2.4 J	1.4 J	--	4.0 J	2.6 J	--	3.0 J	1.9 J	--	32	26	--
Total Furans TEQ (ND=0.5MDL)	2 J	7.1 J	--	1 J	2.4 J	--	2 J	5.9 J	--	1 J	3.4 J	--	10 J	43 J	--
Total D/F TEQ (ND=0.5MDL)	9.4 J	11 J	8 J	3.5 J	3.7 J	3 J	6.1 J	8.6 J	6 J	4.5 J	5.2 J	4 J	45 J	69 J	50 J
Soil Screening Level (Total Dioxins TEQ - Ecological)(Near/Not Near or Upgradient of Local Surface Water Body) (Saturated/Unsaturated) [2, 3]	20	20	--	20	20	--	20	20	--	20	20	--	20	20	--
Soil Screening Level (Total Furans TEQ - Ecological)(Near/Not Near or Upgradient of Local Surface Water Body) (Saturated/Unsaturated) [2, 3]	20	20	--	20	20	--	20	20	--	20	20	--	20	20	--
Soil Screening Level (Total D/F TEQ - Human Health)(Near or Upgradient of Local Surface Water Body) (Saturated/Unsaturated) [2]	5.2 (a)	--	--	5.2 (a)	--	--	5.2 (a)	--	--	5.2 (a)	--	--	5.2 (a)	--	--
Soil Screening Level (Total D/F TEQ - Human Health)(Not Near or Upgradient of Local Surface Water Body) (Saturated/Unsaturated) [2]	7.5 (a) / 11 (a)	--	--	7.5 (a) / 11 (a)	--	--	7.5 (a) / 11 (a)	--	--	7.5 (a) / 11 (a)	--	--	7.5 (a) / 11 (a)	--	--
Sediment Screening Level (Total D/F TEQ - Low-Risk Ecological)	2.5 (b)	21	60	2.5 (b)	21	60	2.5 (b)	21	60	2.5 (b)	21	60	2.5 (b)	21	60
Sediment Screening Level (Total D/F TEQ - High-Risk Ecological)	25 (b)	210	100	25 (b)	210	100	25 (b)	210	100	25 (b)	210	100	25 (b)	210	100

Notes:

[1] The soil/sediment samples from the inactive landfill were obtained from either the landfill cover, waste horizon, or native (peat or glacial) soil beneath the waste horizon.

[2] Where only a single value is shown, the screening level is the same for saturated and unsaturated soils.

[3] Soil screening levels for locations near and not near surface water are the same.

h = humans (TEFs based on MTCA 2007 TEFs (World Health Organization 2005 Reevaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-Like Compounds (Van den Berg et al., 2006)).
m = mammals (TEFs based on MTCA 2007 TEFs (World Health Organization 2005 Reevaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-Like Compounds (Van den Berg et al., 2006)).
b = birds (TEFs based on USEPA 2003 Framework for Application of the Toxicity Equivalence Methodology for Polychlorinated Dioxins, Furans, and Biphenyls in Ecological Risk Assessment).
D/F = Dioxins/furans
TEQ = Toxicity Equivalency Quotient
For non-detect dioxin/furan congener results, since there was at least one positive detection of each congener in soil or sediment at the site, 1/2 the MDL was used in the TEQ calculation.
The TEQ values shown are displayed in units of nanograms per kilogram (ng/kg).
🟨 = Value exceeds soil screening level when rounded to same number of significant figures as soil screening level.
🟥 = Value exceeds sediment screening level when rounded to same number of significant figures as sediment screening level.
MDL = Method detection limit
U = The analyte was not detected at the value reported. Value reported represents the practical quantitation limit (PQL).
J = The analyte was detected at the value reported; the reported value is estimated.
-- = Not applicable or not established.
(a) Screening level for human health
(b) Screening level for mammalian wildlife
Applicable Screening Levels
- A - Not near or upgradient of local surface water body and unsaturated.
- B - Not near or upgradient of local surface water body and saturated.
- C - Near or upgradient of local surface water body and unsaturated.
- D - Near or upgradient of local surface water body and saturated.
- E - Seasonally submerged; results compared to both soil and sediment screening levels.

TABLE 10
SUMMARY OF SOIL/SEDIMENT ANALYTICAL RESULTS
DIOXIN TEQ VALUES - INACTIVE LANDFILL AREA
GOOSE LAKE SITE
SHELTON, WASHINGTON

TEQ/Screening Level Categories (ng/kg)	Sample Identification																	
	GEI-1-26.0-27.0-10192010			GEI-2-4.0-5.0-10192010			GEI-2-12.0-13.0-10192010			GEI-3-4.0-5.0-10182010			GEI-3-16.0-17.0-10182010			GEI-3-29.0-30.0-10182010		
	Glacial			Waste			Peat			Waste			Peat			Peat		
	TEQ (h)(m)	TEQ (b)	TEQ (f)	TEQ (h)(m)	TEQ (b)	TEQ (f)	TEQ (h)(m)	TEQ (b)	TEQ (f)	TEQ (h)(m)	TEQ (b)	TEQ (f)	TEQ (h)(m)	TEQ (b)	TEQ (f)	TEQ (h)(m)	TEQ (b)	TEQ (f)
Applicable Screening Levels:	D / E			C / E			D / E			C / E			D / E			D / E		
Total Dioxins TEQ (ND=0.5MDL)	0.044 J	0.037 J	--	3.1 J	2.3 J	--	0.83 J	0.65 J	--	2.6 J	1.7 J	--	10 J	6.3 J	--	0.19 U	0.17 U	--
Total Furans TEQ (ND=0.5MDL)	0.02 J	0.048 J	--	1 J	3.2 J	--	0.3 J	0.83 J	--	1 J	3.9 J	--	4 J	11 J	--	0.06 U	0.15 U	--
Total D/F TEQ (ND=0.5MDL)	0.078 J	0.085 J	0.07 J	4.7 J	5.4 J	4 J	1.3 J	1.5 J	1 J	4.2 J	5.7 J	4 J	15 J	18 J	10 J	0.25 U	0.33 U	0.3 U
Soil Screening Level (Total Dioxins TEQ - Ecological)(Near/Not Near or Upgradient of Local Surface Water Body) (Saturated/Unsaturated) [2, 3]	20	20	--	20	20	--	20	20	--	20	20	--	20	20	--	20	20	--
Soil Screening Level (Total Furans TEQ - Ecological)(Near/Not Near or Upgradient of Local Surface Water Body) (Saturated/Unsaturated) [2, 3]	20	20	--	20	20	--	20	20	--	20	20	--	20	20	--	20	20	--
Soil Screening Level (Total D/F TEQ - Human Health)(Near or Upgradient of Local Surface Water Body) (Saturated/Unsaturated) [2]	5.2 (a)	--	--	5.2 (a)	--	--	5.2 (a)	--	--	5.2 (a)	--	--	5.2 (a)	--	--	5.2 (a)	--	--
Soil Screening Level (Total D/F TEQ - Human Health)(Not Near or Upgradient of Local Surface Water Body) (Saturated/Unsaturated) [2]	7.5 (a) / 11 (a)	--	--	7.5 (a) / 11 (a)	--	--	7.5 (a) / 11 (a)	--	--	7.5 (a) / 11 (a)	--	--	7.5 (a) / 11 (a)	--	--	7.5 (a) / 11 (a)	--	--
Sediment Screening Level (Total D/F TEQ - Low-Risk Ecological)	2.5 (b)	21	60	2.5 (b)	21	60	2.5 (b)	21	60	2.5 (b)	21	60	2.5 (b)	21	60	2.5 (b)	21	60
Sediment Screening Level (Total D/F TEQ - High-Risk Ecological)	25 (b)	210	100	25 (b)	210	100	25 (b)	210	100	25 (b)	210	100	25 (b)	210	100	25 (b)	210	100

TEQ/Screening Level Categories (ng/kg)	Sample Identification																	
	GEI-6-7.0-8.0-10192010			GEI-6-19.0-20.0-10192010			MW-16-4.0-5.0-10192010			MW-16-9.0-10.0-10192010			MW-17-3.0-4.0-10192010			MW-17-9.0-10.0-10192010		
	Waste			Glacial			Waste			Waste			Cover			Waste		
	TEQ (h)(m)	TEQ (b)	TEQ (f)	TEQ (h)(m)	TEQ (b)	TEQ (f)	TEQ (h)(m)	TEQ (b)	TEQ (f)	TEQ (h)(m)	TEQ (b)	TEQ (f)	TEQ (h)(m)	TEQ (b)	TEQ (f)	TEQ (h)(m)	TEQ (b)	TEQ (f)
Applicable Screening Levels:	D / E			D / E			C			D			C			D		
Total Dioxins TEQ (ND=0.5MDL)	3.6 J	2.9 J	--	0.033 J	0.029 J	--	0.75 J	0.44 J	--	3.0 J	1.4 J	--	24	19	--	16	12	--
Total Furans TEQ (ND=0.5MDL)	2 J	6.8 J	--	0.008 U	0.023 U	--	0.2 J	0.64 J	--	2 J	3.8 J	--	5 J	20 J	--	10 J	40 J	--
Total D/F TEQ (ND=0.5MDL)	5.8 J	9.7 J	6 J	0.043 J	0.053 J	0.05 J	1.2 J	1.1 J	0.9 J	4.7 J	5.1 J	3 J	29 J	39 J	30 J	30 J	51 J	30 J
Soil Screening Level (Total Dioxins TEQ - Ecological)(Near/Not Near or Upgradient of Local Surface Water Body) (Saturated/Unsaturated) [2, 3]	20	20	--	20	20	--	20	20	--	20	20	--	20	20	--	20	20	--
Soil Screening Level (Total Furans TEQ - Ecological)(Near/Not Near or Upgradient of Local Surface Water Body) (Saturated/Unsaturated) [2, 3]	20	20	--	20	20	--	20	20	--	20	20	--	20	20	--	20	20	--
Soil Screening Level (Total D/F TEQ - Human Health)(Near or Upgradient of Local Surface Water Body) (Saturated/Unsaturated) [2]	5.2 (a)	--	--	5.2 (a)	--	--	5.2 (a)	--	--	5.2 (a)	--	--	5.2 (a)	--	--	5.2 (a)	--	--
Soil Screening Level (Total D/F TEQ - Human Health)(Not Near or Upgradient of Local Surface Water Body) (Saturated/Unsaturated) [2]	7.5 (a) / 11 (a)	--	--	7.5 (a) / 11 (a)	--	--	7.5 (a) / 11 (a)	--	--	7.5 (a) / 11 (a)	--	--	7.5 (a) / 11 (a)	--	--	7.5 (a) / 11 (a)	--	--
Sediment Screening Level (Total D/F TEQ - Low-Risk Ecological)	2.5 (b)	21	60	2.5 (b)	21	60	--	--	--	--	--	--	--	--	--	--	--	--
Sediment Screening Level (Total D/F TEQ - High-Risk Ecological)	25 (b)	210	100	25 (b)	210	100	--	--	--	--	--	--	--	--	--	--	--	--

Notes:

[1] The soil/sediment samples from the inactive landfill were obtained from either the landfill cover, waste horizon, or native (peat or glacial) soil beneath the waste horizon.

[2] Where only a single value is shown, the screening level is the same for saturated and unsaturated soils.

[3] Soil screening levels for locations near and not near surface water are the same.

h = humans (TEFs based on MTCA 2007 TEFs (World Health Organization 2005 Reevaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-Like Compounds (Van den Berg et al., 2006)).
m = mammals (TEFs based on MTCA 2007 TEFs (World Health Organization 2005 Reevaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-Like Compounds (Van den Berg et al., 2006)).
b = birds (TEFs based on USEPA 2003 Framework for Application of the Toxicity Equivalence Methodology for Polychlorinated Dioxins, Furans, and Biphenyls in Ecological Risk Assessment).
D/F = Dioxins/furans
TEQ = Toxicity Equivalency Quotient
For non-detect dioxin/furan congener results, since there was at least one positive detection of each congener in soil or sediment at the site, 1/2 the MDL was used in the TEQ calculation.
The TEQ values shown for the congeners are displayed in units of nanograms per kilogram (ng/kg).
🟨 = Value exceeds soil screening level when rounded to same number of significant figures as soil screening level.
🟥 = Value exceeds sediment screening level when rounded to same number of significant figures as sediment screening level.
MDL = Method detection limit
U = The analyte was not detected at the value reported. Value reported represents the practical quantitation limit (PQL).
J = The analyte was detected at the value reported; the reported value is estimated.
-- = Not applicable or not established.
(a) Screening level for human health direct-contact
(b) Screening level for mammalian wildlife
Applicable Screening Levels
- A - Not near or upgradient of local surface water body and unsaturated.
- B - Not near or upgradient of local surface water body and saturated.
- C - Near or upgradient of local surface water body and unsaturated.
- D - Near or upgradient of local surface water body and saturated.
- E - Seasonally submerged; results compared to both soil and sediment screening levels.

TABLE 11

SUMMARY OF SOIL/SEDIMENT ANALYTICAL RESULTS[1]

POLYCHLORINATED BIPHENYLS[2] - INACTIVE LANDFILL AREA

GOOSE LAKE SITE
SHELTON, WASHINGTON

Sample ID	TP-02-11.5	TP-08-8.0	TP-09-12.5	TP-13-5.0	TP-13-24.5	GEI-1-2.0-3.0-10192010	GEI-1-8.0-9.0-10192010	GEI-1-19.0-20.0-10192010	GEI-2-4.0-5.0-10192010	GEI-2-12.0-13.0-10192010	GEI-2-24.0-25.0-10192010	GEI-3-4.0-5.0-10182010	GEI-3-16.0-17.0-10182010	GEI-3-29.0-30.0-10182010	GEI-4-3.5-4.0-10182010	GEI-4-7.0-8.0-10182010	GEI-4-19.0-20.0-10182010	Soil Screening Level (Near or Upgradient of Local Surface Water Body) (Saturated/ Unsaturated)[4]	Soil Screening Level (Not Near or Upgradient of Local Surface Water Body) (Saturated/ Unsaturated)[4]	Sediment Screening Level
Date Sampled	07/08/02	07/11/02	07/08/02	07/08/02	07/08/02	10/19/10	10/19/10	10/19/10	10/19/10	10/19/10	10/19/10	10/18/10	10/18/10	10/18/10	10/18/10	10/18/10	10/18/10			
Depth (ft bgs)	11.5	8	12.5	5	24.5	2-3	8-9	19-20	4-5	12-13	24-25	4-5	16-17	29-30	3.5-4	7-8	19-20			
Sampled Horizon[3]	Waste	Waste	Waste	Waste	Waste	Waste	Peat	Peat	Waste	Peat	Peat	Waste	Peat	Peat	Waste	Peat	Peat			
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Applicable Screening Levels	B	C	B	A	B	C / E	D / E	D / E	C / E	D / E	D / E	C / E	D / E	D / E	C / E	D / E	D / E			
Aroclor-1016	0.0258 U	0.0405 U	0.0322 U	0.0102 U	0.035 U	0.032 U	0.033 U	0.032 U	0.031 U	0.033 U	0.033 U	0.032 U	0.031 U	0.032 U	0.032 U	0.031 U	0.032 U	5.6	5.6	--
Aroclor-1221	0.0258 U	0.0405 U	0.0322 U	0.0102 U	0.035 U	0.032 U	0.033 U	0.032 U	0.031 U	0.033 U	0.033 U	0.032 U	0.031 U	0.032 U	0.032 U	0.031 U	0.032 U	--	--	--
Aroclor-1232	0.0258 U	0.0405 U	0.0322 U	0.0102 U	0.035 U	0.032 U	0.033 U	0.032 U	0.031 U	0.041 UY	0.033 U	0.032 U	0.031 U	0.032 U	0.032 U	0.031 U	0.032 U	--	--	--
Aroclor-1242	0.0258 U	0.0405 U	0.0322 U	0.0102 U	0.035 U	0.032 U	0.033 U	0.032 U	0.031 U	0.033 U	0.033 U	0.032 U	0.031 U	0.032 U	0.032 U	0.031 U	0.032 U	--	--	--
Aroclor-1248	0.0258 U	0.0405 U	0.0322 U	0.0102 U	0.035 U	0.048 UY	0.033 U	0.032 U	0.077 UY	0.033 U	0.033 U	0.032 U	0.078 UY	0.032 U	0.08 UY	0.077 UY	0.032 U	--	--	--
Aroclor-1254	0.0258 U	0.0405 U	0.0322 U	0.0102 U	0.035 U	0.068	0.033 U	0.032 U	0.33	0.083 UY	0.033 U	0.032 U	0.11	0.032 U	0.13	0.12	0.032 U	1.6	1.6	0.23
Aroclor-1260	0.0258 U	0.0405 U	1.93 J	0.0102 U	0.035 U	0.043	0.041	0.032 U	0.46	0.16	0.033 U	0.032 U	0.092	0.032 U	0.088	0.085	0.032 U	--	--	0.138
Total PCBs[5]	0.0258 U	0.0405 U	1.93 J	0.0102 U	0.035 U	0.11	0.041	0.032 U	0.79	0.16	0.033 U	0.032 U	0.2	0.032 U	0.22	0.21	0.032 U	0.004	0.0137/0.273	0.062

Notes:

[1] Chemical analyses conducted by Severn Trent Laboratories, Tacoma, Washington or Analytical Resources, Inc., Tukwila, Washington.

[2] Aroclors 1016, 1221, 1232, 1242, 1248, 1254 and 1260 analyzed by USEPA Method 8082.

[3] The soil/sediment samples from the inactive landfill were obtained from either the landfill cover, waste horizon, or native (peat or glacial) soil beneath the waste horizon.

[4] Where only a single value is shown, the screening level is the same for saturated and unsaturated soils.

[5] Total PCBs were calculated per SAPA guidance (Ecology 2008b); i.e., the sum of Aroclors is represented by the sum of all detected Aroclors, or, when no Aroclors were detected, the sum is represented by the single highest non-detect result.

mg/kg = Milligrams per kilogram

U = The analyte was not detected at the value reported. Value reported represents the practical quantitation limit (PQL).

J = The analyte was detected at the value reported; the reported value is estimated.

UJ = The analyte was not detected at the value reported. Value reported represents the estimated PQL.

UY = Not detected above the associated value; the associated value is elevated due to interference.

PCBs = Polychlorinated biphenyls

ft bgs = Feet below ground surface

PQL = Practical quantitation limit

-- = No screening level available.

🟨 = Value exceeds soil screening level when rounded to same number of significant figures as soil screening level.

🟥 = Value exceeds sediment screening level when rounded to same number of significant figures as sediment screening level.

🟩 = PQL exceeds screening level when rounded to same number of significant figures as screening level.

Applicable Screening Levels

- A - Not near or upgradient of local surface water body and unsaturated.
- B - Not near or upgradient of local surface water body and saturated.
- C - Near or upgradient of local surface water body and unsaturated.
- D - Near or upgradient of local surface water body and saturated.
- E - Seasonally submerged; results compared to both soil and sediment screening levels.

TABLE 11

SUMMARY OF SOIL/SEDIMENT ANALYTICAL RESULTS[1]
POLYCHLORINATED BIPHENYLS2 - INACTIVE LANDFILL AREA
GOOSE LAKE SITE
SHELTON, WASHINGTON

Sample ID	GEI-5-2.5-3.5-10182010	GEI-5-6.0-7.0-10182010	GEI-5-19.0-20.0-10182010	GEI-6-1.0-2.0-10192010	GEI-6-7.0-8.0-10192010	GEI-6-14.0-15.0-10192010	GEI-6-19.0-20.0-10192010	MW-16-4.0-5.0-10192010	MW-16-9.0-10.0-10192010	MW-16-19.0-20.0-10192010	MW-17-3.0-4.0-10192010	MW-17-9.0-10.0-10192010	MW-17-18.0-19.0-10192010	Soil Screening Level (Near or Upgradient of Local Surface Water Body) (Saturated/ Unsaturated)[4]	Soil Screening Level (Not Near or Upgradient of Local Surface Water Body) (Saturated/ Unsaturated)[4]	Sediment Screening Level
Date Sampled	10/18/10	10/18/10	10/18/10	10/19/10	10/19/10	10/19/10	10/19/10	10/19/10	10/19/10	10/19/10	10/19/10	10/19/10	10/19/10			
Depth (ft bgs)	2.5-3.5	6-7	19-20	1-2	7-8	14-15	19-20	4-5	9-10	19-20	3-4	9-10	18-19			
Sampled Horizon[3]	Waste	Peat	Peat	Waste	Waste	Peat	Glacial	Waste	Waste	Peat	Cover	Waste	Peat			
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Applicable Screening Levels	C / E	D / E	D / E	C / E	D / E	D / E	D / E	C	D	D	C	D	D			
Aroclor-1016	0.031 U	0.031 U	0.033 U	0.14 U	0.028 U	0.032 U	0.032 U	0.03 U	0.031 U	0.032 U	0.025 U	0.096	0.032 U	5.6	5.6	--
Aroclor-1221	0.031 U	0.031 U	0.033 U	0.14 U	0.028 U	0.032 U	0.032 U	0.03 U	0.031 U	0.032 U	0.025 U	0.031 U	0.032 U	--	--	--
Aroclor-1232	0.031 U	0.031 U	0.033 U	0.14 U	0.028 U	0.032 U	0.032 U	0.03 U	0.031 U	0.032 U	0.025 U	0.031 U	0.032 U	--	--	--
Aroclor-1242	0.031 U	0.031 U	0.033 U	0.14 U	0.028 U	0.032 U	0.032 U	0.075 UY	0.031 U	0.032 U	0.025 U	0.031 U	0.032 U	--	--	--
Aroclor-1248	0.079 UY	0.039 UY	0.033 U	0.14 U	0.035 UY	0.049 UY	0.032 U	0.03 U	0.16 UY	0.032 U	0.1	0.24	0.1	--	--	--
Aroclor-1254	0.084	0.06	0.033 U	🟩 0.72 UY	0.072	0.069	0.032 U	0.03 U	0.47	0.032 U	0.12	0.33	0.13	1.6	1.6	0.23
Aroclor-1260	0.082	0.065	0.033 U	🟥 2	0.081	0.032 U	0.032 U	0.03 U	0.22	0.045	0.04	0.1	0.07	--	--	0.138
Total PCBs[5]	🟨🟥 0.17	🟨🟥 0.13	🟩 0.033 U	🟨🟥 2	🟨🟥 0.15	🟨🟥 0.069	🟩 0.032 U	🟩 0.075 U	🟨 0.69	🟨 0.045	🟨 0.26	🟨 0.77	🟨 0.3	0.004	0.0137/0.273	0.062

Notes:

[1] Chemical analyses conducted by Severn Trent Laboratories, Tacoma, Washington or Analytical Resources, Inc., Tukwila, Washington.

[2] Aroclors 1016, 1221, 1232, 1242, 1248, 1254 and 1260 analyzed by USEPA Method 8082.

[3] The soil/sediment samples from the inactive landfill were obtained from either the landfill cover, waste horizon, or native (peat or glacial) soil beneath the waste horizon.

[4] Where only a single value is shown, the screening level is the same for saturated and unsaturated soils.

[5] Total PCBs were calculated per SAPA guidance (Ecology 2008b); i.e., the sum of Aroclors is represented by the sum of all detected Aroclors, or, when no Aroclors were detected, the sum is represented by the single highest non-detect result.

mg/kg = Milligrams per kilogram

U = The analyte was not detected at the value reported. Value reported represents the practical quantitation limit (PQL).

J = The analyte was detected at the value reported; the reported value is estimated.

UJ = The analyte was not detected at the value reported. Value reported represents the estimated PQL.

UY = Not detected above the associated value; the associated value is elevated due to interference.

PCBs = Polychlorinated biphenyls

ft bgs = Feet below ground surface

PQL = Practical quantitation limit

-- = No screening level available.

🟨 = Value exceeds soil screening level when rounded to same number of significant figures as soil screening level.

🟥 = Value exceeds sediment screening level when rounded to same number of significant figures as sediment screening level.

🟩= PQL exceeds screening level when rounded to same number of significant figures as screening level.

Applicable Screening Levels

- A - Not near or upgradient of local surface water body and unsaturated.
- B - Not near or upgradient of local surface water body and saturated.
- C - Near or upgradient of local surface water body and unsaturated.
- D - Near or upgradient of local surface water body and saturated.
- E - Seasonally submerged; results compared to both soil and sediment screening levels.

TABLE 12
SUMMARY OF SOIL/SEDIMENT ANALYTICAL RESULTS[1]
VOLATILE ORGANIC COMPOUNDS[2] - INACTIVE LANDFILL AREA
GOOSE LAKE SITE
SHELTON, WASHINGTON

Sample ID	TP-03-9.5	TP-08-8.0	TP-13-5.0	TP-16-10	Trench-04-0.5	Trench-04-8.0	Soil Screening Level[4]
Date Sampled	07/09/02	07/11/02	07/08/02	07/08/02	08/13/02	08/13/02	
Depth (feet)	9.5	8.0	5.0	10.0	0.5	8.0	
Sampled Horizon[3]	Waste	Waste	Waste	Waste	Waste	Glacial	
Units	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
Applicable Screening Levels	A	C	A	D	A	A	
1,1,1,2-tetrachloroethane	5.51 UJ	6.8 U	5.6 U	2.87 U	459 U	460 U	38,000
1,1,1-trichloroethane	5.51 UJ	6.8 U	5.6 U	2.87 U	459 U	460 U	72,000,000
1,1,2,2-tetrachloroethane	5.51 UJ	6.8 U	5.6 U	2.87 U	459 U	460 U	5,000
1,1,2-trichloroethane	5.51 UJ	6.8 U	5.6 U	2.87 U	459 U	460 U	18,000
1,1-dichloroethane	5.51 UJ	6.8 U	5.6 U	2.87 U	459 U	460 U	16,000,000
1,1-dichloroethylene	5.51 UJ	6.8 U	5.6 U	2.87 U	459 U	460 U	4,000,000
1,1-dichloropropene	5.51 UJ	6.8 U	5.6 U	2.87 U	459 U	460 U	--
1,2,3-trichlorobenzene	5.51 UJ	6.8 U	5.6 U	2.87 U	459 U	460 U	20,000
1,2,3-trichloropropane	5.51 UJ	6.8 U	5.6 U	2.87 U	🟩 459 U	🟩 460 U	140
1,2,4-trichlorobenzene	5.51 UJ	6.8 U	5.6 U	2.87 U	459 U	460 U	20,000
1,2,4-trimethylbenzene	5.51 UJ	6.8 U	11.6	2.87 U	459 U	460 U	4,000,000
1,2-dibromo-3-chloropropane (dbcp)	5.51 UJ	6.8 U	5.6 U	2.87 U	459 U	460 U	710
1,2-dichlorobenzene	5.51 UJ	6.8 U	5.6 U	2.87 U	459 U	460 U	7,200,000
1,2-dichloroethane	5.51 UJ	6.8 U	5.6 U	2.87 U	459 U	460 U	11,000
1,2-dichloropropane	5.51 UJ	6.8 U	5.6 U	2.87 U	459 U	460 U	15,000
1,3,5-trimethylbenzene	5.51 UJ	6.8 U	5.61	2.87 U	459 U	460 U	4,000,000
1,3-dichlorobenzene	5.51 UJ	6.8 U	5.6 U	2.87 U	459 U	460 U	--
1,3-dichloropropane	5.51 UJ	6.8 U	5.6 U	2.87 U	459 U	460 U	--
1,4-dichlorobenzene	5.51 UJ	6.8 U	5.6 U	2.87 U	459 U	460 U	20,000
2,2-dichloropropane	5.51 UJ	6.8 U	5.6 U	2.87 U	459 U	460 U	--
2-chlorotoluene	5.51 UJ	6.8 U	5.6 U	2.87 U	459 U	460 U	--
2-phenylbutane	5.51 UJ	6.8 U	16.9	2.87 U	459 U	460 U	--
4-chlorotoluene	5.51 UJ	6.8 U	5.6 U	2.87 U	459 U	460 U	--
Benzene	97 J	6.8 U	5.6 U	2.87 U	459 U	460 U	18,000
Benzene, (1,1-dimethylethyl)	5.51 UJ	6.8 U	5.6 U	2.87 U	459 U	460 U	--
Bromobenzene	5.51 UJ	6.8 U	5.6 U	2.87 U	459 U	460 U	--
Bromodichloromethane	5.51 UJ	6.8 U	5.6 U	2.87 U	459 U	460 U	16,000
Bromomethane	11 UJ	13.6 U	11.2 U	5.75 U	918 U	921 U	110,000
Butylbenzene,n-	5.51 UJ	6.8 U	5.6 U	2.87 U	459 U	460 U	--
Carbon tetrachloride	5.51 UJ	6.8 U	5.6 U	2.87 U	459 U	460 U	7,700
Cfc-11	29.1 J	6.8 U	5.6 U	4.67	459 U	460 U	24,000,000
Cfc-12	5.51 UJ	6.8 U	5.6 U	2.87 U	459 U	460 U	16,000,000
Chlorobenzene	5.51 UJ	6.8 U	5.6 U	2.87 U	459 U	460 U	40,000
Chlorobromomethane	5.51 UJ	6.8 U	5.6 U	2.87 U	459 U	460 U	--
Chlorodibromomethane	5.51 UJ	6.8 U	5.6 U	2.87 U	459 U	460 U	12,000
Chloroethane	5.51 UJ	6.8 U	5.6 U	2.87 U	459 U	460 U	350,000
Chloroform	5.51 UJ	6.8 U	5.6 U	2.87 U	459 U	460 U	160,000
Chloromethane	5.51 UJ	6.8 U	5.6 U	2.87 U	459 U	460 U	77,000
Cis-1,2-dichloroethene	5.51 UJ	6.8 U	5.6 U	2.87 U	459 U	460 U	800,000
Cis-1,3-dichloropropene	5.51 UJ	6.8 U	5.6 U	2.87 U	459 U	460 U	--
Cumene	5.51 UJ	6.8 U	5.6 U	2.87 U	459 U	460 U	8,000,000
Cymene	5.51 UJ	6.8 U	29.9	2.87 U	459 U	460 U	--
Dibromomethane	5.51 UJ	6.8 U	5.6 U	2.87 U	459 U	460 U	800,000
Dichloromethane	38.4 J	8.56	7.24	11.8	459 U	460 U	130,000
Ethylene dibromide	5.51 UJ	6.8 U	5.6 U	2.87 U	🟩 459 U	🟩 460 U	12
Hexachloro-1,3-butadiene	5.51 UJ	6.8 U	5.6 U	2.87 U	459 U	460 U	13,000
Naphthalene	5.51 UJ	6.8 U	5.6 U	2.87 U	459 U	460 U	1,600,000
Propylbenzene,n-	5.51 UJ	6.8 U	5.6 U	2.87 U	459 U	460 U	--
Styrene (monomer)	5.51 UJ	6.8 U	5.6 U	2.87 U	459 U	460 U	33,000
Tetrachloroethene	12.5 J	6.8 U	5.6 U	19.4	459 U	460 U	1,900
Toluene	12.9 J	8.96	4.02 J	12	459 U	460 U	200,000
Trans-1,2-dichloroethene	5.51 UJ	6.8 U	5.6 U	2.87 U	459 U	460 U	1,600,000
Trans-1,3-dichloropropene	5.51 UJ	6.8 U	5.6 U	2.87 U	459 U	460 U	--
Tribromomethane	5.51 UJ	6.8 U	5.6 U	2.87 U	459 U	460 U	130,000
Trichloroethylene	5.51 UJ	6.8 U	5.6 U	2.87 U	459 U	460 U	11,000
Vinyl chloride	5.51 UJ	6.8 U	5.6 U	2.87 U	459 U	460 U	670
Xylene,o-	5.51 UJ	6.8 U	5.6 U	2.87 U	459 U	460 U	160,000,000
Xylene,p-, m-	11 UJ	13.6 U	11.2 U	5.75 U	918 U	921 U	160,000,000

Notes:

[1] Chemical analyses conducted by Severn Trent Laboratories, Tacoma, Washington.

[2] Volatile organic compounds analyzed by USEPA Method 8260B.

[3] The soil/sediment samples from the inactive landfill were obtained from either the landfill cover, waste horizon, or native (peat or glacial) soil beneath the waste horizon.

[4] The value is the same for applicable screening levels A through D.

µg/kg = Micrograms per kilogram

U = The analyte was not detected at the value reported. Value reported represents practical quantitation limit (PQL).

J = The analyte was detected at the value reported; the reported value is estimated.

UJ = The analyte was not detected at the value reported. Value reported represents estimated practical quantitation limit (PQL).

-- = No screening level available.

🟩 = PQL exceeds screening level when rounded to same number of significant figures as screening level.

Applicable Screening Levels

- A - Not near or upgradient of local surface water body and unsaturated.
- B - Not near or upgradient of local surface water body and saturated.
- C - Near or upgradient of local surface water body and unsaturated.
- D - Near or upgradient of local surface water body and saturated.
- E - Seasonally submerged; results compared to both soil and sediment screening levels.

TABLE 13
SUMMARY OF SOIL/SEDIMENT ANALYTICAL RESULTS[1]
SEMIVOLATILE ORGANIC COMPOUNDS[2] - INACTIVE LANDFILL AREA
GOOSE LAKE SITE
SHELTON, WASHINGTON

Sample ID	TP-03-9.5	TP-08-8.0	TP-13-5.0	TP-16-10	Trench-04-0.5	Trench-04-8.0	GEI-1-2.0-3.0-10192010	GEI-1-8.0-9.0-10192010	GEI-1-19.0-20.0-10192010	GEI-2-4.0-5.0-10192010	GEI-2-12.0-13.0-10192010	Soil Screening Level [5]	Sediment Screening Level
Date Sampled	07/09/02	07/11/02	07/08/02	07/08/02	08/13/02	08/13/02	10/19/10	10/19/10	10/19/10	10/19/10	10/19/10		
Depth (ft bgs)	9.5	8.0	5.0	10.0	0.5	8.0	2-3	8-9	19-20	4-5	12-13		
Sampled Horizon[3]	Waste	Waste	Waste	Waste	Waste	Glacial	Waste	Peat	Peat	Waste	Peat		
Units	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
Applicable Screening Levels	A	C	A	D	A	A	C / E	D / E	D / E	C / E	D / E		
1,2,4-trichlorobenzene	51.4 UJ	57.9 U	149 U	23.6 U	133 U	1,490 UJ	--	--	--	--	--	20,000	--
1,2-dichlorobenzene	51.4 UJ	57.9 U	149 U	23.6 U	133 U	1,490 UJ	66 U	200 U	200 U	64 U	200 U	7,200,000	--
1,2-diphenylhydrazine	51.4 UJ	57.9 U	149 U	23.6 U	133 U	7,450 UJ	66 U	200 U	200 U	64 U	200 U	1,300	--
1,3-dichlorobenzene	51.4 UJ	57.9 U	149 U	23.6 U	133 U	1,490 UJ	--	--	--	--	--	--	--
1,4-dichlorobenzene	51.4 UJ	57.9 U	149 U	23.6 U	133 U	1,490 UJ	77 U	200 U	200 U	130 U	200 U	20,000	--
2,4,5-trichlorophenol	51.4 UJ	57.9 U	149 U	23.6 U	133 UJ	1,490 UJ	330 U	990 U	980 U	320 U	980 U	4,000	--
2,4,6-trichlorophenol	128 UJ	145 U	373 U	58.9 U	331 UJ	3,720 UJ	330 U	990 U	980 U	320 U	980 U	10,000	--
2,4-dichlorophenol	51.4 UJ	57.9 U	149 U	23.6 U	133 UJ	1,490 UJ	330 U	990 U	980 U	320 U	980 U	240,000	--
2,4-dimethylphenol	112 J	57.9 U	149 U	23.6 U	133 UJ	1,490 UJ	66 U	200 U	200 U	64 U	200 U	1,600,000	--
2,4-dinitrophenol	257 UJ	290 U	746 U	118 U	663 UJ	7,450 UJ	660 U	2000 U	2000 U	640 U	2000 U	20,000	--
2,4-dinitrotoluene	51.4 UJ	57.9 U	149 U	23.6 U	133 U	1,490 UJ	330 UJ	990 UJ	980 UJ	320 UJ	980 UJ	160,000	--
2,6-dinitrotoluene	51.4 UJ	57.9 U	149 U	23.6 U	133 U	1,490 UJ	330 U	990 U	980 U	320 U	980 U	80,000	--
2-chloronaphthalene	5.14 UJ	14.5 U	14.9 U	2.36 U	13.3 U	149 UJ	66 U	200 U	200 U	64 U	200 U	6,400,000	--
2-chlorophenol	51.4 UJ	57.9 U	149 U	23.6 U	133 UJ	1,490 UJ	66 U	200 U	200 U	64 U	200 U	400,000	--
2-methylnaphthalene	170 J	24.3	345	11.2	13.3 U	149 UJ	120	200 U	200 U	64 U	200 U	320,000	469
2-methylphenol	995 J	57.9 U	149 U	23.6 U	133 UJ	1,490 UJ	--	--	--	--	--	4,000,000	--
2-nitroaniline	51.4 UJ	57.9 U	149 U	23.6 U	133 U	1,490 UJ	--	--	--	--	--	--	--
2-nitrophenol	51.4 UJ	57.9 U	149 U	23.6 U	133 UJ	1,490 UJ	--	--	--	--	--	--	--
3,3'-dichlorobenzidine	51.4 UJ	57.9 U	149 U	23.6 U	133 U	1,490 UJ	330 U	990 U	980 U	320 U	980 U	2,200	--
3,5,5-trimethyl-2-cyclohexene-1-one	51.4 UJ	57.9 U	149 U	23.6 U	133 U	1,490 UJ	66 U	200 U	200 U	64 U	200 U	1,100,000	--
3-nitroaniline	51.4 UJ	57.9 U	149 U	23.6 U	133 U	1,490 UJ	--	--	--	--	--	--	--
4,6-dinitro-2-methylphenol	257 UJ	290 U	746 U	118 U	663 UJ	7,450 UJ	--	--	--	--	--	--	--
4-bromophenyl phenyl ether	51.4 UJ	57.9 U	149 U	23.6 U	133 U	1,490 UJ	--	--	--	--	--	--	--
4-chlorophenyl methyl sulfone	51.4 UJ	57.9 U	149 U	23.6 U	NA	NA	--	--	--	--	--	--	--
4-nitrophenol	257 UJ	290 U	746 U	118 U	663 UJ	283 UJ[4]	330 U	990 U	980 U	320 U	980 U	7,000	--
Acenaphthene	490 J	14.5 U	14.9 U	2.36 U	13.3 U	149 UJ	66 U	200 U	200 U	64 U	200 U	20,000	1,060
Acenaphthylene	1,890 J	14.5 U	14.9 U	2.36 U	13.3 U	149 UJ	66 U	200 U	200 U	64 U	200 U	--	470
Aniline	51.4 UJ	57.9 U	149 U	23.6 U	331 U	3,720 UJ	66 U	200 U	200 U	64 U	200 U	180,000	--
Anthracene	720 J	5.79 U	14.9 U	2.36 U	24.2	149 UJ	66 U	200 U	200 U	64 U	200 U	24,000,000	1,230
Azobenzene	--	--	--	--	--	--	66 U	200 U	200 U	64 U	200 U	9,100	--
Benzidine	642 UJ	290 U	1,860 U	294 U	663 U	7,450 UJ	660 UR	2000 UR	2000 UR	640 UR	2000 UR	200	--
Benzo(g,h,i)perylene	422 J	5.79 U	14.9 U	154	43.5	149 UJ	66 U	200 U	200 U	64 U	200 U	--	4,020
Benzoic acid	12,800 UJ	308	746 U	118 U	1,660 U	18,600 UJ	660 U	2000 U	2000 U	640 U	2000 U	320,000,000	2,910
Benzyl alcohol	51.4 UJ	57.9 U	149 U	23.6 U	133 UJ	1,490 UJ	330 U	990 U	980 U	320 U	980 U	24,000,000	--
Benzyl butyl phthalate	51.4 UJ	57.9 U	149 U	23.6 U	133 U	1,490 UJ	66 U	200 U	200 U	64 U	200 U	16,000,000	260
Bis(2-chloroethoxy)methane	51.4 UJ	57.9 U	149 U	23.6 U	133 U	1,490 UJ	--	--	--	--	--	--	--
Bis (2-chloroethyl)ether	51.4 UJ	57.9 U	149 U	23.6 U	133 U	1,490 UJ	66 U	200 U	200 U	64 U	200 U	910	--
Bis(2-chloroisopropyl)ether	51.4 UJ	57.9 U	149 U	23.6 U	133 U	1,490 UJ	66 U	200 U	200 U	64 U	200 U	3,200,000	--
Bis(2-ethylhexyl)phthalate	128 UJ	57.9 U	373 U	58.9 U	133 U	1,490 UJ	79	200 U	200 U	64 U	200 U	71,000	2,520
Carbazole	51.4 UJ	57.9 U	149 U	23.6 U	133 U	1,490 UJ	66 U	200 U	200 U	64 U	200 U	50,000	--
Cyclohexanone	1,030 UJ	57.9 U	149 U	23.6 U	133 U	1,490 UJ	--	--	--	--	--	400,000,000	--
Dibenzofuran	479 J	57.9 U	149 U	23.6 U	133 U	1,490 UJ	66 U	200 U	200 U	64 U	200 U	160,000	399
Diethyl phthalate	51.4 UJ	57.9 U	149 U	23.6 U	133 U	1,490 UJ	75	200 U	200 U	64 U	200 U	100,000	--
Dimethyl phthalate	51.4 UJ	57.9 U	149 U	23.6 U	453	1,490 UJ	66 U	200 U	200 U	64 U	200 U	200,000	311
Di-n-butylphthalate	128 UJ	1,500	373 U	58.9 U	331 U	3,720 UJ	66 U	200 U	200 U	64 U	200 U	200,000	103
Di-n-octylphthalate	51.4 UJ	57.9 U	149 U	23.6 U	133 U	1,490 UJ	66 U	200 U	200 U	64 U	200 U	1,600,000	20
Fluoranthene	8,090 J	175	14.9 U	2.36 U	195	200 J	66 U	250	200 U	64 U	200 U	3,200,000	11,100
Fluorene	563 J	34	305	2.36 U	13.3 U	149 UJ	66 U	200 U	200 U	64 U	200 U	30,000	--
Hexachloro-1,3-butadiene	51.4 UJ	57.9 U	149 U	23.6 U	133 U	1,490 UJ	66 U	200 U	200 U	64 U	200 U	13,000	--
Hexachlorobenzene	51.4 UJ	57.9 U	149 U	23.6 U	133 U	1,490 UJ	66 U	200 U	200 U	64 U	200 U	630	--
Hexachlorocyclopentadiene	51.4 UJ	57.9 U	149 U	23.6 U	133 U	1,490 UJ	330 U	990 U	980 U	320 U	980 U	10,000	--
Hexachloroethane	51.4 UJ	57.9 U	149 U	23.6 U	133 U	1,490 UJ	66 U	200 U	200 U	64 U	200 U	71,000	--
Methanamine, n-methyl-n-nitroso	257 UJ	290 U	746 U	118 U	663 U	7,450 UJ	--	--	--	--	--	--	--
Naphthalene	13,400 J	29.9	182	14.6	24.3	149 UJ	--	--	--	--	--	1,600,000	529
N-nitroso-di-n-propylamine	51.4 UJ	57.9 U	149 U	23.6 U	133 U	1,490 UJ	66 U	200 U	200 U	64 U	200 U	140	--
N-nitrosodiphenylamine	51.4 UJ	57.9 U	149 U	23.6 U	133 U	1,490 UJ	66 U	200 U	200 U	64 U	200 U	20,000	--
P-chloroaniline	51.4 UJ	57.9 U	149 U	23.6 U	133 U	1,490 UJ	330 U	990 U	980 U	320 U	980 U	320,000	--
Pentachlorophenol	51.4 UJ	145 U	149 U	23.6 U	133 UJ	1,490 UJ	330 U	990 U	980 U	320 U	980 U	8,300	--
Phenanthrene	6,630 J	32.6	185	2.36 U	79.2	149 UJ	120	270	200 U	64 U	200 U	--	6,100
Phenol	1,490 J	65.5	149 U	23.6 U	133 UJ	1,490 UJ	66 U	200 U	200 U	64 U	200 U	30,000	--
P-nitroaniline	51.4 UJ	57.9 U	149 U	23.6 U	133 U	1,490 UJ	--	--	--	--	--	--	--
Pyrene	11,700 J	618	14.9 U	2.36 U	133	247 J	66 U	350	200 U	64 U	200 U	2,400,000	8,790
Pyridine	642 UJ	724 U	1,860 U	294 U	663 U	7,450 UJ	330 U	990 U	980 U	320 U	980 U	80,000	--
Benzo(a)anthracene (cPAH)	472 J	11.6 U	29.8 U	4.71 U	26.5 U	298 UJ	66 U	200 U	200 U	64 U	200 U	*See TEQ*	4,260
Chrysene (cPAH)	565 J	11.6 U	29.8 U	4.71 U	116.0	298 UJ	66 U	200 U	200 U	64 U	200 U	*See TEQ*	5,940
Total Benzofluoranthenes (cPAH)	560 J	11.6 U	29.8 U	4.71 U	115	298 UJ	66 U	200 U	200 U	64 U	200 U	*See TEQ*	11,000
Benzo(a)pyrene (cPAH)	439 J	5.79 U	14.9 U	2.36 U	35.7	149 UJ	66 U	200 U	200 U	64 U	200 U	*See TEQ*	3,300
Indeno(1,2,3-cd)pyrene (cPAH)	134 J	5.79 U	14.9 U	2.36 U	37.7	149 UJ	66 U	200 U	200 U	64 U	200 U	*See TEQ*	4,120
Dibenz(a,h)anthracene (cPAH)	5.14 UJ	5.79 U	14.9 U	2.36 U	13.3 U	149 UJ	66 U	200 U	200 U	64 U	200 U	*See TEQ*	800
Total cPAHs TEQ[4]	560 J	4.4 U	11 U	1.8 U	53	110 UJ	47 U	141 U	141 U	45 U	141 U	140	--

Notes:

[1] Chemical analyses conducted by Severn Trent Laboratories, Tacoma, Washington or Analytical Resources, Inc., Tukwila, Washington.

[2] Semivolatile organic compounds analyzed by USEPA Method 8270.

[3] The soil/sediment samples from the inactive landfill were obtained from either the landfill cover, waste horizon, or native (peat or glacial) soil beneath the waste horizon.

[4] TEQ calculated using toxicity equivalency factors (TEFs) listed in WAC 173-340-900, Table 708-2. For non-detect results, if there was at least one positive detection of the analyte in any RI soil or sediment sample, 1/2 the practical quantitation limit was used in the calculation. Otherwise, zero was used for non-detect results.

[5] The value is the same for applicable screening levels A through D.

cPAH = Carcinogenic polycyclic aromatic hydrocarbon

TEQ = Toxicity Equivalency Quotient

SVOCs = Semivolatile organic compounds

ft bgs = Feet below ground surface

PQL = Practical quantitation limit

µg/kg = Micrograms per kilogram

U = The analyte was not detected at the value reported. Value reported represents practical quantitation limit (PQL).
J = The analyte was detected at the value reported; the reported value is estimated.
UJ = The analyte was not detected at the value reported. Value reported represents estimated practical quantitation limit (PQL).
R = Datum rejected based on quality control data review/validation.
-- = Not applicable or not established or not analyzed.
🟨 = Value exceeds soil screening level when rounded to same number of significant figures as soil screening level.
🟥 = Value exceeds sediment screening level when rounded to same number of significant figures as sediment screening level.
🟩 = PQL exceeds screening level when rounded to same number of significant figures as screening level.

Applicable Screening Levels
- A - Not near or upgradient of local surface water body and unsaturated.
- B - Not near or upgradient of local surface water body and saturated.
- C - Near or upgradient of local surface water body and unsaturated.
- D - Near or upgradient of local surface water body and saturated.
- E - Seasonally submerged; results compared to both soil and sediment screening levels.

TABLE 13
SUMMARY OF SOIL/SEDIMENT ANALYTICAL RESULTS[1]
SEMIVOLATILE ORGANIC COMPOUNDS[2] - INACTIVE LANDFILL AREA
GOOSE LAKE SITE
SHELTON, WASHINGTON

Sample ID	GEI-2-24.0-25.0-10192010	GEI-3-4.0-5.0-10182010	GEI-3-16.0-17.0-10182010	GEI-3-29.0-30.0-10182010	GEI-4-3.5-4.0-10182010	GEI-4-7.0-8.0-10182010	GEI-4-19.0-20.0-10182010	GEI-4-30.0-32.0-10182010	GEI-5-2.5-3.5-10182010	GEI-5-6.0-7.0-10182010	Soil Screening Level [5]	Sediment Screening Level
Date Sampled	10/19/10	10/18/10	10/18/10	10/18/10	10/18/10	10/18/10	10/18/10	10/18/10	10/18/10	10/18/10		
Depth (ft bgs)	24-25	4-5	16-17	29-30	3.5-4	7-8	19-20	30-32	2.5-3.5	6-7		
Sampled Horizon[3]	Peat	Waste	Peat	Peat	Waste	Peat	Peat	Glacial	Waste	Peat		
Units	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
Applicable Screening Levels	D / E	C / E	D / E	D / E	C / E	D / E	D / E	D / E	C / E	D / E		
1,2,4-trichlorobenzene	--	--	--	--	--	--	--	--	--	--	20,000	--
1,2-dichlorobenzene	200 U	160 U	66 U	200 U	65 U	66 U	200 U	61 U	66 U	65 U	7,200,000	--
1,2-diphenylhydrazine	200 U	160 U	66 U	200 U	65 U	66 U	200 U	61 U	66 U	65 UJ	1,300	--
1,3-dichlorobenzene	--	--	--	--	--	--	--	--	--	--	--	--
1,4-dichlorobenzene	200 U	160 U	78 U	200 U	75 U	92 U	200 U	61 U	66 U	74 U	20,000	--
2,4,5-trichlorophenol	1000 U	820 U	330 U	1000 U	330 U	330 U	990 U	300 U	330 U	320 U	4,000	--
2,4,6-trichlorophenol	1000 U	820 U	330 U	1000 U	330 U	330 U	990 U	300 U	330 U	320 U	10,000	--
2,4-dichlorophenol	1000 U	820 U	330 U	1000 U	330 U	330 U	990 U	300 U	330 U	320 U	240,000	--
2,4-dimethylphenol	200 U	160 U	66 U	200 U	65 U	66 U	200 U	61 U	66 U	65 U	1,600,000	--
2,4-dinitrophenol	2000 U	1600 UJ	660 UJ	2000 UJ	650 UJ	660 UJ	2000 UJ	610 U	660 UJ	650 UJ	20,000	--
2,4-dinitrotoluene	1000 UJ	820 UJ	330 UJ	1000 UJ	330 UJ	330 UJ	990 UJ	300 U	330 UJ	320 UJ	160,000	--
2,6-dinitrotoluene	1000 U	820 U	330 U	1000 U	330 U	330 U	990 U	300 U	330 U	320 UJ	80,000	--
2-chloronaphthalene	200 U	160 U	66 U	200 U	65 U	66 U	200 U	61 U	66 U	65 U	6,400,000	--
2-chlorophenol	200 U	160 U	66 U	200 U	65 U	66 U	200 U	61 U	66 U	65 U	400,000	--
2-methylnaphthalene	200 U	160 U	66 U	200 U	65 U	66 U	200 U	61 U	69	66	320,000	469
2-methylphenol	--	--	--	--	--	--	--	--	--	--	4,000,000	--
2-nitroaniline	--	--	--	--	--	--	--	--	--	--	--	--
2-nitrophenol	--	--	--	--	--	--	--	--	--	--	--	--
3,3'-dichlorobenzidine	1000 U	820 U	330 U	1000 U	330 U	330 U	990 U	300 U	330 U	320 UR	2,200	--
3,5,5-trimethyl-2-cyclohexene-1-one	200 U	160 U	66 U	200 U	65 U	66 U	200 U	61 U	66 U	65 U	1,100,000	--
3-nitroaniline	--	--	--	--	--	--	--	--	--	--	--	--
4,6-dinitro-2-methylphenol	--	--	--	--	--	--	--	--	--	--	--	--
4-bromophenyl phenyl ether	--	--	--	--	--	--	--	--	--	--	--	--
4-chlorophenyl methyl sulfone	--	--	--	--	--	--	--	--	--	--	--	--
4-nitrophenol	1000 U	820 U	330 U	1000 U	330 U	330 U	990 U	300 UJ	330 U	320 U	7,000	--
Acenaphthene	200 U	160 U	66 U	200 U	65 U	66 U	200 U	61 U	66 U	65 U	20,000	1,060
Acenaphthylene	200 U	160 U	66 U	200 U	65 U	66 U	200 U	61 U	66 U	65 U	--	470
Aniline	200 U	160 U	66 U	200 U	65 U	66 U	200 U	61 U	66 U	65 UJ	180,000	--
Anthracene	200 U	160 U	66 U	200 U	65 U	66 U	200 U	61 U	66 U	65 U	24,000,000	1,230
Azobenzene	200 U	160 U	66 U	200 U	65 U	66 U	200 U	61 U	66 U	65 UJ	9,100	--
Benzidine	2000 UR	1600 UR	660 UR	2000 UR	650 UR	660 UR	2000 UR	610 U	660 UR	650 UR	200	--
Benzo(g,h,i)perylene	200 U	160 U	66 U	200 U	65 U	66 U	200 U	61 U	66 U	65 U	--	4,020
Benzoic acid	2000 U	1600 U	660 U	2000 U	650 U	660 U	2000 U	610 U	660 U	650 U	320,000,000	2,910
Benzyl alcohol	1000 U	820 UJ	330 UJ	1000 UJ	330 UJ	330 UJ	990 UJ	300 UJ	330 UJ	320 UJ	24,000,000	--
Benzyl butyl phthalate	200 U	160 U	66 U	200 U	65 U	66 U	200 U	61 U	66 U	65 U	16,000,000	260
Bis(2-chloroethoxy)methane	--	--	--	--	--	--	--	--	--	--	--	--
Bis (2-chloroethyl)ether	200 U	160 U	66 U	200 U	65 U	66 U	200 U	61 U	66 U	65 U	910	--
Bis(2-chloroisopropyl)ether	200 U	160 U	66 U	200 U	65 U	66 U	200 U	61 U	66 U	65 U	3,200,000	--
Bis(2-ethylhexyl)phthalate	200 U	160 U	66 U	200 U	100	570	11000	61 U	4200	65 U	71,000	2,520
Carbazole	200 U	160 U	66 U	200 U	65 U	66 U	200 U	61 U	66 U	65 U	50,000	--
Cyclohexanone	--	--	--	--	--	--	--	--	--	--	400,000,000	--
Dibenzofuran	200 U	160 U	66 U	200 U	65 U	66 U	200 U	61 U	66 U	65 U	160,000	399
Diethyl phthalate	200 U	160 U	66 U	200 U	65 U	66 U	200 U	61 U	66 U	65 U	100,000	--
Dimethyl phthalate	200 U	160 U	66 U	200 U	65 U	66 U	200 U	61 U	66 U	65 U	200,000	311
Di-n-butylphthalate	200 U	160 U	66 U	200 U	65 U	66 U	200 U	61 U	66 U	65 UR	200,000	103
Di-n-octylphthalate	200 U	160 U	66 U	200 U	65 U	66 U	200 U	61 U	66 U	65 UJ	1,600,000	20
Fluoranthene	200 U	160 U	66 U	200 U	65 U	66 U	200 U	61 U	66 U	65 U	3,200,000	11,100
Fluorene	200 U	160 U	66 U	200 U	65 U	66 U	200 U	61 U	70	65 U	30,000	--
Hexachloro-1,3-butadiene	200 U	160 U	66 U	200 U	65 U	66 U	200 U	61 U	66 U	65 U	13,000	--
Hexachlorobenzene	200 U	160 U	66 U	200 U	65 U	66 U	200 U	61 U	66 U	65 UJ	630	--
Hexachlorocyclopentadiene	1000 U	820 U	330 U	1000 U	330 U	330 U	990 U	300 U	330 U	320 UR	10,000	--
Hexachloroethane	200 U	160 U	66 U	200 U	65 U	66 U	200 U	61 U	66 U	65 UJ	71,000	--
Methanamine, n-methyl-n-nitroso	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene	--	--	--	--	--	--	--	--	--	--	1,600,000	529
N-nitroso-di-n-propylamine	200 U	160 U	66 U	200 U	65 U	66 U	200 U	61 U	66 U	65 U	140	--
N-nitrosodiphenylamine	200 U	160 U	66 U	200 U	65 U	66 U	200 U	61 U	66 U	65 U	20,000	--
P-chloroaniline	1000 U	820 U	330 U	1000 U	330 U	330 U	990 U	300 U	330 U	320 UR	320,000	--
Pentachlorophenol	1000 U	820 U	330 U	1000 U	330 U	330 U	990 U	300 U	330 U	320 U	8,300	--
Phenanthrene	200 U	160 U	85	200 U	84	75	200 U	61 U	66 U	120 J	--	6,100
Phenol	200 U	160 U	66 U	200 U	65 U	66 U	200 U	61 U	66 U	65 U	30,000	--
P-nitroaniline	--	--	--	--	--	--	--	--	--	--	--	--
Pyrene	200 U	160 U	66 U	200 U	65 U	66 U	200 U	61 U	66 U	65 U	2,400,000	8,790
Pyridine	1000 U	820 U	330 U	1000 U	330 U	330 U	990 U	300 U	330 U	320 U	80,000	--
Benzo(a)anthracene (cPAH)	200 U	160 U	66 U	200 U	65 U	66 U	200 U	61 U	66 U	65 U	*See TEQ*	4,260
Chrysene (cPAH)	200 U	160 U	66 U	200 U	65 U	66 U	200 U	61 U	66 U	65 U	*See TEQ*	5,940
Total Benzofluoranthenes (cPAH)	200 U	160 U	66 U	200 U	65 U	66 U	200 U	61 U	66 U	65 U	*See TEQ*	11,000
Benzo(a)pyrene (cPAH)	200 U	160 U	66 U	200 U	65 U	66 U	200 U	61 U	66 U	65 UJ	*See TEQ*	3,300
Indeno(1,2,3-cd)pyrene (cPAH)	200 U	160 U	66 U	200 U	65 U	66 U	200 U	61 U	66 U	65 U	*See TEQ*	4,120
Dibenz(a,h)anthracene (cPAH)	200 U	160 U	66 U	200 U	65 U	66 U	200 U	61 U	66 U	65 UJ	*See TEQ*	800
Total cPAHs TEQ[4]	141 U	113 U	47 U	141 U	46 U	47 U	141 U	43 U	47 U	46 UJ	140	--

Notes:

[1] Chemical analyses conducted by Severn Trent Laboratories, Tacoma, Washington or Analytical Resources, Inc., Tukwila, Washington.

[2] Semivolatile organic compounds analyzed by USEPA Method 8270.

[3] The soil/sediment samples from the inactive landfill were obtained from either the landfill cover, waste horizon, or native (peat or glacial) soil beneath the waste horizon.

[4] TEQ calculated using toxicity equivalency factors (TEFs) listed in WAC 173-340-900, Table 708-2. For non-detect results, if there was at least one positive detection of the analyte in any RI soil or sediment sample, 1/2 the practical quantitation limit was used in the calculation. Otherwise, zero was used for non-detect results.

[5] The value is the same for applicable screening levels A through D.

cPAH = Carcinogenic polycyclic aromatic hydrocarbon

TEQ = Toxicity Equivalency Quotient

SVOCs = Semivolatile organic compounds

ft bgs = Feet below ground surface

PQL = Practical quantitation limit

µg/kg = Micrograms per kilogram

U = The analyte was not detected at the value reported. Value reported represents practical quantitation limit (PQL).
J = The analyte was detected at the value reported; the reported value is estimated.
UJ = The analyte was not detected at the value reported. Value reported represents estimated practical quantitation limit (PQL).
R = Datum rejected based on quality control data review/validation.
-- = Not applicable or not established or not analyzed.

🟨 = Value exceeds soil screening level when rounded to same number of significant figures as soil screening level.
🟥 = Value exceeds sediment screening level when rounded to same number of significant figures as sediment screening level.
🟩 = PQL exceeds screening level when rounded to same number of significant figures as screening level.

Applicable Screening Levels
- A - Not near or upgradient of local surface water body and unsaturated.
- B - Not near or upgradient of local surface water body and saturated.
- C - Near or upgradient of local surface water body and unsaturated.
- D - Near or upgradient of local surface water body and saturated.
- E - Seasonally submerged; results compared to both soil and sediment screening levels.

TABLE 13
SUMMARY OF SOIL/SEDIMENT ANALYTICAL RESULTS[1]
SEMIVOLATILE ORGANIC COMPOUNDS[2] - INACTIVE LANDFILL AREA
GOOSE LAKE SITE
SHELTON, WASHINGTON

Sample ID	GEI-5-19.0-20.0-10182010	GEI-6-1.0-2.0-10192010	GEI-6-7.0-8.0-10192010	GEI-6-14.0-15.0-10192010	MW-16-4.0-5.0-10192010	MW-16-9.0-10.0-10192010	MW-16-19.0-20.0-10192010	MW-17-3.0-4.0-10192010	MW-17-9.0-10.0-10192010	MW-17-18.0-19.0-10192010	Soil Screening Level [5]	Sediment Screening Level
Date Sampled	10/18/10	10/19/10	10/19/10	10/19/10	10/19/10	10/19/10	10/19/10	10/19/10	10/19/10	10/19/10		
Depth (ft bgs)	19-20	1-2	7-8	14-15	4-5	9-10	19-20	3-4	9-10	18-19		
Sampled Horizon[3]	Peat	Waste	Waste	Peat	Waste	Waste	Peat	Cover	Waste	Peat		
Units	μg/kg	μg/kg	μg/kg	μg/kg	μg/kg	μg/kg	μg/kg	μg/kg	μg/kg	μg/kg	μg/kg	μg/kg
Applicable Screening Levels	D / E	C / E	D / E	D / E	C	D	D	C	D	D		
1,2,4-trichlorobenzene	--	--	--	--	--	--	--	--	--	--	20,000	--
1,2-dichlorobenzene	200 U	65 U	200 U	65 U	65 U	65 U	200 U	180 U	65 U	65 UJ	7,200,000	--
1,2-diphenylhydrazine	200 U	65 U	200 U	65 U	65 U	65 U	200 U	180 U	65 U	65 UJ	1,300	--
1,3-dichlorobenzene	--	--	--	--	--	--	--	--	--	--	--	--
1,4-dichlorobenzene	200 U	150 U	200 U	88 U	99 U	160 U	200 U	180 U	120 U	85 UJ	20,000	--
2,4,5-trichlorophenol	980 U	330 U	980 U	330 U	320 U	330 U	990 U	910 U	330 U	320 U	4,000	--
2,4,6-trichlorophenol	980 U	330 U	980 U	330 U	320 U	330 U	990 U	910 U	330 U	320 U	10,000	--
2,4-dichlorophenol	980 U	330 U	980 U	330 U	320 U	330 U	990 U	910 U	330 U	320 U	240,000	--
2,4-dimethylphenol	200 U	65 U	200 U	65 U	65 U	65 U	200 U	180 U	65 UR	65 U	1,600,000	--
2,4-dinitrophenol	2000 UJ	650 U	2000 U	650 U	650 U	650 U	2000 U	1800 U	650 UR	650 U	20,000	--
2,4-dinitrotoluene	980 UJ	330 UJ	980 UJ	330 UJ	320 UJ	330 UJ	990 UJ	910 UJ	330 UJ	320 UJ	160,000	--
2,6-dinitrotoluene	980 U	330 U	980 U	330 U	320 U	330 U	990 U	910 U	330 U	320 UJ	80,000	--
2-chloronaphthalene	200 U	65 U	200 U	65 U	65 U	65 U	200 U	180 U	65 U	65 UJ	6,400,000	--
2-chlorophenol	200 U	65 U	200 U	65 U	65 U	65 U	200 U	180 U	65 U	65 U	400,000	--
2-methylnaphthalene	200 U	180	200 U	65 U	65 U	150	200 U	180 U	65 U	130 J	320,000	469
2-methylphenol	--	--	--	--	--	--	--	--	--	--	4,000,000	--
2-nitroaniline	--	--	--	--	--	--	--	--	--	--	--	--
2-nitrophenol	--	--	--	--	--	--	--	--	--	--	--	--
3,3'-dichlorobenzidine	980 U	330 U	980 U	330 U	320 U	330 U	990 U	910 U	330 UR	320 UJ	2,200	--
3,5,5-trimethyl-2-cyclohexene-1-one	200 U	65 U	200 U	65 U	65 U	65 U	200 U	180 U	65 U	65 UJ	1,100,000	--
3-nitroaniline	--	--	--	--	--	--	--	--	--	--	--	--
4,6-dinitro-2-methylphenol	--	--	--	--	--	--	--	--	--	--	--	--
4-bromophenyl phenyl ether	--	--	--	--	--	--	--	--	--	--	--	--
4-chlorophenyl methyl sulfone	--	--	--	--	--	--	--	--	--	--	--	--
4-nitrophenol	980 U	330 U	980 U	330 U	320 U	330 U	990 U	910 U	330 U	320 U	7,000	--
Acenaphthene	200 U	400	200 U	65 U	65 U	65 U	200 U	180 U	65 U	110 J	20,000	1,060
Acenaphthylene	200 U	650	200 U	65 U	65 U	65 U	200 U	180 U	65 U	65 UJ	--	470
Aniline	200 U	65 U	200 U	65 U	65 U	65 U	200 U	180 U	65 UJ	65 UJ	180,000	--
Anthracene	200 U	880	200 U	65 U	65 U	65 U	200 U	180 U	65 U	65 UJ	24,000,000	1,230
Azobenzene	200 U	65 U	200 U	65 U	65 U	65 U	200 U	180 U	65 U	65 UJ	9,100	--
Benzidine	2000 UR	650 UR	2000 UR	650 UR	650 UR	650 UR	2000 UR	1800 UR	650 UR	650 UR	200	--
Benzo(g,h,i)perylene	200 U	1000	200 U	65 U	65 U	65 U	200 U	180 U	65 U	65 UJ	--	4,020
Benzoic acid	2000 U	650 U	2000 U	650 U	650 U	650 U	2000 U	1800 U	650 UR	650 U	320,000,000	2,910
Benzyl alcohol	980 UJ	330 U	980 U	330 U	320 U	330 U	990 U	910 U	330 UJ	320 U	24,000,000	--
Benzyl butyl phthalate	200 U	65 U	200 U	65 U	65 U	65 U	200 U	180 U	65 U	97 J	16,000,000	260
Bis(2-chloroethoxy)methane	--	--	--	--	--	--	--	--	--	--	--	--
Bis (2-chloroethyl)ether	200 U	65 U	200 U	65 U	65 U	65 U	200 U	180 U	65 U	65 UJ	910	--
Bis(2-chloroisopropyl)ether	200 U	65 U	200 U	65 U	65 U	65 U	200 U	180 U	65 U	65 UJ	3,200,000	--
Bis(2-ethylhexyl)phthalate	200 U	68	200 U	65 U	65 U	65 U	200 U	180 U	1600 J	65 UJ	71,000	2,520
Carbazole	200 U	65 U	200 U	65 U	65 U	65 U	200 U	180 U	65 U	65 UJ	50,000	--
Cyclohexanone	--	--	--	--	--	--	--	--	--	--	400,000,000	--
Dibenzofuran	200 U	540	200 U	65 U	65 U	110	200 U	180 U	65 U	78 J	160,000	399
Diethyl phthalate	200 U	65 U	200 U	65 U	65 U	65 U	200 U	180 U	65 U	94 J	100,000	--
Dimethyl phthalate	200 U	65 U	200 U	65 U	65 U	65 U	200 U	180 U	65 U	65 UJ	200,000	311
Di-n-butylphthalate	200 U	65 U	200 U	65 U	65 U	65 U	200 U	180 U	65 U	65 UJ	200,000	103
Di-n-octylphthalate	200 U	65 U	200 U	65 U	65 U	65 U	200 U	180 U	65 U	65 UJ	1,600,000	20
Fluoranthene	200 U	--	240	65 U	65 U	170	200 U	180 U	65 U	480 J	3,200,000	11,100
Fluorene	200 U	210	200 U	65 U	65 U	170	200 U	180 U	65 U	97 J	30,000	--
Hexachloro-1,3-butadiene	200 U	65 U	200 U	65 U	65 U	65 U	200 U	180 U	65 U	65 UJ	13,000	--
Hexachlorobenzene	200 U	65 U	200 U	65 U	65 U	65 U	200 U	180 U	65 U	65 UJ	630	--
Hexachlorocyclopentadiene	980 U	330 U	980 U	330 U	320 U	330 U	990 U	910 U	330 UJ	320 UJ	10,000	--
Hexachloroethane	200 U	65 U	200 U	65 U	65 U	65 U	200 U	180 U	65 U	65 UJ	71,000	--
Methanamine, n-methyl-n-nitroso	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene	--	--	--	--	--	--	--	--	--	--	1,600,000	529
N-nitroso-di-n-propylamine	200 U	65 U	200 U	65 U	65 U	65 U	200 U	180 U	65 U	65 UJ	140	--
N-nitrosodiphenylamine	200 U	65 U	200 U	65 U	65 U	65 U	200 U	180 U	65 U	65 UJ	20,000	--
P-chloroaniline	980 U	330 U	980 U	330 U	320 U	330 U	990 U	910 U	330 UJ	320 UJ	320,000	--
Pentachlorophenol	980 U	330 U	980 U	330 U	320 U	330 U	990 U	910 U	330 UJ	320 U	8,300	--
Phenanthrene	200 U	--	200 U	65 U	130	420	200 U	180 U	65 U	380 J	--	6,100
Phenol	200 U	65 U	200 U	65 U	65 U	65 U	200 U	180 U	65 U	130	30,000	--
P-nitroaniline	--	--	--	--	--	--	--	--	--	--	--	--
Pyrene	200 U	--	200 U	65 U	65 U	84	200	180 U	65 U	310 J	2,400,000	8,790
Pyridine	980 U	330 U	980 U	330 U	320 U	330 U	990 U	910 U	330 UR	320 UJ	80,000	--
Benzo(a)anthracene (cPAH)	200 U	880	200 U	65 U	65 U	65 U	200 U	180 U	65 U	65 UJ	*See TEQ*	4,260
Chrysene (cPAH)	200 U	1500	270	65 U	65 U	65 U	200 U	300	65 U	70 J	*See TEQ*	5,940
Total Benzofluoranthenes (cPAH)	200 U	1400	200 U	65 U	65 U	65 U	200 U	180 U	65 U	65 UJ	*See TEQ*	11,000
Benzo(a)pyrene (cPAH)	200 U	840	200 U	65 U	65 U	65 U	200 U	180 U	65 U	65 UJ	*See TEQ*	3,300
Indeno(1,2,3-cd)pyrene (cPAH)	200 U	360	200 U	65 U	65 U	65 U	200 U	180 U	65 U	65 UJ	*See TEQ*	4,120
Dibenz(a,h)anthracene (cPAH)	200 U	65 U	200 U	65 U	65 U	65 U	200 U	180 U	65 U	65 UJ	*See TEQ*	800
Total cPAHs TEQ[4]	141 U	1122	143	46 U	46 U	46 U	141 U	129	46 U	46 J	140	--

Notes:

[1] Chemical analyses conducted by Severn Trent Laboratories, Tacoma, Washington or Analytical Resources, Inc., Tukwila, Washington.

[2] Semivolatile organic compounds analyzed by USEPA Method 8270.

[3] The soil/sediment samples from the inactive landfill were obtained from either the landfill cover, waste horizon, or native (peat or glacial) soil beneath the waste horizon.

[4] TEQ calculated using toxicity equivalency factors (TEFs) listed in WAC 173-340-900, Table 708-2. For non-detect results, if there was at least one positive detection of the analyte in any RI soil or sediment sample, 1/2 the practical quantitation limit was used in the calculation. Otherwise, zero was used for non-detect results.

[5] The value is the same for applicable screening levels A through D.

cPAH = Carcinogenic polycyclic aromatic hydrocarbon
TEQ = Toxicity Equivalency Quotient
SVOCs = Semivolatile organic compounds
ft bgs = Feet below ground surface
PQL = Practical quantitation limit
μg/kg = Micrograms per kilogram
U = The analyte was not detected at the value reported. Value reported represents practical quantitation limit (PQL).
J = The analyte was detected at the value reported; the reported value is estimated.
UJ = The analyte was not detected at the value reported. Value reported represents estimated practical quantitation limit (PQL).
R = Datum rejected based on quality control data review/validation.
-- = Not applicable or not established or not analyzed.
🟨 = Value exceeds soil screening level when rounded to same number of significant figures as soil screening level.
🟥 = Value exceeds sediment screening level when rounded to same number of significant figures as sediment screening level.
🟩 = PQL exceeds screening level when rounded to same number of significant figures as screening level.

Applicable Screening Levels
- A - Not near or upgradient of local surface water body and unsaturated.
- B - Not near or upgradient of local surface water body and saturated.
- C - Near or upgradient of local surface water body and unsaturated.
- D - Near or upgradient of local surface water body and saturated.
- E - Seasonally submerged; results compared to both soil and sediment screening levels.

TABLE 14
SUMMARY OF SOIL/SEDIMENT ANALYTICAL RESULTS[1]
CONVENTIONAL CHEMISTRY[2] - INACTIVE LANDFILL AREA
GOOSE LAKE SITE
SHELTON, WASHINGTON

Sample ID		TP-03-9.5	TP-07-9.5	TP-08-8	TP-12-7	TP-13-5	GEI-1-2.0-3.0-10192010	GEI-1-8.0-9.0-10192010	GEI-1-19.0-20.0-10192010	GEI-2-4.0-5.0-10192010	GEI-2-12.0-13.0-10192010	GEI-2-24.0-25.0-10192010	GEI-3-4.0-5.0-10182010	GEI-3-16.0-17.0-10182010	GEI-3-29.0-30.0-10182010	GEI-4-3.5-4.0-10182010	GEI-4-7.0-8.0-10182010	Soil Screening Level[4]	Sediment Screening Level
Date Sampled		07/09/02	07/08/02	07/11/02	07/11/02	07/08/02	10/19/10	10/19/10	10/19/10	10/19/10	10/19/10	10/19/10	10/18/10	10/18/10	10/18/10	10/18/10	10/18/10		
Depth (ft bgs)		9.5	9.5	8.0	7.0	5.0	2-3	8-9	19-20	4-5	12-13	24-25	4-5	16-17	29-30	3.5-4	7-8		
Sampled Horizon[3]		Waste	Waste	Waste	Waste	Waste	Waste	Peat	Peat	Waste	Peat	Peat	Waste	Peat	Peat	Waste	Peat		
Applicable Screening Levels		A	B	C	C	A	C / E	D / E	D / E	C / E	D / E	D / E	C / E	D / E	D / E	C / E	D / E		
Total Sulfide	mg/kg	2 U	2 U	233	29.9 U	58 U	2550	3780	12.7	3170	523	6.07 U	426	1300	7.55 U	2240	2090	--	702
Total Organic Carbon	Percent	--	--	--	--	--	42.7	36.1	--	--	--	--	--	--	--	46.6	53.5	--	9.82

Notes:

[1] Chemical analyses conducted by Severn Trent Laboratories, Tacoma, Washington or Analytical Resources, Inc., Tukwila, Washington.

[2] Total sulfide analyzed by USEPA Method 9030B. Other analyses by USEPA Method 160.3M and USEPA Method 160.4PLUMB81TC.

[3] The soil/sediment samples from the inactive landfill were obtained from either the landfill cover, waste horizon, or native (peat or glacial) soil beneath the waste horizon.

[4] Applies to applicable screening levels A through D.

mg/kg = Milligrams per kilogram
U = The analyte was not detected at the value reported. Value represents the practical quantitation limit (PQL).
UJ = The analyte was not detected at the value reported. Value reported represents the estimated PQL.
J = Estimated concentration.
🟨 = Value exceeds soil screening level when rounded to same number of significant figures as soil screening level.
🟥 = Value exceeds sediment screening level when rounded to same number of significant figures as sediment screening level.
ft bgs = Feet below ground surface
PQL = Practical quantitation limit
-- = Not applicable or not established or not analyzed.
Applicable Screening Levels
- A - Not near or upgradient of local surface water body and unsaturated.
- B - Not near or upgradient of local surface water body and saturated.
- C - Near or upgradient of local surface water body and unsaturated.
- D - Near or upgradient of local surface water body and saturated.
- E - Seasonally submerged; results compared to both soil and sediment screening levels.

TABLE 14
SUMMARY OF SOIL/SEDIMENT ANALYTICAL RESULTS[1]
CONVENTIONAL CHEMISTRY[2] - INACTIVE LANDFILL AREA
GOOSE LAKE SITE
SHELTON, WASHINGTON

Sample ID		**GEI-4-19.0-20.0-10182010**	**GEI-5-2.5-3.5-10182010**	**GEI-5-6.0-7.0-10182010**	**GEI-5-19.0-20.0-10182010**	**GEI-6-1.0-2.0-10192010**	**GEI-6-7.0-8.0-10192010**	**GEI-6-14.0-15.0-10192010**	**MW-16-4.0-5.0-10192010**	**MW-16-19.0-20.0-10192010**	**MW-17-3.0-4.0-10192010**	**MW-17-18.0-19.0-10192010**	**Soil Screening Level[4]**	**Sediment Screening Level**
Date Sampled		10/18/10	10/18/10	10/18/10	10/18/10	10/19/10	10/19/10	10/19/10	10/19/10	10/19/10	10/19/10	10/19/10		
Depth (ft bgs)		19-20	2.5-3.5	6-7	19-20	1-2	7-8	14-15	4-5	19-20	3-4	18-19		
Sampled Horizon[3]		Peat	Waste	Peat	Peat	Waste	Waste	Peat	Waste	Peat	Cover	Peat		
Applicable Screening Levels		D / E	C / E	D / E	D / E	C / E	D / E	D / E	C	D	C	D		
Total Sulfide	mg/kg	8.59 U	1500	3770	79.5	1.27 U	17800	65.5	62.7	--	1.05 U	--	--	702
Total Organic Carbon	Percent	--	81	11.6	--	9.13	48.8	--	73.6	91.9	13.3	39.3	--	9.82

Notes:

[1] Chemical analyses conducted by Severn Trent Laboratories, Tacoma, Washington or Analytical Resources, Inc., Tukwila, Washington.

[2] Total sulfide analyzed by USEPA Method 9030B. Other analyses by USEPA Method 160.3M and USEPA Method 160.4PLUMB81TC.

[3] The soil/sediment samples from the inactive landfill were obtained from either the landfill cover, waste horizon, or native (peat or glacial) soil beneath the waste horizon.

[4] Applies to applicable screening levels A through D.

mg/kg = Milligrams per kilogram

U = The analyte was not detected at the value reported. Value represents the practical quantitation limit (PQL).

UJ = The analyte was not detected at the value reported. Value reported represents the estimated PQL.

J = Estimated concentration.

🟨 = Value exceeds soil screening level when rounded to same number of significant figures as soil screening level.

🟥 = Value exceeds sediment screening level when rounded to same number of significant figures as sediment screening level.

ft bgs = Feet below ground surface

PQL = Practical quantitation limit

-- = Not applicable or not established or not analyzed.

Applicable Screening Levels

- A - Not near or upgradient of local surface water body and unsaturated.
- B - Not near or upgradient of local surface water body and saturated.
- C - Near or upgradient of local surface water body and unsaturated.
- D - Near or upgradient of local surface water body and saturated.
- E - Seasonally submerged; results compared to both soil and sediment screening levels.

TABLE 15
SUMMARY OF SOIL ANALYTICAL RESULTS
METALS[1] - DISPOSAL LAGOON AREA
GOOSE LAKE SITE
SHELTON, WASHINGTON

Sample ID	TP-22-0.3	TP-24-1.0	TP-27-2.0	TP-28-1.0	TP-29-1.0	TP-30-1.0	TP-31-1.0	TP-32-1.0	HA1-0.5	HA1-2.0	HA2-0.5	HA2-2.5	SB-001	SB-002	SB-003	Soil Screening Level (Near or Upgradient of Local Surface Water Body) (Saturated/Unsaturated)[2]
Sample Date	08/12/02	07/12/02	07/12/02	07/12/02	08/12/02	08/12/02	08/12/02	08/12/02	12/16/1997	12/16/1997	12/17/1997	12/17/1997	4/17/1997	4/17/1997	4/17/1997	
Depth (ft bgs)	0.3	1.0	2.0	1.0	1.0	1.0	1.0	1.0	0.5	2	0.5	2.5	3	4-6	2.5	
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Applicable Screening Levels	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
Chromium	34	33.6	19.6	17.4	NA	NA	NA	NA	6.06	9.8	10.9	20.8	16.6	21.2	27.4	48
Copper	46.4	49.6	18.6	24.2	NA	NA	NA	NA	114	6.6	8.26	17.5	9.4	214	65.2	36
Arsenic	1.55	1.67	1.4	0.985 U	1.05	0.909 U	0.983 U	2.0	1 U	1.33	1.05	1.38	1.1	4.4	2.1	20
Lead	36.5	28.8	14.2	8.61	NA	NA	NA	NA	10 U	15.6	10 U	13.8	8.7	57.4	15	24/110
Hexavalent chromium	0.0863 U	0.13	0.171	0.102 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	240
Mercury	0.0206 U	0.0228 U	0.0211 U	0.0386	NA	NA	NA	NA	0.111	0.05 U	0.05 U	0.05 U	0.12 U	0.2	0.11 U	0.07
Antimony	NA	NA	NA	NA	NA	NA	NA	NA	5 U	5 U	5 U	5 U	1.2 U	1.8	1.1 U	5
Cadmium	NA	NA	NA	NA	NA	NA	NA	NA	0.25 U	0.25 U	0.25 U	0.25 U	0.59 U	0.19	0.13	14
Nickel	NA	NA	NA	NA	NA	NA	NA	NA	1.5 U	3.59	7.58	15.7	6.1	12.6	23.5	48
Silver	NA	NA	NA	NA	NA	NA	NA	NA	2.5 U	2.5 U	2.5 U	2.5 U	0.59 U	0.36	0.56 U	400
Zinc	NA	NA	NA	NA	NA	NA	NA	NA	11.8	7.38	12	21	12.1	20.7	37	120

Notes:

[1] Metals analyzed by USEPA 6000/7000 Series methods.

[2] Where only a single value is shown, the screening level is the same for saturated and unsaturated soils.

mg/kg = Milligrams per kilogram

NA = The compound was not analyzed.

U = The analyte was not detected at the value reported. Value reported represents the practical quantitation limit (PQL).

UJ = The analyte was not detected at the value reported. Value reported represents the estimated PQL.

J = Estimated concentration.

UY = Not detected above the associated value; the associated value is elevated due to interference.

R = Datum rejected based on quality control data review/validation.

ft bgs = Feet below ground surface

PQL = Practical quantitation limit

🟨 = Value exceeds soil screening level when rounded to same number of significant figures as soil screening level.

🟩= PQL exceeds screening level when rounded to same number of significant figures as screening level.

Applicable Screening Levels

A - Not near or upgradient of local surface water body and unsaturated.

B - Not near or upgradient of local surface water body and saturated.

C - Near or upgradient of local surface water body and unsaturated.

D - Near or upgradient of local surface water body and saturated.

E - Seasonally submerged; results compared to both soil and sediment screening levels.

TABLE 16
SUMMARY OF SOIL ANALYTICAL RESULTS
DIOXIN CONGENERS - DISPOSAL LAGOON AREA
GOOSE LAKE SITE
SHELTON, WASHINGTON

Congeners and TEFs	Sample ID	Sample Depth (feet bgs)	Concentration (ng/kg)
1,2,3,4,6,7,8-HpCDF **WHO TEF[1] for:** **Humans/Mammals = 0.01** **EPA TEF[4] for:** **Birds = 0.01** **Fish = 0.01**	SH-TP-01	2.5	10.5
	SH-TP-02	2.5	0.0761 U
	SH-TP-03	3	0.0989 U
	SH-TP-04	3	10.1
	SH-TP-05	2.5	2.479 U
	SH-TP-06	2.5	2.27 J
	SH-TP-07 (dup of SH-TP-06)	2.5	9.2
1,2,3,4,7,8,9-HpCDF **WHO TEF for:** **Humans/Mammals = 0.01** **EPA TEF for:** **Birds = 0.01** **Fish = 0.01**	SH-TP-01	2.5	0.876 J
	SH-TP-02	2.5	0.0883 U
	SH-TP-03	3	0.115 U
	SH-TP-04	3	0.73 J
	SH-TP-05	2.5	0.414 J
	SH-TP-06	2.5	0.423 J
	SH-TP-07 (dup of SH-TP-06)	2.5	0.691 J
1,2,3,4,6,7,8-HpCDD **WHO TEF for:** **Humans/Mammals = 0.01** **EPA TEF for:** **Birds = <0.001** **Fish = 0.001**	SH-TP-01	2.5	22.5
	SH-TP-02	2.5	0.267 U
	SH-TP-03	3	0.215 U
	SH-TP-04	3	16.9
	SH-TP-05	2.5	7.45
	SH-TP-06	2.5	8.25
	SH-TP-07 (dup of SH-TP-06)	2.5	20.4
1,2,3,6,7,8-HxCDD **WHO TEF for:** **Humans/Mammals = 0.1** **EPA TEF for:** **Birds = 0.01** **Fish = 0.01**	SH-TP-01	2.5	2.88
	SH-TP-02	2.5	0.219 U
	SH-TP-03	3	0.193 U
	SH-TP-04	3	1.53 J
	SH-TP-05	2.5	2.62
	SH-TP-06	2.5	1.55 J
	SH-TP-07 (dup of SH-TP-06)	2.5	2.39 J
1,2,3,7,8,9-HxCDD **WHO TEF for:** **Humans/Mammals = 0.1** **EPA TEF for:** **Birds = 0.1** **Fish = 0.01**	SH-TP-01	2.5	2.05 J
	SH-TP-02	2.5	0.212 U
	SH-TP-03	3	0.187 U
	SH-TP-04	3	0.926 J
	SH-TP-05	2.5	2.31 J
	SH-TP-06	2.5	1.22 J
	SH-TP-07 (dup of SH-TP-06)	2.5	1.72 J
1,2,3,4,7,8-HxCDD **WHO TEF for:** **Humans/Mammals = 0.1** **EPA TEF for:** **Birds = 0.05** **Fish = 0.5**	SH-TP-01	2.5	1.58 J
	SH-TP-02	2.5	0.199 U
	SH-TP-03	3	0.171 U
	SH-TP-04	3	0.703 J
	SH-TP-05	2.5	1.83 J
	SH-TP-06	2.5	0.941 J
	SH-TP-07 (dup of SH-TP-06)	2.5	1.28 J
1,2,3,4,7,8-HxCDF **WHO TEF for:** **Humans/Mammals = 0.1** **EPA TEF for:** **Birds = 0.1** **Fish = 0.1**	SH-TP-01	2.5	1.61 J
	SH-TP-02	2.5	0.0664 U
	SH-TP-03	3	0.0393 U
	SH-TP-04	3	0.75 J
	SH-TP-05	2.5	1.68 J
	SH-TP-06	2.5	0.816 J
	SH-TP-07 (dup of SH-TP-06)	2.5	1.31 J
1,2,3,6,7,8-HxCDF **WHO TEF for:** **Humans/Mammals = 0.1** **EPA TEF for:** **Birds = 0.1** **Fish = 0.1**	SH-TP-01	2.5	1.78 J
	SH-TP-02	2.5	0.0706 U
	SH-TP-03	3	0.0407 U
	SH-TP-04	3	0.745 J
	SH-TP-05	2.5	2 J
	SH-TP-06	2.5	1.02 J
	SH-TP-07 (dup of SH-TP-06)	2.5	1.5 J
1,2,3,7,8,9-HxCDF **WHO TEF for:** **Humans/Mammals = 0.1** **EPA TEF for:** **Birds = 0.1** **Fish = 0.1**	SH-TP-01	2.5	0.569 J
	SH-TP-02	2.5	0.0949 U
	SH-TP-03	3	0.0519 U
	SH-TP-04	3	0.26 J
	SH-TP-05	2.5	0.588 J
	SH-TP-06	2.5	0.378 J
	SH-TP-07 (dup of SH-TP-06)	2.5	0.408 J

TABLE 16
SUMMARY OF SOIL ANALYTICAL RESULTS
DIOXIN CONGENERS - DISPOSAL LAGOON AREA
GOOSE LAKE SITE
SHELTON, WASHINGTON

Congeners and TEFs	Sample ID	Sample Depth (feet bgs)	Concentration (ng/kg)
2,3,4,6,7,8-HxCDF **WHO TEF for:** **Humans/Mammals = 0.1** **EPA TEF for:** **Birds = 0.1** **Fish = 0.1**	SH-TP-01	2.5	1.77 J
	SH-TP-02	2.5	0.0751 U
	SH-TP-03	3	0.0458 U
	SH-TP-04	3	0.837 J
	SH-TP-05	2.5	1.94 J
	SH-TP-06	2.5	1.02 J
	SH-TP-07 (dup of SH-TP-06)	2.5	1.46 J
1,2,3,7,8-PeCDF **WHO TEF for:** **Humans/Mammals = 0.03** **EPA TEF for:** **Birds = 0.1** **Fish = 0.05**	SH-TP-01	2.5	2.57
	SH-TP-02	2.5	0.204 U
	SH-TP-03	3	0.171 U
	SH-TP-04	3	1.04 J
	SH-TP-05	2.5	2.91
	SH-TP-06	2.5	1.43 J
	SH-TP-07 (dup of SH-TP-06)	2.5	2.09 J
2,3,4,7,8-PeCDF **WHO TEF for:** **Humans/Mammals = 0.3** **EPA TEF for:** **Birds = 1** **Fish = 0.5**	SH-TP-01	2.5	1.49 J
	SH-TP-02	2.5	0.206 U
	SH-TP-03	3	0.173 U
	SH-TP-04	3	0.687 J
	SH-TP-05	2.5	1.7 J
	SH-TP-06	2.5	1.49 J
	SH-TP-07 (dup of SH-TP-06)	2.5	1.78 J
1,2,3,7,8-PeCDD **WHO TEF for:** **Humans/Mammals = 1** **EPA TEF for:** **Birds = 1** **Fish = 1**	SH-TP-01	2.5	1.37 J
	SH-TP-02	2.5	0.161 U
	SH-TP-03	3	0.0879 U
	SH-TP-04	3	0.582 J
	SH-TP-05	2.5	1.74 J
	SH-TP-06	2.5	0.773 J
	SH-TP-07 (dup of SH-TP-06)	2.5	1.16 J
2,3,7,8-TCDF **WHO TEF for:** **Humans/Mammals = 0.1** **EPA TEF for:** **Birds = 1** **Fish = 0.05**	SH-TP-01	2.5	3.07
	SH-TP-02	2.5	0.0867 U
	SH-TP-03	3	0.0598 U
	SH-TP-04	3	1.2
	SH-TP-05	2.5	3.69
	SH-TP-06	2.5	0.863
	SH-TP-07 (dup of SH-TP-06)	2.5	2.34
2,3,7,8-TCDD **WHO TEF for:** **Humans/Mammals = 1** **EPA TEF for:** **Birds = 1** **Fish = 1**	SH-TP-01	2.5	0.779
	SH-TP-02	2.5	0.118 U
	SH-TP-03	3	0.114 U
	SH-TP-04	3	0.407 J
	SH-TP-05	2.5	1.02
	SH-TP-06	2.5	0.0958 U
	SH-TP-07 (dup of SH-TP-06)	2.5	0.647
OCDF **WHO TEF for:** **Humans/Mammals = 0.0003** **EPA TEF for:** **Birds = 0.0001** **Fish = <0.0001**	SH-TP-01	2.5	38.1
	SH-TP-02	2.5	0.318 U
	SH-TP-03	3	0.289 U
	SH-TP-04	3	32.3
	SH-TP-05	2.5	1.32 J
	SH-TP-06	2.5	2.82 J
	SH-TP-07 (dup of SH-TP-06)	2.5	34.2

TABLE 16
SUMMARY OF SOIL ANALYTICAL RESULTS
DIOXIN CONGENERS - DISPOSAL LAGOON AREA
GOOSE LAKE SITE
SHELTON, WASHINGTON

Congeners and TEFs	Sample ID	Sample Depth (feet bgs)	Concentration (ng/kg)
OCDD **WHO TEF for:** **Humans/Mammals = 0.0003** **EPA TEF for:** **Birds = 0.0001** **Fish = <0.0001**	SH-TP-01	2.5	183
	SH-TP-02	2.5	1.84 J
	SH-TP-03	3	1.25 J
	SH-TP-04	3	127
	SH-TP-05	2.5	10
	SH-TP-06	2.5	71.2
	SH-TP-07 (dup of SH-TP-06)	2.5	166

Notes:

[1] WHO TEF Source: World Health Organization 2005 Reevaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-Like Compounds (Van den Berg et al., 2006). Human and mammal dioxin/furan TEFs based on MTCA 2007 TEFs (World Health Organization 2005 Reevaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-Like Compounds (Van den Berg et al., 2006).

[2] EPA TEF Source: Framework for Application of the Toxicity Equivalence Methodology for Polychlorinated Dioxins, Furans, and Biphenyls in Ecological Risk Assessment (USEPA, 2003) .Bird and fish dioxin/furan TEFs based on USEPA 2003 Framework for Application of the Toxicity Equivalence Methodology for Polychlorinated Dioxins, Furans, and Biphenyls in Ecological Risk Assessment.

ng/kg = Nanograms per kilogram
U = Congener was not detected at a concentration exceeding the value reported. Value reported represents method detection limit (MDL).
J = Congener was detected at the reported value but is considered to be estimated.
HpCDF = Heptachlorodibenzofuran
HpCDD = Heptachlorodibenzo-p-dioxin
HxCDD = Hexachlorodibenzo-p-dioxin
HxCDF = Hexachlorodibenzofuran
PeCDF = Pentachlorodibenzofuran
PeCDD = Pentachlorodibenzo-p-dioxin
TCDF = Tetrachlorodibenzofuran
TCDD = Tetrachlorodibenzo-p-dioxin
OCDF = Octachlorodibenzofuran
OCDD = Octachlorodibenzo-p-dioxin
TEF = Toxicity equivalency factor
ft bgs = Feet below ground surface

TABLE 17
SUMMARY OF SOIL ANALYTICAL RESULTS
DIOXIN TEQ VALUES - DISPOSAL LAGOON AREA
GOOSE LAKE SITE
SHELTON, WASHINGTON

TEQ/Screening Level Categories (ng/kg)	Sample Identification													
	SH-TP-01		SH-TP-02		SH-TP-03		SH-TP-04		SH-TP-05		SH-TP-06		SH-TP-07 (dup of SH-TP-06)	
	2.5'		2.5'		3'		3'		2.5'		2.5'		2.5'	
	TEQ (m)(h)	TEQ (b)	TEQ (m)(h)	TEQ (b)	TEQ (m)(h)	TEQ (b)	TEQ (m)(h)	TEQ (b)	TEQ (m)(h)	TEQ (b)	TEQ (m)(h)	TEQ (b)	TEQ (m)(h)	TEQ (b)
Applicable Screening Levels:	C		C		C		C		C		C		C	
Total Dioxins TEQ (ND=0.5MDL)	3.1	2.6	0.17	0.16	0.13	0.12	1.5	1.2	3.5	3.2	1.3	1.1	2.6	2.2
Total Furans TEQ (ND=0.5MDL)	2	5.5	0.05 U	0.17 U	0.04 U	0.13 U	0.7	2.4	2	6.3	0.9	2.8	1	4.9
Total D/F TEQ (ND=0.5MDL)	4.6	--	0.23	--	0.17	--	2.2	--	5.1	--	2.2	--	4	--
Soil Screening Level (Total Dioxins TEQ - Ecological)(Near or Upgradient of Local Surface Water Body)[1]	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Soil Screening Level (Total Furans TEQ - Ecological)(Near or Upgradient of Local Surface Water Body)[1]	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Soil Screening Level (Total D/F TEQ - Human Health)(Near or Upgradient of Local Surface Water Body)[1]	5.2 (a)	--	5.2 (a)	--	5.2 (a)	--	5.2 (a)	--	5.2 (a)	--	5.2 (a)	--	5.2 (a)	--

Notes:

[1] The soil screening levels are the same for saturated and unsaturated soils.

h = humans (TEFs based on MTCA 2007 TEFs (World Health Organization 2005 Reevaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-Like Compounds (Van den Berg et al., 2006)).

m = mammals (TEFs based on MTCA 2007 TEFs (World Health Organization 2005 Reevaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-Like Compounds (Van den Berg et al., 2006)).

b = birds (TEFs based on USEPA 2003 Framework for Application of the Toxicity Equivalence Methodology for Polychlorinated Dioxins, Furans, and Biphenyls in Ecological Risk Assessment).

D/F = Dioxins/furans

TEQ = Toxicity Equivalency Quotient

For non-detect dioxin/furan congener results, since there was at least one positive detection of each congener in soil or sediment at the site, 1/2 the MDL was used in the TEQ calculation.

The TEQ values shown are displayed in units of nanograms per kilogram (ng/kg).

MDL = Method detection limit

PQL = Practical quantitation limit

U = Analyte was not detected at the value reported. Value reported represents the practical quantitation limit (PQL), with exceptions noted.

-- = Not applicable or not established.

(a) Screening level for human health

Applicable Screening Levels

A - Not near or upgradient of local surface water body and unsaturated.

B - Not near or upgradient of local surface water body and saturated.

C - Near or upgradient of local surface water body and unsaturated.

D - Near or upgradient of local surface water body and saturated.

E - Seasonally submerged; results compared to both soil and sediment screening levels.

TABLE 18
SUMMARY OF SOIL ANALYTICAL RESULTS
POLYCHLORINATED BIPHENYLS[1] - DISPOSAL LAGOON AREA
GOOSE LAKE SITE
SHELTON, WASHINGTON

Sample ID	TP-22-0.3	TP-24-1.0	TP-27-2.0	TP-28-1.0	SH-TP-01	SH-TP-02	SH-TP-03	SH-TP-04	SH-TP-05	SH-TP-06	SH-TP-07 (field dup of SH-TP-06)	Soil Screening Level (Near or Upgradient of Local Surface Water Body) (Unsaturated)
Date Sampled	08/12/02	07/12/02	07/12/02	07/12/02	06/18/08	06/19/08	06/20/08	06/21/08	06/22/08	06/23/08	06/24/08	
Depth (feet)	0.3	1.0	2.0	1.0	2.5	2.5	3	3	2.5	2.5	2.5	
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Applicable Screening Levels	C	C	C	C	C	C	C	C	C	C	C	
Aroclor-1016	0.0095 U	0.0106 U	0.0104 U	0.0106 U	0.01 U	0.01 U	0.0099 U	0.0097 U	0.0096 U	0.0098 U	0.01 U	5.6
Aroclor-1221	0.0095 U	0.0106 U	0.0104 U	0.0106 U	0.01 U	0.01 U	0.0099 U	0.0097 U	0.0096 U	0.0098 U	0.01 U	--
Aroclor-1232	0.0095 U	0.0106 U	0.0104 U	0.0106 U	0.01 U	0.01 U	0.0099 U	0.0097 U	0.0096 U	0.0098 U	0.01 U	--
Aroclor-1242	0.0095 U	0.0106 U	0.0104 U	0.0106 U	0.01 U	0.01 U	0.0099 U	0.0097 U	0.0096 U	0.0098 U	0.01 U	--
Aroclor-1248	0.0095 U	0.0106 U	0.0104 U	0.0106 U	0.01 U	0.01 U	0.0099 U	0.0097 U	0.0096 U	0.0098 U	0.01 U	--
Aroclor-1254	0.0095 U	0.0106 U	0.0104 U	0.0106 U	0.01 U	0.01 U	0.0099 U	0.0097 U	0.0096 U	0.0098 U	0.01 U	1.6
Aroclor-1260	0.0095 U	0.0106 U	0.0104 U	0.0106 U	0.01 U	0.01 U	0.0099 U	0.0097 U	0.0096 U	0.0098 U	0.01 U	--
Total PCBs[2]	0.0095 U	0.0106 U	0.0104 U	0.0106 U	0.01 U	0.01 U	0.0099 U	0.0097 U	0.0096 U	0.0098 U	0.01 U	0.004

Notes:

[1] Aroclors 1016, 1221, 1232, 1242, 1248, 1254 and 1260 analyzed by USEPA Method 8082.

[2] Total PCBs were calculated per SAPA guidance (Ecology 2008b); i.e., the sum of Aroclors is represented by the sum of all detected Aroclors, or, when no Aroclors were detected, the sum is represented by the single highest non-detect result.

mg/kg = Milligrams per kilogram

U = The analyte was not detected at the value reported. Value reported represents the practical quantitation limit (PQL).

-- = No screening level available.

🟩 = PQL exceeds screening level when rounded to same number of significant figures as screening level.

Applicable Screening Levels

A - Not near or upgradient of local surface water body and unsaturated.
B - Not near or upgradient of local surface water body and saturated.
C - Near or upgradient of local surface water body and unsaturated.
D - Near or upgradient of local surface water body and saturated.
E - Seasonally submerged; results compared to both soil and sediment screening levels.

TABLE 19

SUMMARY OF SOIL ANALYTICAL RESULTS[1]

VOLATILE ORGANIC COMPOUNDS[2] - DISPOSAL LAGOON AREA

GOOSE LAKE SITE
SHELTON, WASHINGTON

Sample ID	TP-28-1.0	Soil Screening Level (Near or Upgradient of Local Surface Water Body)
Date Sampled	07/12/02	
Depth (feet)	1.0	
Units	µg/kg	µg/kg
1,1,1,2-tetrachloroethane	1.52 UJ	38,000
1,1,1-trichloroethane	1.52 UJ	72,000,000
1,1,2,2-tetrachloroethane	1.52 UJ	5,000
1,1,2-trichloroethane	1.52 UJ	18,000
1,1-dichloroethane	1.52 UJ	16,000,000
1,1-dichloroethylene	1.52 UJ	4,000,000
1,1-dichloropropene	1.52 UJ	--
1,2,3-trichlorobenzene	1.52 UJ	20,000
1,2,3-trichloropropane	1.52 UJ	140
1,2,4-trichlorobenzene	1.52 UJ	20,000
1,2,4-trimethylbenzene	1.52 UJ	4,000,000
1,2-dibromo-3-chloropropane (dbcp)	1.52 UJ	710
1,2-dichlorobenzene	1.52 UJ	7,200,000
1,2-dichloroethane	1.52 UJ	11,000
1,2-dichloropropane	1.52 UJ	15,000
1,3,5-trimethylbenzene	1.52 UJ	4,000,000
1,3-dichlorobenzene	1.52 UJ	--
1,3-dichloropropane	1.52 UJ	--
1,4-dichlorobenzene	1.52 UJ	20,000
2,2-dichloropropane	1.52 UJ	--
2-chlorotoluene	1.52 UJ	--
2-phenylbutane	1.52 UJ	--
4-chlorotoluene	1.52 UJ	--
Benzene	1.52 UJ	18,000
Benzene, (1,1-dimethylethyl)	1.52 UJ	--
Bromobenzene	1.52 UJ	--
Bromodichloromethane	1.52 UJ	16,000
Bromomethane	3.03 UJ	110,000
Butylbenzene,n-	1.52 UJ	--
Carbon tetrachloride	1.52 UJ	7,700
Cfc-11	1.52 UJ	24,000,000
Cfc-12	1.52 UJ	16,000,000
Chlorobenzene	1.52 UJ	40,000
Chlorobromomethane	1.52 UJ	--
Chlorodibromomethane	1.52 UJ	12,000
Chloroethane	1.52 UJ	350,000
Chloroform	1.52 UJ	160,000
Chloromethane	1.52 UJ	77,000
Cis-1,2-dichloroethene	1.52 UJ	800,000
Cis-1,3-dichloropropene	1.52 UJ	--
Cumene	1.52 UJ	8,000,000
Cymene	1.52 UJ	--

TABLE 19

SUMMARY OF SOIL ANALYTICAL RESULTS[1]

VOLATILE ORGANIC COMPOUNDS[2] - DISPOSAL LAGOON AREA

GOOSE LAKE SITE

SHELTON, WASHINGTON

Sample ID	**TP-28-1.0**	**Soil Screening Level (Near or Upgradient of Local Surface Water Body)**
Date Sampled	07/12/02	
Depth (feet)	1.0	
Units	µg/kg	µg/kg
Dibromomethane	1.52 UJ	800,000
Dichloromethane	10.6 J	130,000
Ethylene dibromide	1.52 UJ	12
Hexachloro-1,3-butadiene	1.52 UJ	13,000
Naphthalene	1.52 UJ	1,600,000
Propylbenzene,n-	1.52 UJ	--
Styrene (monomer)	1.52 UJ	33,000
Tetrachloroethene	1.52 UJ	1,900
Toluene	1.52 UJ	200,000
Trans-1,2-dichloroethene	1.52 UJ	1,600,000
Trans-1,3-dichloropropene	1.52 UJ	--
Tribromomethane	1.52 UJ	130,000
Trichloroethylene	1.52 UJ	11,000
Vinyl chloride	1.52 UJ	670
Xylene,o-	1.52 UJ	160,000,000
Xylene,p-, m-	3.03 UJ	160,000,000

Notes:

[1] Chemical analyses conducted by Severn Trent Laboratories, Tacoma, Washington.

[2] Volatile organic compounds analyzed by USEPA Method 8260B.

µg/kg = Micrograms per kilogram

J = The analyte was detected at the value reported; the reported value is estimated.

UJ = The analyte was not detected at the value reported. The value reported represents the estimated practical quantitation limit (PQL).

-- = No screening level available.

TABLE 20
SUMMARY OF SOIL ANALYTICAL RESULTS
TOTAL SULFIDE[1] - DISPOSAL LAGOON AREA
GOOSE LAKE SITE
SHELTON, WASHINGTON

Sample ID	TP-22-0.3	TP-24-1.0	TP-27-2.0	TP-28-1.0	SH-TP-01	SH-TP-02	SH-TP-03	SH-TP-04	SH-TP-05	SH-TP-06	SH-TP-07 (field dup of SH-TP-06)	Soil Screening Level
Date Sampled	08/12/02	07/12/02	07/12/02	07/12/02	06/18/08	06/19/08	06/20/08	06/21/08	06/22/08	06/23/08	06/24/08	
Depth (feet)	0.3	1.0	2.0	1.0	2.5	2.5	3	3	2.5	2.5	2.5	
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Total Sulfide	8.2 U	8.9 U	8.0 U	8.4 U	20 UJ	20 UJ	20 UJ	28.0	20 UJ	20 UJ	23.0	--

Notes:

[1] Total sulfide analyzed by USEPA Method 9030B.

mg/kg = Milligrams per kilogram

U = The analyte was not detected at the value reported. Value reported represents the practical quantitation limit (PQL).

UJ = The analyte was not detected at the value reported. The value reported represents the estimated practical quantitation limit (PQL).

-- = No screening level available.

TABLE 21
SUMMARY OF SOIL/SEDIMENT ANALYTICAL RESULTS
METALS[1] - OTHER AREAS
GOOSE LAKE SITE
SHELTON, WASHINGTON

Sample ID	MW-07-15	MW-08-35	MW-15-5.0-10212010	MW-15-40.0-10212010	MW-18-5.0-10212010	MW-18-7.5-10212010	MW-18-15.0-10212010	MW-18-20.0-10212010	S2-1	Soil Screening Level (Near or Upgradient of Local Surface Water Body) (Saturated/ Unsaturated) [2]	Soil Screening Level (Not Near or Upgradient of Local Surface Water Body) (Saturated/ Unsaturated) [2]
Sample Date	07/23/02	07/22/02	10/21/10	10/21/10	10/21/10	10/21/10	10/21/10	10/21/10	12/18/97		
Depth (ft bgs)	15.0	35.0	5	40	5	7.5	15	20	1		
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Applicable Screening Levels	A	C	C	D	A	A	B	B	C		
Chromium	27.9	24.7	--	--	94	57	58	40	32	48	48
Copper	44.7	31.3	--	--	659 J	258 J	57 J	48.1	33.7	36	36/70
Arsenic	1.16	0.954 U	1.1	0.9	6.2	3.4	1.7	--	1.88	20	20
Lead	3.36	1.44	--	--	292 J	210 J	5 U	--	10 U	24/110	120
Hexavalent chromium	0.103 U	0.0997 U	--	--	--	--	--	--	--	240	240
Mercury	0.0197 U	0.0208 U	--	--	0.7 J	0.23 J	0.02 UJ	--	0.05 U	0.07	0.1
Antimony	--	--	--	--	--	--	--	--	5 U	5	5
Cadmium	--	--	--	--	--	--	--	--	0.25 U	14	14
Nickel	--	--	--	--	--	--	--	--	29.9	48	48
Silver	--	--	--	--	--	--	--	--	2.5 U	400	400
Zinc	--	--	--	--	--	--	--	--	748	120	120

Notes:

[1] Metals analyzed by USEPA 6000/7000 Series methods.

[2] Where only a single value is shown, the screening level is the same for saturated and unsaturated soils.

mg/kg = Milligrams per kilogram

U = The analyte was not detected at the value reported. Value reported represents the practical quantitation limit (PQL).

UJ = The analyte was not detected at the value reported. Value reported represents the estimated PQL.

J = Estimated concentration.

🟨 = Value exceeds soil screening level when rounded to same number of significant figures as soil screening level.

ft bgs = Feet below ground surface

PQL = Practical quantitation limit

-- = Not analyzed.

Applicable Screening Levels

A - Not near or upgradient of local surface water body and unsaturated.
B - Not near or upgradient of local surface water body and saturated.
C - Near or upgradient of local surface water body and unsaturated.
D - Near or upgradient of local surface water body and saturated.
E - Seasonally submerged; results compared to both soil and sediment screening levels.

TABLE 22
SUMMARY OF SOIL/SEDIMENT ANALYTICAL RESULTS[1]
DIOXIN CONGENERS[2] - OTHER AREAS
GOOSE LAKE SITE
SHELTON, WASHINGTON

Congeners and TEFs	Sample ID	Sample Depth (feet bgs)	Concentration (ng/kg)
1,2,3,4,6,7,8-HpCDF WHO TEF[3] for: Humans/Mammals = 0.01 EPA TEF[4] for: Birds = 0.01 Fish = 0.01	S-2-0.5-1 [5]	0.5-1	6.093
	S-4-0.1-0.7 [5]	0.1-0.7	2.796 J
	S-5-0-0.5[5]	0-0.5	10.814 J
	S-6A-0.1-0.5[5]	0.1-0.5	22.728
1,2,3,4,7,8,9-HpCDF WHO TEF for: Humans/Mammals = 0.01 EPA TEF for: Birds = 0.01 Fish = 0.01	S-2-0.5-1	0.5-1	0.823 J
	S-4-0.1-0.7	0.1-0.7	0.346 U
	S-5-0-0.5	0-0.5	0.664 U
	S-6A-0.1-0.5	0.1-0.5	1.877 U
1,2,3,4,6,7,8-HpCDD WHO TEF for: Humans/Mammals = 0.01 EPA TEF for: Birds = <0.001 Fish = 0.001	S-2-0.5-1	0.5-1	7.363
	S-4-0.1-0.7	0.1-0.7	16.646 J
	S-5-0-0.5	0-0.5	39.691 J
	S-6A-0.1-0.5	0.1-0.5	78.59
1,2,3,6,7,8-HxCDD WHO TEF for: Humans/Mammals = 0.1 EPA TEF for: Birds = 0.01 Fish = 0.01	S-2-0.5-1	0.5-1	0.559 J
	S-4-0.1-0.7	0.1-0.7	1.052 J
	S-5-0-0.5	0-0.5	3.438
	S-6A-0.1-0.5	0.1-0.5	5.821
1,2,3,7,8,9-HxCDD WHO TEF for: Humans/Mammals = 0.1 EPA TEF for: Birds = 0.1 Fish = 0.01	S-2-0.5-1	0.5-1	0.264 J
	S-4-0.1-0.7	0.1-0.7	1.133 J
	S-5-0-0.5	0-0.5	3.822
	S-6A-0.1-0.5	0.1-0.5	5.203 J
1,2,3,4,7,8-HxCDD WHO TEF for: Humans/Mammals = 0.1 EPA TEF for: Birds = 0.05 Fish = 0.5	S-2-0.5-1	0.5-1	0.229 U
	S-4-0.1-0.7	0.1-0.7	0.327 J
	S-5-0-0.5	0-0.5	1.324 J
	S-6A-0.1-0.5	0.1-0.5	2.645
1,2,3,4,7,8-HxCDF WHO TEF for: Humans/Mammals = 0.1 EPA TEF for: Birds = 0.1 Fish = 0.1	S-2-0.5-1	0.5-1	0.952 J
	S-4-0.1-0.7	0.1-0.7	0.758 J
	S-5-0-0.5	0-0.5	2.527 J
	S-6A-0.1-0.5	0.1-0.5	2.682 J
1,2,3,6,7,8-HxCDF WHO TEF for: Humans/Mammals = 0.1 EPA TEF for: Birds = 0.1 Fish = 0.1	S-2-0.5-1	0.5-1	0.509 J
	S-4-0.1-0.7	0.1-0.7	0.48 J
	S-5-0-0.5	0-0.5	1.426 J
	S-6A-0.1-0.5	0.1-0.5	1.886 J
1,2,3,7,8,9-HxCDF WHO TEF for: Humans/Mammals = 0.1 EPA TEF for: Birds = 0.1 Fish = 0.1	S-2-0.5-1	0.5-1	0.213 U
	S-4-0.1-0.7	0.1-0.7	0.29 U
	S-5-0-0.5	0-0.5	0.265 U
	S-6A-0.1-0.5	0.1-0.5	0.683 U
2,3,4,6,7,8-HxCDF WHO TEF for: Humans/Mammals = 0.1 EPA TEF for: Birds = 0.1 Fish = 0.1	S-2-0.5-1	0.5-1	0.209 J
	S-4-0.1-0.7	0.1-0.7	0.318 J
	S-5-0-0.5	0-0.5	1.765 J
	S-6A-0.1-0.5	0.1-0.5	2.708
1,2,3,7,8-PeCDF WHO TEF for: Humans/Mammals = 0.03 EPA TEF for: Birds = 0.1 Fish = 0.05	S-2-0.5-1	0.5-1	0.18 U
	S-4-0.1-0.7	0.1-0.7	1.328 J
	S-5-0-0.5	0-0.5	2.656 J
	S-6A-0.1-0.5	0.1-0.5	2.245 J

TABLE 22
SUMMARY OF SOIL/SEDIMENT ANALYTICAL RESULTS[1]
DIOXIN CONGENERS[2] - OTHER AREAS
GOOSE LAKE SITE
SHELTON, WASHINGTON

Congeners and TEFs	Sample ID	Sample Depth (feet bgs)	Concentration (ng/kg)
2,3,4,7,8-PeCDF WHO TEF for: Humans/Mammals = 0.3 EPA TEF for: Birds = 1 Fish = 0.5	S-2-0.5-1	0.5-1	0.166 U
	S-4-0.1-0.7	0.1-0.7	1.182 J
	S-5-0-0.5	0-0.5	3.405
	S-6A-0.1-0.5	0.1-0.5	2.651
1,2,3,7,8-PeCDD WHO TEF for: Humans/Mammals = 1 EPA TEF for: Birds = 1 Fish = 1	S-2-0.5-1	0.5-1	0.165 U
	S-4-0.1-0.7	0.1-0.7	0.652 J
	S-5-0-0.5	0-0.5	1.592 J
	S-6A-0.1-0.5	0.1-0.5	3.18
2,3,7,8-TCDF WHO TEF for: Humans/Mammals = 0.1 EPA TEF for: Birds = 1 Fish = 0.05	S-2-0.5-1	0.5-1	0.759
	S-4-0.1-0.7	0.1-0.7	1.672
	S-5-0-0.5	0-0.5	4.108
	S-6A-0.1-0.5	0.1-0.5	3.53
2,3,7,8-TCDD WHO TEF for: Humans/Mammals = 1 EPA TEF for: Birds = 1 Fish = 1	S-2-0.5-1	0.5-1	0.13 U
	S-4-0.1-0.7	0.1-0.7	1.368
	S-5-0-0.5	0-0.5	3.766
	S-6A-0.1-0.5	0.1-0.5	0.513 U
OCDF WHO TEF for: Humans/Mammals = 0.0003 EPA TEF for: Birds = 0.0001 Fish = <0.0001	S-2-0.5-1	0.5-1	33.383
	S-4-0.1-0.7	0.1-0.7	11.415
	S-5-0-0.5	0-0.5	31.546
	S-6A-0.1-0.5	0.1-0.5	120.606
OCDD WHO TEF for: Humans/Mammals = 0.0003 EPA TEF for: Birds = 0.0001 Fish = <0.0001	S-2-0.5-1	0.5-1	64.375
	S-4-0.1-0.7	0.1-0.7	107.052
	S-5-0-0.5	0-0.5	291.913
	S-6A-0.1-0.5	0.1-0.5	496.757

Notes:

[1] Chemical analyses conducted by Columbia Analytical Services of Kelso, Washington.

[2] Dioxins and furans analyzed by USEPA Method 8290.

[3] WHO TEF Source: MTCA 2007 TEFs (World Health Organization 2005 Reevaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-Like Compounds (Van den Berg et al., 2006).

[4] EPA TEF Source: Framework for Application of the Toxicity Equivalence Methodology for Polychlorinated Dioxins, Furans, and Biphenyls in Ecological Risk Assessment (USEPA, 2003) .

[5] S-2 and S-4 were collected in areas that are seasonally submerged (e.g. soil/sediment); S-5 and S-6A were collected in upland locations that are not seasonally submerged (e.g. soil).

ng/kg = Nanograms per kilogram

U = Congener was not detected at a concentration exceeding the value reported. Value reported represents method detection limit (MDL).

J = Congener was detected at the reported value but is considered to be estimated.

HpCDF = Heptachlorodibenzofuran

HpCDD = Heptachlorodibenzo-p-dioxin

HxCDD = Hexachlorodibenzo-p-dioxin

HxCDF = Hexachlorodibenzofuran

PeCDF = Pentachlorodibenzofuran

PeCDD = Pentachlorodibenzo-p-dioxin

TCDF = Tetrachlorodibenzofuran

TCDD = Tetrachlorodibenzo-p-dioxin

OCDF = Octachlorodibenzofuran

OCDD = Octachlorodibenzo-p-dioxin

TEF = Toxicity equivalency factor

TEQ = Toxicity equivalency quotient

ft bgs = Feet below ground surface

TABLE 23
SUMMARY OF SOIL/SEDIMENT ANALYTICAL RESULTS
DIOXIN TEQ VALUES - OTHER AREAS
GOOSE LAKE SITE
SHELTON, WASHINGTON

TEQ/Screening Level Categories (ng/kg)	Sample Identification							
	S-2-0.5-1		S-4-0.1-0.7		S-5-0-0.5		S-6A-0.1-0.5	
	TEQ (m)(h)	TEQ (b)	TEQ (m)(h)	TEQ (b)	TEQ (m)(h)	TEQ (b)	TEQ (m)(h)	TEQ (b)
Applicable Screening Levels:	C / E		C / E		C		A	
Total Dioxins TEQ (ND=0.5MDL)	0.33	0.23	2.5	2.2	6.7	6.0	5.7	4.4
Total Furans TEQ (ND=0.5MDL)	0.4	1.1	0.8	3.2	2	8.5	2	7.4
Total D/F TEQ (ND=0.5MDL)	0.69	1.3	3.2	5.4	8.9	14	8	12
Soil Screening Level (Total Dioxins TEQ - Ecological)(Near/Not Near or Upgradient of Local Surface Water Body) (Saturated/Unsaturated)$^{1, 2}$	20	20	20	20	20	20	20	20
Soil Screening Level (Total Furans TEQ - Ecological)(Near/Not Near or Upgradient of Local Surface Water Body) (Saturated/Unsaturated)$^{1, 2}$	20	20	20	20	20	20	20	20
Soil Screening Level (Total D/F TEQ - Human Health)(Near or Upgradient of Local Surface Water Body) (Saturated/Unsaturated)^{1}	5.2 (a)	--	5.2 (a)	--	5.2 (a)	--	5.2 (a)	--
Soil Screening Level (Total D/F TEQ - Human Health)(Not Near or Upgradient of Local Surface Water Body) (Saturated/Unsaturated)^{1}	7.5 (a) / 11 (a)	--	7.5 (a) / 11 (a)	--	7.5 (a) / 11 (a)	--	7.5 (a) / 11 (a)	--
Sediment Screening Level (Total D/F TEQ - Low-Risk Ecological)	2.5 (b)	21	2.5 (b)	21	--	--	--	--
Sediment Screening Level (Total D/F TEQ - High-Risk Ecological)	25 (b)	210	25 (b)	210	--	--	--	--

Notes:

[1] Where only a single value is shown, the screening level is the same for saturated and unsaturated soils.

[2] Soil screening levels for locations near and not near surface water are the same.

h = humans (TEFs based on MTCA 2007 TEFs (World Health Organization 2005 Reevaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-Like Compounds (Van den Berg et al., 2006)).

m = mammals (TEFs based on MTCA 2007 TEFs (World Health Organization 2005 Reevaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-Like Compounds (Van den Berg et al., 2006)).

b = birds (TEFs based on USEPA 2003 Framework for Application of the Toxicity Equivalence Methodology for Polychlorinated Dioxins, Furans, and Biphenyls in Ecological Risk Assessment).

D/F = Dioxins/furans

TEQ = Toxicity Equivalency Quotient

For non-detect dioxin/furan congener results, since there was at least one positive detection of each congener in soil or sediment at the site, 1/2 the MDL was used in the TEQ calculation.

The TEQ values shown for the congeners are displayed in units of nanograms per kilogram (ng/kg).

🟨 = Value exceeds soil screening level when rounded to same number of significant figures as soil screening level.

🟥 = Value exceeds sediment screening level when rounded to same number of significant figures as sediment screening level.

only. Soil/sediment samples S-2 and S-4 were collected in areas that are seasonally submerged, so they are compared to soil and sediment screening levels; soil samples S-5 and S-6A were collected in upland locations that are not seasonally submerged, so they are compared to soil screening levels only.

MDL = Method detection limit

PQL = Practical quantitation limit

-- = Not applicable or not established.

(a) Screening level for human health

(b) Screening level for mammalian wildlife

Applicable Screening Levels

- A - Not near or upgradient of local surface water body and unsaturated.
- B - Not near or upgradient of local surface water body and saturated.
- C - Near or upgradient of local surface water body and unsaturated.
- D - Near or upgradient of local surface water body and saturated.
- E - Seasonally submerged; results compared to both soil and sediment screening levels.

TABLE 24
SUMMARY OF SOIL/SEDIMENT ANALYTICAL RESULTS[1]
POLYCHLORINATED BIPHENYLS[2] - OTHER AREAS
GOOSE LAKE SITE
SHELTON, WASHINGTON

Sample ID	MW-07-15	MW-08-35	MW-11	MW-12	MW-18-5.0-10212010	MW-18-7.5-10212010	MW-18-15.0-10212010	Soil Screening Level (Near or Upgradient of Local Surface Water Body) (Saturated/Unsaturated) [4]	Soil Screening Level (Not Near or Upgradient of Local Surface Water Body) (Saturated/Unsaturated) [4]
Date Sampled	07/23/02	07/22/02	12/30/05	12/30/05	10/21/10	10/21/10	10/21/10		
Depth (ft bgs)	15.0	35.0	5.0	5.0	5	7.5	15		
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Applicable Screening Levels	A	C	A	A	A	A	B		
Aroclor-1016	0.0101 U	0.0101 U	--	--	0.032 U	0.031 U	0.031 U	5.6	5.6
Aroclor-1221	0.0101 U	0.0101 U	0.20 U	0.20 U	0.032 U	0.031 U	0.031 U	--	--
Aroclor-1232	0.0101 U	0.0101 U	0.20 U	0.20 U	0.032 U	0.031 U	0.031 U	--	--
Aroclor-1242	0.0101 U	0.0101 U	0.20 U	0.20 U	0.032 U	0.031 U	0.031 U	--	--
Aroclor-1248	0.0101 U	0.0101 U	0.20 U	0.20 U	0.032 U	0.062 UY	0.031 U	--	--
Aroclor-1254	0.0101 U	0.0101 U	0.20 U	0.20 U	0.032 U	0.1	0.031 U	1.6	1.6
Aroclor-1260	0.0101 U	0.0101 U	0.20 U	0.20 U	0.032 U	0.15	0.031 U	--	--
Total PCBs[3]	0.0101 U	0.0101 U	0.20 U	0.20 U	0.03 U	0.3	0.03 U	0.004	0.0137/0.273

Notes:

[1] Chemical analyses conducted by Severn Trent Laboratories, Tacoma, Washington or Advanced Analytical Laboratory or Analytical Resources, Inc., Tukwila, Washington.

[2] Aroclors 1016, 1221, 1232, 1242, 1248, 1254 and 1260 analyzed by USEPA Method 8082.

[3] Total PCBs were calculated per SAPA guidance (Ecology 2008b); i.e., the sum of Aroclors is represented by the sum of all detected Aroclors, or, when no Aroclors were detected, the sum is represented by the single highest non-detect

[4] Where only a single value is shown, the screening level is the same for saturated and unsaturated soils.

mg/kg = Milligrams per kilogram

U = The analyte was not detected at the value reported. Value reported represents the practical quantitation limit (PQL).

-- = No screening level available.

UY = Not detected above the associated value; the associated value is elevated due to interference.

PCBs = Polychlorinated biphenyls

ft bgs = Feet below ground surface

PQL = Practical quantitation limit

🟨 = Value exceeds soil screening level when rounded to same number of significant figures as soil screening level.

🟩 = PQL exceeds screening level when rounded to same number of significant figures as screening level.

Applicable Screening Levels

- A - Not near or upgradient of local surface water body and unsaturated.
- B - Not near or upgradient of local surface water body and saturated.
- C - Near or upgradient of local surface water body and unsaturated.
- D - Near or upgradient of local surface water body and saturated.
- E - Seasonally submerged; results compared to both soil and sediment screening levels.

TABLE 25
SUMMARY OF SOIL/SEDIMENT ANALYTICAL RESULTS[1]
VOLATILE ORGANIC COMPOUNDS[2] - OTHER AREAS
GOOSE LAKE SITE
SHELTON, WASHINGTON

Sample ID	**MW-07-15**	**MW-08-35**	**Soil Screening Level**
Date Sampled	07/23/02	07/22/02	
Depth (feet)	15.0	35.0	
Units	µg/kg	µg/kg	µg/kg
1,1,1,2-tetrachloroethane	1.27 U	1.25 U	38,000
1,1,1-trichloroethane	1.27 U	1.25 U	72,000,000
1,1,2,2-tetrachloroethane	1.27 U	1.25 U	5,000
1,1,2-trichloroethane	1.27 U	1.25 U	18,000
1,1-dichloroethane	1.27 U	1.25 U	16,000,000
1,1-dichloroethylene	1.27 U	1.25 U	4,000,000
1,1-dichloropropene	1.27 U	1.25 U	--
1,2,3-trichlorobenzene	1.27 U	1.25 U	20,000
1,2,3-trichloropropane	1.27 U	1.25 U	140
1,2,4-trichlorobenzene	1.27 U	1.25 U	20,000
1,2,4-trimethylbenzene	1.27 U	1.25 U	4,000,000
1,2-dibromo-3-chloropropane (dbcp)	1.27 U	1.25 U	710
1,2-dichlorobenzene	1.27 U	1.25 U	7,200,000
1,2-dichloroethane	1.27 U	1.25 U	11,000
1,2-dichloropropane	1.27 U	1.25 U	15,000
1,3,5-trimethylbenzene	1.27 U	1.25 U	4,000,000
1,3-dichlorobenzene	1.27 U	1.25 U	--
1,3-dichloropropane	1.27 U	1.25 U	--
1,4-dichlorobenzene	1.27 U	1.25 U	20,000
2,2-dichloropropane	1.27 U	1.25 U	--
2-chlorotoluene	1.27 U	1.25 U	--
2-phenylbutane	1.27 U	1.25 U	--
4-chlorotoluene	1.27 U	1.25 U	--
Benzene	1.27 U	1.25 U	18,000
Benzene, (1,1-dimethylethyl)	1.27 U	1.25 U	--
Bromobenzene	1.27 U	1.25 U	--
Bromodichloromethane	1.27 U	1.25 U	16,000
Bromomethane	2.55 U	2.5 U	110,000
Butylbenzene,n-	1.27 U	1.25 U	--
Carbon tetrachloride	1.27 U	1.25 U	7,700
Cfc-11	1.27 U	1.25 U	24,000,000
Cfc-12	1.27 U	1.25 U	16,000,000
Chlorobenzene	1.27 U	1.25 U	40,000
Chlorobromomethane	1.27 U	1.25 U	--
Chlorodibromomethane	1.27 U	1.25 U	12,000
Chloroethane	1.27 U	1.25 U	350,000
Chloroform	1.27 U	1.25 U	160,000
Chloromethane	1.27 U	1.25 U	77,000
Cis-1,2-dichloroethene	1.27 U	1.25 U	800,000
Cis-1,3-dichloropropene	1.27 U	1.25 U	--

Sample ID	MW-07-15	MW-08-35	Soil Screening Level
Date Sampled	07/23/02	07/22/02	
Depth (feet)	15.0	35.0	
Units	µg/kg	µg/kg	µg/kg
Cumene	1.27 U	1.25 U	8,000,000
Cymene	1.27 U	1.25 U	--
Dibromomethane	1.27 U	1.25 U	800,000
Dichloromethane	1.27 U	1.25 U	130,000
Ethylene dibromide	1.27 U	1.25 U	12
Hexachloro-1,3-butadiene	1.27 U	1.25 U	13,000
Naphthalene	1.27 U	1.25 U	1,600,000
Propylbenzene,n-	1.27 U	1.25 U	--
Styrene (monomer)	1.27 U	1.25 U	33,000
Tetrachloroethene	1.27 U	1.25 U	1,900
Toluene	1.27 U	1.25 U	200,000
Trans-1,2-dichloroethene	1.27 U	1.25 U	1,600,000
Trans-1,3-dichloropropene	1.27 U	1.25 U	--
Tribromomethane	1.27 U	1.25 U	130,000
Trichloroethylene	1.27 U	1.25 U	11,000
Vinyl chloride	1.27 U	1.25 U	670
Xylene,o-	1.27 U	1.25 U	160,000,000
Xylene,p-, m-	2.55 U	2.5 U	160,000,000

Notes:

[1] Chemical analyses conducted by Severn Trent Laboratories, Tacoma, Washington.

[2] Volatile organic compounds analyzed by USEPA Method 8260B.

µg/kg = Micrograms per kilogram

U = The analyte was not detected at the value reported. Value reported represents the practical quantitation limit (PQL).

-- = No screening level available.

TABLE 26

SUMMARY OF SOIL/SEDIMENT ANALYTICAL RESULTS[1]

SEMIVOLATILE ORGANIC COMPOUNDS[2] - OTHER AREAS

GOOSE LAKE SITE
SHELTON, WASHINGTON

Sample ID	MW-07-15	MW-08-35	MW-11_051230	MW-12_051230	MW-18-5.0-10212010	MW-18-7.5-10212010	MW-18-15.0-10212010	Soil Screening Level [4]
Date Sampled	07/23/02	07/22/02	12/30/05	12/30/05	10/21/10	10/21/10	10/21/10	
Depth (feet)	15.0	35.0	5.0	5.0	5.0	7.5	15.0	
Units	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
Applicable Screening Levels	A	C	A	A	A	A	B	
1,2,4-trichlorobenzene	13.5 U	13.4 U	100 U	100 U	--	--	--	20,000
1,2-dichlorobenzene	13.5 U	13.4 U	100 U	100 U	190 U	180 U	65 U	7,200,000
1,2-diphenylhydrazine	13.5 U	13.4 U	--	--	190 U	180 U	65 U	1,300
1,3-dichlorobenzene	13.5 U	13.4 U	100 U	100 U	--	--	--	--
1,4-dichlorobenzene	13.5 U	13.4 U	100 U	100 U	190 U	180 U	65 U	20,000
2,4,5-trichlorophenol	13.5 U	13.4 U	500 U	500 U	970 U	920 U	320 U	4,000
2,4,6-trichlorophenol	33.6 U	33.4 U	500 U	500 U	970 U	920 U	320 U	10,000
2,4-dichlorophenol	13.5 U	13.4 U	500 U	500 U	970 U	920 U	320 U	240,000
2,4-dimethylphenol	13.5 U	13.4 U	500 U	500 U	190 U	180 U	65 U	1,600,000
2,4-dinitrophenol	67.3 U	66.8 U	500 U	500 U	1900 U	1800 U	650 U	20,000
2,4-dinitrotoluene	13.5 U	13.4 U	--	--	970 UJ	920 UJ	320 UJ	160,000
2,6-dinitrotoluene	13.5 U	13.4 U	--	--	970 U	920 U	320 U	80,000
2-chloronaphthalene	1.35 U	1.34 U	100 U	100 U	190 U	180 U	65 U	6,400,000
2-chlorophenol	13.5 U	13.4 U	500 U	500 U	190 U	180 U	65 U	400,000
2-methylnaphthalene	1.35 U	1.34 U	--	--	190 U	180 U	65 U	320,000
2-methylphenol	13.5 U	13.4 U	100 U	100 U	--	--	--	4,000,000
2-nitroaniline	13.5 U	13.4 U	--	--	--	--	--	--
2-nitrophenol	13.5 U	13.4 U	500 U	500 U	--	--	--	--
3,3'-dichlorobenzidine	13.5 U	13.4 U	--	--	970 U	920 U	320 U	2,200
3,5,5-trimethyl-2-cyclohexene-1-one	13.5 U	13.4 U	--	--	190 U	180 U	65 U	1,100,000
3-nitroaniline	13.5 U	13.4 U	--	--	--	--	--	--
4,6-dinitro-2-methylphenol	67.3 U	66.8 U	--	--	--	--	--	--
4-bromophenyl phenyl ether	13.5 U	13.4 U	100 U	100 U	--	--	--	--
4-chlorophenyl methyl sulfone	13.5 U	13.4 U	--	--	--	--	--	--
4-nitrophenol	67.3 U	66.8 U	500 U	500 U	970 U	920 U	320 U	7,000
Acenaphthene	1.35 U	1.34 U	100 U	100 U	190 U	180 U	65 U	20,000
Acenaphthylene	1.35 U	1.34 U	100 U	100 U	190 U	180 U	65 U	--
Aniline	13.5 U	13.4 U	--	--	190 U	180 U	65 U	180,000
Anthracene	1.35 U	1.34 U	100 U	100 U	190 U	180 U	65 U	24,000,000
Azobenzene	--	--	--	--	190 U	180 U	65 U	9,100
Benzidine	67.3 U	66.8 U	--	--	1900 UJ	1800 UJ	650 UJ	200
Benzo(g,h,i)perylene	1.35 U	1.34 U	100 U	100 U	190 U	180 U	65 U	--
Benzoic acid	67.3 U	66.8 U	--	--	1900 U	1800 U	650 U	320,000,000
Benzyl alcohol	13.5 U	13.4 U	--	--	970 U	920 U	320 U	24,000,000
Benzyl butyl phthalate	13.5 U	13.4 U	500 U	500 U	190 U	180 U	65 U	16,000,000
Bis(2-chloroethoxy)methane	13.5 U	13.4 U	100 U	100 U	--	--	--	--
Bis(2-chloroethyl)ether	13.5 U	13.4 U	--	--	190 U	180 U	65 U	910
Bis(2-chloroisopropyl)ether	13.5 U	13.4 U	--	--	190 U	180 U	65 U	3,200,000
Bis(2-ethylhexyl)phthalate	23.5 U	13.4 U	--	--	190	430	65 U	71,000
Carbazole	13.5 U	13.4 U	--	--	190 U	180 U	65 U	50,000
Cyclohexanone	--	--	--	--	--	--	--	400,000,000
Dibenzofuran	13.5 U	13.4 U	--	--	190 U	180 U	65 U	160,000
Diethyl phthalate	13.5 U	13.4 U	100 U	100 U	190 U	180 U	65 U	100,000
Dimethyl phthalate	13.5 U	13.4 U	100 U	100 U	190 U	180 U	65 U	200,000
Di-n-butylphthalate	33.6 U	33.4 U	100 U	100 U	190 U	180 U	65 U	200,000
Di-n-octylphthalate	13.5 U	13.4 U	500 U	500 U	190 U	180 U	65 U	1,600,000
Fluoranthene	1.35 U	1.34 U	100 U	100 U	300	270	65 U	3,200,000
Fluorene	1.35 U	1.34 U	100 U	100 U	190 U	180 U	65 U	30,000
Hexachloro-1,3-butadiene	13.5 U	13.4 U	500 U	500 U	190 U	180 U	65 U	13,000
Hexachlorobenzene	13.5 U	13.4 U	100 U	100 U	190 U	180 U	65 U	630
Hexachlorocyclopentadiene	13.5 U	13.4 U	100 U	100 U	970 U	920 U	320 U	10,000
Hexachloroethane	13.5 U	13.4 U	100 U	100 U	190 U	180 U	65 U	71,000
Methanamine, n-methyl-n-nitroso	67.3 U	66.8 U	--	--	--	--	--	--
Naphthalene	1.35 U	1.34 U	100 U	100 U	--	--	--	1,600,000
N-nitroso-di-n-propylamine	13.5 U	13.4 U	--	--	190 U	180 U	65 U	140
N-nitrosodiphenylamine	13.5 U	13.4 U	100 U	100 U	970 U	920 U	320 U	20,000
P-chloroaniline	13.5 U	13.4 U	--	--	970 U	920 U	320 U	320,000
Pentachlorophenol	13.5 U	13.4 U	500 U	500 U	970 U	920 U	320 U	8,300
Phenanthrene	1.35 U	1.34 U	100 U	100 U	260	360	65 U	--
Phenol	13.5 U	13.4 U	500 U	500 U	190 U	180 U	65 U	30,000
P-nitroaniline	13.5 U	13.4 U	--	--	--	--	--	--
Pyrene	1.35 U	1.34 U	100 U	100 U	190 U	330	65 U	2,400,000
Pyridine	67.3 U	66.8 U	--	--	970 U	920 U	320 U	80,000
2,3,4,6-Tetrachlorophenol	--	--	100 U	100 U	--	--	--	2,400,000
2,4,6-Tribromophenol	--	--	500 U	500 U	--	--	--	--
2,6-Dichlorophenol	--	--	500 U	500 U	--	--	--	--
4-Chloro-3-Methylphenol	--	--	500 U	500 U	--	--	--	--
4-Chlorophenyl-Phenylether	--	--	500 U	500 U	--	--	--	--
Bis(2-ethylhexyl)ether	--	--	100 U	100 U	--	--	--	--
m,p-Cresol	--	--	100 U	100 U	--	--	--	400,000
Benzo(a)anthracene (cPAH)	2.69 U	2.67 U	100 U	100 U	190 U	180 U	65 U	*See TEQ*

Sample ID	MW-07-15	MW-08-35	MW-11_051230	MW-12_051230	MW-18-5.0-10212010	MW-18-7.5-10212010	MW-18-15.0-10212010	Soil Screening Level [4]
Date Sampled	07/23/02	07/22/02	12/30/05	12/30/05	10/21/10	10/21/10	10/21/10	
Depth (feet)	15.0	35.0	5.0	5.0	5.0	7.5	15.0	
Units	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
Applicable Screening Levels	A	C	A	A	A	A	B	
Chrysene (cPAH)	2.69 U	2.67 U	100 U	100 U	190 U	180 U	65 U	*See TEQ*
Total Benzofluoranthenes (cPAH)	2.69 U	2.67 U	--	--	--	--	--	*See TEQ*
Benzo(b)fluoranthene (cPAH)	--	--	100 U	100 U	190 U	180 U	65 U	*See TEQ*
Benzo(k)fluoranthene (cPAH)	--	--	100 U	100 U	190 U	180 U	65 U	*See TEQ*
Benzo(a)pyrene (cPAH)	1.35 U	1.34 U	100 U	100 U	190 U	180 U	65 U	*See TEQ*
Indeno(1,2,3-cd)pyrene (cPAH)	1.35 U	1.34 U	100 U	100 U	190 UJ	180 UJ	65 UJ	*See TEQ*
Dibenz(a,h)anthracene (cPAH)	1.35 U	1.34 U	100 U	100 U	190 U	180 U	65 U	*See TEQ*
Total cPAHs TEQ[3]	1.0 U	1.0 U	71 U	71 U	134 UJ	127 UJ	46 UJ	140

Notes:

[1] Chemical analyses conducted by Severn Trent Laboratories, Tacoma, Washington or Advanced Analytical Laboratory or Analytical Resources, Inc., Tukwila, Washington.

[2] Semivolatile organic compounds analyzed by USEPA Method 8270.

[3] TEQ calculated using toxicity equivalent factors (TEFs) listed in MTCA Table 708-2. For non-detect results, if there was at least one positive detection of the analyte in any RI soil or sediment sample, 1/2 the practical quantitation limit was used in the calculation. Otherwise, zero was used for non-detect results.

[4] The value is the same for applicable screening levels A through D.

cPAH = Carcinogenic polycyclic aromatic hydrocarbon

TEQ = Toxicity Equivalency Quotient

µg/kg = Micrograms per kilogram

U = The analyte was not detected at the value reported. Value reported represents the practical quantitation limit (PQL).

J = The analyte was detected at the value reported; the reported value is estimated.

UJ = The analyte was not detected at the value reported. Value reported represents estimated practical quantitation limit (PQL).

-- = Not applicable or not established or not analyzed.

SVOCs = Semivolatile organic compounds

ft bgs = Feet below ground surface

PQL = Practical quantitation limit

🟩 = PQL exceeds screening level when rounded to same number of significant figures as screening level.

🟨 = Value exceeds soil screening level when rounded to same number of significant figures as soil screening level.

Applicable Screening Levels

A - Not near or upgradient of local surface water body and unsaturated.
B - Not near or upgradient of local surface water body and saturated.
C - Near or upgradient of local surface water body and unsaturated.
D - Near or upgradient of local surface water body and saturated.
E - Seasonally submerged; results compared to both soil and sediment screening levels.

TABLE 27

SUMMARY OF SOIL/SEDIMENT ANALYTICAL RESULTS[1]

TOTAL PETROLEUM HYDROCARBONS[2] - OTHER AREAS

GOOSE LAKE SITE
SHELTON, WASHINGTON

Sample Identification	MW-07-15	MW-08-35	MW-11_051230	MW-12_051230	MW-15-25.0-10212010	
Date Sampled	07/23/02	07/22/02	12/30/05	12/30/05	10/21/10	
Depth (feet)	15.0	35.0	5.0	5.0	25.0	**Soil Screening Level [3]**
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Applicable Screening Levels	A	C	A	A	C	
Gasoline-range	--	--	--	--	20 U	100
Diesel-range	25.5 U	24.3 U	20 U	20 U	50 U	200
Heavy oil-range	51 U	48.6 U	50 U	50 U	100 U	2,000
Kerosene/Jet fuel	--	--	20 U	20 U	--	2,000

Notes:

[1] Chemical analyses conducted by Severn Trent Laboratories, Tacoma, Washington, Analytical Resources Inc., Tukwila, Washington, or Advanced Analytical Laboratory.

[2] Hydrocarbons analyzed by Ecology Method NWTPH-Dx or NWTPH-HCID.

[3] The value is the same for applicable screening levels A through D.

mg/kg = Milligrams per kilogram

U = The analyte was not detected at the value reported. Value reported represents the practical quantitation limit (PQL).

-- = not analyzed

Applicable Screening Levels

- A - Not near or upgradient of local surface water body and unsaturated.
- B - Not near or upgradient of local surface water body and saturated.
- C - Near or upgradient of local surface water body and unsaturated.
- D - Near or upgradient of local surface water body and saturated.
- E - Seasonally submerged; results compared to both soil and sediment screening levels.

TABLE 28
SUMMARY OF SOIL/SEDIMENT ANALYTICAL RESULTS[1]
CONVENTIONAL CHEMISTRY[2] - OTHER AREAS
GOOSE LAKE SITE
SHELTON, WASHINGTON

	Sample ID	**MW-07-15**	**MW-08-35**	**MW-15-5.0-10212010**	**MW-15-40.0-10212010**	**MW-18-7.5-10212010**	**MW-18-15.0-10212010**	**Soil Screening Level**
	Date Sampled	07/23/02	07/22/02	10/21/10	10/21/10	10/21/10	10/21/10	
	Depth (feet)	15.0	35.0	5.0	40.0	7.5	15.0	
Total Sulfide	mg/kg	7.2 U	6.8 U	--	--	--	--	--
Total Organic Carbon	percent	--	--	0.377	0.133	13.9	0.609	--

Notes:

[1] Chemical analyses conducted by Severn Trent Laboratories, Tacoma, Washington and Analytical Resources, Inc., Tukwila, Washington.

[2] Total sulfide analyzed by USEPA Method 9030B; TOC by Plumb, 1981.

mg/kg = Milligrams per kilogram

U = The analyte was not detected at the value reported. Value reported represents the practical quantitation limit (PQL).

-- = No screening level available or not analyzed.

TABLE 29

GROUNDWATER AND GOOSE LAKE SURFACE WATER ELEVATIONS

GOOSE LAKE SITE

SHELTON, WASHINGTON

Monitoring Well[1] (Casing Elevation)	Date Measured	Depth to Water[2] (feet)	Water Elevation[3] (feet)
MW-01	08/12/02	18.32	222.85
(241.17)	11/12/02	21.51	219.66
	02/12/03	14.58	226.59
	05/12/03	13.26	227.91
	11/30/10	16.00	225.17
MW-02	08/12/02	18.54	222.57
(241.11)	11/12/02	21.79	219.32
	02/12/03	14.86	226.25
	05/12/03	13.57	227.54
	11/30/10	16.31	224.80
MW-03	08/12/02	17.83	224.44
(242.27)	11/12/02	21.13	221.14
	02/12/03	13.90	228.37
	05/12/03	12.61	229.66
	11/30/10	15.74	226.53
MW-04	08/12/02	22.27	224.85
(247.12)	11/12/02	Dry	--
	02/12/03	18.01	229.11
	05/12/03	17.07	230.05
	11/30/10	20.20	226.92
MW-05	08/12/02	31.05	229.06
(260.11)	11/12/02	Dry	--
	02/12/03	25.73	234.38
	05/12/03	25.29	234.82
	11/30/10	28.78	231.33
MW-06	08/12/02	37.95	226.83
(264.78)	11/12/02	Dry	--
	02/12/03	32.68	232.10
	05/12/03	32.03	232.75
	11/30/10	36.16	228.62
MW-07	08/12/02	25.77	220.62
(246.39)	11/12/02	29.79	216.60
	02/12/03	21.99	224.40
	05/12/03	20.81	225.58
	11/30/10	23.35	223.04
MW-08	08/12/02	42.11	225.16
(267.27)	11/12/02	45.04	222.23
	02/12/03	38.45	228.82
	05/12/03	37.28	229.99
	11/30/10	40.41	226.86
MW-09	08/12/02	14.11	226.69
(240.80)	11/12/02	17.71	223.09
	02/12/03	9.93	230.87
	05/12/03	9.37	231.43
	11/30/10	10.40	230.40
MW-10	08/12/02	28.10	233.00
(261.10)	11/12/02	33.05	228.05
	02/12/03	21.77	239.33
	05/12/03	22.03	239.07
	11/30/10	26.18	234.92
MW-11 (242.82)	11/30/10	17.91	224.91
MW-12 (239.83)	11/30/10	12.38	227.45
MW-13 (244.09)	11/30/10	14.15	229.94
MW-14 (209.38)	11/30/10	12.81	196.57
MW-15 (264.70)	11/30/10	35.26	229.44
MW-16 (238.12)	11/30/10	10.58	227.54
MW-17 (233.01)	11/30/10	5.54	227.47
MW-18 (236.49)	11/30/10	11.52	224.97
Goose Lake Surface Water Level	08/12/02	-- (staff gage not installed)	--
(Low Gage Elevation = 224.02)	11/12/02	1.36	222.66
	02/12/03	-- (water level above top of staff gage)	--
(High Gage Elevation = 231.15)	05/12/03	0.26	230.89
	11/30/10	(surveyed relative to MW-17)	227.57

Monitoring Well [1] (Casing Elevation)	Date Measured	Depth to Water [2] (feet)	Water Elevation [3] (feet)
MW-14** (209.52)	05/17/09	10.01	199.51
	08/17/09	11.93	197.59
	11/17/09	9.52	200.00
	02/17/10	8.69	200.83
	05/17/10	10.48	199.04
GMW-1 (B-1)** (214.80)	05/17/09	12.30	202.50
	08/17/09	14.82	199.98
	11/17/09	12.40	202.40
	02/17/10	11.06	203.74
	05/17/10	13.39	201.41

Notes:

[1] Locations of the monitoring wells are shown in Figure 10.

[2] The depths to groundwater were measured relative to the tops of the well casings. The Goose Lake surface water level was measured relative to staff gages installed by GeoEngineers on November 12, 2002 and May 12, 2003 unless otherwise noted.

[3] Groundwater and surface water elevations were calculated by subtracting the water depths from the well casing and staff gage elevations. The well casing and staff gage elevations were surveyed relative to the "Sanderson" controlling monument (elevation 270.42, NGVD 1929), located north of the Site at Sanderson Air Field.

-- = Not measured

** Groundwater level data collected during transducer study conducted by Shelton Hills LLC (*Hydrogeologic and Geotechnical Services Proposed Infiltration Pond System Report*; GeoEngineers, 2011b). Vertical datum for top of casing elevation is unknown.

TABLE 30
SUMMARY OF GROUNDWATER ANALYTICAL RESULTS[1]
TOTAL METALS[2] - ALL AREAS
GOOSE LAKE SITE
SHELTON, WASHINGTON

Monitoring Well	MW-01						MW-02						Groundwater Screening Levels (Protective of Drinking Water Use)	Groundwater Screening Levels (Protective of Surface Water)
Sample ID	MW-01-02Q3	MW-01-02Q4	MW-01-03Q1	MW-01-03Q2	MW-01-03Q2 DUP	MW-1-11302010	MW-02-02Q3	MW-02-02Q3 DUP	MW-02-02Q4	MW-02-03Q1	MW-02-03Q2	MW-2-12012010		
Sample Date	08/13/02	11/12/02	02/12/03	05/13/03	05/13/03	11/30/10	08/13/02	08/13/02	11/12/02	02/12/03	05/13/03	12/01/10		
Units	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Applicable Screening Levels	A						A							
Arsenic	0.0018	0.00112	0.003 U	0.001 U	0.001 U	0.00171	0.0022	0.0029	0.00632	0.0036	0.0032	0.00358	0.005	0.005
Cadmium	--	--	--	--	--	--	--	--	--	--	--	--	0.005	0.00025
Total Chromium	0.0059 U	0.00933	0.0051	0.0021	0.0028	0.00796	0.0032 U	0.0042 U	0.0079	0.0066	0.0017	0.00275	0.1	0.057 (a)
Copper	0.0221	0.0216	0.0116	0.0052	0.0076	0.0247	0.0046	0.0049	0.0289	0.0188	0.0026	0.00521	0.59	0.0035
Lead	0.0011	0.001	0.0006	0.0005 U	0.0016	0.0104	0.0005 U	0.0006	0.00198	0.0007	0.0005 U	0.000421	0.015	0.00054
Hexavalent chromium	0.01 U	0.00604 J	0.01 U	0.01 U	0.01 U	--	0.01 U	0.01 U	0.00661 J	0.01 U	0.01 U	--	0.048	0.01
Mercury	0.0002 U	0.0002 U	0.0002 UJ	0.0002 U	0.0002 U	0.0000139	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.00000276	0.002	0.000012
Antimony	--	--	--	--	--	0.000079	--	--	--	--	--	0.000047	0.006	0.0056
Nickel	--	--	--	--	--	0.00336	--	--	--	--	--	0.00043	0.1	0.049
Silver	--	--	--	--	--	--	--	--	--	--	--	--	0.08	26
Zinc	--	--	--	--	--	0.00379	--	--	--	--	--	0.00085	4.8	0.032

Monitoring Well	MW-03					MW-04			MW-05				Groundwater Screening Levels (Protective of Drinking Water Use)	Groundwater Screening Levels (Protective of Surface Water)
Sample ID	MW-03-02Q3	MW-03-02Q4	MW-03-03Q1	MW-03-03Q2	MW-3-12012010	MW-04-02Q3	MW-04-03Q1	MW-04-03Q2	MW-05-02Q3	MW-05-03Q1	MW-05-03Q2	SH-5*		
Sample Date	08/13/02	11/12/02	02/12/03	05/13/03	12/01/10	08/13/02	02/12/03	05/13/03	08/13/02	02/12/03	05/13/03	12/30/05		
Units	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Applicable Screening Levels	B					A			B					
Arsenic	0.001 U	0.00166	0.003 U	0.001 U	0.00007	0.0025	0.003 U	0.001 U	0.001 U	0.003 U	0.001 U	0.005 U	0.005	0.005
Cadmium	--	--	--	--	--	--	--	--	--	--	--	0.005 U	0.005	0.00025
Total Chromium	0.0048 U	0.005 U	0.0031	0.0012	0.00014	0.0304	0.0021	0.0021	0.0034 U	0.001 U	0.0033	0.01 U	0.1	0.057 (a)
Copper	0.0017	0.0106	0.0039	0.0015	0.0004	0.0545	0.0025	0.0025	0.0089	0.0111	0.0078	--	0.59	0.0035
Lead	0.0008	0.00544	0.002	0.0005 U	0.000168	0.0036	0.0005 U	0.0005 U	0.0005 U	0.0008	0.0005 U	0.002 U	0.015	0.00054
Hexavalent chromium	0.01 U	0.0039 J	0.01 U	0.01 U	--	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	--	0.048	0.01
Mercury	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.00000077	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0005 U	0.002	0.000012
Antimony	--	--	--	--	0.000022	--	--	--	--	--	--	--	0.006	0.0056
Nickel	--	--	--	--	0.00085	--	--	--	--	--	--	--	0.1	0.049
Silver	--	--	--	--	--	--	--	--	--	--	--	--	0.08	26
Zinc	--	--	--	--	0.00026	--	--	--	--	--	--	--	4.8	0.032

Notes:

[1] Chemical analyses conducted by Severn Trent Laboratories, Tacoma, Washington, Analytical Resources, Inc., Tukwila, Washington, Frontier Global Sciences, Seattle, Washington, and Advanced Analytical Laboratory.

[2] Metals analyzed by USEPA 6000/7000 Series methods (pre-2010) or EPA1631/EPA1632/FGS-022-W/FGS-054 (2010). Results shown are for total metals, except asterisked samples (*).

* results shown are for dissolved metals.

(a) There are no regulatory surface water criteria for total chromium; the screening level for trivalent chromium is listed, as hexavalent chromium has not been detected above screening levels in groundwater.

U = The analyte was not detected at the value reported. Value reported represents the practical quantitation limit (PQL).

J = The analyte was detected at the value reported; the reported value is estimated.

U = The analyte was not detected at the value reported. Value reported represents the PQL or MDL.

UJ = The analyte was not detected at the value reported. Value reported represents the estimated PQL.

🟨 = Value exceeds groundwater screening level protective of drinking water use when rounded to same number of significant figures as the screening level.

🟥 = Value exceeds groundwater screening level protective of surface water when rounded to same number of significant figures as the screening level.

🟩 = PQL exceeds screening level when rounded to same number of significant figures as screening level.

mg/L = Milligrams per liter

MDL = Method detection limit

PQL = Practical quantitation limit

-- = Not analyzed.

Applicable Screening Levels

A - Not near or upgradient of local surface water body. Results were compared to groundwater screening levels protective of drinking water.

B - Near or upgradient of local surface water body. Results were compared to groundwater screening levels protective of both drinking water and surface water.

TABLE 30
SUMMARY OF GROUNDWATER ANALYTICAL RESULTS[1]
TOTAL METALS[2] - ALL AREAS
GOOSE LAKE SITE
SHELTON, WASHINGTON

Monitoring Well	MW-06				MW-07							MW-08						Groundwater Screening Levels (Protective of Drinking Water Use)	Groundwater Screening Levels (Protective of Surface Water)
Sample ID	MW-06-02Q3	MW-06-03Q1	MW-06-03Q2	MW-6-12012010	MW-07-02Q3	MW-07-02Q4	MW-07-03Q1	MW-07-03Q1 DUP	MW-07-03Q2	SH-7*	MW-7-11302010	MW-08-02Q3	MW-08-02Q4	MW-08-02Q4-DUP	MW-08-03Q1	MW-08-03Q2	MW-8-12012010		
Sample Date	08/13/02	02/12/03	05/13/03	12/01/10	08/12/02	11/13/02	02/12/03	02/12/03	05/13/03	12/30/05	11/30/10	08/12/02	11/12/02	11/12/02	02/12/03	05/13/03	12/01/10		
Units	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Applicable Screening Levels	B				A							B							
Arsenic	0.001 U	0.003 U	0.001 U	0.0001	0.001 U	0.0036	0.003 U	0.003 U	0.001 U	0.005 U	0.000009 J	0.0037	0.0005 U	0.0005 U	0.003 U	0.001 U	0.000096	0.005	0.005
Cadmium	--	--	--	--	--	--	--	--	--	0.005 U	--	--	--	--	--	--	--	0.005	0.00025
Total Chromium	0.001 U	0.001 U	0.0014	--	0.0065	0.0508 J	0.0433	0.0372	0.0011	0.01 U	0.00011	0.0838	0.0157	0.0247	0.0023	0.003	--	0.1	0.057 (a)
Copper	0.00159	0.0019	0.001 U	--	0.0107	0.0949 J	0.0763	0.0622	0.001 U	--	0.00014	0.107	0.0216	0.0276	0.0033	0.0023	--	0.59	0.0035
Lead	0.0005 U	0.0005 U	0.0005 U	--	0.0008	0.0049 J	0.0082	0.0071	0.0005 U	0.002 U	0.000007 J	0.0062	0.00102	0.0014	0.0005 U	0.0005 U	--	0.015	0.00054
Hexavalent chromium	0.01 U	0.01 U	0.01 U	--	0.01 U	0.0138	0.01 U	0.01 U	0.01 U	--	--	0.0123	0.00603 J	0.00648 J	0.01 U	0.01 U	--	0.048	0.01
Mercury	0.0002 U	0.0002 U	0.0002 U	--	0.0002 U	0.000113 U	0.0002 U	0.0002 U	0.0002 U	0.0005 U	0.00000018	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	--	0.002	0.000012
Antimony	--	--	--	--	--	--	--	--	--	--	0.00001	--	--	--	--	--	--	0.006	0.0056
Nickel	--	--	--	--	--	--	--	--	--	--	0.00018	--	--	--	--	--	--	0.1	0.049
Silver	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.08	26
Zinc	--	--	--	--	--	--	--	--	--	--	0.00026	--	--	--	--	--	--	4.8	0.032

Monitoring Well	MW-09				MW-10						MW-11		MW-12		MW-13	MW-15	MW-16		MW-17	MW-18	Groundwater Screening Levels (Protective of Drinking Water Use)	Groundwater Screening Levels (Protective of Surface Water)
Sample ID	MW-09-02Q3	MW-09-02Q4	MW-09-03Q1	MW-09-03Q2	MW-10-02Q3	MW-10-02Q4	MW-10-03Q1	MW-10-03Q2	SH-10*	MW-10-11302010	SH-11*	MW-11-12012010	SH-12*	MW-12-12012010	MW-13-11302010	MW-15-12012010	MW-16-12012010	DUP-1-12012010 (MW-16 DUP)	MW-17-12012010	MW-18-12012010		
Sample Date	08/13/02	11/12/02	02/12/03	05/13/03	08/12/02	11/12/02	02/12/03	05/13/03	12/30/05	11/30/10	12/30/05	12/01/10	12/30/05	12/01/10	11/30/10	12/01/10	12/01/10	12/01/10	12/01/10	12/01/10		
Units	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Applicable Screening Levels	B				B						A		A		B	B	B		B	A		
Arsenic	0.001 U	0.00185	0.003 U	0.0015	0.0015	0.00263	0.003 U	0.001 U	0.005 U	0.000016	0.005 U	0.000033	0.005 U	0.000217	0.000304	0.000009 U	0.00009 U	0.00009 U	0.00009 U	0.000061	0.005	0.005
Cadmium	--	--	--	--	--	--	--	--	0.005 U	--	0.005 U	--	0.005 U	--	--	--	--	--	--	--	0.005	0.00025
Total Chromium	0.0102	0.0207	0.0042	0.0054	0.0078	0.005 U	0.0017	0.0014	0.01 U	--	0.02	0.00012	0.01	0.00055	0.00392	--	0.0199	0.0189	0.0417	0.00089	0.1	0.057 (a)
Copper	0.0236	0.0618	0.0166	0.0149	0.03	0.00598	0.0045	0.0015	--	--	--	0.00073	--	0.00156	0.0308	--	0.00681	0.00754	0.00536	0.00706	0.59	0.0035
Lead	0.0014	0.00312	0.0023	0.0008	0.0018	0.0005 U	0.0009	0.0005 U	0.002 U	--	0.002 U	0.000003 U	0.002 U	0.000087	0.00155	--	0.00355	0.00341	0.00488	0.000098	0.015	0.00054
Hexavalent chromium	0.01 U	0.0084 J	0.01 U	0.01 U	0.01 U	0.00331 J	0.01 U	0.01 U	--	--	--	--	--	--	--	--	--	--	--	--	0.048	0.01
Mercury	0.0002 U	0.0002 U	0.0002 U	0.0003	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0005 U	--	0.0005 U	0.00000103	0.0005 U	0.00000223	0.0000133	--	0.0000235	0.0000234	0.0000589	0.00000467	0.002	0.000012
Antimony	--	--	--	--	--	--	--	--	--	--	--	0.00003	--	--	--	--	0.000318 J	0.000405	0.000298 J	--	0.006	0.0056
Nickel	--	--	--	--	--	--	--	--	--	--	--	0.00012	--	--	--	--	0.0122	0.0129	0.024	--	0.1	0.049
Silver	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.00012 U	0.00006 U	0.00012 U	--	0.08	26
Zinc	--	--	--	--	--	--	--	--	--	--	--	0.00017	--	--	--	--	0.0161	0.00795	0.0261	--	4.8	0.032

Notes:

[1] Chemical analyses conducted by Severn Trent Laboratories, Tacoma, Washington, Analytical Resources, Inc., Tukwila, Washington, Frontier Global Sciences, Seattle, Washington, and Advanced Analytical Laboratory.

[2] Metals analyzed by USEPA 6000/7000 Series methods (pre-2010) or EPA1631/EPA1632/FGS-022-W/FGS-054 (2010). Results shown are for total metals, except asterisked samples (*).

* results shown are for dissolved metals.

(a) There are no regulatory surface water criteria for total chromium; the screening level for trivalent chromium is listed, as hexavalent chromium has not been detected above screening levels in groundwater.

U = The analyte was not detected at the value reported. Value reported represents the practical quantitation limit (PQL).

J = The analyte was detected at the value reported; the reported value is estimated.

U = The analyte was not detected at the value reported. Value reported represents the PQL or MDL.

UJ = The analyte was not detected at the value reported. Value reported represents the estimated PQL.

🟨 = Value exceeds groundwater screening level protective of drinking water use when rounded to same number of significant figures as the screening level.

🟥 = Value exceeds groundwater screening level protective of surface water when rounded to same number of significant figures as the screening level.

🟩 = PQL exceeds screening level when rounded to same number of significant figures as screening level.

mg/L = Milligrams per liter

MDL = Method detection limit

PQL = Practical quantitation limit

-- = Not analyzed.

Applicable Screening Levels

A - Not near or upgradient of local surface water body. Results were compared to groundwater screening levels protective of drinking water.

B - Near or upgradient of local surface water body. Results were compared to groundwater screening levels protective of both drinking water and surface water.

TABLE 31

SUMMARY OF GROUNDWATER ANALYTICAL RESULTS^1

DIOXIN TEQ VALUES - ALL AREAS

GOOSE LAKE SITE
SHELTON, WASHINGTON

Monitoring Well	MW-12	MW-15	MW-16		MW-17	MW-18	Groundwater Screening Levels (Protective of Drinking Water Use)	Groundwater Screening Levels (Protective of Surface Water)
Sample ID	MW-12-12012010	MW-15-12012010	MW-16-12012010	DUP-1-12012010 (MW-16 DUP)	MW-17-12012010	MW-18-12012010		
Date Sampled	12/1/2010	12/1/2010	12/1/2010	12/1/2010	12/1/2010	12/1/2010		
Units	pg/L	pg/L	pg/L	pg/L	pg/L	pg/L		
Applicable Screening Levels	A	B	B		B	A		
Dioxins and Furans by EPA1613B								
2,3,7,8-TCDD	0.46 U	0.64 U	0.484 U	0.618 U	0.595 U	0.296 U	*See TEQ*	*See TEQ*
1,2,3,7,8-PeCDD	0.5 U	1.66	0.528 U	0.487 U	0.489 U	0.303 U	*See TEQ*	*See TEQ*
1,2,3,4,7,8-HxCDD	0.221 U	1.06	0.532 U	0.628 U	0.752 U	0.305 U	*See TEQ*	*See TEQ*
1,2,3,6,7,8-HxCDD	0.23 U	2.8	0.632 U	0.841 U	0.623 U	0.316 U	*See TEQ*	*See TEQ*
1,2,3,7,8,9-HxCDD	0.235 U	2.06 U	0.612 U	0.824 U	0.744 U	0.35 U	*See TEQ*	*See TEQ*
1,2,3,4,6,7,8-HpCDD	2.78 U	35.5	45.1 J	82.9	31.1 J	4.06 U	*See TEQ*	*See TEQ*
OCDD	7.16	181	345 J	750 J	354	30.3 J	*See TEQ*	*See TEQ*
2,3,7,8-TCDF	0.28	1.76	0.227 U	0.284 U	0.5 U	0.161 U	*See TEQ*	*See TEQ*
1,2,3,7,8-PeCDF	0.161 U	1.6	0.8 U	0.45 U	0.45 U	0.19 U	*See TEQ*	*See TEQ*
2,3,4,7,8-PeCDF	0.16 U	1.56 U	1.2 J	0.467 U	1.16 J	0.52 J	*See TEQ*	*See TEQ*
1,2,3,4,7,8-HxCDF	0.26	1.06 U	0.474 U	1.42 U	1.1 J	0.246 U	*See TEQ*	*See TEQ*
1,2,3,6,7,8-HxCDF	0.167 U	1.28	0.402 U	0.55 U	0.39 U	0.23 U	*See TEQ*	*See TEQ*
2,3,4,6,7,8-HxCDF	0.17 U	1.24	0.448 U	0.596 U	0.456 U	0.254 U	*See TEQ*	*See TEQ*
1,2,3,7,8,9-HxCDF	0.195 U	0.188 U	0.495 U	0.517 U	0.423 U	0.299 U	*See TEQ*	*See TEQ*
1,2,3,4,6,7,8-HpCDF	1.04 U	12.9	9.38 J	16.1 J	9.2 J	1.32 J	*See TEQ*	*See TEQ*
1,2,3,4,7,8,9-HpCDF	0.26 U	0.84	1.15 U	1.32 U	0.852 U	0.584 U	*See TEQ*	*See TEQ*
OCDF	4.34	36	12.8 J	19.8 J	14.5 J	2.94 J	*See TEQ*	*See TEQ*
Total Dioxins/Furans TEQ (ND=0.5MDL)	1.13	4.5	1.71 J	2.18 J	1.72 J	0.618 J	30	1 to 4 (0.005)*

Notes:

1) Chemical analyses conducted by Analytical Resources, Inc., Tukwila, Washington.

* The lowest risk-based screening level criteria for dioxins/furans is 0.005 pg/L. PQLs typically range from 1 to 4 pg/L. Sample-specific MDL will vary from sample to sample, and any positive dioxin/furan TEQ detection above the MDL (assuming the MDL is above 0.005 pg/L) is considered an exceedance.

🟨 = Value exceeds groundwater screening level protective of drinking water use when rounded to same number of significant figures as the screening level.

🟥 = Value exceeds groundwater screening level protective of surface water when rounded to same number of significant figures as the screening level.

Dioxin/furan TEFs based on MTCA 2007 TEFs (World Health Organization 2005 Reevaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-Like Compounds (Van den Berg et al., 2006)).

TEQ = Toxicity equivalency quotient

TEF = Toxicity equivalency factor

HpCDF = Heptachlorodibenzofuran

HpCDD = Heptachlorodibenzo-p-dioxin

HxCDD = Hexachlorodibenzo-p-dioxin

HxCDF = Hexachlorodibenzofuran

PeCDF = Pentachlorodibenzofuran

PeCDD = Pentachlorodibenzo-p-dioxin

TCDF = Tetrachlorodibenzofuran

TCDD = Tetrachlorodibenzo-p-dioxin

OCDF = Octachlorodibenzofuran

OCDD = Octachlorodibenzo-p-dioxin

For non-detect dioxin/furan congener results, since there was at least one positive detection of each congener in groundwater or surface water at the site, 1/2 the MDL was used in the TEQ calculation.

pg/L = Picograms per liter

ND = Not detected

MDL = Method detection limit

PQL = Practical quantitation limit

U = The analyte was not detected at the value reported. Value reported represents the PQL or MDL.

J = Estimated concentration.

Applicable Screening Levels

A - Not near or upgradient of local surface water body. Results were compared to groundwater screening levels protective of drinking water.

B - Near or upgradient of local surface water body. Results were compared to groundwater screening levels protective of both drinking water and surface water.

TABLE 32
SUMMARY OF GROUNDWATER ANALYTICAL RESULTS[1]
POLYCHLORINATED BIPHENYLS[2] - ALL AREAS
GOOSE LAKE SITE
SHELTON, WASHINGTON

Monitoring Well	**MW-01**						**MW-02**						**MW-03**					**Groundwater Screening Levels (Protective of Drinking Water Use)**	**Groundwater Screening Levels (Protective of Surface Water)**
Sample ID	**MW-01-02Q3**	**MW-01-02Q4**	**MW-01-03Q1**	**MW-01-03Q2**	**MW-01-03Q2 DUP**	**MW-1-11302010**	**MW-02-02Q3**	**MW-02-02Q3 DUP**	**MW-02-02Q4**	**MW-02-03Q1**	**MW-02-03Q2**	**MW-2-12012010**	**MW-03-02Q3**	**MW-03-02Q4**	**MW-03-03Q1**	**MW-03-03Q2**	**MW-3-12012010**		
Date Sampled	08/13/02	11/12/02	02/12/03	05/13/03	05/13/03	11/30/10	08/13/02	08/13/02	11/12/02	02/12/03	05/13/03	12/01/10	08/13/02	11/12/02	02/12/03	05/13/03	12/01/10		
Units	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
Applicable Screening Levels	A						A						B						
Aroclor-1016	0.0095 UJ	0.0095 U	0.0095 U	0.0094 U	0.0094 UJ	0.01 U	0.0095 U	0.0094 U	0.0095 U	0.0096 UJ	0.0094 U	0.01 U	0.0095 U	0.0095 U	0.0095 U	0.0094 U	0.01 U	1.1	0.01
Aroclor-1221	0.019 UJ	0.0191 U	0.0191 U	0.019 U	0.019 UJ	0.01 U	0.019 U	0.019 U	0.0191 U	0.0192 UJ	0.0189 U	0.01 U	0.019 U	0.019 U	0.019 U	0.019 U	0.01 U	--	--
Aroclor-1232	0.0095 UJ	0.0095 U	0.0095 U	0.0094 U	0.0094 UJ	0.01 U	0.0095 U	0.0094 U	0.0095 U	0.0096 UJ	0.0094 U	0.01 U	0.0095 U	0.0095 U	0.0095 U	0.0094 U	0.01 U	--	--
Aroclor-1242	0.0095 UJ	0.0095 U	0.0095 U	0.0094 U	0.0094 UJ	0.01 U	0.0095 U	0.0094 U	0.0095 U	0.0096 UJ	0.0094 U	0.01 U	0.0095 U	0.0095 U	0.0095 U	0.0094 U	0.01 U	--	--
Aroclor-1248	0.0095 UJ	0.0095 U	0.0095 U	0.0094 U	0.0094 UJ	0.01 U	0.0095 U	0.0094 U	0.0095 U	0.0096 UJ	0.0094 U	0.01 U	0.0095 U	0.0095 U	0.0095 U	0.0094 U	0.01 U	--	--
Aroclor-1254	0.0095 UJ	0.0095 U	0.0095 U	0.0094 U	0.0094 UJ	0.01 U	0.0095 U	0.0094 U	0.0095 U	0.0096 UJ	0.0094 U	0.01 U	0.0095 U	0.0095 U	0.0095 U	0.0094 U	0.01 U	0.32	0.01
Aroclor-1260	0.0095 UJ	0.0095 U	0.0095 U	0.0094 U	0.0094 UJ	0.01 U	0.0095 U	0.0094 U	0.00257 J	0.0096 UJ	0.0094 U	0.01 U	0.0095 U	0.0095 U	0.0095 U	0.0094 U	0.01 U	--	0.014
Total PCBs[3]	0.019 UJ	0.0191 U	0.0191 U	0.019 U	0.019 UJ	0.01 U	0.019 U	0.019 U	0.00257 J	0.0192 UJ	0.0189 U	0.01 U	0.019 U	0.019 U	0.019 U	0.019 U	0.01 U	0.044	0.01

Monitoring Well	**MW-04**			**MW-05**				**MW-06**			**MW-07**							**Groundwater Screening Levels (Protective of Drinking Water Use)**	**Groundwater Screening Levels (Protective of Surface Water)**
Sample ID	**MW-04-02Q3**	**MW-04-03Q1**	**MW-04-03Q2**	**MW-05-02Q3**	**MW-05-03Q1**	**MW-05-03Q2**	**SH-5**	**MW-06-02Q3**	**MW-06-03Q1**	**MW-06-03Q2**	**MW-07-02Q3**	**MW-07-02Q4**	**MW-07-03Q1**	**MW-07-03Q1 DUP**	**MW-07-03Q2**	**SH-7**	**MW-7-11302010**		
Date Sampled	08/13/02	02/12/03	05/13/03	08/13/02	02/12/03	05/13/03	12/30/05	08/13/02	02/12/03	05/13/03	08/12/02	11/13/02	02/12/03	02/12/03	05/13/03	12/30/05	11/30/10		
Units	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	ug/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
Applicable Screening Levels	A			B				B			A								
Aroclor-1016	0.0094 U	0.0097 U	0.0095 U	0.0094 U	0.0095 U	0.0094 U	--	0.00957 U	0.0095 U	0.0094 U	0.0094 U	0.0094 U	0.0095 U	0.0096 U	0.0094 U	--	0.01 U	1.1	0.01
Aroclor-1221	0.019 U	0.0194 U	0.019 U	0.0189 U	0.019 U	0.019 U	0.1 U	0.0191 U	0.0189 U	0.019 U	0.019 U	0.019 U	0.0191 U	0.0191 U	0.019 U	0.1 U	0.01 U	--	--
Aroclor-1232	0.0094 U	0.0097 U	0.0095 U	0.0094 U	0.0095 U	0.0094 U	0.1 U	0.00957 U	0.0095 U	0.0094 U	0.0094 U	0.0094 U	0.0095 U	0.0096 U	0.0094 U	0.1 U	0.01 U	--	--
Aroclor-1242	0.0094 U	0.0097 U	0.0095 U	0.0094 U	0.0095 U	0.0094 U	0.1 U	0.00957 U	0.0095 U	0.0094 U	0.0094 U	0.0094 U	0.0095 U	0.0096 U	0.0094 U	0.1 U	0.01 U	--	--
Aroclor-1248	0.0094 U	0.0097 U	0.0095 U	0.0094 U	0.0095 U	0.0094 U	0.1 U	0.00957 U	0.0095 U	0.0094 U	0.0094 U	0.0094 U	0.0095 U	0.0096 U	0.0094 U	0.1 U	0.01 U	--	--
Aroclor-1254	0.0094 U	0.0097 U	0.0095 U	0.0094 U	0.0095 U	0.0094 U	0.1 U	0.00957 U	0.0095 U	0.0094 U	0.0094 U	0.0094 U	0.0095 U	0.0096 U	0.0094 U	0.1 U	0.01 U	0.32	0.01
Aroclor-1260	0.0094 U	0.0097 U	0.0095 U	0.0094 U	0.0095 U	0.0094 U	0.1 U	0.00957 U	0.0095 U	0.0094 U	0.0094 U	0.0094 U	0.0095 U	0.0096 U	0.0094 U	0.1 U	0.01 U	--	0.014
Total PCBs[3]	0.019 U	0.0194 U	0.019 U	0.0189 U	0.019 U	0.019 U	0.1 U	0.0191 U	0.0189 U	0.019 U	0.019 U	0.019 U	0.0191 U	0.0191 U	0.019 U	0.1 U	0.01 U	0.044	0.01

Notes:

[1] Chemical analyses conducted by Severn Trent Laboratories, Tacoma, Washington; Analytical Resources, Inc., Tukwila, Washington; and Advanced Analytical Laboratory.

[2] Aroclors 1016, 1221, 1232, 1242, 1248, 1254 and 1260 analyzed by USEPA Method 8082 or 8082 (low level).

[3] Total PCBs were calculated per SAPA guidance (Ecology 2008b); i.e., the sum of Aroclors is represented by the sum of all detected Aroclors, or, when no Aroclors were detected, the sum is represented by the single highest non-detect result.

µg/l = Micrograms per liter

U = The analyte was not detected at the value reported. Value reported represents the practical quantitation limit (PQL).

UJ = The analyte was not detected at the value reported. Value reported represents estimated practical quantitation limit (PQL).

J = Estimated concentration.

UY = Not detected above the associated value; the associated value is elevated due to interference.

🟨 = Value exceeds groundwater screening level protective of drinking water use when rounded to same number of significant figures as the screening level.

🟥 = Value exceeds groundwater screening level protective of surface water when rounded to same number of significant figures as the screening level.

🟩 = PQL exceeds screening level when rounded to same number of significant figures as screening level.

PCBs = Polychlorinated biphenyls

PQL = Practical quantitation limit

-- = Not applicable or not established or not analyzed.

Applicable Screening Levels

A - Not near or upgradient of local surface water body. Results were compared to groundwater screening levels protective of drinking water.

B - Near or upgradient of local surface water body. Results were compared to groundwater screening levels protective of both drinking water and surface water.

TABLE 32
SUMMARY OF GROUNDWATER ANALYTICAL RESULTS[1]
POLYCHLORINATED BIPHENYLS[2] - ALL AREAS
GOOSE LAKE SITE
SHELTON, WASHINGTON

Monitoring Well	**MW-08**					**MW-09**				**MW-10**					**Groundwater Screening Levels (Protective of Drinking Water Use)**	**Groundwater Screening Levels (Protective of Surface Water)**
Sample ID	**MW-08-02Q3**	**MW-08-02Q4**	**MW-08-02Q4 DUP**	**MW-08-03Q1**	**MW-08-03Q2**	**MW-09-02Q3**	**MW-09-02Q4**	**MW-09-03Q1**	**MW-09-03Q2**	**MW-10-02Q3**	**MW-10-02Q4**	**MW-10-03Q1**	**MW-10-03Q2**	**SH-10**		
Date Sampled	08/12/02	11/12/02	11/12/02	02/12/03	05/13/03	08/13/02	11/12/02	02/12/03	05/13/03	08/12/02	11/12/02	02/12/03	05/13/03	12/30/05		
Units	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	ug/l	µg/l	µg/l
Applicable Screening Levels	B					B				B						
Aroclor-1016	0.0095 U	0.0094 U	0.0095 U	0.0095 U	0.0094 U	0.0095 U	0.0095 U	0.0095 UJ	0.0095 U	0.0095 U	0.0094 U	0.0095 U	0.0095 U	--	1.1	0.01
Aroclor-1221	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.0191 U	0.019 UJ	0.0191 U	0.019 U	0.019 U	0.0189 U	0.019 U	0.1 U	--	--
Aroclor-1232	0.0095 U	0.0094 U	0.0095 U	0.0095 U	0.0094 U	0.0095 U	0.0095 U	0.0095 UJ	0.0095 U	0.0095 U	0.0094 U	0.0095 U	0.0095 U	0.1 U	--	--
Aroclor-1242	0.0095 U	0.0094 U	0.0095 U	0.0095 U	0.0094 U	0.0095 U	0.0095 U	0.0095 UJ	0.0095 U	0.0095 U	0.0094 U	0.0095 U	0.0095 U	0.1 U	--	--
Aroclor-1248	0.0095 U	0.0094 U	0.0095 U	0.0095 U	0.0094 U	0.0095 U	0.0095 U	0.0095 UJ	0.0095 U	0.0095 U	0.0094 U	0.0095 U	0.0095 U	0.1 U	--	--
Aroclor-1254	0.0095 U	0.0094 U	0.0095 U	0.0095 U	0.0094 U	0.0095 U	0.0095 U	0.0095 UJ	0.0095 U	0.0095 U	0.0094 U	0.0095 U	0.0095 U	0.1 U	0.32	0.01
Aroclor-1260	0.0095 U	0.0094 U	0.0095 U	0.0095 U	0.0094 U	0.0095 U	0.0095 U	0.0095 UJ	0.0095 U	0.0095 U	0.0094 U	0.0095 U	0.0095 U	0.1 U	--	0.014
Total PCBs[3]	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.0191 U	0.019 UJ	0.0191 U	0.019 U	0.019 U	0.0189 U	0.019 U	0.1 U	0.044	0.01

Monitoring Well	**MW-11**		**MW-12**		**MW-13**	**MW-16**		**MW-17**	**MW-18**	**Groundwater Screening Levels (Protective of Drinking Water Use)**	**Groundwater Screening Levels (Protective of Surface Water)**
Sample ID	**SH-11**	**MW-11-12012010**	**SH-12**	**MW-12-12012010**	**MW-13-11302010**	**MW-16-12012010**	**DUP-1-12012010 (MW-16 DUP)**	**MW-17-12012010**	**MW-18-12012010**		
Date Sampled	12/30/05	12/01/10	12/30/05	12/01/10	11/30/10	12/01/10	12/01/10	12/01/10	12/01/10		
Units	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
Applicable Screening Levels	A		A		B	B		B	A		
Aroclor-1016	--	0.01 U	--	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	1.1	0.01
Aroclor-1221	0.1 U	0.01 U	0.1 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	--	--
Aroclor-1232	0.1 U	0.01 U	0.1 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	--	--
Aroclor-1242	0.1 U	0.01 U	0.1 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	--	--
Aroclor-1248	0.1 U	0.01 U	0.1 U	0.01 U	0.01 U	0.01 U	0.028 UY	0.014 UY	0.01 U	--	--
Aroclor-1254	0.1 U	0.01 U	0.1 U	0.01 U	0.01 U	0.029	0.039	0.016	0.01 U	0.32	0.01
Aroclor-1260	0.1 U	0.01 U	0.1 U	0.01 U	0.01 U	0.01 U	0.014	0.01 U	0.01 U	--	0.014
Total PCBs[3]	0.1 U	0.01 U	0.1 U	0.01 U	0.01 U	0.029	0.053	0.016	0.01 U	0.044	0.01

Notes:

[1] Chemical analyses conducted by Severn Trent Laboratories, Tacoma, Washington; Analytical Resources, Inc., Tukwila, Washington; and Advanced Analytical Laboratory.

[2] Aroclors 1016, 1221, 1232, 1242, 1248, 1254 and 1260 analyzed by USEPA Method 8082 or 8082 (low level).

[3] Total PCBs were calculated per SAPA guidance (Ecology 2008b); i.e., the sum of Aroclors is represented by the sum of all detected Aroclors, or, when no Aroclors were detected, the sum is represented by the single highest non-detect result.

µg/l = Micrograms per liter

U = The analyte was not detected at the value reported. Value reported represents the practical quantitation limit (PQL).

UJ = The analyte was not detected at the value reported. Value reported represents estimated practical quantitation limit (PQL).

J = Estimated concentration.

UY = Not detected above the associated value; the associated value is elevated due to interference.

🟨 = Value exceeds groundwater screening level protective of drinking water use when rounded to same number of significant figures as the screening level.

🟥 = Value exceeds groundwater screening level protective of surface water when rounded to same number of significant figures as the screening level.

🟩 = PQL exceeds screening level when rounded to same number of significant figures as screening level.

PCBs = Polychlorinated biphenyls

PQL = Practical quantitation limit

-- = Not applicable or not established or not analyzed.

Applicable Screening Levels

A - Not near or upgradient of local surface water body. Results were compared to groundwater screening levels protective of drinking water.

B - Near or upgradient of local surface water body. Results were compared to groundwater screening levels protective of both drinking water and surface water.

TABLE 33
SUMMARY OF GROUNDWATER ANALYTICAL RESULTS[1]
VOLATILE ORGANIC COMPOUNDS - ALL AREAS
GOOSE LAKE SITE
SHELTON, WASHINGTON

Monitoring Well	**MW-5**	**MW-7**	**MW-10**	**MW-11**	**MW-12**	**Groundwater Screening Levels (Protective of Drinking Water Use)**	**Groundwater Screening Levels (Protective of Surface Water)**
Sample ID	SH-5_051230 12/30/05	SH-7_051230 12/30/05	SH-10_051230 12/30/05	SH-11_051230 12/30/05	SH-12_051230 12/30/05		
Date Sampled	12/30/05	12/30/05	12/30/05	12/30/05	12/30/05		
Units	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
Applicable Screening Levels	B	A	B	A	A		
VOCs by SW8260							
1,1,1,2-Tetrachloroethane	1 U	1 U	1 U	1 U	1 U	1.7	--
1,1,1-Trichloroethane	1 U	1 U	1 U	1 U	1 U	200	930000
1,1,2,2-Tetrachloroethane	1 U	1 U	1 U	1 U	1 U	0.22	0.2
1,1,2-Trichloroethane	1 U	1 U	1 U	1 U	1 U	0.77	0.59
1,1-Dichloroethane	1 U	1 U	1 U	1 U	1 U	1600	--
1,1-Dichloroethene	1 U	1 U	1 U	1 U	1 U	7	0.2
1,1-Dichloropropene	1 U	1 U	1 U	1 U	1 U	--	--
1,2,3-Trichlorobenzene	1 U	1 U	1 U	1 U	1 U	--	--
1,2,3-Trichloropropane	1 U	1 U	1 U	1 U	1 U	0.5	--
1,2,4-Trichlorobenzene	1 U	1 U	1 U	1 U	1 U	1.5	2
1,2,4-Trimethylbenzene	1 U	1 U	1 U	1 U	1 U	--	--
1,2-Dibromo-3-Chloropropane	1 U	1 U	1 U	1 U	1 U	--	--
1,2-dibromoethane (EDB)	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.2	--
1,2-Dichlorobenzene (o-Dichlorobenzene)	1 U	1 U	1 U	1 U	1 U	600	420
1,2-Dichloroethane (EDC)	1 U	1 U	1 U	1 U	1 U	0.48	0.38
1,2-Dichloropropane	1 U	1 U	1 U	1 U	1 U	5	0.5
1,3,5-Trimethylbenzene	1 U	1 U	1 U	1 U	1 U	80	--
1,3-Dichlorobenzene (m-Dichlorobenzene)	1 U	1 U	1 U	1 U	1 U	--	320
1,3-Dichloropropane	1 U	1 U	1 U	1 U	1 U	--	--
1,4-Dichlorobenzene (p-Dichlorobenzene)	1 U	1 U	1 U	1 U	1 U	75	63
2,2-Dichloropropane	1 U	1 U	1 U	1 U	1 U	--	--
2-Chlorotoluene	1 U	1 U	1 U	1 U	1 U	160	--
4-Chlorotoluene	1 U	1 U	1 U	1 U	1 U	--	--
Benzene	1 U	1 U	1 U	1 U	1 U	0.8	1.2
Bromobenzene	1 U	1 U	1 U	1 U	1 U	--	--
Bromodichloromethane	1 U	1 U	1 U	1 U	1 U	0.71	0.27
Bromoform (Tribromomethane)	1 U	1 U	1 U	1 U	1 U	5.5	4.3
Bromomethane	1 U	1 U	1 U	1 U	1 U	11	47
Carbon Tetrachloride	1 U	1 U	1 U	1 U	1 U	0.63	0.23
Chlorobenzene	1 U	1 U	1 U	1 U	1 U	100	130
Chloroethane	1 U	1 U	1 U	1 U	1 U	--	--
Chloroform	1 U	1 U	1 U	1 U	1 U	80	5.7
Chloromethane	1 U	1 U	1 U	1 U	1 U	--	--
Cis-1,2-Dichloroethene	1 U	1 U	1 U	1 U	1 U	16	--
Cis-1,3-Dichloropropene	1 U	1 U	1 U	1 U	1 U	--	--
Dibromochloromethane	1 U	1 U	1 U	1 U	1 U	0.52	0.4
Dibromomethane	1 U	1 U	1 U	1 U	1 U	80	48
Dichlorodifluoromethane (CFC-12)	1 U	1 U	1 U	1 U	1 U	1600	--
Ethylbenzene	1 U	1 U	1 U	1 U	1 U	700	530
Hexachlorobutadiene	1 U	1 U	1 U	1 U	1 U	0.56	0.5
Isopropylbenzene (Cumene)	1 U	1 U	1 U	1 U	1 U	800	--
Methylene Chloride	1 U	1 U	1 U	1 U	1 U	5	17
Naphthalene	1 U	1 U	1 U	1 U	1 U	160	4900
n-Butylbenzene	1 U	1 U	1 U	1 U	1 U	--	--
n-Propylbenzene	1 U	1 U	1 U	1 U	1 U	800	--
p-Isopropyltoluene	1 U	1 U	1 U	1 U	1 U	--	--
Sec-Butylbenzene	1 U	1 U	1 U	1 U	1 U	--	--
Styrene	1 U	1 U	1 U	1 U	1 U	100	--
Tert-Butylbenzene	1 U	1 U	1 U	1 U	1 U	--	--
Tetrachloroethene	1 U	1 U	1 U	1 U	1 U	5	16
Toluene	1 U	1 U	1 U	1 U	1 U	640	1300
Total Xylenes	1 U	1 U	1 U	1 U	1 U	1600	--
Trans-1,2-Dichloroethene	1 U	1 U	1 U	1 U	1 U	--	--
Trans-1,3-Dichloropropene	1 U	1 U	1 U	1 U	1 U	--	--
Trichloroethene (TCE)	1 U	1 U	1 U	1 U	1 U	5	4.3
Trichlorofluoromethane (CFC-11)	1 U	1 U	1 U	1 U	1 U	--	--
Vinyl Chloride	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2	0.2

Notes:

[1] Chemical analyses conducted by Advanced Analytical Laboratory.

µg/l = Micrograms per liter

U = The analyte was not detected at the value reported. Value reported represents the practical quantitation limit (PQL).

🟨 = Value exceeds groundwater screening level protective of drinking water use when rounded to same number of significant figures as the screening level.

🟥 = Value exceeds groundwater screening level protective of surface water when rounded to same number of significant figures as the screening level.

🟩 = PQL exceeds screening level when rounded to same number of significant figures as screening level.

PQL = Practical quantitation limit

-- = Not applicable or not established.

VOCs = Volatile organic compounds

Applicable Screening Levels

A - Not near or upgradient of local surface water body. Results were compared to groundwater screening levels protective of drinking water.

B - Near or upgradient of local surface water body. Results were compared to groundwater screening levels protective of both drinking water and surface water.

TABLE 34

SUMMARY OF GROUNDWATER ANALYTICAL RESULTS[1]
SEMIVOLATILE ORGANIC COMPOUNDS - ALL AREAS

GOOSE LAKE SITE
SHELTON, WASHINGTON

Monitoring Well	**MW-5**	**MW-7**	**MW-10**	**MW-11**	**MW-12**	**MW-16**		**MW-17**	**MW-18**	**Groundwater Screening Levels (Protective of Drinking Water Use)**	**Groundwater Screening Levels (Protective of Surface Water)**
Sample ID	**SH-5_051230**	**SH-7_051230**	**SH-10_051230**	**SH-11_051230**	**SH-12_051230**	**MW-16-12012010**	**DUP-1-12012010 (MW-16 DUP)**	**MW-17-12012010**	**MW-18-12012010**		
Date Sampled	12/30/05	12/30/05	12/30/05	12/30/05	12/30/05	12/01/10	12/01/10	12/01/10	12/01/10		
Units	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
Applicable Screening Levels	B	A	B	A	A	B		B	A		
cPAHs by SW8270SIM											
Benzo(a)anthracene	2 U	2 U	2 U	2 U	2 U	0.01 U	0.01 U	0.01 U	0.01 U	*See TEQ*	*See TEQ*
Benzo(a)pyrene	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.01 U	0.01 U	0.01 U	0.01 U	*See TEQ*	*See TEQ*
Benzofluoranthenes (Sum)	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.01 U	0.01 U	0.01 U	0.01 U	*See TEQ*	*See TEQ*
Chrysene	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.01 U	0.01 U	0.01 U	0.01 U	*See TEQ*	*See TEQ*
Dibenzo(a,h)anthracene	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.01 U	0.01 U	0.01 U	0.01 U	*See TEQ*	*See TEQ*
Indeno(1,2,3-cd)pyrene	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.01 U	0.01 U	0.01 U	0.01 U	*See TEQ*	*See TEQ*
Total cPAHs TEQ (ND=0.5PQL)	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.007 U	0.007 U	0.007 U	0.007 U	0.012	0.01
SVOCs by SW8270D											
1,2-Dichlorobenzene (o-Dichlorobenzene)	2 U	2 U	2 U	2 U	2 U	1 U	1 U	1 U	1 U	600	420
1,2-Diphenylhydrazine	--	--	--	--	--	1 U	1 U	1 U	1 U	1	1
1,4-Dichlorobenzene (p-Dichlorobenzene)	2 U	2 U	2 U	2 U	2 U	1 U	1 U	1 U	1 U	75	63
2,2'-Oxybis[1-chloropropane]	2 U	2 U	2 U	2 U	2 U	1 U	1 U	1 U	1 U	320	1400
2,4,5-Trichlorophenol	10 U	10 U	10 U	10 U	10 U	5 U	5 U	5 U	5 U	800	1800
2,4,6-Trichlorophenol	10 U	10 U	10 U	10 U	10 U	5 U	5 U	5 U	5 U	5	5
2,4-Dichlorophenol	10 U	10 U	10 U	10 U	10 U	5 U	5 U	5 U	5 U	24	77
2,4-Dimethylphenol	10 U	10 U	10 U	10 U	10 U	1 U	1 U	1 U	1 U	160	380
2,4-Dinitrophenol	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	32	69
2,4-Dinitrotoluene	--	--	--	--	--	5 U	5 U	5 U	5 U	32	5
2,6-Dinitrotoluene	--	--	--	--	--	5 U	5 U	5 U	5 U	16	--
2-Chloronaphthalene	2 U	2 U	2 U	2 U	2 U	1 U	1 U	1 U	1 U	640	1000
2-Chlorophenol	2 U	2 U	2 U	2 U	2 U	1 U	1 U	1 U	1 U	40	97
2-Methylnaphthalene	--	--	--	--	--	1 U	1 U	1 U	1 U	32	--
3,3'-Dichlorobenzidine	--	--	--	--	--	5 U	5 U	5 U	5 U	5	5
4-Chloroaniline	--	--	--	--	--	5 U	5 U	5 U	5 U	32	--
4-Nitrophenol (p-Nitrophenol)	10 U	10 U	10 U	10 U	10 U	5 U	5 U	5 U	5 U	--	--
Acenaphthene	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	1 U	1 U	1 U	960	640
Acenaphthylene	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	1 U	1 U	1 U	--	--
Aniline	--	--	--	--	--	1 U	1 U	1 U	1 U	7.7	--
Anthracene	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	1 U	1 U	1 U	4800	8300
Azobenzene	--	--	--	--	--	1 U	1 U	1 U	1 U	1	--
Benzidine	--	--	--	--	--	10 U	10 U	10 U	10 U	10	10
Benzo(ghi)perylene	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	1 U	1 U	1 U	--	--
Benzoic Acid	--	--	--	--	--	10 U	10 U	10 U	10 U	64000	--
Benzyl Alcohol	--	--	--	--	--	5 U	5 U	5 U	5 U	2400	--
Bis(2-Chloroethyl)Ether	2 U	2 U	2 U	2 U	2 U	1 U	1 U	1 U	1 U	1	1
Bis(2-Ethylhexyl) Phthalate	--	--	--	--	--	1 U	1 U	1 U	1 U	6	1.2
Butyl benzyl phthalate	10 U	10 U	10 U	10 U	10 U	1 U	1 U	1 U	1 U	3200	1300
Carbazole	--	--	--	--	--	1 U	1 U	1 U	1 U	4.4	--
Dibenzofuran	--	--	--	--	--	1 U	1 U	1 U	1 U	32	--
Dibutyl phthalate	2 U	2 U	2 U	2 U	2 U	1 U	1 U	1 U	1 U	1600	2000
Diethyl phthalate	10 U	10 U	10 U	10 U	10 U	1 U	1 U	1 U	1 U	13000	17000
Dimethyl phthalate	2 U	2 U	2 U	2 U	2 U	1 U	1 U	1 U	1 U	16000	72000
Di-N-Octyl Phthalate	10 U	10 U	10 U	10 U	10 U	1 U	1 U	1 U	1 U	320	--
Fluoranthene	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	1 U	1 U	1 U	640	90
Fluorene	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	1 U	1 U	1 U	640	1100
Hexachlorobenzene	2 U	2 U	2 U	2 U	2 U	1 U	1 U	1 U	1 U	1	1
Hexachlorobutadiene	10 U	10 U	10 U	10 U	10 U	1 U	1 U	1 U	1 U	1	1
Hexachlorocyclopentadiene	2 U	2 U	2 U	2 U	2 U	5 U	5 U	5 U	5 U	48	40
Hexachloroethane	--	--	--	--	--	1 U	1 U	1 U	1 U	3.1	1.4
Isophorone	--	--	--	--	--	1 U	1 U	1 U	1 U	46	8.4
N-Nitrosodi-n-propylamine	--	--	--	--	--	1 U	1 U	1 U	1 U	--	1
N-Nitrosodiphenylamine	2 U	2 U	2 U	2 U	2 U	1 U	1 U	1 U	1 U	--	3.3
Pentachlorophenol	10 U	10 U	10 U	10 U	10 U	5 U	5 U	5 U	5 U	5	5
Phenanthrene	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	1 U	1 U	1 U	--	--
Phenol	2 U	2 U	2 U	2 U	2 U	1 U	1 U	1 U	1 U	4800	21000
Pyrene	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	1 U	1 U	1 U	1 U	480	830
Pyridine	--	--	--	--	--	5 U	5 U	5 U	5 U	8	--
2,3,4,6-Tetrachlorophenol	2 U	2 U	2 U	2 U	2 U	--	--	--	--	480	--
2,6-Dichlorophenol	10 U	10 U	10 U	10 U	10 U	--	--	--	--	--	--
4-Chloro-3-Methylphenol	10 U	10 U	10 U	10 U	10 U	--	--	--	--	--	--
4-Chlorophenyl-Phenylether	2 U	2 U	2 U	2 U	2 U	--	--	--	--	--	--
Bis(2-ethylhexyl)ether	2 U	2 U	2 U	2 U	2 U	--	--	--	--	--	--
m,p-Cresol	2 U	2 U	2 U	2 U	2 U	--	--	--	--	400	--
o-Cresol (2-methylphenol)	2 U	2 U	2 U	2 U	2 U	--	--	--	--	400	--
1,2,4,5-Tetrachlorobenzene	2 U	2 U	2 U	2 U	2 U	--	--	--	--	4.8	1
1,2,4-Trichlorobenzene	2 U	2 U	2 U	2 U	2 U	--	--	--	--	1.5	2
1,3-Dichlorobenzene (m-Dichlorobenzene)	2 U	2 U	2 U	2 U	2 U	--	--	--	--	--	320
2-Nitrophenol	10 U	10 U	10 U	10 U	10 U	--	--	--	--	--	--
2-sec-Butyl-4,6-dinitrophenol	10 U	10 U	10 U	10 U	10 U	--	--	--	--	--	--
4-Bromophenyl phenyl ether	2 U	2 U	2 U	2 U	2 U	--	--	--	--	--	--
Bis(2-Chloroethoxy)Methane	2 U	2 U	2 U	2 U	2 U	--	--	--	--	--	--
Hexachloropropene	10 U	10 U	10 U	10 U	10 U	--	--	--	--	--	--
Naphthalene	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	--	--	--	--	160	4900
Pentachlorobenzene	2 U	2 U	2 U	2 U	2 U	--	--	--	--	13	1.4
Pentachloroethane	2 U	2 U	2 U	2 U	2 U	--	--	--	--	--	--

Notes:

[1] Chemical analyses conducted by Severn Trent Laboratories, Tacoma, Washington and Analytical Resources, Inc., Tukwila, Washington.

µg/l = Micrograms per liter

U = The analyte was not detected at the value reported. Value reported represents the practical quantitation limit (PQL).

🟨 = Value exceeds groundwater screening level protective of drinking water use when rounded to same number of significant figures as the screening level.

🟥 = Value exceeds groundwater screening level protective of surface water when rounded to same number of significant figures as the screening level.

🟩 = PQL exceeds screening level when rounded to same number of significant figures as screening level.

PQL = Practical quantitation limit

-- = Not applicable or not established.

TEQ = Toxicity equivalency quotient

cPAHs = Carcinogenic polycyclic aromatic hydrocarbons

SVOCs = Semivolatile organic compounds

Applicable Screening Levels

A - Not near or upgradient of local surface water body. Results were compared to groundwater screening levels protective of drinking water.

B - Near or upgradient of local surface water body. Results were compared to groundwater screening levels protective of both drinking water and surface water.

TABLE 35
SUMMARY OF GROUNDWATER ANALYTICAL RESULTS[1]
TOTAL PETROLEUM HYDROCARBONS - ALL AREAS
GOOSE LAKE SITE
SHELTON, WASHINGTON

Monitoring Well	**MW-5**	**MW-7**	**MW-10**	**MW-11**	**MW-12**	**Groundwater Screening Levels (Protective of Drinking Water Use)**	**Groundwater Screening Levels (Protective of Surface Water)**
Sample ID	**SH-5**	**SH-7**	**SH-10**	**SH-11**	**SH-12**		
Date Sampled	12/30/05	12/30/05	12/30/05	12/30/05	12/30/05		
Units	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Applicable Screening Levels	B	A	B	A	A		
TPH							
Kerosene/Jet fuel	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	--	--
Diesel/Fuel oil	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.5	--
Heavy oil	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.5	--

Notes:

[1] Chemical analyses conducted by Advanced Analytical Laboratory.

mg/l = Milligrams per liter

TPH = Total petroleum hydrocarbons

U = The analyte was not detected at the value reported. Value reported represents the practical quantitation limit (PQL).

🟨 = Value exceeds groundwater screening level protective of drinking water use when rounded to same number of significant figures as the screening level.

🟥 = Value exceeds groundwater screening level protective of surface water when rounded to same number of significant figures as the screening level.

PQL = Practical quantitation limit

-- = Not applicable or not established.

Applicable Screening Levels

A - Not near or upgradient of local surface water body. Results were compared to groundwater screening levels protective of drinking water.

B - Near or upgradient of local surface water body. Results were compared to groundwater screening levels protective of both drinking water and surface water.

TABLE 36
SUMMARY OF GROUNDWATER ANALYTICAL RESULTS[1]
TOTAL SULFIDE[2] - ALL AREAS
GOOSE LAKE SITE
SHELTON, WASHINGTON

Monitoring Well	MW-01					MW-02					MW-03				MW-04			MW-05			Groundwater Screening Levels (Protective of Drinking Water Use)	Groundwater Screening Levels (Protective of Surface Water)
Sample ID	MW-01-02Q3	MW-01-02Q4	MW-01-03Q1	MW-01-03Q2	MW-01-03Q2 DUP	MW-02-02Q3	MW-02-02Q3 DUP	MW-02-02Q4	MW-02-03Q1	MW-02-03Q2	MW-03-02Q3	MW-03-02Q4	MW-03-03Q1	MW-03-03Q2	MW-04-02Q3	MW-04-03Q1	MW-04-03Q2	MW-05-02Q3	MW-05-03Q1	MW-05-03Q2		
Date Sampled	08/13/02	11/12/02	02/12/03	05/15/03	05/15/03	08/13/02	08/13/02	11/12/02	02/12/03	05/15/03	08/13/02	11/12/02	02/12/03	05/15/03	08/13/02	02/12/03	05/15/03	08/13/02	02/12/03	05/15/03		
Units	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Applicable Screening Levels	A					A					B				A			B				
Total Sulfide	0.8 U	0.8 U	0.8 U	0.005 U	0.005 U	0.8 U	0.8 U	0.8 U	0.8 U	0.005 U	0.8 U	0.8 U	0.8 U	0.005 U	0.8 U	0.8 U	0.005 U	0.8 U	0.8 U	0.005 U	--	--

Monitoring Well	MW-06			MW-07					MW-08					MW-09				MW-10				Groundwater Screening Levels (Protective of Drinking Water Use)	Groundwater Screening Levels (Protective of Surface Water)
Sample ID	MW-06-02Q3	MW-06-03Q1	MW-06-03Q2	MW-07-02Q3	MW-07-02Q4	MW-07-03Q1	MW-07-03Q1 DUP	MW-07-03Q2	MW-08-02Q3	MW-08-02Q4	MW-08-02Q4 DUP	MW-08-03Q1	MW-08-03Q2	MW-09-02Q3	MW-09-02Q4	MW-09-03Q1	MW-09-03Q2	MW-10-02Q3	MW-10-02Q4	MW-10-03Q1	MW-10-03Q2		
Date Sampled	08/13/02	02/12/03	05/15/03	08/12/02	11/13/02	02/12/03	02/12/03	05/15/03	08/12/02	11/12/02	11/12/02	02/12/03	05/15/03	08/13/02	11/12/02	02/12/03	05/15/03	08/12/02	11/12/02	02/12/03	05/15/03		
Units	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Applicable Screening Levels	B			A					B					B				B					
Total Sulfide	0.005 U	0.8 U	0.005 U	0.005 U	0.8 U	0.8 U	0.8 U	0.005 U	0.005 U	0.8 U	0.8 U	0.8 U	0.005 U	0.8 U	0.8 U	0.8 U	0.005 U	0.005 U	0.8 U	0.8 U	0.005 U	--	--

Monitoring Well	MW-16		MW-17	MW-18	Groundwater Screening Levels (Protective of Drinking Water Use)	Groundwater Screening Levels (Protective of Surface Water)
Sample ID	MW-16-12012010	DUP-1-12012010 (MW-16 DUP)	MW-17-12012010	MW-18-12012010		
Date Sampled	12/01/10	12/01/10	12/01/10	12/01/10		
Units	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Applicable Screening Levels	B		B	A		
Total Sulfide	4.28	5.69	12.1	0.05 U	--	--

Notes:

[1] Chemical analyses conducted by Severn Trent Laboratories, Tacoma, Washington or Analytical Resources, Inc., Tukwila, Washington.

[2] Total sulfide analyzed by USEPA Method E376.2 or USEPA Method 9030M.

mg/l = Milligrams per liter

U = The analyte was not detected at the value reported. Value reported represents the practical quantitation limit (PQL).

🟨 = Value exceeds groundwater screening level protective of drinking water use when rounded to same number of significant figures as the screening level.

🟥 = Value exceeds groundwater screening level protective of surface water when rounded to same number of significant figures as the screening level.

PQL = Practical quantitation limit

-- = Not applicable or not established.

Applicable Screening Levels

A - Not near or upgradient of local surface water body. Results were compared to groundwater screening levels protective of drinking water.

B - Near or upgradient of local surface water body. Results were compared to groundwater screening levels protective of both drinking water and surface water.

TABLE 37
GOOSE LAKE BATHYMETRY DATA
MAY 24, 2001 RECONNAISSANCE
GOOSE LAKE SITE
SHELTON, WASHINGTON

Station ID #	Station Location	Recorded Depth (ft)	Station Coordinates	
			Latitude	Longitude
	N-W Transect 1			
1	off right side, ~ 50’ off launch	3.50	NA	NA
2	west side, ~30' south of shrub	3.00	NA	NA
3	south side, ~30' north of dead-head	4.00	NA	NA
	N-W Transect 2			
4	south side, 2nd transect	5.50	47.23013	123.1348
5	new middle, 2nd transect	8.00	47.23030	123.1349
6	north of middle, along submerged AV (SAV)	NA	47.23050	123.1348
7	15' off shore, north shore, off test pit '4'	2.00	47.23070	123.1348
	N-W Transect 3			
32	~30’ off north shore	3.75	47.23207	123.1360
33	~300’ off north shore, edge of landfill area	6.00	47.23148	123.1356
34	~80’ west of SAV (see station 6)	6.25	47.23043	123.1351
35	~80’ of 1st large dead head, black ooze	9.00	47.23005	123.1351
36	Large dead head along south shore	3.00	47.22985	123.1351
	N-W Transect 4			
27	2nd large deadhead (see point 10) south shore, ~20’ off shore	2.75	47.22968	123.1357
28	~half way from island, saw a mud puppy	8.25	47.23013	123.1357
29	Organic sheen on water ~ 200’ NE of island	10.25	47.23107	123.1361
30	~200’ off shore	7.00	47.23170	123.1364
31	~30’ off shore	7.00	47.23200	123.1366
	N-W Transect 5			
22	North shore, ~15’ off dead head cluster	3.00	47.23088	123.1378
23	~300’ off north shore, black ooze, north end of landfill area	9.00	47.23050	123.1377
24	~300’ off south shore ~ 50’ from start of dead heads in cove	8.50	47.22992	123.1373
25	In cluster of dead heads – some black sheen	5.50	47.22955	123.1371
26	Off bow, stern facing shore line	1.50	47.22937	123.1369

Station ID #	Station Location	Recorded Depth (ft)	Station Coordinates	
			Latitude	Longitude
N-W Transect 6				
17	In line with south western access road - start of 6th N-W transect at lake's western edge - in line from the large dead head with white top on north bank	1.00	47.22945	123.1384
18	~ 160’ off shore, black ooze - north edge of dead heads	8.00	47.22962	123.1385
19	~100’ off shore, in line with SE angled LWD. Some black organics and sheen	7.25	47.23027	123.1388
20	~50’ off shore, no black sheen or ooze, large dead head	8.00	47.23050	123.1389
21	At white topped dead head ~ 15’ off shore	5.00	47.23072	123.1389
E-W Transect 1				
8	In line with cottonwood, ~40' off shore (E-W transect)	3.50	47.23085	123.1352
9	~ 80-100' from island, in line with first dead head (3rd N-W transect)	7.50	47.23075	123.1358
10	~30' off water island, in line with 4th N-W transect (2nd large deadhead-south shore)	8.00	47.23065	123.1361
11	~30' west of island, in line with 5th N-W transect (dead head cluster) saw large fish movement – likely a bass	6.00	47.23053	123.1366
12	~200' west of island, in line with middle of black sediment - sheen on water	8.00	47.23042	123.1371
13	~ mid-way between island and west shore, perhaps just a bit further west, in line with west edge of LWD on south shore	8.25	47.23030	123.1377
14	~250' from west shore, in line with point and deadhead Sediment still very black and oozy	7.00	47.23000	123.1382
15	~100' from west shore, in line with last access road on south shore (S2-1 from PEG map)	7.50	47.22997	123.1387
16	~5' off of west shore (SAV)	1.75	47.22972	123.1392

NA = Not available

TABLE 38
SUMMARY OF SURFACE WATER ANALYTICAL RESULTS[1]
METALS[2] - GOOSE LAKE
GOOSE LAKE SITE
SHELTON, WASHINGTON

Sample Identification	SW-1-bottom	SW-1-top	SW-2-bottom	SW-2-top	SW-3-bottom	SW-3-top	SW-DUP[3]	Surface Water Screening Level
Sample Date	06/04/02	06/04/02	06/04/02	06/04/02	06/04/02	06/04/02	06/04/02	
Units	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Arsenic (dissolved)	0.000236	0.000189	0.000173	0.000219	0.000181	0.00022	0.000205	0.000098
Cadmium (total)	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.00025
Total Chromium (total)	0.0102 U	0.00766 U	0.011 U	0.0113 U	0.0108 U	0.0106 U	0.00934 U	0.057*
Hexavalent chromium (total)	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01
Copper (dissolved)	0.00243	0.00213	0.00179	0.00227	0.00187	0.00204	0.00272	0.0035
Lead (total)	0.0008	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.00054
Mercury (total)	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.000012
Mercury (dissolved)	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.000012

Notes:

[1] Chemical analyses conducted by Severn Trent Laboratories, Tacoma, Washington.

[2] Metals analyzed by USEPA 6000/7000 Series methods.

[3] Field duplicate of SW-3-top.

* Value listed is for Chromium(III).

mg/l = Milligrams per liter

U = The analyte was not detected at the value reported. Value reported represents the practical quantitation limit (PQL).

🟨 = Value exceeds screening level when rounded to same number of significant figures as screening level.

🟩 = PQL exceeds screening level when rounded to same number of significant figures as screening level.

TABLE 39
SUMMARY OF SURFACE WATER ANALYTICAL RESULTS[1]
POLYCHLORINATED BIPHENYLS[2] - GOOSE LAKE
GOOSE LAKE SITE
SHELTON, WASHINGTON

Sample Identification	**SW-1-bottom**	**SW-1-top**	**SW-2-bottom**	**SW-2-top**	**SW-3-bottom**	**SW-3-top**	**SW-DUP[3]**	**Surface Water Screening Level**
Date Sampled	06/04/02	06/04/02	06/04/02	06/04/02	06/04/02	06/04/02	06/04/02	
Units	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
Aroclor-1016	0.0106 U	0.0106 U	0.0107 U	0.0106 U	0.0106 U	0.0107 U	0.0107 U	0.01
Aroclor-1221	0.0212 U	0.0211 U	0.0214 U	0.0212 U	0.0212 U	0.0215 U	0.0214 U	--
Aroclor-1232	0.0106 U	0.0106 U	0.0107 U	0.0106 U	0.0106 U	0.0107 U	0.0107 U	--
Aroclor-1242	0.0106 U	0.0106 U	0.0107 U	0.0106 U	0.0106 U	0.0107 U	0.0107 U	--
Aroclor-1248	0.0106 U	0.0106 U	0.0107 U	0.0106 U	0.0106 U	0.0107 U	0.0107 U	--
Aroclor-1254	0.0106 U	0.0106 U	0.0107 U	0.0106 U	0.0106 U	0.0107 U	0.0107 U	0.01
Aroclor-1260	0.0106 U	0.0106 U	0.0107 U	0.0106 U	0.0106 U	0.0107 U	0.0107 U	0.014
Total PCBs[4]	0.0212 U	0.0211 U	0.0214 U	0.0212 U	0.0212 U	0.0215 U	0.0214 U	0.01

Notes:

[1] Chemical analyses conducted by Severn Trent Laboratories, Tacoma, Washington.

[2] Aroclors 1016, 1221, 1232, 1242, 1248, 1254 and 1260 analyzed by USEPA Method 8082.

[3] Field duplicate of SW-3-top.

[4] Total PCBs were calculated per SAPA guidance (Ecology 2008b); i.e., the sum of Aroclors is represented by the sum of all detected Aroclors, or, when no Aroclors were detected, the sum is represented by the single highest non-detect result.

µg/l = Micrograms per liter

U = The analyte was not detected at the value reported. Value reported represents the practical quantitation limit (PQL).

-- = No screening level available.

🟩 = PQL exceeds screening level when rounded to same number of significant figures as screening level.

TABLE 40

SUMMARY OF SURFACE WATER ANALYTICAL RESULTS[1]

CONVENTIONAL CHEMISTRY - GOOSE LAKE

GOOSE LAKE SITE

SHELTON, WASHINGTON

Compounds	Units	Sample Identification	SW-1-bottom	SW-1-top	SW-2-bottom	SW-2-top	SW-3-bottom	SW-3-top	SW-DUP[2]	Surface Water Screening Level
		Date Sampled	06/04/02	06/04/02	06/04/02	06/04/02	06/04/02	06/04/02	06/04/02	
Total Sulfide[3]	mg/l		0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	--
pH[4]	pH units		NA	NA	6.33	NA	NA	7.04	NA	--
Turbidity[5]	NTU		NA	NA	14	NA	NA	15	NA	--
Hardness[6]	mg/l		52	46	65	48	47	46	50	--
Alkalinity[7]	mg/l		25	23	31	17	20	18	23	--
Conductivity[8]	µmhos/cm		NA	NA	100	NA	NA	93	NA	--

Notes:

[1] Chemical analyses conducted by Severn Trent Laboratories, Tacoma, Washington.

[2] Field duplicate of SW-3-top.

[3] Total sulfide analyzed by USEPA Method E376.2.

[4] pH analyzed by USEPA Method E150.1.

[5] Turbidity analyzed by USEPA Method E180.1.

[6] Hardness analyzed by USEPA Method SM2340C.

[7] Alkalinity analyzed by USEPA Method 2320B.

[8] Conductivity analyzed by USEPA Method SM 2510B.

mg/l = Milligrams per liter

U = The analyte was not detected at the reported value. Reported value represents the practical quantitation limit (PQL).

NA = The parameter was not analyzed.

NTU = Nephelometric turbidity units

µmhos/cm = Micromhos per centimeter

-- = No screening level available.

TABLE 41

SUMMARY OF FIELD PARAMETER DATA - GOOSE LAKE SURFACE WATER
(JUNE 4, 2002 SAMPLING EVENT)

GOOSE LAKE SITE
SHELTON, WASHINGTON

Weather: Cloudy, drizzling off & on **Sampling Crew:** Jeff Fisher and Marlene Heller

Sampling Area	Parameter	Depth	Value	Notes
Station SW-1 (distal) Total Depth = 11.8 ft	pH	water surface	6.64	air temp = 18.4 (begin sampling)
		depth (9.7 ft)	6.86	air temp = 16.0 (end sampling)
	temperature (deg C)	water surface	17.6	
		depth (9.7 ft)	17.8	N 47° 13' 40.7"
	conductivity	water surface	0.100	W 123° 13' 11.8"
		depth (9.7 ft)	0.098	
	dissolved oxygen (mg/L)	water surface	8.43	
		depth (9.7 ft)	8.40	
Station SW-2 (proximal) Total Depth = 11.7 ft	pH	water surface		
		depth (9.5 ft)	5.78	
	temperature (deg C)	water surface		
		depth (9.5 ft)	14.9	N 47° 23' 4.6"
	conductivity	water surface		W 123° 13' 4.5"
		depth (9.5 ft)	0.104	
	dissolved oxygen (mg/L)	water surface	-	
		depth (9.5 ft)	1.52	
Station SW-3 (proximal) Total Depth = 6.6 ft	pH	water surface	6.75	
		depth (4.5 ft)	6.73	air temp = 14.8 (end sampling)
	temperature (deg C)	water surface	17.9	
		depth (4.5 ft)	17.9	N 47° 13' 5.5"
	conductivity	water surface	0.098	W 123° 8' 0.3"
		depth (4.5 ft)	0.098	
	dissolved oxygen (mg/L)	water surface	8.49	
		depth (4.5 ft)	8.70	
Duplicate (SW-3) Total Depth = 6.6 ft	pH	water surface	6.75	
	temperature (deg C)	water surface	17.9	
	conductivity	water surface	0.098	
	dissolved oxygen (mg/L)	water surface	8.49	

Notes:

mg/L = Milligrams per liter

TABLE 42
SUMMARY OF FIELD PARAMETER DATA - GOOSE LAKE SURFACE WATER
(JUNE 11, 2002 SAMPLING EVENT)
GOOSE LAKE SITE
SHELTON, WASHINGTON

Weather: sunny, warm/ calm water
air temperature = 19.5-30.4 deg C

Sampling Crew: Jeff Vanderwerth and Marlene Heller

Sampling Area	Parameter	Depth	Value	Notes
Station SW-1 (distal) Total Depth = 11.0 ft	pH	water surface	6.59	1350 = start WQ sampling at SW-1
		depth (10.0 ft)	5.86	
	temperature (deg C)	water surface	19.6	
		depth (10.0 ft)	14.8	
	conductivity	water surface	0.101	
		depth (10.0 ft)	0.109	
	dissolved oxygen (mg/L)	water surface	8.00	
		depth (10.0 ft)	0.23	
Station SW-2 (proximal) Total depth = 11.0 ft	pH	water surface	6.70	1500 = start WQ sampling at SW-2
		depth (10.0 ft)	6.03	
	temperature (deg C)	water surface	20.6	
		depth (10.0 ft)	15.2	
	conductivity	water surface	0.101	
		depth (10.0 ft)	0.114	
	dissolved oxygen (mg/L)	water surface	8.50	
		depth (10.0 ft)	1.35	
Station SW-3 (proximal) Total depth = 6.4 ft	pH	water surface	6.72	1526 = start WQ sampling at SW-3
		depth (5.4 ft)	6.64	
	temperature (deg C)	water surface	19.5	
		depth (5.4 ft)	17.6	
	conductivity	water surface	0.101	
		depth (5.4 ft)	0.102	
	dissolved oxygen (mg/L)	water surface	8.45	
		depth (5.4 ft)	8.70	
Long Line 1 (near SW-1) Total Depth at WQ Station = 7.1 ft	pH	water surface	7.10	1125 = moved long line into cove
		depth (6 ft)	6.85	1150 = finish baiting with trout attractor/setting line
	temperature (deg C)	water surface	19.2	1205 = start WQ measurements for long line 1
		depth (6 ft)	17.5	1216 = end WQ measurements for long line 1
	conductivity	water surface	0.101	WP 049 = west end of long line 1
		depth (6 ft)	0.101	N 47 13' 46.5"
	dissolved oxygen (mg/L)	water surface	8.47	W 123 08' 10.4"
		depth (6 ft)	7.56	WP 050 = east end of long line 1 N 47 13' 46.5" W 123 08' 09.6" WP 051 = WQ station for long line 1 N 47 13' 46.3" W 123 08' 09.9"
Long Line 2 (near SW-2) Total Depth at WQ Station = 11.1 ft	pH	water surface	6.95	1432 = long line 2 is set and baited
		depth (10.1 ft)	6.42	1450 = start WQ measurments for long line 2
	temperature (deg C)	water surface	21.5	WP 057 = end of long line 2
		depth (10.1 ft)	15.4	N 47 13' 55.3"
	conductivity	water surface	0.101	W 123 08' 07.2"
		depth (10.1 ft)	0.119	WP 058 = mid-point of long line 2 WQ station
	dissolved oxygen (mg/L)	water surface	7.98	N 47 13' 55.1"
		depth (10.1 ft)	-1.60	W 123 08' 07.2"

TABLE 42
SUMMARY OF FIELD PARAMETER DATA - GOOSE LAKE SURFACE WATER
(JUNE 11, 2002 SAMPLING EVENT)
GOOSE LAKE SITE
SHELTON, WASHINGTON

Weather: sunny, warm/ calm water
air temperature = 19.5-30.4 deg C

Sampling Crew: Jeff Vanderwerth and Marlene Heller

Sampling Area	Parameter	Depth	Value	Notes
Gill Net 1 (near SW-1) Total Depth at WQ Station = 11.6 ft	pH	1.2 ft	6.63	1223 = started checking gill net 1
		2.2 ft	6.59	1300 = finished checking gill net 1
		3.2 ft	6.54	1302 = start WQ sampling for gill net 1
		4.2 ft	6.50	
		5.2 ft	6.51	
		6.2 ft	6.57	
		7.2 ft	6.69	
		8.2 ft	6.29	
		9.2 ft	6.23	
		10.2 ft	5.94	
	temperature (deg C)	1.2 ft	19.9	WP 052 = west end of gill net 1
		2.2 ft	18.8	N 47 13' 48.0"
		3.2 ft	18.0	W 123 08' 11.5"
		4.2 ft	17.7	WP 053 = east end of gill net 1
		5.2 ft	17.5	N 47 13' 48.8"
		6.2 ft	17.4	W 123 08' 08.7"
		7.2 ft	17.4	WP 054 = mid-point of gill net at WQ station
		8.2 ft	16.7	N 47 13' 48.1"
		9.2 ft	15.8	W 123 08' 09.7"
		10.2 ft	14.4	
	conductivity	1.2 ft	0.101	
		2.2 ft	0.101	
		3.2 ft	0.101	
		4.2 ft	0.101	
		5.2 ft	0.101	
		6.2 ft	0.101	
		7.2 ft	0.101	
		8.2 ft	0.103	
		9.2 ft	0.105	
		10.2 ft	0.113	
	dissolved oxygen (mg/L)	1.2 ft	7.85	
		2.2 ft	8.17	
		3.2 ft	7.85	
		4.2 ft	7.93	
		5.2 ft	7.96	
		6.2 ft	7.83	
		7.2 ft	6.61	
		8.2 ft	5.67	
		9.2 ft	1.90	
		10.2 ft	-0.90	

TABLE 42
SUMMARY OF FIELD PARAMETER DATA - GOOSE LAKE SURFACE WATER
(JUNE 11, 2002 SAMPLING EVENT)
GOOSE LAKE SITE
SHELTON, WASHINGTON

Weather: sunny, warm/ calm water
air temperature = 19.5-30.4 deg C

Sampling Crew: Jeff Vanderwerth and Marlene Heller

Sampling Area	Parameter	Depth	Value	Notes
Gill Net 2 (near SW-2) Total Depth = 11.6 ft	pH	1.6 ft	6.77	1400 = start checking gill net 2 1415 = fish caught live in gill net 2 (first 1/4 of net) 1422 = end checking gill net 2 1505 = start WQ sampling for gill net 2 1522 = end WQ sampling for gill net 2
		2.6 ft	6.67	
		3.6 ft	6.70	
		4.6 ft	6.66	
		5.6 ft	6.60	
		6.6 ft	6.40	
		7.6 ft	6.31	
		8.6 ft	6.16	
		9.6 ft	6.05	
		10.6 ft	6.17	
	temperature (deg C)	1.6 ft	20.3	WP 055 = west end of gill net 2 N 47 13' 52.2" W 123 08' 06.5" WP 056 = east end of gill net 2 N 47 13' 52.8" W 123 08' 03.8" WP 059 = mid-point of gill net 2 WQ station N 47 13' 52.8" W 123 08' 05.6"
		2.6 ft	18.3	
		3.6 ft	17.8	
		4.6 ft	17.5	
		5.6 ft	17.4	
		6.6 ft	17.2	
		7.6 ft	17.0	
		8.6 ft	16.5	
		9.6 ft	15.8	
		10.6 ft	14.7	
	conductivity	1.6 ft	0.101	
		2.6 ft	0.101	
		3.6 ft	0.101	
		4.6 ft	0.101	
		5.6 ft	0.101	
		6.6 ft	0.101	
		7.6 ft	0.101	
		8.6 ft	0.101	
		9.6 ft	0.104	
		10.6 ft	0.122	
	dissolved oxygen (mg/L)	1.6 ft	7.16	
		2.6 ft	7.44	
		3.6 ft	7.95	
		4.6 ft	8.21	
		5.6 ft	7.75	
		6.6 ft	7.91	
		7.6 ft	7.14	
		8.6 ft	6.30	
		9.6 ft	4.70	
		10.6 ft	0.90	

Notes:
mg/L = Milligrams per liter

TABLE 43
SUMMARY OF SOIL/SEDIMENT ANALYTICAL RESULTS[1]
METALS[2] - GOOSE LAKE AND DRAINAGE RAVINE
GOOSE LAKE SITE
SHELTON, WASHINGTON

Metal	**Area**	**Sample Station**	**Sample Depth (feet)**	**Applicable Screening Levels**	**Concentration (mg/kg dry-weight)**	**Sediment Screening Level (mg/kg)**	**Soil Screening Level (Near or Upgradient of Local Surface Water Body) (Saturated/Unsaturated) [3] (mg/kg)**
Antimony	Goose Lake	SED-01	0-0.15	F	0.26	0.6	--
		SED-01	1.7-4.1	F	0.18	0.6	--
		SED-01 (DUP)	1.7-4.1	F	0.36	0.6	--
		SED-03	6.2-9.7	F	0.33	0.6	--
		SED-04	0-0.15	F	0.63	0.6	--
		SED-04	1.8-5.6	F	0.32	0.6	--
		SED-05	5.1-5.6	F	0.12 J	0.6	--
	Drainage Ravine	SED-09	0-0.4	C / E	0.37	0.6	5
Arsenic (arsenite)	Goose Lake	SED-01	0-0.15	F	7.3	31.4	--
		SED-01	1.7-4.1	F	3.0	31.4	--
		SED-01 (DUP)	1.7-4.1	F	2.9	31.4	--
		SED-02	0.9-1.5	F	3.1	31.4	--
		SED-03	0-0.15	F	11.5	31.4	--
		SED-03	1.9-5.8	F	2.4	31.4	--
		SED-03	6.2-9.7	F	5.7	31.4	--
		SED-04	0-0.15	F	13.3	31.4	--
		SED-04	1.8-5.6	F	3.0	31.4	--
		SED-05	0-0.15	F	10.6	31.4	--
		SED-05	2.3-5.1	F	1.6	31.4	--
		SED-05	5.1-5.6	F	1.3	31.4	--
		SED-06	0-0.15	F	11.2	31.4	--
		SED-06	1.3-5	F	2.1	31.4	--
		SED-07	0-0.15	F	17.7	31.4	--
		SED-07	2-5.3	F	2.5	31.4	--
		SED-08	0-0.15	F	8.8	31.4	--
		SED-08	1.8-4.8	F	2.10 U	31.4	--
	Drainage Ravine	SED-09	0-0.4	C / E	1.9	31.4	20
Cadmium	Goose Lake	SED-01	0-0.15	F	0.67	2.39	--
		SED-01	1.7-4.1	F	0.16 U	2.39	--
		SED-01 (DUP)	1.7-4.1	F	0.16 U	2.39	--
		SED-03	6.2-9.7	F	0.18 U	2.39	--
		SED-04	0-0.15	F	1.27	2.39	--
		SED-04	1.8-5.6	F	0.11 U	2.39	--
		SED-05	5.1-5.6	F	0.13	2.39	--
	Drainage Ravine	SED-09	0-0.4	C / E	0.21	2.39	14
Total Chromium	Goose Lake	SED-01	0-0.15	F	50	95	--
		SED-01	1.7-4.1	F	14	95	--
		SED-01 (DUP)	1.7-4.1	F	14	95	--
		SED-02	0.9-1.5	F	12	95	--
		SED-03	0-0.15	F	29	95	--
		SED-03	1.9-5.8	F	30	95	--
		SED-03	6.2-9.7	F	28	95	--
		SED-04	0-0.15	F	36	95	--
		SED-04	1.8-5.6	F	34	95	--
		SED-05	0-0.15	F	56	95	--
		SED-05	2.3-5.1	F	41	95	--
		SED-05	5.1-5.6	F	52	95	--
		SED-06	0-0.15	F	33	95	--
		SED-06	1.3-5	F	39	95	--
		SED-07	0-0.15	F	49	95	--
		SED-07	2-5.3	F	41	95	--
		SED-08	0-0.15	F	50	95	--
		SED-08	1.8-4.8	F	13	95	--

TABLE 43
SUMMARY OF SOIL/SEDIMENT ANALYTICAL RESULTS[1]
METALS[2] - GOOSE LAKE AND DRAINAGE RAVINE
GOOSE LAKE SITE
SHELTON, WASHINGTON

Metal	Area	Sample Station	Sample Depth (feet)	Applicable Screening Levels	Concentration (mg/kg dry-weight)	Sediment Screening Level (mg/kg)	Soil Screening Level (Near or Upgradient of Local Surface Water Body) (Saturated/Unsaturated) [3] (mg/kg)
Total Chromium (cont.)	Drainage Ravine	SED-09	0-0.4	C / E	28.7	95	48
		SED-10	0.5-2	C / E	80	95	48
		SED-10	4-4.5	D / E	61	95	48
		SED-11	0.75-1.25	C / E	49	95	48
		SED-12	0-0.5	C / E	62	95	48
Hexavalent Chromium	Goose Lake	SED-01	0-0.15	F	32 UJ	--	--
		SED-01	1.7-4.1	F	64 UJ	--	--
		SED-01 (DUP)	1.7-4.1	F	64 UJ	--	--
		SED-02	0.9-1.5	F	70 UJ	--	--
		SED-03	0-0.15	F	6.4 U	--	--
		SED-03	1.9-5.8	F	64 UJ	--	--
		SED-03	6.2-9.7	F	35 UJ	--	--
		SED-04	0-0.15	F	13 UJ	--	--
		SED-04	1.8-5.6	F	64 UJ	--	--
		SED-05	0-0.15	F	14 UJ	--	--
		SED-05	2.3-5.1	F	160 UJ	--	--
		SED-05	5.1-5.6	F	32 UJ	--	--
		SED-06	0-0.15	F	13 UJ	--	--
		SED-06	1.3-5	F	70 UJ	--	--
		SED-07	0-0.15	F	13 UJ	--	--
		SED-07	2-5.3	F	70 UJ	--	--
		SED-08	0-0.15	F	14 UJ	--	--
		SED-08	1.8-4.8	F	64 UJ	--	--
	Drainage Ravine	SED-09	0-0.4	C / E	24 J	--	240
Copper	Goose Lake	SED-01	0-0.15	F	227	619	--
		SED-01	1.7-4.1	F	6.40 U	619	--
		SED-01 (DUP)	1.7-4.1	F	6.50 U	619	--
		SED-03	6.2-9.7	F	7.10 U	619	--
		SED-04	0-0.15	F	321	619	--
		SED-04	1.8-5.6	F	7	619	--
		SED-05	5.1-5.6	F	19	619	--
	Drainage Ravine	SED-09	0-0.4	C / E	258	619	36
		SED-10	0.5-2	C / E	35	619	36
		SED-10	4-4.5	D / E	38	619	36
		SED-11	0.75-1.25	C / E	42	619	36
		SED-12	0-0.5	C / E	54	619	36
Lead	Goose Lake	SED-01	0-0.15	F	61	335	--
		SED-01	1.7-4.1	F	0.44	335	--
		SED-01 (DUP)	1.7-4.1	F	0.40	335	--
		SED-02	0.9-1.5	F	3.6	335	--
		SED-03	0-0.15	F	92	335	--
		SED-03	1.9-5.8	F	1.2	335	--
		SED-03	6.2-9.7	F	0.45	335	--
		SED-04	0-0.15	F	108	335	--
		SED-04	1.8-5.6	F	1.27	335	--
		SED-05	0-0.15	F	122	335	--
		SED-05	2.3-5.1	F	2.8	335	--
		SED-05	5.1-5.6	F	3.4	335	--
		SED-06	0-0.15	F	99	335	--
		SED-06	1.3-5	F	2	335	--
		SED-07	0-0.15	F	81	335	--
		SED-07	2-5.3	F	0.92	335	--
		SED-08	0-0.15	F	61	335	--
		SED-08	1.8-4.8	F	0.48	335	--

TABLE 43
SUMMARY OF SOIL/SEDIMENT ANALYTICAL RESULTS[1]
METALS[2] - GOOSE LAKE AND DRAINAGE RAVINE
GOOSE LAKE SITE
SHELTON, WASHINGTON

Metal	Area	Sample Station	Sample Depth (feet)	Applicable Screening Levels	Concentration (mg/kg dry-weight)	Sediment Screening Level (mg/kg)	Soil Screening Level (Near or Upgradient of Local Surface Water Body) (Saturated/Unsaturated) [3] (mg/kg)
Lead (cont.)	Drainage Ravine	SED-09	0-0.4	C / E	26.8	335	24/110
		SED-10	0.5-2	C / E	4	335	24/110
		SED-10	4-4.5	D / E	3	335	24/110
		SED-11	0.75-1.25	C / E	11	335	24/110
		SED-12	0-0.5	C / E	10	335	24/110
Mercury	Goose Lake	SED-01	0-0.15	F	0.29	0.8	--
		SED-01	1.7-4.1	F	0.02 U	0.8	--
		SED-01 (DUP)	1.7-4.1	F	0.02 U	0.8	--
		SED-02	0.9-1.5	F	0.04 UJ	0.8	--
		SED-03	0-0.15	F	0.33	0.8	--
		SED-03	1.9-5.8	F	0.02	0.8	--
		SED-03	6.2-9.7	F	0.02 U	0.8	--
		SED-04	0-0.15	F	0.45	0.8	--
		SED-04	1.8-5.6	F	0.02	0.8	--
		SED-05	0-0.15	F	0.94 J	0.8	--
		SED-05	2.3-5.1	F	0.02	0.8	--
		SED-05	5.1-5.6	F	0.02 U	0.8	--
		SED-06	0-0.15	F	0.46	0.8	--
		SED-06	1.3-5	F	0.04 UJ	0.8	--
		SED-07	0-0.15	F	0.56	0.8	--
		SED-07	2-5.3	F	0.03 UJ	0.8	--
		SED-08	0-0.15	F	0.32 J	0.8	--
		SED-08	1.8-4.8	F	0.02 U	0.8	--
	Drainage Ravine	SED-09	0-0.4	C / E	0.17	0.8	0.07
Nickel	Goose Lake	SED-01	0-0.15	F	41	53.1	--
		SED-01	1.7-4.1	F	12.8 U	53.1	--
		SED-01 (DUP)	1.7-4.1	F	12.9 U	53.1	--
		SED-03	6.2-9.7	F	14.10 U	53.1	--
		SED-04	0-0.15	F	44	53.1	--
		SED-04	1.8-5.6	F	9.10 U	53.1	--
		SED-05	5.1-5.6	F	24	53.1	--
	Drainage Ravine	SED-09	0-0.4	C / E	28.8	53.1	48
		SED-10	0.5-2	C / E	46	53.1	48
		SED-10	4-4.5	D / E	46	53.1	48
		SED-11	0.75-1.25	C / E	35	53.1	48
		SED-12	0-0.5	C / E	52	53.1	48
Silver	Goose Lake	SED-01	0-0.15	F	5.4 U	0.545	--
		SED-01	1.7-4.1	F	6.4 U	0.545	--
		SED-01 (DUP)	1.7-4.1	F	6.5 U	0.545	--
		SED-03	6.2-9.7	F	7.1 U	0.545	--
		SED-04	0-0.15	F	6.7 U	0.545	--
		SED-04	1.8-5.6	F	4.5 U	0.545	--
		SED-05	5.1-5.6	F	2.6 U	0.545	--
	Drainage Ravine	SED-09	0-0.4	C / E	2.8 U	0.545	400

TABLE 43
SUMMARY OF SOIL/SEDIMENT ANALYTICAL RESULTS[1]
METALS[2] - GOOSE LAKE AND DRAINAGE RAVINE

GOOSE LAKE SITE
SHELTON, WASHINGTON

Metal	**Area**	**Sample Station**	**Sample Depth (feet)**	**Applicable Screening Levels**	**Concentration (mg/kg dry-weight)**	**Sediment Screening Level (mg/kg)**	**Soil Screening Level (Near or Upgradient of Local Surface Water Body) (Saturated/Unsaturated) [3] (mg/kg)**
Zinc	Goose Lake	SED-01	0-0.15	F	158	683	--
		SED-01	1.7-4.1	F	6.40 U	683	--
		SED-01 (DUP)	1.7-4.1	F	6.50 U	683	--
		SED-03	6.2-9.7	F	7.10 U	683	--
		SED-04	0-0.15	F	245	683	--
		SED-04	1.8-5.6	F	4.50 U	683	--
		SED-05	5.1-5.6	F	26	683	--
	Drainage Ravine	SED-09	0-0.4	C / E	37.0	683	120

Notes:

[1] Chemical analyses conducted by Columbia Analytical Services of Kelso, Washington.

[2] Metals analyzed by USEPA 6000/7000 Series methods.

[3] Where only a single value is shown, the screening level is the same for saturated and unsaturated soils.

mg/kg = Milligrams per kilogram

U = Analyte was not detected at the value reported. Value reported represents practical quantitation limit (PQL).

J = The analyte was detected at the value reported; the reported value is estimated.

UJ = The analyte was not detected at the value reported. Value reported represents the estimated practical quantitation limit (PQL).

-- = Not applicable, or no screening level available.

🟨 = Value exceeds soil screening level when rounded to same number of significant figures as soil screening level.

🟥 = Value exceeds sediment screening level when rounded to same number of significant figures as sediment screening level.

🟩 = PQL exceeds screening level when rounded to same number of significant figures as screening level.

Applicable Screening Levels

- A - Not near or upgradient of local surface water body and unsaturated.
- B - Not near or upgradient of local surface water body and saturated.
- C - Near or upgradient of local surface water body and unsaturated.
- D - Near or upgradient of local surface water body and saturated.
- E - Seasonally submerged; results compared to both soil and sediment screening levels.
- F - Results compared to sediment screening levels.

TABLE 44
SUMMARY OF SOIL/SEDIMENT ANALYTICAL RESULTS
DIOXIN CONGENERS[1] - GOOSE LAKE AND DRAINAGE RAVINE
GOOSE LAKE SITE
SHELTON, WASHINGTON

Congeners and TEFs	Area	Sample Identification	Sample Depth (ft bgs)	Concentration (ng/kg)
1,2,3,4,6,7,8-HpCDF WHO TEF[2] for: Humans/Mammals = 0.01 EPA TEF[3] for: Birds = 0.01 Fish = 0.01	Goose Lake	SED-04-0-0.15	0-0.15	11.753
		SED-04-1.8-5.6	1.8-5.6	1.95 U
		SED-05-0-0.15	0-0.15	35.502
		SED-05-2.3-5.1	2.3-5.1	1.32 U
		SED-08-0-0.15	0-0.15	3.272
		SED-08-1.8-4.8	1.8-4.8	2.479 U
		SED-08-1.8-4.8 (DUP-02)	1.8-4.8	3.125 U
	Drainage Ravine	SED-10-0.5-2	0.5-2	0.188 U
		SED-10-4-4.5	4-4.5	0.872 J
		SED-11-0.75-1.25	0.75-1.25	2.733 J
		SED-12-0-0.5	0-0.5	3.841
		SED-09-0-0.4	0-0.4	22.56 J
		SH-DR-01	0.4-1	1.88 J
		SH-DR-06	0-0.5	5.96
1,2,3,4,7,8,9-HpCDF WHO TEF for: Humans/Mammals = 0.01 EPA TEF for: Birds = 0.01 Fish = 0.01	Goose Lake	SED-04-0-0.15	0-0.15	2.74 U
		SED-04-1.8-5.6	1.8-5.6	3.12 U
		SED-05-0-0.15	0-0.15	4.02 U
		SED-05-2.3-5.1	2.3-5.1	2.11 U
		SED-08-0-0.15	0-0.15	1.153 U
		SED-08-1.8-4.8	1.8-4.8	3.972 U
		SED-08-1.8-4.8 (DUP-02)	1.8-4.8	5.009 U
	Drainage Ravine	SED-10-0.5-2	0.5-2	0.255 U
		SED-10-4-4.5	4-4.5	0.275 U
		SED-11-0.75-1.25	0.75-1.25	0.484 U
		SED-12-0-0.5	0-0.5	0.454 U
		SED-09-0-0.4	0-0.4	2.50 U
		SH-DR-01	0.4-1	0.25 J
		SH-DR-06	0-0.5	0.595 J
1,2,3,4,6,7,8-HpCDD WHO TEF for: Humans/Mammals = 0.01 EPA TEF for: Birds = <0.001 Fish = 0.001	Goose Lake	SED-04-0-0.15	0-0.15	36.681
		SED-04-1.8-5.6	1.8-5.6	2.58 U
		SED-05-0-0.15	0-0.15	137.577
		SED-05-2.3-5.1	2.3-5.1	1.90 U
		SED-08-0-0.15	0-0.15	13.88
		SED-08-1.8-4.8	1.8-4.8	4.106 U
		SED-08-1.8-4.8 (DUP-02)	1.8-4.8	4.741 U
	Drainage Ravine	SED-10-0.5-2	0.5-2	0.331 J
		SED-10-4-4.5	4-4.5	0.67 J
		SED-11-0.75-1.25	0.75-1.25	12.625
		SED-12-0-0.5	0-0.5	22.547
		SED-09-0-0.4	0-0.4	161.09
		SH-DR-01	0.4-1	8.43
		SH-DR-06	0-0.5	19.7
1,2,3,6,7,8-HxCDD WHO TEF for: Humans/Mammals = 0.1 EPA TEF for: Birds = 0.01 Fish = 0.01	Goose Lake	SED-04-0-0.15	0-0.15	1.57 U
		SED-04-1.8-5.6	1.8-5.6	1.70 U
		SED-05-0-0.15	0-0.15	6.365 J
		SED-05-2.3-5.1	2.3-5.1	1.40 U
		SED-08-0-0.15	0-0.15	0.997 U
		SED-08-1.8-4.8	1.8-4.8	2.564 U
		SED-08-1.8-4.8 (DUP-02)	1.8-4.8	3.044 U
	Drainage Ravine	SED-10-0.5-2	0.5-2	0.135 U
		SED-10-4-4.5	4-4.5	0.122 U
		SED-11-0.75-1.25	0.75-1.25	1.276 J
		SED-12-0-0.5	0-0.5	1.991 J
		SED-09-0-0.4	0-0.4	15.34
		SH-DR-01	0.4-1	1.13 J
		SH-DR-06	0-0.5	3.45

TABLE 44
SUMMARY OF SOIL/SEDIMENT ANALYTICAL RESULTS
DIOXIN CONGENERS[1] - GOOSE LAKE AND DRAINAGE RAVINE
GOOSE LAKE SITE
SHELTON, WASHINGTON

Congeners and TEFs	Area	Sample Identification	Sample Depth (ft bgs)	Concentration (ng/kg)
1,2,3,7,8,9-HxCDD WHO TEF for: Humans/Mammals = 0.1 EPA TEF for: Birds = 0.1 Fish = 0.01	Goose Lake	SED-04-0-0.15	0-0.15	1.76 U
		SED-04-1.8-5.6	1.8-5.6	1.90 U
		SED-05-0-0.15	0-0.15	7.739
		SED-05-2.3-5.1	2.3-5.1	1.56 U
		SED-08-0-0.15	0-0.15	1.081 U
		SED-08-1.8-4.8	1.8-4.8	2.862 U
		SED-08-1.8-4.8 (DUP-02)	1.8-4.8	3.397 U
	Drainage Ravine	SED-10-0.5-2	0.5-2	0.152 U
		SED-10-4-4.5	4-4.5	0.138 U
		SED-11-0.75-1.25	0.75-1.25	1.676 J
		SED-12-0-0.5	0-0.5	2.389 J
		SED-09-0-0.4	0-0.4	43.15
		SH-DR-01	0.4-1	0.938 J
		SH-DR-06	0-0.5	2.87
1,2,3,4,7,8-HxCDD WHO TEF for: Humans/Mammals = 0.1 EPA TEF for: Birds = 0.05 Fish = 0.5	Goose Lake	SED-04-0-0.15	0-0.15	1.98 U
		SED-04-1.8-5.6	1.8-5.6	2.14 U
		SED-05-0-0.15	0-0.15	2.79 U
		SED-05-2.3-5.1	2.3-5.1	1.76 U
		SED-08-0-0.15	0-0.15	1.16 U
		SED-08-1.8-4.8	1.8-4.8	3.224 U
		SED-08-1.8-4.8 (DUP-02)	1.8-4.8	3.827 U
	Drainage Ravine	SED-10-0.5-2	0.5-2	0.178 U
		SED-10-4-4.5	4-4.5	0.161 U
		SED-11-0.75-1.25	0.75-1.25	0.543 J
		SED-12-0-0.5	0-0.5	1.232 J
		SED-09-0-0.4	0-0.4	16.54
		SH-DR-01	0.4-1	0.61 J
		SH-DR-06	0-0.5	1.94 J
1,2,3,4,7,8-HxCDF WHO TEF for: Humans/Mammals = 0.1 EPA TEF for: Birds = 0.1 Fish = 0.1	Goose Lake	SED-04-0-0.15	0-0.15	1.70 U
		SED-04-1.8-5.6	1.8-5.6	1.39 U
		SED-05-0-0.15	0-0.15	6.501
		SED-05-2.3-5.1	2.3-5.1	1.04 U
		SED-08-0-0.15	0-0.15	0.799 U
		SED-08-1.8-4.8	1.8-4.8	2.142 U
		SED-08-1.8-4.8 (DUP-02)	1.8-4.8	2.498 U
	Drainage Ravine	SED-10-0.5-2	0.5-2	0.145 U
		SED-10-4-4.5	4-4.5	0.126 U
		SED-11-0.75-1.25	0.75-1.25	1.027 J
		SED-12-0-0.5	0-0.5	1.235 J
		SED-09-0-0.4	0-0.4	7.77
		SH-DR-01	0.4-1	0.419 J
		SH-DR-06	0-0.5	1.67 J

TABLE 44
SUMMARY OF SOIL/SEDIMENT ANALYTICAL RESULTS
DIOXIN CONGENERS[1] - GOOSE LAKE AND DRAINAGE RAVINE
GOOSE LAKE SITE
SHELTON, WASHINGTON

Congeners and TEFs	Area	Sample Identification	Sample Depth (ft bgs)	Concentration (ng/kg)
1,2,3,6,7,8-HxCDF WHO TEF for: Humans/Mammals = 0.1 EPA TEF for: Birds = 0.1 Fish = 0.1	Goose Lake	SED-04-0-0.15	0-0.15	1.51 U
		SED-04-1.8-5.6	1.8-5.6	1.23 U
		SED-05-0-0.15	0-0.15	2.42 U
		SED-05-2.3-5.1	2.3-5.1	0.93 U
		SED-08-0-0.15	0-0.15	0.743 U
		SED-08-1.8-4.8	1.8-4.8	1.905 U
		SED-08-1.8-4.8 (DUP-02)	1.8-4.8	2.221 U
	Drainage Ravine	SED-10-0.5-2	0.5-2	0.127 U
		SED-10-4-4.5	4-4.5	0.11 U
		SED-11-0.75-1.25	0.75-1.25	0.329 J
		SED-12-0-0.5	0-0.5	0.746 J
		SED-09-0-0.4	0-0.4	3.60
		SH-DR-01	0.4-1	0.359 J
		SH-DR-06	0-0.5	1.8 J
1,2,3,7,8,9-HxCDF WHO TEF for: Humans/Mammals = 0.1 EPA TEF for: Birds = 0.1 Fish = 0.1	Goose Lake	SED-04-0-0.15	0-0.15	1.98 U
		SED-04-1.8-5.6	1.8-5.6	1.61 U
		SED-05-0-0.15	0-0.15	3.16 U
		SED-05-2.3-5.1	2.3-5.1	1.21 U
		SED-08-0-0.15	0-0.15	1.083 U
		SED-08-1.8-4.8	1.8-4.8	2.489 U
		SED-08-1.8-4.8 (DUP-02)	1.8-4.8	2.904 U
	Drainage Ravine	SED-10-0.5-2	0.5-2	0.161 U
		SED-10-4-4.5	4-4.5	0.14 U
		SED-11-0.75-1.25	0.75-1.25	0.161 U
		SED-12-0-0.5	0-0.5	0.134 U
		SED-09-0-0.4	0-0.4	2.50 U
		SH-DR-01	0.4-1	0.106 U
		SH-DR-06	0-0.5	0.657 J
2,3,4,6,7,8-HxCDF WHO TEF for: Humans/Mammals = 0.1 EPA TEF for: Birds = 0.1 Fish = 0.1	Goose Lake	SED-04-0-0.15	0-0.15	1.72 U
		SED-04-1.8-5.6	1.8-5.6	1.40 U
		SED-05-0-0.15	0-0.15	2.76 U
		SED-05-2.3-5.1	2.3-5.1	1.05 U
		SED-08-0-0.15	0-0.15	0.867 U
		SED-08-1.8-4.8	1.8-4.8	2.169 U
		SED-08-1.8-4.8 (DUP-02)	1.8-4.8	2.529 U
	Drainage Ravine	SED-10-0.5-2	0.5-2	0.143 U
		SED-10-4-4.5	4-4.5	0.124 U
		SED-11-0.75-1.25	0.75-1.25	0.545 J
		SED-12-0-0.5	0-0.5	0.913 J
		SED-09-0-0.4	0-0.4	5.19
		SH-DR-01	0.4-1	0.412 J
		SH-DR-06	0-0.5	2.09 J

TABLE 44
SUMMARY OF SOIL/SEDIMENT ANALYTICAL RESULTS
DIOXIN CONGENERS[1] - GOOSE LAKE AND DRAINAGE RAVINE
GOOSE LAKE SITE
SHELTON, WASHINGTON

Congeners and TEFs	Area	Sample Identification	Sample Depth (ft bgs)	Concentration (ng/kg)
1,2,3,7,8-PeCDF **WHO TEF for:** **Humans/Mammals = 0.03** **EPA TEF for:** **Birds = 0.1** **Fish = 0.05**	Goose Lake	SED-04-0-0.15	0-0.15	1.93 U
		SED-04-1.8-5.6	1.8-5.6	1.38 U
		SED-05-0-0.15	0-0.15	4.986
		SED-05-2.3-5.1	2.3-5.1	0.87 U
		SED-08-0-0.15	0-0.15	0.615 U
		SED-08-1.8-4.8	1.8-4.8	2.21 U
		SED-08-1.8-4.8 (DUP-02)	1.8-4.8	2.854 U
	Drainage Ravine	SED-10-0.5-2	0.5-2	0.181 U
		SED-10-4-4.5	4-4.5	0.156 U
		SED-11-0.75-1.25	0.75-1.25	0.771 J
		SED-12-0-0.5	0-0.5	1.296 J
		SED-09-0-0.4	0-0.4	6.80 J
		SH-DR-01	0.4-1	0.463 J
		SH-DR-06	0-0.5	2.61
2,3,4,7,8-PeCDF **WHO TEF for:** **Humans/Mammals = 0.3** **EPA TEF for:** **Birds = 1** **Fish = 0.5**	Goose Lake	SED-04-0-0.15	0-0.15	1.90 U
		SED-04-1.8-5.6	1.8-5.6	1.35 U
		SED-05-0-0.15	0-0.15	8.166
		SED-05-2.3-5.1	2.3-5.1	0.85 U
		SED-08-0-0.15	0-0.15	0.621 U
		SED-08-1.8-4.8	1.8-4.8	2.167 U
		SED-08-1.8-4.8 (DUP-02)	1.8-4.8	2.798 U
	Drainage Ravine	SED-10-0.5-2	0.5-2	0.167 U
		SED-10-4-4.5	4-4.5	0.144 U
		SED-11-0.75-1.25	0.75-1.25	0.983 J
		SED-12-0-0.5	0-0.5	1.525 J
		SED-09-0-0.4	0-0.4	9.66
		SH-DR-01	0.4-1	0.32 J
		SH-DR-06	0-0.5	2.06 J
1,2,3,7,8-PeCDD **WHO TEF for:** **Humans/Mammals = 1** **EPA TEF for:** **Birds = 1** **Fish = 1**	Goose Lake	SED-04-0-0.15	0-0.15	1.945 U
		SED-04-1.8-5.6	1.8-5.6	2.01 U
		SED-05-0-0.15	0-0.15	3.353 J
		SED-05-2.3-5.1	2.3-5.1	1.75 U
		SED-08-0-0.15	0-0.15	0.994 U
		SED-08-1.8-4.8	1.8-4.8	2.835 U
		SED-08-1.8-4.8 (DUP-02)	1.8-4.8	3.571 U
	Drainage Ravine	SED-10-0.5-2	0.5-2	0.181 U
		SED-10-4-4.5	4-4.5	0.18 U
		SED-11-0.75-1.25	0.75-1.25	0.748 J
		SED-12-0-0.5	0-0.5	1.588 J
		SED-09-0-0.4	0-0.4	9.04
		SH-DR-01	0.4-1	0.361 J
		SH-DR-06	0-0.5	1.75 J

TABLE 44
SUMMARY OF SOIL/SEDIMENT ANALYTICAL RESULTS
DIOXIN CONGENERS[1] - GOOSE LAKE AND DRAINAGE RAVINE

GOOSE LAKE SITE
SHELTON, WASHINGTON

Congeners and TEFs	Area	Sample Identification	Sample Depth (ft bgs)	Concentration (ng/kg)
2,3,7,8-TCDF WHO TEF for: Humans/Mammals = 0.1 EPA TEF for: Birds = 1 Fish = 0.05	Goose Lake	SED-04-0-0.15	0-0.15	3.998
		SED-04-1.8-5.6	1.8-5.6	2.41 U
		SED-05-0-0.15	0-0.15	9.951
		SED-05-2.3-5.1	2.3-5.1	1.63 U
		SED-08-0-0.15	0-0.15	3.57 U
		SED-08-1.8-4.8	1.8-4.8	3.23 U
		SED-08-1.8-4.8 (DUP-02)	1.8-4.8	3.89 U
	Drainage Ravine	SED-10-0.5-2	0.5-2	0.135 U
		SED-10-4-4.5	4-4.5	0.152 U
		SED-11-0.75-1.25	0.75-1.25	1.468
		SED-12-0-0.5	0-0.5	1.82
		SED-09-0-0.4	0-0.4	13.25
		SH-DR-01	0.4-1	0.552
		SH-DR-06	0-0.5	4.32
2,3,7,8-TCDD WHO TEF for: Humans/Mammals = 1 EPA TEF for: Birds = 1 Fish = 1	Goose Lake	SED-04-0-0.15	0-0.15	1.65 U
		SED-04-1.8-5.6	1.8-5.6	1.59 U
		SED-05-0-0.15	0-0.15	2.51 U
		SED-05-2.3-5.1	2.3-5.1	1.55 U
		SED-08-0-0.15	0-0.15	0.639 U
		SED-08-1.8-4.8	1.8-4.8	2.584 U
		SED-08-1.8-4.8 (DUP-02)	1.8-4.8	3.794 U
	Drainage Ravine	SED-10-0.5-2	0.5-2	0.108 U
		SED-10-4-4.5	4-4.5	0.147 U
		SED-11-0.75-1.25	0.75-1.25	0.355 J
		SED-12-0-0.5	0-0.5	0.481 J
		SED-09-0-0.4	0-0.4	2.92
		SH-DR-01	0.4-1	0.232 J
		SH-DR-06	0-0.5	0.918
OCDF WHO TEF for: Humans/Mammals = 0.0003 EPA TEF for: Birds = 0.0001 Fish = <0.0001	Goose Lake	SED-04-0-0.15	0-0.15	37.208
		SED-04-1.8-5.6	1.8-5.6	3.53 U
		SED-05-0-0.15	0-0.15	104.001
		SED-05-2.3-5.1	2.3-5.1	3.54 U
		SED-08-0-0.15	0-0.15	5.448 U
		SED-08-1.8-4.8	1.8-4.8	7.652 U
		SED-08-1.8-4.8 (DUP-02)	1.8-4.8	12.24 U
	Drainage Ravine	SED-10-0.5-2	0.5-2	0.43 U
		SED-10-4-4.5	4-4.5	4.597 J
		SED-11-0.75-1.25	0.75-1.25	10.479
		SED-12-0-0.5	0-0.5	13.266
		SED-09-0-0.4	0-0.4	81.81 J
		SH-DR-01	0.4-1	4.96 J
		SH-DR-06	0-0.5	14.1

TABLE 44
SUMMARY OF SOIL/SEDIMENT ANALYTICAL RESULTS
DIOXIN CONGENERS[1] - GOOSE LAKE AND DRAINAGE RAVINE
GOOSE LAKE SITE
SHELTON, WASHINGTON

Congeners and TEFs	Area	Sample Identification	Sample Depth (ft bgs)	Concentration (ng/kg)
OCDD WHO TEF for: Humans/Mammals = 0.0003 EPA TEF for: Birds = 0.0001 Fish = <0.0001	Goose Lake	SED-04-0-0.15	0-0.15	317.654
		SED-04-1.8-5.6	1.8-5.6	3.49 U
		SED-05-0-0.15	0-0.15	1188.133
		SED-05-2.3-5.1	2.3-5.1	29.161
		SED-08-0-0.15	0-0.15	116.483
		SED-08-1.8-4.8	1.8-4.8	5.599 U
		SED-08-1.8-4.8 (DUP-02)	1.8-4.8	8.197 U
	Drainage Ravine	SED-10-0.5-2	0.5-2	3.267 J
		SED-10-4-4.5	4-4.5	5.385 J
		SED-11-0.75-1.25	0.75-1.25	58.85
		SED-12-0-0.5	0-0.5	123.561
		SED-09-0-0.4	0-0.4	767.04 J
		SH-DR-01	0.4-1	52.1
		SH-DR-06	0-0.5	111

Notes:

[1] Dioxins and furans analyzed by USEPA Method 8290 or USEPA Method 1613B.

[2] Human and mammal dioxin/furan TEFs based on MTCA 2007 TEFs (World Health Organization 2005 Reevaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-Like Compounds (Van den Berg et al., 2006).

[3] Bird and fish dioxin/furan TEFs based on USEPA 2003 Framework for Application of the Toxicity Equivalence Methodology for Polychlorinated Dioxins, Furans, and Biphenyls in Ecological Risk Assessment.

ng/kg = Nanograms per kilogram
U = Congener was not detected at a concentration exceeding the value reported. Value reported represents method detection limit (MDL).
J = The congener was detected at the value shown but is considered to be estimated.
HpCDF = Heptachlorodibenzofuran
HpCDD = Heptachlorodibenzo-p-dioxin
HxCDD = Hexachlorodibenzo-p-dioxin
HxCDF = Hexachlorodibenzofuran
PeCDF = Pentachlorodibenzofuran
PeCDD = Pentachlorodibenzo-p-dioxin
TCDF = Tetrachlorodibenzofuran
TCDD = Tetrachlorodibenzo-p-dioxin
OCDF = Octachlorodibenzofuran
OCDD = Octachlorodibenzo-p-dioxin
TEF = Toxicity equivalency factor
ft bgs = Feet below ground surface
MDL = Method detection limit

TABLE 45
SUMMARY OF SOIL/SEDIMENT ANALYTICAL RESULTS
DIOXIN TEQ VALUES - GOOSE LAKE AND DRAINAGE RAVINE
GOOSE LAKE SITE
SHELTON, WASHINGTON

TEQ/Screening Level Categories (ng/kg)	Goose Lake Sediment																	
	SED-04-0-0.15			SED-04-1.8-5.6			SED-05-0-0.15			SED-05-2.3-5.1			SED-08-0-0.15			SED-08-1.8-4.8		
	TEQ (f)	TEQ (m)	TEQ (b)	TEQ (f)	TEQ (m)	TEQ (b)	TEQ (f)	TEQ (m)	TEQ (b)	TEQ (f)	TEQ (m)	TEQ (b)	TEQ (f)	TEQ (m)	TEQ (b)	TEQ (f)	TEQ (m)	TEQ (b)
Applicable Screening Levels:		F			F			F			F			F			F	
Total Dioxins TEQ (ND=0.5MDL)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Furans TEQ (ND=0.5MDL)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total D/F TEQ (ND=0.5MDL)	4	3.7	7.5	3 U	2.8 U	4.2 U	10	13	15	3	2.4	3.3	4	1.6	4.4	5 U	4.2 U	6.2 U
Soil Screening Level (Total Dioxins TEQ - Ecological)(Near or Upgradient of Local Surface Water Body)[1]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Soil Screening Level (Total Furans TEQ - Ecological)(Near or Upgradient of Local Surface Water Body)[1]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Soil Screening Level (Total D/F TEQ - Human Health)(Near or Upgradient of Local Surface Water Body)[1]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sediment Screening Level (Total D/F TEQ - Low-Risk Ecological)	60	2.5 (b)	21	60	2.5 (b)	21	60	2.5 (b)	21	60	2.5 (b)	21	60	2.5 (b)	21	60	2.5 (b)	21
Sediment Screening Level (Total D/F TEQ - High-Risk Ecological)	100	25 (b)	210	100	25 (b)	210	100	25 (b)	210	100	25 (b)	210	100	25 (b)	210	100	25 (b)	210

TEQ/Screening Level Categories (ng/kg)	Goose Lake Sediment			Drainage Ravine Soil/Sediment													
	SED-08-1.8-4.8 (DUP-02)			SED-09-0-0.4		SED-10-0.5-2		SED-10-4-4.5		SED-11-0.75-1.25		SED-12-0-0.5		SH-DR-01		SH-DR-06	
	TEQ (f)	TEQ (m)	TEQ (b)	TEQ (m)(h)	TEQ (b)	TEQ (m)(h)	TEQ (b)	TEQ (m)(h)	TEQ (b)	TEQ (m)(h)	TEQ (b)	TEQ (m)(h)	TEQ (b)	TEQ (m)(h)	TEQ (b)	TEQ (m)(h)	TEQ (b)
Applicable Screening Levels:		F		C / E		C / E		D / E		C / E		C / E		C / E		C / E	
Total Dioxins TEQ (ND=0.5MDL)	--	--	--	21	16	0.17	0.16	0.19	0.18	1.6	1.3	2.9	2.4	0.96	0.77	3.7	3.2
Total Furans TEQ (ND=0.5MDL)	--	--	--	7	26	0.07 U	0.19 U	0.07	0.19	0.7	2.8	1	3.8	0.3	1.1	2	7.3
Total D/F TEQ (ND=0.5MDL)	6 U	5.4 U	8.0 U	28	42	0.24	0.35	0.26	0.37	2.3	4.1	3.9	6.2	1.3	1.8	5.5	11
Soil Screening Level (Total Dioxins TEQ - Ecological)(Near or Upgradient of Local Surface Water Body)[1]	--	--	--	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Soil Screening Level (Total Furans TEQ - Ecological)(Near or Upgradient of Local Surface Water Body)[1]	--	--	--	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Soil Screening Level (Total D/F TEQ - Human Health)(Near or Upgradient of Local Surface Water Body)[1]	--	--	--	5.2 (a)	--	5.2 (a)	--	5.2 (a)	--	5.2 (a)	--	5.2 (a)	--	5.2 (a)	--	5.2 (a)	--
Sediment Screening Level (Total D/F TEQ - Low-Risk Ecological)	60	2.5 (b)	21	2.5 (b)	21	2.5 (b)	21	2.5 (b)	21	2.5 (b)	21	2.5 (b)	21	2.5 (b)	21	2.5 (b)	21
Sediment Screening Level (Total D/F TEQ - High-Risk Ecological)	100	25 (b)	210	25 (b)	210	25 (b)	210	25 (b)	210	25 (b)	210	25 (b)	210	25 (b)	210	25 (b)	210

Notes:

[1] The screening level is the same for saturated and unsaturated soils.

h = humans (TEFs based on MTCA 2007 TEFs (World Health Organization 2005 Reevaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-Like Compounds (Van den Berg et al., 2006)).

m = mammals (TEFs based on MTCA 2007 TEFs (World Health Organization 2005 Reevaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-Like Compounds (Van den Berg et al., 2006)).

b = birds (TEFs based on USEPA 2003 Framework for Application of the Toxicity Equivalence Methodology for Polychlorinated Dioxins, Furans, and Biphenyls in Ecological Risk Assessment).

f = fish (TEFs based on USEPA 2003 Framework for Application of the Toxicity Equivalence Methodology for Polychlorinated Dioxins, Furans, and Biphenyls in Ecological Risk Assessment).

D/F = Dioxins/furans

TEQ = Toxicity Equivalency Quotient

The TEQ values shown for the congeners are displayed in units of nanograms per kilogram (ng/kg).

U = No dioxin or furan congeners were detected above method detection limits.

-- = Not applicable.

🟨 = Value exceeds soil screening level when rounded to same number of significant figures as soil screening level.

🟥 = Value exceeds sediment screening level when rounded to same number of significant figures as sediment screening level.

🟩 = TEQ exceeds low-risk sediment screening level when rounded to same number of significant figures as screening level, but no congeners were detected.

For non-detect dioxin/furan congener results, since there was at least one positive detection of each congener in soil or sediment at the site, 1/2 the MDL was used in the TEQ calculation.

MDL = Method detection limit

(a) Screening level for human health

(b) Screening level for mammalian wildlife

Applicable Screening Levels

- A - Not near or upgradient of local surface water body and unsaturated.
- B - Not near or upgradient of local surface water body and saturated.
- C - Near or upgradient of local surface water body and unsaturated.
- D - Near or upgradient of local surface water body and saturated.
- E - Seasonally submerged; results compared to both soil and sediment screening levels.
- F - Results compared to sediment screening levels.

TABLE 46
SUMMARY OF SOIL/SEDIMENT ANALYTICAL RESULTS[1]
POLYCHLORINATED BIPHENYLS[2] - GOOSE LAKE AND DRAINAGE RAVINE
GOOSE LAKE SITE
SHELTON, WASHINGTON

PCB Aroclor	Area	Sample Identification	Depth (feet)	Applicable Screening Levels	Concentration (µg/kg)	Sediment Screening Level (µg/kg)	Soil Screening Level (Near or Upgradient of Local Surface Water Body) [5] (µg/kg)
AROCLOR-1016	Goose Lake	SED-01	0-0.15	F	48 U[4]	--	--
		SED-01	1.7-4.1	F	29 U[4]	--	--
		SED-01 (DUP)	1.7-4.1	F	24 U[4]	--	--
		SED-02	0.9-1.5	F	40 U[4]	--	--
		SED-03	0-0.15	F	46 U[4]	--	--
		SED-03	1.9-5.8	F	19 U[4]	--	--
		SED-03	6.2-9.7	F	32 U[4]	--	--
		SED-04	0-0.15	F	24 U[4]	--	--
		SED-04	1.8-5.6	F	41 U[4]	--	--
		SED-05	0-0.15	F	75 U[4]	--	--
		SED-05	2.3-5.1	F	11 U[4]	--	--
		SED-05	5.1-5.6	F	3.9 U[4]	--	--
		SED-06	0-0.15	F	51 U[4]	--	--
		SED-06	1.3-5.0	F	39 U[4]	--	--
		SED-07	0-0.15	F	27 U[4]	--	--
		SED-07	2.0-5.3	F	18 U[4]	--	--
		SED-08	0-0.15	F	55 U[4]	--	--
		SED-08	1.8-4.8	F	38 U[4]	--	--
	Drainage Ravine	SED-09	0-0.4	C / E	42 U	--	5,600
		SED-10	0.5-2	C / E	11 U	--	5,600
		SED-10	4-4.5	D / E	8.3 U	--	5,600
		SED-11	0.75-1.25	C / E	8.2 U	--	5,600
		SED-12	0-0.5	C / E	9.3 U	--	5,600
		SH-DR-01	0.4-1	C / E	11 U	--	5,600
		SH-DR-02	0-0.5	C / E	12 U	--	5,600
		SH-DR-03	0-0.5	C / E	12 U	--	5,600
		SH-DR-04	0-0.5	C / E	12 U	--	5,600
		SH-DR-05	0-0.5	C / E	12 U	--	5,600
		SH-DR-06	0-0.5	C / E	14 U	--	5,600
AROCLOR-1221	Goose Lake	SED-01	0-0.15	F	48 U[4]	--	--
		SED-01	1.7-4.1	F	29 U[4]	--	--
		SED-01 (DUP)	1.7-4.1	F	24 U[4]	--	--
		SED-02	0.9-1.5	F	40 U[4]	--	--
		SED-03	0-0.15	F	46 U[4]	--	--
		SED-03	1.9-5.8	F	19 U[4]	--	--
		SED-03	6.2-9.7	F	32 U[4]	--	--
		SED-04	0-0.15	F	24 U[4]	--	--
		SED-04	1.8-5.6	F	41 U[4]	--	--
		SED-05	0-0.15	F	75 U[4]	--	--
		SED-05	2.3-5.1	F	11 U[4]	--	--
		SED-05	5.1-5.6	F	3.9 U[4]	--	--
		SED-06	0-0.15	F	51 U[4]	--	--
		SED-06	1.3-5.0	F	39 U[4]	--	--
		SED-07	0-0.15	F	27 U[4]	--	--
		SED-07	2.0-5.3	F	18 U[4]	--	--
		SED-08	0-0.15	F	55 U[4]	--	--
		SED-08	1.8-4.8	F	38 U[4]	--	--
	Drainage Ravine	SED-09	0-0.4	C / E	84 U	--	--
		SED-10	0.5-2	C / E	21 U	--	--
		SED-10	4-4.5	D / E	17 U	--	--
		SED-11	0.75-1.25	C / E	17 U	--	--
		SED-12	0-0.5	C / E	19 U	--	--
		SH-DR-01	0.4-1	C / E	11 U	--	--
		SH-DR-02	0-0.5	C / E	12 U	--	--
		SH-DR-03	0-0.5	C / E	12 U	--	--
		SH-DR-04	0-0.5	C / E	12 U	--	--
		SH-DR-05	0-0.5	C / E	12 U	--	--
		SH-DR-06	0-0.5	C / E	14 U	--	--
AROCLOR-1232	Goose Lake	SED-01	0-0.15	F	48 U[4]	--	--
		SED-01	1.7-4.1	F	29 U[4]	--	--
		SED-01 (DUP)	1.7-4.1	F	24 U[4]	--	--
		SED-02	0.9-1.5	F	40 U[4]	--	--
		SED-03	0-0.15	F	46 U[4]	--	--
		SED-03	1.9-5.8	F	19 U[4]	--	--
		SED-03	6.2-9.7	F	32 U[4]	--	--
		SED-04	0-0.15	F	24 U[4]	--	--
		SED-04	1.8-5.6	F	41 U[4]	--	--
		SED-05	0-0.15	F	75 U[4]	--	--
		SED-05	2.3-5.1	F	11 U[4]	--	--
		SED-05	5.1-5.6	F	3.9 U[4]	--	--
		SED-06	0-0.15	F	51 U[4]	--	--
		SED-06	1.3-5.0	F	39 U[4]	--	--
AROCLOR-1232	Goose Lake	SED-07	0-0.15	F	27 U[4]	--	--
		SED-07	2.0-5.3	F	18 U[4]	--	--
		SED-08	0-0.15	F	55 U[4]	--	--
		SED-08	1.8-4.8	F	38 U[4]	--	--
	Drainage Ravine	SED-09	0-0.4	C / E	42 U	--	--
		SED-10	0.5-2	C / E	11 U	--	--
		SED-10	4-4.5	D / E	8.3 U	--	--
		SED-11	0.75-1.25	C / E	8.2 U	--	--
		SED-12	0-0.5	C / E	9.3 U	--	--
		SH-DR-01	0.4-1	C / E	11 U	--	--
		SH-DR-02	0-0.5	C / E	12 U	--	--
		SH-DR-03	0-0.5	C / E	12 U	--	--
		SH-DR-04	0-0.5	C / E	12 U	--	--
		SH-DR-05	0-0.5	C / E	12 U	--	--
		SH-DR-06	0-0.5	C / E	14 U	--	--

TABLE 46
SUMMARY OF SOIL/SEDIMENT ANALYTICAL RESULTS[1]
POLYCHLORINATED BIPHENYLS[2] - GOOSE LAKE AND DRAINAGE RAVINE
GOOSE LAKE SITE
SHELTON, WASHINGTON

PCB Aroclor	Area	Sample Identification	Depth (feet)	Applicable Screening Levels	Concentration (µg/kg)	Sediment Screening Level (µg/kg)	Soil Screening Level (Near or Upgradient of Local Surface Water Body) [5] (µg/kg)
AROCLOR-1242	Goose Lake	SED-01	0-0.15	F	48 U[4]	--	--
		SED-01	1.7-4.1	F	29 U[4]	--	--
		SED-01 (DUP)	1.7-4.1	F	24 U[4]	--	--
		SED-02	0.9-1.5	F	40 U[4]	--	--
		SED-03	0-0.15	F	46 U[4]	--	--
		SED-03	1.9-5.8	F	19 U[4]	--	--
		SED-03	6.2-9.7	F	32 U[4]	--	--
		SED-04	0-0.15	F	24 U[4]	--	--
		SED-04	1.8-5.6	F	41 U[4]	--	--
		SED-05	0-0.15	F	75 U[4]	--	--
		SED-05	2.3-5.1	F	11 U[4]	--	--
		SED-05	5.1-5.6	F	3.9 U[4]	--	--
		SED-06	0-0.15	F	51 U[4]	--	--
		SED-06	1.3-5.0	F	39 U[4]	--	--
		SED-07	0-0.15	F	27 U[4]	--	--
		SED-07	2.0-5.3	F	18 U[4]	--	--
		SED-08	0-0.15	F	55 U[4]	--	--
		SED-08	1.8-4.8	F	38 U[4]	--	--
	Drainage Ravine	SED-09	0-0.4	C / E	42 U	--	--
		SED-10	0.5-2	C / E	11 U	--	--
		SED-10	4-4.5	D / E	8.3 U	--	--
		SED-11	0.75-1.25	C / E	8.2 U	--	--
		SED-12	0-0.5	C / E	9.3 U	--	--
		SH-DR-01	0.4-1	C / E	11 U	--	--
		SH-DR-02	0-0.5	C / E	12 U	--	--
		SH-DR-03	0-0.5	C / E	12 U	--	--
		SH-DR-04	0-0.5	C / E	12 U	--	--
		SH-DR-05	0-0.5	C / E	12 U	--	--
		SH-DR-06	0-0.5	C / E	14 U	--	--
AROCLOR-1248	Goose Lake	SED-01	0-0.15	F	48 U[4]	--	--
		SED-01	1.7-4.1	F	29 U[4]	--	--
		SED-01 (DUP)	1.7-4.1	F	24 U[4]	--	--
		SED-02	0.9-1.5	F	40 U[4]	--	--
		SED-03	0-0.15	F	46 U[4]	--	--
		SED-03	1.9-5.8	F	19 U[4]	--	--
		SED-03	6.2-9.7	F	32 U[4]	--	--
		SED-04	0-0.15	F	24 U[4]	--	--
		SED-04	1.8-5.6	F	41 U[4]	--	--
		SED-05	0-0.15	F	75 U[4]	--	--
		SED-05	2.3-5.1	F	11 U[4]	--	--
		SED-05	5.1-5.6	F	3.9 U[4]	--	--
		SED-06	0-0.15	F	51 U[4]	--	--
		SED-06	1.3-5.0	F	39 U[4]	--	--
		SED-07	0-0.15	F	27 U[4]	--	--
		SED-07	2.0-5.3	F	18 U[4]	--	--
		SED-08	0-0.15	F	55 U[4]	--	--
		SED-08	1.8-4.8	F	38 U[4]	--	--
	Drainage Ravine	SED-09	0-0.4	C / E	42 U	--	--
		SED-10	0.5-2	C / E	11 U	--	--
		SED-10	4-4.5	D / E	8.3 U	--	--
		SED-11	0.75-1.25	C / E	8.2 U	--	--
		SED-12	0-0.5	C / E	9.3 U	--	--
		SH-DR-01	0.4-1	C / E	11 U	--	--
		SH-DR-02	0-0.5	C / E	12 U	--	--
		SH-DR-03	0-0.5	C / E	12 U	--	--
		SH-DR-04	0-0.5	C / E	12 U	--	--
		SH-DR-05	0-0.5	C / E	12 U	--	--
		SH-DR-06	0-0.5	C / E	14 U	--	--
AROCLOR-1254	Goose Lake	SED-01	0-0.15	F	48 U[4]	230	--
		SED-01	1.7-4.1	F	29 U[4]	230	--
		SED-01 (DUP)	1.7-4.1	F	24 U[4]	230	--
		SED-02	0.9-1.5	F	40 U[4]	230	--
		SED-03	0-0.15	F	46 U[4]	230	--
AROCLOR-1254	Goose Lake	SED-03	1.9-5.8	F	19 U[4]	230	--
		SED-03	6.2-9.7	F	32 U[4]	230	--
		SED-04	0-0.15	F	24 U[4]	230	--
		SED-04	1.8-5.6	F	41 U[4]	230	--
		SED-05	0-0.15	F	75 U[4]	230	--
		SED-05	2.3-5.1	F	11 U[4]	230	--
		SED-05	5.1-5.6	F	3.9 U[4]	230	--
		SED-06	0-0.15	F	51 U[4]	230	--
		SED-06	1.3-5.0	F	39 U[4]	230	--
		SED-07	0-0.15	F	27 U[4]	230	--
		SED-07	2.0-5.3	F	18 U[4]	230	--
		SED-08	0-0.15	F	55 U[4]	230	--
		SED-08	1.8-4.8	F	38 U[4]	230	--
	Drainage Ravine	SED-09	0-0.4	C / E	42 U	230	1,600
		SED-10	0.5-2	C / E	11 U	230	1,600
		SED-10	4-4.5	D / E	8.3 U	230	1,600
		SED-11	0.75-1.25	C / E	8.2 U	230	1,600
		SED-12	0-0.5	C / E	9.3 U	230	1,600
		SH-DR-01	0.4-1	C / E	11 U	230	1,600
		SH-DR-02	0-0.5	C / E	12 U	230	1,600
		SH-DR-03	0-0.5	C / E	12 U	230	1,600
		SH-DR-04	0-0.5	C / E	12 U	230	1,600
		SH-DR-05	0-0.5	C / E	12 U	230	1,600
		SH-DR-06	0-0.5	C / E	14 U	230	1,600

TABLE 46
SUMMARY OF SOIL/SEDIMENT ANALYTICAL RESULTS[1]
POLYCHLORINATED BIPHENYLS[2] - GOOSE LAKE AND DRAINAGE RAVINE

GOOSE LAKE SITE
SHELTON, WASHINGTON

PCB Aroclor	Area	Sample Identification	Depth (feet)	Applicable Screening Levels	Concentration (µg/kg)	Sediment Screening Level (µg/kg)	Soil Screening Level (Near or Upgradient of Local Surface Water Body) [5] (µg/kg)
		SED-01	1.7-4.1	F	85 J	138	--
		SED-01	0-0.15	F	580 J	138	--
		SED-01 (DUP)	1.7-4.1	F	64 J	138	--
		SED-02	0.9-1.5	F	40 U[4]	138	--
		SED-03	0-0.15	F	500 J	138	--
		SED-03	1.9-5.8	F	19 U[4]	138	--
		SED-03	6.2-9.7	F	32 U[4]	138	--
		SED-04	0-0.15	F	440 J	138	--
		SED-04	1.8-5.6	F	41 U[4]	138	--
		SED-05	0-0.15	F	900	138	--
		SED-05	2.3-5.1	F	11 U[4]	138	--
		SED-05	5.1-5.6	F	3.9 U[4]	138	--
		SED-06	0-0.15	F	600 J	138	--
		SED-06	1.3-5.0	F	39 U[4]	138	--
		SED-07	0-0.15	F	580 J	138	--
		SED-07	2.0-5.3	F	18 U[4]	138	--
		SED-08	0-0.15	F	380	138	--
		SED-08	1.8-4.8	F	38 U[4]	138	--
	Drainage Ravine	SED-09	0-0.4	C / E	47	138	--
		SED-10	0.5-2	C / E	11 U	138	--
		SED-10	4-4.5	D / E	8.3 U	138	--
		SED-11	0.75-1.25	C / E	8.2 U	138	--
		SED-12	0-0.5	C / E	9.3 U	138	--
		SH-DR-01	0.4-1	C / E	11 U	138	--
		SH-DR-02	0-0.5	C / E	12 U	138	--
		SH-DR-03	0-0.5	C / E	12 U	138	--
		SH-DR-04	0-0.5	C / E	12 U	138	--
		SH-DR-05	0-0.5	C / E	12 U	138	--
		SH-DR-06	0-0.5	C / E	14 U	138	--
TOTAL PCBs[4]	Goose Lake	SED-01	0-0.15	F	580 J	62	--
		SED-01	1.7-4.1	F	85 J	62	--
		SED-01 (DUP)	1.7-4.1	F	64 J	62	--
		SED-02	0.9-1.5	F	40 U[4]	62	--
		SED-03	0-0.15	F	500 J	62	--
		SED-03	1.9-5.8	F	19 U[4]	62	--
		SED-03	6.2-9.7	F	32 U[4]	62	--
		SED-04	0-0.15	F	440 J	62	--
		SED-04	1.8-5.6	F	41 U[4]	62	--
		SED-05	0-0.15	F	900	62	--
		SED-05	2.3-5.1	F	11 U[4]	62	--
		SED-05	5.1-5.6	F	3.9 U[4]	62	--
		SED-06	0-0.15	F	600 J	62	--
		SED-06	1.3-5.0	F	39 U[4]	62	--
		SED-07	0-0.15	F	580 J	62	--
		SED-07	2.0-5.3	F	18 U[4]	62	--
		SED-08	0-0.15	F	380	62	--
		SED-08	1.8-4.8	F	38 U[4]	62	--
TOTAL PCBs[3]	Drainage Ravine	SED-09	0-0.4	C / E	47	62	4
		SED-10	0.5-2	C / E	21 U	62	4
		SED-10	4-4.5	D / E	17 U	62	4
		SED-11	0.75-1.25	C / E	17 U	62	4
		SED-12	0-0.5	C / E	19 U	62	4
		SH-DR-01	0.4-1	C / E	11 U	62	4
		SH-DR-02	0-0.5	C / E	12 U	62	4
		SH-DR-03	0-0.5	C / E	12 U	62	4
		SH-DR-04	0-0.5	C / E	12 U	62	4
		SH-DR-05	0-0.5	C / E	12 U	62	4
		SH-DR-06	0-0.5	C / E	14 U	62	4

Notes:

[1] Chemical analyses conducted by Columbia Analytical Services of Kelso, Washington.

[2] Aroclors 1016, 1221, 1232, 1242, 1248, 1254 and 1260 analyzed by USEPA Method 8082.

[3] Total PCBs were calculated per SAPA guidance (Ecology 2008b); i.e., the sum of Aroclors is represented by the sum of all detected Aroclors, or, when no Aroclors were detected, the sum is represented by the single highest non-detect result.

[4] The analyte was not detected at the value reported. Value reported represents method detection limit (MDL).

[5] The screening level is the same for saturated and unsaturated soils.

PCBs = Polychlorinated biphenyls

µg/kg = Micrograms per kilogram

U = analyzed and not detected at the value reported. Value reported represents practical quantitation limit (PQL), with exceptions noted.

J = The analyte was detected at the value reported; the reported value is estimated.

-- = Not applicable, or no screening level available.

🟨 = Value exceeds soil screening level when rounded to same number of significant figures as soil screening level.

🟥 = Value exceeds sediment screening level when rounded to same number of significant figures as sediment screening level.

🟩 = PQL exceeds screening level when rounded to same number of significant figures as screening level.

Applicable Screening Levels

- A - Not near or upgradient of local surface water body and unsaturated.
- B - Not near or upgradient of local surface water body and saturated.
- C - Near or upgradient of local surface water body and unsaturated.
- D - Near or upgradient of local surface water body and saturated.
- E - Seasonally submerged; results compared to both soil and sediment screening levels.
- F - Results compared to sediment screening levels.

TABLE 47
SUMMARY OF SOIL/SEDIMENT ANALYTICAL RESULTS[1]
SEMIVOLATILE ORGANIC COMPOUNDS[2]
GOOSE LAKE AND DRAINAGE RAVINE
GOOSE LAKE SITE
SHELTON, WASHINGTON

Analyte	Sample Station	Sample Depth (feet)	Applicable Screening Levels	Concentration (µg/kg)	Sediment Screening Level (µg/kg)	Soil Screening Level (Near or Upgradient of Local Surface Water Body) (Unsaturated) (µg/kg)
1,2-DICHLOROBENZENE	SED-01	0-0.15	F	170U	--	--
	SED-01	1.7-4.1	F	97U	--	--
	SED-01 (DUP)	1.7-4.1	F	97U	--	--
	SED-04	0-0.15	F	100U	--	--
	SED-04	1.8-5.6	F	140U	--	--
	SED-09	0-0.4	C / E	110U[4]	--	7,200,000
1,3-DICHLOROBENZENE	SED-01	0-0.15	F	170U	--	--
	SED-01	1.7-4.1	F	97U	--	--
	SED-01 (DUP)	1.7-4.1	F	97U	--	--
	SED-04	0-0.15	F	100U	--	--
	SED-04	1.8-5.6	F	140U	--	--
	SED-09	0-0.4	C / E	110U[4]	--	--
1,4-DICHLOROBENZENE	SED-01	0-0.15	F	170U	--	--
	SED-01	1.7-4.1	F	97U	--	--
	SED-01 (DUP)	1.7-4.1	F	97U	--	--
	SED-04	0-0.15	F	100U	--	--
	SED-04	1.8-5.6	F	140U	--	--
	SED-09	0-0.4	C / E	98U[4]	--	20,000
2,4-DIMETHYLPHENOL	SED-01	0-0.15	F	810U	--	--
	SED-01	1.7-4.1	F	490U	--	--
	SED-01 (DUP)	1.7-4.1	F	490U	--	--
	SED-04	0-0.15	F	500U	--	--
	SED-04	1.8-5.6	F	690U	--	--
	SED-09	0-0.4	C / E	630U[4]	--	1,600,000
2-METHYLNAPHTHALENE	SED-01	0-0.15	F	170U	469	--
	SED-01	1.7-4.1	F	97U	469	--
	SED-01 (DUP)	1.7-4.1	F	97U	469	--
	SED-04	0-0.15	F	100U	469	--
	SED-04	1.8-5.6	F	140U	469	--
	SED-09	0-0.4	C / E	130U[4]	469	320,000
2-METHYLPHENOL	SED-01	0-0.15	F	170U	--	--
	SED-01	1.7-4.1	F	97U	--	--
	SED-01 (DUP)	1.7-4.1	F	97U	--	--
	SED-04	0-0.15	F	100U	--	--
	SED-04	1.8-5.6	F	140U	--	--
	SED-09	0-0.4	C / E	100U[4]	--	4,000,000
ACENAPHTHENE	SED-01	0-0.15	F	170U	1,060	--
	SED-01	1.7-4.1	F	97U	1,060	--
	SED-01 (DUP)	1.7-4.1	F	97U	1,060	--
	SED-04	0-0.15	F	100U	1,060	--
	SED-04	1.8-5.6	F	140U	1,060	--
	SED-09	0-0.4	C / E	110U[4]	1,060	20,000
ACENAPHTHYLENE	SED-01	0-0.15	F	170U	470	--
	SED-01	1.7-4.1	F	97U	470	--
	SED-01 (DUP)	1.7-4.1	F	97U	470	--
	SED-04	0-0.15	F	120	470	--
	SED-04	1.8-5.6	F	140U	470	--
	SED-09	0-0.4	C / E	68U[4]	470	--
ANTHRACENE	SED-01	0-0.15	F	170U	1,230	--
	SED-01	1.7-4.1	F	97U	1,230	--
	SED-01 (DUP)	1.7-4.1	F	97U	1,230	--
	SED-04	0-0.15	F	190	1,230	--
	SED-04	1.8-5.6	F	140U	1,230	--
	SED-09	0-0.4	C / E	97U[4]	1,230	24,000,000
BENZO(G,H,I)PERYLENE	SED-01	0-0.15	F	550J	4,020	--
	SED-01	1.7-4.1	F	97U	4,020	--
	SED-01 (DUP)	1.7-4.1	F	97U	4,020	--
	SED-04	0-0.15	F	690	4,020	--
	SED-04	1.8-5.6	F	140U	4,020	--
	SED-09	0-0.4	C / E	43U[4]	4,020	--
BENZOIC ACID	SED-01	0-0.15	F	1,200J	2,910	--
	SED-01	1.7-4.1	F	2,000U	2,910	--
	SED-01 (DUP)	1.7-4.1	F	2,000U	2,910	--
	SED-04	0-0.15	F	2,000U	2,910	--
	SED-04	1.8-5.6	F	2,800U	2,910	--
	SED-09	0-0.4	C / E	6,600R	2,910	320,000,000
BENZYL ALCOHOL	SED-01	0-0.15	F	170U	--	--
	SED-01	1.7-4.1	F	97U	--	--
	SED-01 (DUP)	1.7-4.1	F	97U	--	--
	SED-04	0-0.15	F	100U	--	--
	SED-04	1.8-5.6	F	140U	--	--
	SED-09	0-0.4	C / E	120U[4]	--	24,000,000
BENZYL BUTYL PHTHALATE	SED-01	0-0.15	F	170U	260	--
	SED-01	1.7-4.1	F	97U	260	--
	SED-01 (DUP)	1.7-4.1	F	97U	260	--
	SED-04	0-0.15	F	100U	260	--
	SED-04	1.8-5.6	F	140U	260	--
	SED-09	0-0.4	C / E	270R	260	16,000,000
BIS(2-ETHYLHEXYL)PHTHALATE	SED-01	0-0.15	F	2,000U[4]	2,520	--
	SED-01	1.7-4.1	F	2,000U	2,520	--
	SED-01 (DUP)	1.7-4.1	F	2,000U	2,520	--
	SED-04	0-0.15	F	2,000U	2,520	--
	SED-04	1.8-5.6	F	1,700U[4]	2,520	--
	SED-09	0-0.4	C / E	110R	2,520	71,000
DIBENZOFURAN	SED-01	0-0.15	F	170U	399	--
	SED-01	1.7-4.1	F	97U	399	--
	SED-01 (DUP)	1.7-4.1	F	97U	399	--
	SED-04	0-0.15	F	100U	399	--
	SED-04	1.8-5.6	F	140U	399	--
	SED-09	0-0.4	C / E	120U[4]	399	160,000
DIETHYL PHTHALATE	SED-01	0-0.15	F	170U	--	--
	SED-01	1.7-4.1	F	97U	--	--
	SED-01 (DUP)	1.7-4.1	F	97U	--	--
	SED-04	0-0.15	F	100U	--	--
	SED-04	1.8-5.6	F	140U	--	--
	SED-09	0-0.4	C / E	130U[4]	--	100,000

TABLE 47

SUMMARY OF SOIL/SEDIMENT ANALYTICAL RESULTS[1]

SEMIVOLATILE ORGANIC COMPOUNDS[2]

GOOSE LAKE AND DRAINAGE RAVINE

GOOSE LAKE SITE
SHELTON, WASHINGTON

Analyte	Sample Station	Sample Depth (feet)	Applicable Screening Levels	Concentration (µg/kg)	Sediment Screening Level (µg/kg)	Soil Screening Level (Near or Upgradient of Local Surface Water Body) (Unsaturated) (µg/kg)
DIMETHYL PHTHALATE	SED-01	0-0.15	F	170U	311	--
	SED-01	1.7-4.1	F	97U	311	--
	SED-01 (DUP)	1.7-4.1	F	97U	311	--
	SED-04	0-0.15	F	100U	311	--
	SED-04	1.8-5.6	F	140U	311	--
	SED-09	0-0.4	C / E	110U[4]	311	200,000
DI-N-BUTYLPHTHALATE	SED-01	0-0.15	F	42U[4]	103	--
	SED-01	1.7-4.1	F	97U	103	--
	SED-01 (DUP)	1.7-4.1	F	97U	103	--
	SED-04	0-0.15	F	100U	103	--
	SED-04	1.8-5.6	F	36U[4]	103	--
	SED-09	0-0.4	C / E	110U[4]	103	200,000
DI-N-OCTYLPHTHALATE	SED-01	0-0.15	F	27U[4]	20	--
	SED-01	1.7-4.1	F	16U[4]	20	--
	SED-01 (DUP)	1.7-4.1	F	16U[4]	20	--
	SED-04	0-0.15	F	17U[4]	20	--
	SED-04	1.8-5.6	F	23U[4]	20	--
	SED-09	0-0.4	C / E	68U[4]	20	1,600,000
FLUORANTHENE	SED-01	0-0.15	F	890J	11,100	--
	SED-01	1.7-4.1	F	97U	11,100	--
	SED-01 (DUP)	1.7-4.1	F	97U	11,100	--
	SED-04	0-0.15	F	1400	11,100	--
	SED-04	1.8-5.6	F	140U	11,100	--
	SED-09	0-0.4	C / E	100U[4]	11,100	3,200,000
HEXACHLORO-1,3-BUTADIENE	SED-01	0-0.15	F	170U	--	--
	SED-01	1.7-4.1	F	97U	--	--
	SED-01 (DUP)	1.7-4.1	F	97U	--	--
	SED-04	0-0.15	F	100U	--	--
	SED-04	1.8-5.6	F	140U	--	--
	SED-09	0-0.4	C / E	120U[4]	--	13,000
HEXACHLOROBENZENE	SED-01	0-0.15	F	170U	--	--
	SED-01	1.7-4.1	F	97U	--	--
	SED-01 (DUP)	1.7-4.1	F	97U	--	--
	SED-04	0-0.15	F	100U	--	--
	SED-04	1.8-5.6	F	140U	--	--
	SED-09	0-0.4	C / E	130U[4]	--	630
HEXACHLOROETHANE	SED-01	0-0.15	F	170U	--	--
	SED-01	1.7-4.1	F	97U	--	--
	SED-01 (DUP)	1.7-4.1	F	97U	--	--
	SED-04	0-0.15	F	100U	--	--
	SED-04	1.8-5.6	F	140U	--	--
	SED-09	0-0.4	C / E	96U[4]	--	71,000
PENTACHLOROPHENOL	SED-01	0-0.15	F	810U	--	--
	SED-01	1.7-4.1	F	490U	--	--
	SED-01 (DUP)	1.7-4.1	F	490U	--	--
	SED-04	0-0.15	F	500U	--	--
	SED-04	1.8-5.6	F	690U	--	--
	SED-09	0-0.4	C / E	470R	--	8,300
PHENANTHRENE	SED-01	0-0.15	F	510J	6,100	--
	SED-01	1.7-4.1	F	97U	6,100	--
	SED-01 (DUP)	1.7-4.1	F	99	6,100	--
	SED-04	0-0.15	F	870	6,100	--
	SED-04	1.8-5.6	F	140U	6,100	--
	SED-09	0-0.4	C / E	85U[4]	6,100	--
PHENOL	SED-01	0-0.15	F	490U	--	--
	SED-01	1.7-4.1	F	290U	--	--
	SED-01 (DUP)	1.7-4.1	F	300U	--	--
	SED-04	0-0.15	F	300U	--	--
	SED-04	1.8-5.6	F	410U	--	--
	SED-09	0-0.4	C / E	120R	--	30,000
PYRENE	SED-01	0-0.15	F	1,400J	8,790	--
	SED-01	1.7-4.1	F	110	8,790	--
	SED-01 (DUP)	1.7-4.1	F	120	8,790	--
	SED-04	0-0.15	F	2,400	8,790	--
	SED-04	1.8-5.6	F	140U	8,790	--
	SED-09	0-0.4	C / E	110U[4]	8,790	2,400,000
BENZO(A)ANTHRACENE (cPAH)	SED-01	0-0.15	F	170U	4,260	--
	SED-01	1.7-4.1	F	97U	4,260	--
	SED-01 (DUP)	1.7-4.1	F	97U	4,260	--
	SED-04	0-0.15	F	270	4,260	--
	SED-04	1.8-5.6	F	140U	4,260	--
	SED-09	0-0.4	C / E	45U[4]	4,260	--
CHRYSENE (cPAH)	SED-01	0-0.15	F	180J	5,940	--
	SED-01	1.7-4.1	F	97U	5,940	--
	SED-01 (DUP)	1.7-4.1	F	97U	5,940	--
	SED-04	0-0.15	F	330	5,940	--
	SED-04	1.8-5.6	F	140U	5,940	--
	SED-09	0-0.4	C / E	45U[4]	5,940	--
BENZO(B)FLUORANTHENE (cPAH)	SED-01	0-0.15	F	300J	11,000*	--
	SED-01	1.7-4.1	F	97U	11,000*	--
	SED-01 (DUP)	1.7-4.1	F	97U	11,000*	--
	SED-04	0-0.15	F	660	11,000*	--
	SED-04	1.8-5.6	F	140U	11,000*	--
	SED-09	0-0.4	C / E	39U[4]	11,000*	--
BENZO(K)FLUORANTHENE (cPAH)	SED-01	0-0.15	F	170U	11,000*	--
	SED-01	1.7-4.1	F	97U	11,000*	--
	SED-01 (DUP)	1.7-4.1	F	97U	11,000*	--
	SED-04	0-0.15	F	100U	11,000*	--
	SED-04	1.8-5.6	F	140U	11,000*	--
	SED-09	0-0.4	C / E	67U[4]	11,000*	--
BENZO(A)PYRENE (cPAH)	SED-01	0-0.15	F	280J	3,300	--
	SED-01	1.7-4.1	F	97U	3,300	--
	SED-01 (DUP)	1.7-4.1	F	97U	3,300	--
	SED-04	0-0.15	F	530	3,300	--
	SED-04	1.8-5.6	F	140U	3,300	--
	SED-09	0-0.4	C / E	40U[4]	3,300	--

TABLE 47

SUMMARY OF SOIL/SEDIMENT ANALYTICAL RESULTS[1]
SEMIVOLATILE ORGANIC COMPOUNDS[2]
GOOSE LAKE AND DRAINAGE RAVINE

GOOSE LAKE SITE
SHELTON, WASHINGTON

Analyte	Sample Station	Sample Depth (feet)	Applicable Screening Levels	Concentration (µg/kg)	Sediment Screening Level (µg/kg)	Soil Screening Level (Near or Upgradient of Local Surface Water Body) (Unsaturated) (µg/kg)
INDENO(1,2,3-CD)PYRENE (cPAH)	SED-01	0-0.15	F	250J	4,120	--
	SED-01	1.7-4.1	F	97U	4,120	--
	SED-01 (DUP)	1.7-4.1	F	97U	4,120	--
	SED-04	0-0.15	F	370	4,120	--
	SED-04	1.8-5.6	F	140U	4,120	--
	SED-09	0-0.4	C / E	20U[4]	4,120	--
DIBENZ(A,H)ANTHRACENE (cPAH)	SED-01	0-0.15	F	170U	800	--
	SED-01	1.7-4.1	F	97U	800	--
	SED-01 (DUP)	1.7-4.1	F	97U	800	--
	SED-04	0-0.15	F	100U	800	--
	SED-04	1.8-5.6	F	140U	800	--
	SED-09	0-0.4	C / E	41U[4]	800	--
Total cPAHs TEQ[3]	SED-01	0-0.15	F	350	--	--
	SED-01	1.7-4.1	F	68U	--	--
	SED-01 (DUP)	1.7-4.1	F	68U	--	--
	SED-04	0-0.15	F	670	--	--
	SED-04	1.8-5.6	F	99U	--	--
	SED-09	0-0.4	C / E	29U[4]	--	140

Notes:

[1] Chemical analyses conducted by Columbia Analytical Services of Kelso, Washington.

[2] Semivolatile organic compounds analyzed by USEPA Method 8270C.

[3] TEQ calculated using toxicity equivalent factors (TEFs) listed in MTCA Table 708-2. For non-detect results, if there was at least one positive detection of the analyte in any RI soil or sediment sample, 1/2 the practical quantitation limit (or method detection limit) was used in the calculation. Otherwise, zero was used for non-detect results.

[4] The analyte was not detected at the value reported. Value reported represents method detection limit (MDL).

* Value listed is for total benzofluoranthenes.

µg/kg = Micrograms per kilogram

U = Analyte was not detected at the value reported. Value reported represents the practical quantitation limit (PQL), with exceptions noted.

J = The analyte was detected at the value reported; the reported value is estimated.

R = Datum rejected based on quality control data review/validation.

-- = Not applicable, or no screening level available.

🟩 = PQL (or MDL where noted) exceeds screening level when rounded to same number of significant figures as screening level.

🟪 = Value rejected ("R" flag) based on data quality assessment.

🟨 = Value exceeds soil screening level when rounded to same number of significant figures as soil screening level.

🟥 = Value exceeds sediment screening level when rounded to same number of significant figures as sediment screening level.

🟦 = Results for blue-shaded samples were compared to both soil and sediment screening levels; results for samples with no blue shading were compared to sediment screening levels only. Drainage ravine soil/sediment samples (SED-09 through SED-12) were collected from locations that are seasonally submerged, so they are compared to sediment and soil values. Goose Lake sediment samples (SED-01 to SED-08) were compared to sediment values only.

Applicable Screening Levels

- A - Not near or upgradient of local surface water body and unsaturated.
- B - Not near or upgradient of local surface water body and saturated.
- C - Near or upgradient of local surface water body and unsaturated.
- D - Near or upgradient of local surface water body and saturated.
- E - Seasonally submerged; results compared to both soil and sediment screening levels.
- F - Results compared to sediment screening levels.

TABLE 48
SUMMARY OF SOIL/SEDIMENT ANALYTICAL RESULTS
CONVENTIONAL CHEMISTRY[1]
GOOSE LAKE AND DRAINAGE RAVINE SEDIMENT
GOOSE LAKE SITE
SHELTON, WASHINGTON

Conventional Parameter	Sample Station	Sample Depth (feet)	Applicable Screening Levels	Concentration	Sediment Screening Level (mg/kg)	Soil Screening Level (Near or Upgradient of Local Surface Water Body) (Unsaturated) (mg/kg)
Sulfide[2] (mg/kg)	SED-01	0-0.15	F	6,990 J	702	--
	SED-01	1.7-4.1	F	409 J	702	--
	SED-01 DUP	1.7-4.1	F	232 J	702	--
	SED-02	0.9-1.5	F	69 J	702	--
	SED-03	0-0.15	F	30,000 J	702	--
	SED-03	1.9-5.8	F	5 J	702	--
	SED-03	6.2-9.7	F	8 J	702	--
	SED-04	0-0.15	F	57,900 J	702	--
	SED-04	1.8-5.6	F	17 J	702	--
	SED-05	0-0.15	F	11,700 J	702	--
	SED-05	2.3-5.1	F	40 J	702	--
	SED-05	5.1-5.6	F	16 J	702	--
	SED-06	0-0.15	F	72,400 J	702	--
	SED-06	1.3-5	F	25 J	702	--
	SED-07	0-0.15	F	29,100 J	702	--
	SED-07	2-5.3	F	7 J	702	--
	SED-08	0-0.15	F	6,060 J	702	--
	SED-08	1.8-4.8	F	290 J	702	--
	SED-09	0-0.4	C / E	14	702	--
Total Organic Carbon[3] (%)	SED-01	0-0.15	F	13 (a)	9.82	--
	SED-01	1.7-4.1	F	47.3 (a)	9.82	--
	SED-01 DUP	1.7-4.1	F	45.6 (a)	9.82	--
	SED-02	0.9-1.5	F	43.6 (a)	9.82	--
	SED-03	0-0.15	F	12.1 (a)	9.82	--
	SED-03	1.9-5.8	F	33.7 (a)	9.82	--
	SED-03	6.2-9.7	F	50.1 (a)	9.82	--
	SED-04	0-0.15	F	15.3 (a)	9.82	--
	SED-04	1.8-5.6	F	39 (a)	9.82	--
	SED-05	0-0.15	F	27.7 (a)	9.82	--
	SED-05	2.3-5.1	F	19.9 (a)	9.82	--
	SED-05	5.1-5.6	F	1.87	9.82	--
	SED-06	0-0.15	F	12.3 (a)	9.82	--
	SED-06	1.3-5	F	38 (a)	9.82	--
	SED-07	0-0.15	F	15.3 (a)	9.82	--
	SED-07	2-5.3	F	34.9 (a)	9.82	--
	SED-08	0-0.15	F	13.7 (a)	9.82	--
	SED-08	1.8-4.8	F	44.8 (a)	9.82	--
	SED-09	0-0.4	C / E	31.4 (a)	9.82	--
Ammonia[4] (mg/kg)	SED-01	0-0.15	F	262 J	--	--
	SED-01	1.7-4.1	F	570 J	--	--
	SED-DUP-01	1.7-4.1	F	598 J	--	--
	SED-02	0.9-1.5	F	187 J	--	--
	SED-03	0-0.15	F	29.8 J	--	--
	SED-03	1.9-5.8	F	87 J	--	--
	SED-03	6.2-9.7	F	94.8 J	--	--
	SED-04	0-0.15	F	446 J	--	--
	SED-04	1.8-5.6	F	116 J	--	--
	SED-05	0-0.15	F	163 J	--	--
	SED-05	2.3-5.1	F	124 J	--	--
	SED-05	5.1-5.6	F	55.2 J	--	--
	SED-06	0-0.15	F	32.2 J	--	--
	SED-06	1.3-5	F	179 J	--	--
	SED-07	0-0.15	F	53.6 J	--	--
	SED-07	2-5.3	F	139 J	--	--
	SED-08	0-0.15	F	63.5 J	--	--
	SED-08	1.8-4.8	F	394 J	--	--
	SED-09	0-0.4	C / E	33	--	--

Conventional Parameter	Sample Station	Sample Depth (feet)	Applicable Screening Levels	Concentration	Sediment Screening Level (mg/kg)	Soil Screening Level (Near or Upgradient of Local Surface Water Body) (Unsaturated) (mg/kg)
Oxygen-Reduction Potential[5] (mV)	SED-03	6.2-9.7	F	234	--	--
	SED-09	0-0.4	C / E	108	--	--
pH[6] (pH Units)	SED-01	0-0.15	F	6.82	--	--
	SED-01	1.7-4.1	F	7.09	--	--
	SED-DUP-01	1.7-4.1	F	7.05	--	--
	SED-02	0.9-1.5	F	6.6 J	--	--
	SED-03	0-0.15	F	6.89	--	--
	SED-03	1.9-5.8	F	6.18	--	--
	SED-03	6.2-9.7	F	5.95	--	--
	SED-04	0-0.15	F	7.08	--	--
	SED-04	1.8-5.6	F	5.69	--	--
	SED-05	0-0.15	F	6.96 J	--	--
	SED-05	2.3-5.1	F	6.89	--	--
	SED-05	5.1-5.6	F	7.15	--	--
	SED-06	0-0.15	F	6.96	--	--
	SED-06	1.3-5	F	6.63 J	--	--
	SED-07	0-0.15	F	6.87	--	--
	SED-07	2-5.3	F	5.99 J	--	--
	SED-08	0-0.15	F	7.16 J	--	--
	SED-08	1.8-4.8	F	6.57	--	--
	SED-09	0-0.4	C / E	5.24	--	--
Total Solids[7] (%)	SED-02	0.9-1.5	F	15.2	--	--
	SED-03	6.2-9.7	F	9.45	--	--
	SED-05	0-0.15	F	7.99	--	--
	SED-05	5.1-5.6	F	76.4	--	--
	SED-06	1.3-5	F	15.4	--	--
	SED-07	2-5.3	F	16.6	--	--
	SED-08	0-0.15	F	10.9	--	--
	SED-09	0-0.4	C / E	24	--	--

Notes:

[1] Chemical analyses conducted by Columbia Analytical Services of Kelso, Washington.

[2] Sulfide analyzed by USEPA 9030B.

[3] Total organic carbon (TOC) analyzed by USEPA 9060.

[4] Ammonia analyzed by PLUMB NH3S.

[5] Oxidation-reduction potential analyzed by ASTM D1498-76.

[6] pH analyzed by USEPA 9045C.

[7] Total solids analyzed by Puget Sound Estuary Program (PSEP) 160.3 mod.

(a) TOC in surficial black silt samples is generally lower than in underlying native organic sediments. This suggests TOC is naturally occurring. Accordingly, TOC is not considered a COPC.

mg/kg = Milligrams per kilogram

mV = Millivolts

J = The analyte was detected at the value reported; the reported value is estimated.

-- = Not applicable, or no screening level available.

🟨 = Value exceeds screening level when rounded to same number of significant figures as screening level.

🟥 = Value exceeds sediment screening level when rounded to same number of significant figures as sediment screening level.

🟦 = Results for blue-shaded samples were compared to both soil and sediment screening levels; results for samples with no blue shading were compared to sediment screening levels only. Drainage ravine soil/sediment samples (SED-09 through SED-12) were collected from locations that are seasonally submerged, so they are compared to sediment and soil screening levels. Goose Lake sediment samples (SED-01 to SED-08) are compared to sediment screening levels only.

Applicable Screening Levels

A - Not near or upgradient of local surface water body and unsaturated.

B - Not near or upgradient of local surface water body and saturated.

C - Near or upgradient of local surface water body and unsaturated.

D - Near or upgradient of local surface water body and saturated.

E - Seasonally submerged; results compared to both soil and sediment screening levels.

F - Results compared to sediment screening levels.

TABLE 49
SUMMARY OF FISH TISSUE ANALYTICAL RESULTS[1]
METALS[2]
GOOSE LAKE SITE
SHELTON, WASHINGTON

Metal	**Concentration (mg/kg wet-weight)**	**Sample**
Arsenic	0.1 U	gl-Fish 1, body
	0.1 U	gl-Fish 1, fillet
	0.1 U	gl-Fish 2, body
	0.1 U	gl-Fish 2, fillet
	0.1 U	gl-Fish 3, body
	0.1 U	gl-Fish 3, fillet
	0.2 U	gl-Fish 4, body
	0.1 U	gl-Fish 4, fillet
Cadmium	0.01 U	gl-Fish 1, body
	0.01 U	gl-Fish 1, fillet
	0.01 U	gl-Fish 2, body
	0.01 U	gl-Fish 2, fillet
	0.03	gl-Fish 3, body
	0.01 U	gl-Fish 3, fillet
	0.02 U	gl-Fish 4, body
	0.01 U	gl-Fish 4, fillet
Copper	0.56	gl-Fish 1, body
	0.87	gl-Fish 1, fillet
	0.70	gl-Fish 2, body
	0.48	gl-Fish 2, fillet
	0.77	gl-Fish 3, body
	0.73	gl-Fish 3, fillet
	0.62	gl-Fish 4, body
	0.80	gl-Fish 4, fillet
Lead	0.02	gl-Fish 1, body
	0.01	gl-Fish 1, fillet
	0.05	gl-Fish 2, body
	0.01	gl-Fish 2, fillet
	0.04	gl-Fish 3, body
	0.004 U	gl-Fish 3, fillet
	0.04	gl-Fish 4, body
	0.01	gl-Fish 4, fillet
Mercury	0.04	gl-Fish 1, body
	0.06	gl-Fish 1, fillet
	0.03	gl-Fish 2, body
	0.05	gl-Fish 2, fillet
	0.04	gl-Fish 3, body
	0.05	gl-Fish 3, fillet
	0.03	gl-Fish 4, body
	0.05	gl-Fish 4, fillet

Metal	Concentration (mg/kg wet-weight)	Sample
Nickel	0.06	gl-Fish 1, body
	0.07	gl-Fish 1, fillet
	0.09	gl-Fish 2, body
	0.07	gl-Fish 2, fillet
	0.11	gl-Fish 3, body
	0.06	gl-Fish 3, fillet
	0.09	gl-Fish 4, body
	0.05	gl-Fish 4, fillet
Zinc	16.00	gl-Fish 1, body
	4.70	gl-Fish 1, fillet
	17.50	gl-Fish 2, body
	5.80	gl-Fish 2, fillet
	24.80	gl-Fish 3, body
	6.60	gl-Fish 3, fillet
	26.60	gl-Fish 4, body
	5.30	gl-Fish 4, fillet

Notes:

[1] Chemical analyses conducted by Columbia Analytical Services of Kelso, Washington.

[2] Metals analyzed by EPA 6000/7000 Series methods.

mg/kg = Milligrams per kilogram

U = The analyte was not detected at the value reported.

gl = Goose Lake

TABLE 50

SUMMARY OF FISH TISSUE ANALYTICAL RESULTS[1]

DIOXIN TEQ VALUES AND POLYCHLORINATED BIPHENYL[2] CONGENERS

GOOSE LAKE SITE
SHELTON, WASHINGTON

Congener	Fish 1-Body	Fish 1-Fillet	Fish 2-Body	Fish 2-Fillet
Dioxins TEQ (f) (ng/kg)				
2,3,7,8-TCDD	ND	ND	ND	ND
1,2,3,7,8-PeCDD	ND	ND	ND	ND
1,2,3,4,7,8-HxCDD	ND	ND	ND	ND
1,2,3,6,7,8-HxCDD	ND	ND	ND	ND
1,2,3,7,8,9-HxCDD	ND	ND	ND	ND
1,2,3,4,6,7,8-HpCDD	ND	ND	ND	ND
OCDD	< 0.0005797	< 0.0001044	< 0.0001236	< 0.00008240
Furans TEQ (f) (ng/kg)				
2,3,7,8-TCDF	0.06475	ND	0.1320	ND
1,2,3,7,8-PeCDF	ND	ND	ND	ND
2,3,4,7,8-PeCDF	ND	ND	0.4275	ND
1,2,3,4,7,8-HxCDF	ND	ND	ND	ND
1,2,3,6,7,8-HxCDF	ND	ND	ND	ND
1,2,3,7,8,9-HxCDF	ND	ND	ND	ND
2,3,4,6,7,8-HxCDF	ND	ND	ND	ND
1,2,3,4,6,7,8-HpCDF	ND	ND	ND	ND
1,2,3,4,7,8,9-HpCDF	ND	ND	ND	ND
OCDF	ND	ND	ND	ND
Total D/F TEQ (ng/kg)	0.06533	0.0001044	0.5596	0.00008240
PCBs (µg/kg)				
PCB 8	ND	ND	ND	ND
PCB 18	ND	ND	ND	ND
PCB 28	0.86	ND	0.66	ND
PCB 52	4.2	0.79	2.7	ND
PCB 44	1.5	ND	1.4	ND
PCB 66	2.1	ND	1.1	ND
PCB 60	ND	ND	ND	ND
PCB 90 + PCB 101	24	4.5	14	ND
PCB 81 (3,4,4',5)	ND	ND	ND	ND
PCB 87	44	1.0	3.3	ND
PCB 77 (3,3',4,4')	ND	ND	ND	ND
PCB 123 (2,3',4,4',5')	ND	ND	ND	ND
PCB 118 (2,3',4,4',5)	ND	ND	ND	ND
PCB 114 (2,3,4,4',5)	ND	ND	ND	ND
PCB 184	ND	ND	ND	ND
PCB 153	66	12	35	3.3
PCB 105 (2,3,3',4,4')	1.9	ND	ND	ND
PCB 138	53	9.8	28	2.4
PCB 158	ND	1.1	ND	ND
PCB 126 (3,3',4,4',5)	ND	ND	ND	ND
PCB 166	ND	ND	ND	ND
PCB 187	44	9.4	24	2.2
PCB 183	21	4.4	12	ND
PCB 128	40	0.71	2.3	ND
PCB 167 (2,3',4,4',5,5')	1.5	ND	0.86	ND
PCB 156 (2,3,3',4,4',5)	9.3	ND	ND	ND
PCB 157 (2,3,3',4,4',5')	ND	ND	ND	ND
PCB 180 (2,2',3,4,4',5,5')	56	11	27	2.2
PCB 169 (3,3',4,4',5,5')	ND	ND	ND	ND
PCB 170 (2,2',3,3',4,4',5)	26	5.2	13	ND
PCB 189 (2,3,3',4,4',5,5')	0.90	ND	0.60	ND
PCB 195	5.3	1.3	2.4	ND
PCB 206	3.3	1.1	1.4	ND
PCB 209	0.64	ND	ND	ND
Total PCB Congeners (µg/kg)	406	62	170	10

Congener	Fish 3-Body	Fish 3-Fillet	Fish 4-Body	Fish 4-Fillet
Dioxins TEQ (f) (ng/kg)				
2,3,7,8-TCDD	ND	ND	ND	ND
1,2,3,7,8-PeCDD	ND	ND	ND	ND
1,2,3,4,7,8-HxCDD	ND	ND	ND	ND
1,2,3,6,7,8-HxCDD	ND	ND	ND	ND
1,2,3,7,8,9-HxCDD	ND	ND	ND	ND
1,2,3,4,6,7,8-HpCDD	ND	ND	ND	ND
OCDD	< 0.0001045	ND	< 0.0001514	< 0.0001048
Furans TEQ (f) (ng/kg)				
2,3,7,8-TCDF	0.07455	ND	0.1411	ND
1,2,3,7,8-PeCDF	ND	ND	ND	ND
2,3,4,7,8-PeCDF	ND	ND	0.4640	ND
1,2,3,4,7,8-HxCDF	ND	ND	ND	ND
1,2,3,6,7,8-HxCDF	ND	ND	ND	ND
1,2,3,7,8,9-HxCDF	ND	ND	ND	ND
2,3,4,6,7,8-HxCDF	ND	ND	ND	ND
1,2,3,4,6,7,8-HpCDF	ND	ND	ND	ND
1,2,3,4,7,8,9-HpCDF	ND	ND	ND	ND
OCDF	ND	ND	ND	ND
Total D/F TEQ (ng/kg)	0.07465	ND	0.6052	0.0001048
PCBs (µg/kg)				
PCB 8	ND	ND	ND	ND
PCB 18	0.53	ND	ND	ND
PCB 28	1.0	ND	0.85	ND
PCB 52	2.7	ND	3.1	ND
PCB 44	1.4	ND	1.3	ND
PCB 66	1.4	ND	1.2	ND
PCB 60	ND	ND	ND	ND
PCB 90 + PCB 101	14	ND	17	2.7
PCB 81 (3,4,4',5)	ND	ND	ND	ND
PCB 87	3.5	ND	4.6	ND
PCB 77 (3,3'4,4')	ND	ND	ND	ND
PCB 123 (2,3',4,4',5')	ND	ND	ND	ND
PCB 118 (2,3',4,4',5)	ND	ND	ND	ND
PCB 114 (2,3,4,4',5)	ND	ND	ND	ND
PCB 184	ND	ND	ND	ND
PCB 153	39	2.4	54	7.7
PCB 105 (2,3,3',4,4')	ND	ND	ND	ND
PCB 138	31	1.7	39	5.7
PCB 158	3.2	ND	3.9	0.71
PCB 126 (3,3',4,4',5)	ND	ND	ND	ND
PCB 166	ND	ND	ND	ND
PCB 187	29	1.7	32	5.4
PCB 183	13	ND	16	2.8
PCB 128	2.3	ND	ND	ND
PCB 167 (2,3',4,4',5,5')	1.0	ND	1.2	ND
PCB 156 (2,3,3',4,4',5)	ND	ND	ND	ND
PCB 157 (2,3,3',4,4',5')	ND	ND	ND	ND
PCB 180 (2,2',3,4,4',5,5')	32	1.6	44	5.3
PCB 169 (3,3',4,4',5,5')	ND	ND	ND	ND
PCB 170 (2,2',3,3',4,4',5)	16	0.71	19	2.4
PCB 189 (2,3,3',4,4',5,5')	0.56	ND	0.56	ND
PCB 195	3.0	ND	3.9	ND
PCB 206	2.0	ND	2.3	ND
PCB 209	ND	ND	ND	ND
Total PCB Congeners (µg/kg)	197	8.1	244	33

Notes:

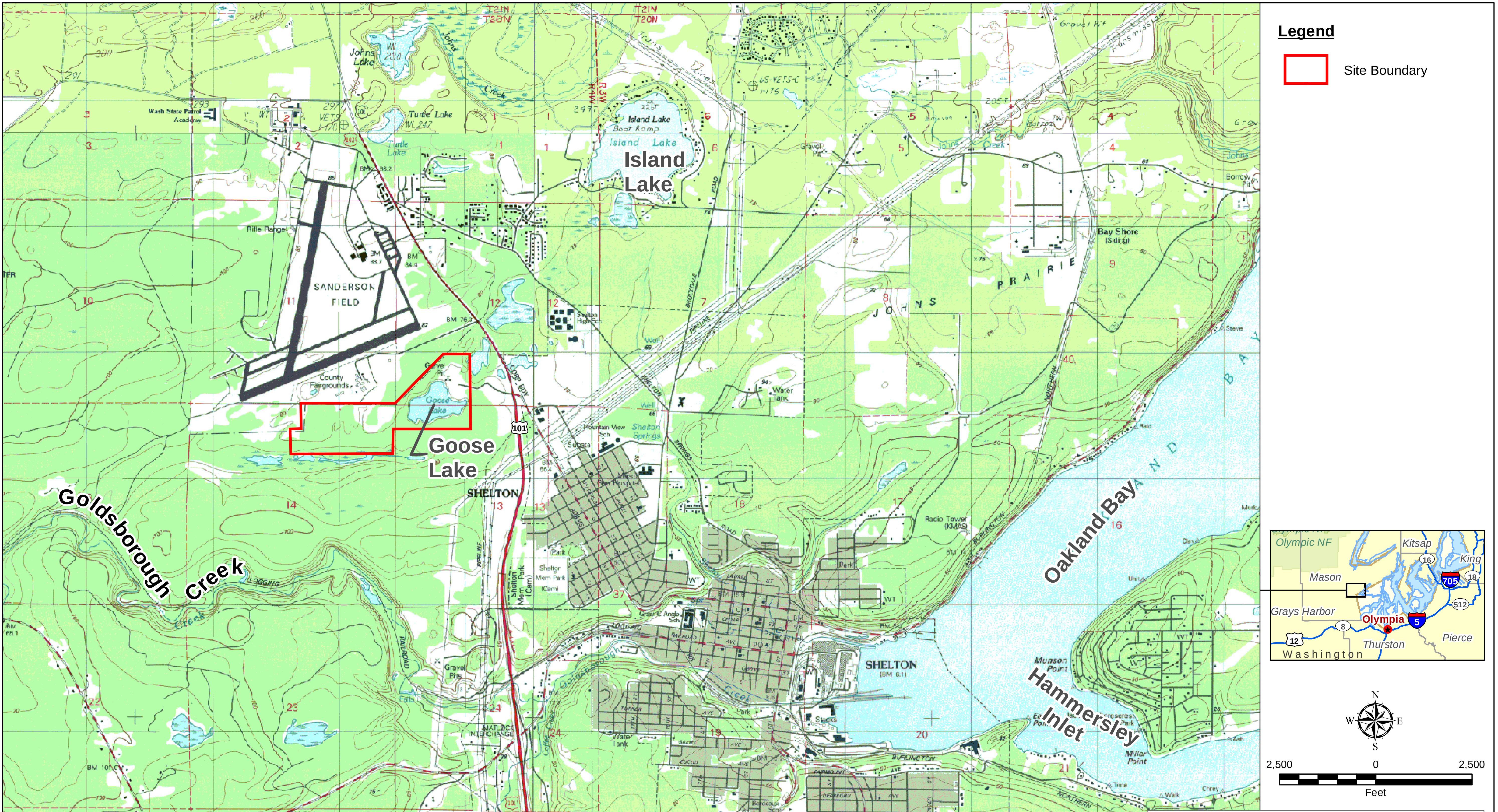
[1] Chemical analyses conducted by Columbia Analytical Services of Kelso, Washington.

[2] Polychlorinated biphenyls analyzed by EPA Method 8082.

f = fish (TEFs based on USEPA 2003 Framework for Application of the Toxicity Equivalence Methodology for Polychlorinated Dioxins, Furans, and Biphenyls in Ecological Risk Assessment).

ng/kg = Nanograms per kilogram
µg/kg = Micrograms per kilogram
D/F = Dioxins/furans
TEQ = Toxicity Equivalency Quotient
TCDD = Tetrachlorodibenzo-p-dioxin
PeCDD = Pentachlorodibenzo-p-dioxin
HxCDD = Hexachlorodibenzo-p-dioxin
HpCDD = Heptachlorodibenzo-p-dioxin
OCDD = Octachlorodibenzo-p-dioxin
TCDF = Tetrachlorodibenzofuran
PeCDF = Pentachlorodibenzofuran
HxCDF = Hexachlorodibenzofuran
HpCDF = Heptachlorodibenzofuran
OCDF = Octachlorodibenzofuran
PCBs = Polychlorinated biphenyls
ND = Congener was not detected above the practical quantitation limit (PQL).

FIGURES



Reference: Topo map obtained from NGS_Topo_US_2D, http://server.arcgisonline.com/arcgis/services (February 2009)
ESRI Data & Maps, Street Maps 2005

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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Vicinity Map

Goose Lake Site
Shelton, Washington

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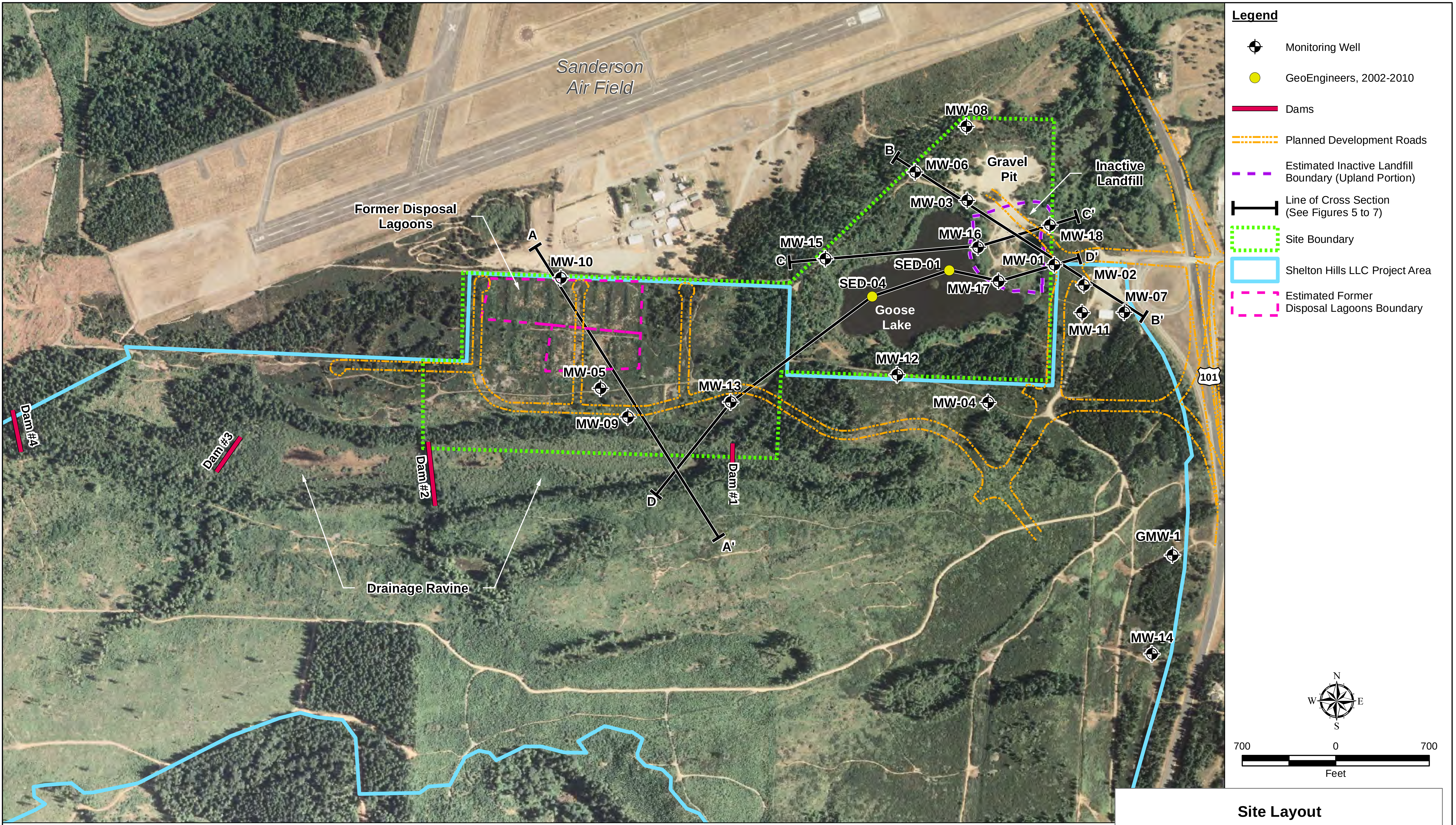
Figure 1



Reference: 2006 NAIP Imagery obtained from US Department of Agriculture, January 2009.
All other GIS layers created by GeoEngineers, Inc.

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Site Layout

Goose Lake Site
Shelton, Washington

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Figure 2

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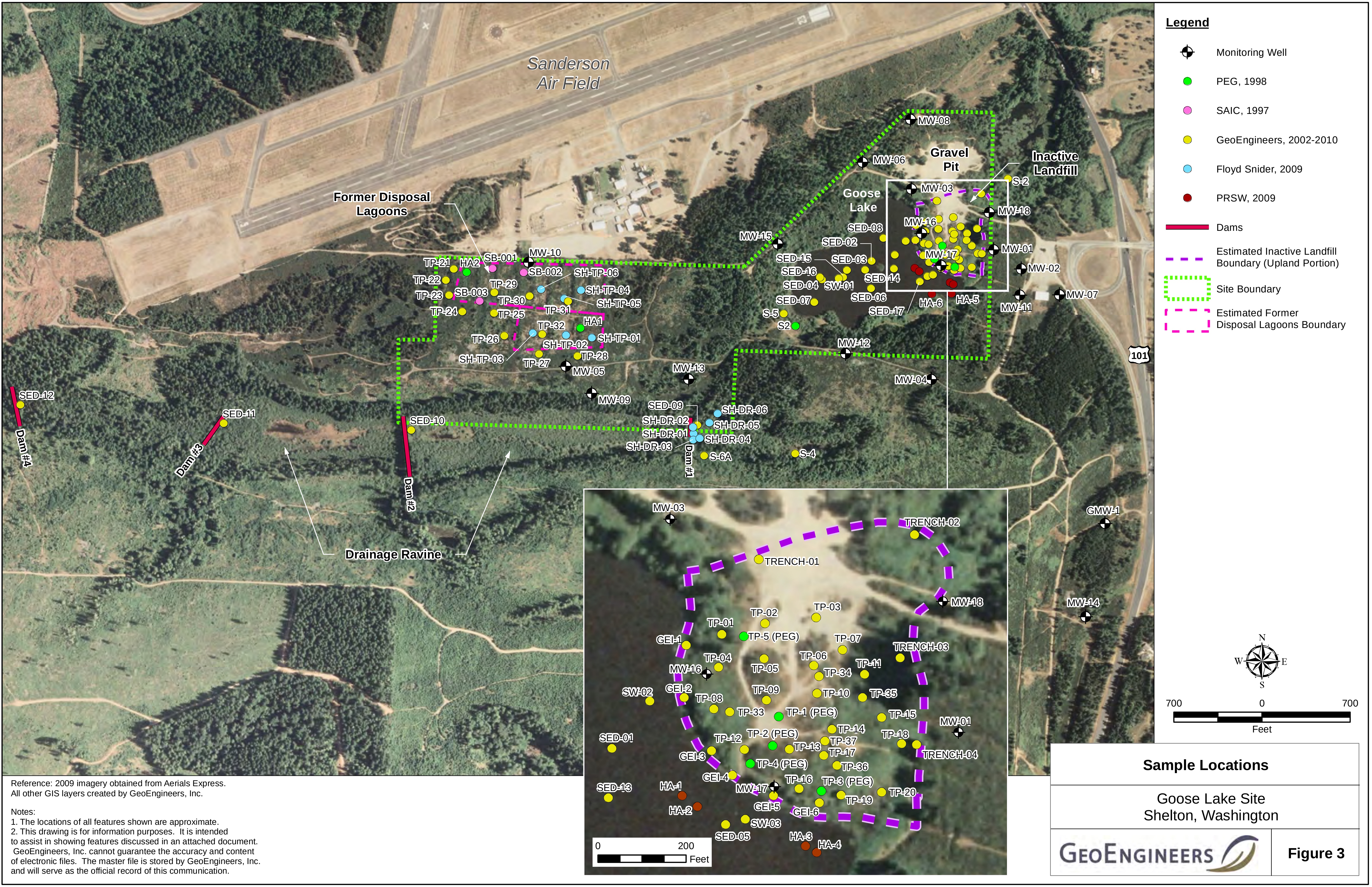

Reference: 2009 imagery obtained from Aerials Express.
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Sample Locations

Goose Lake Site
Shelton, Washington

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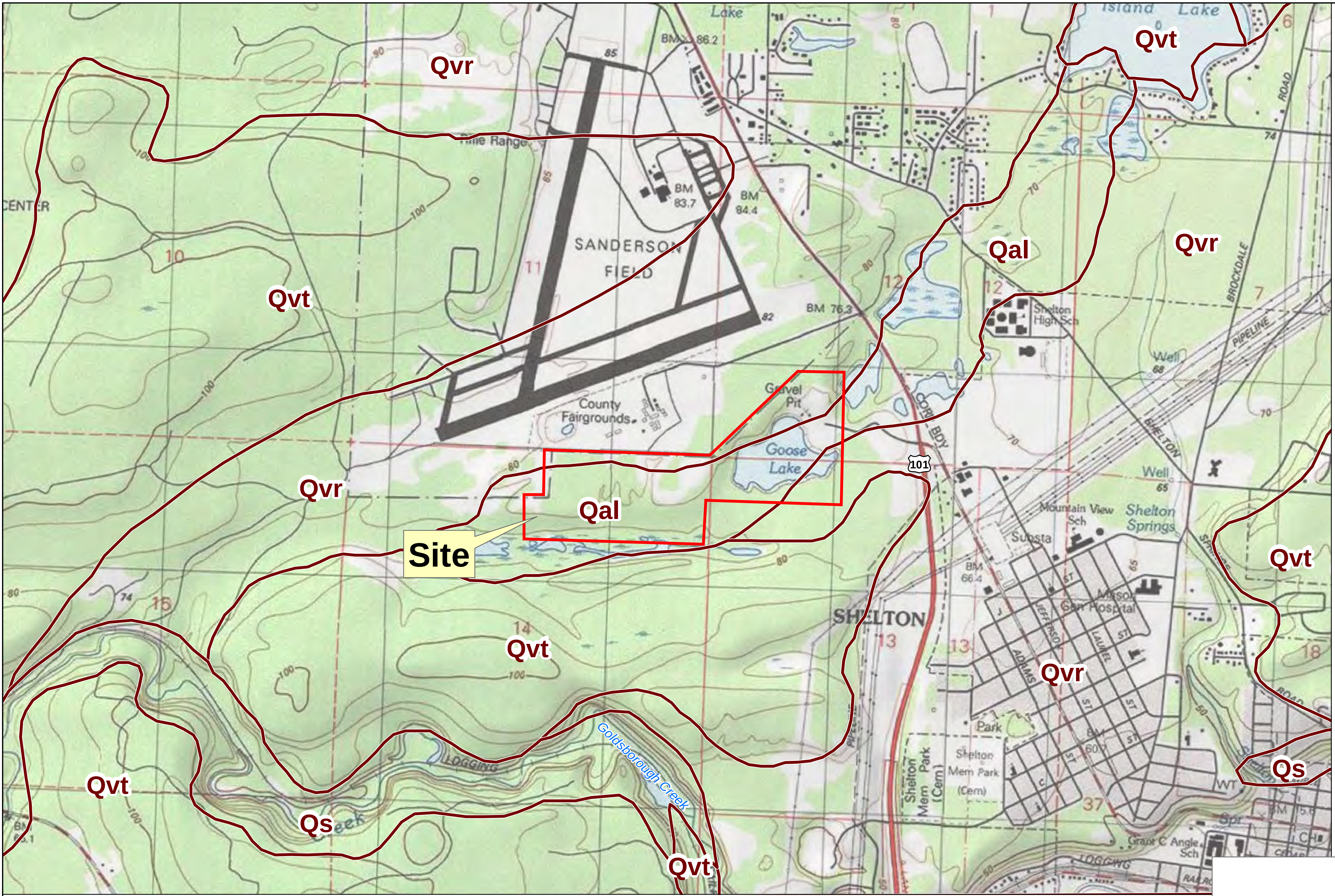
Figure 3



Legend

🟥 Site Boundary

▭ Geologic Unit Boundary

Geologic Units:
Qal = Alluvial deposits
Qvt = Vashon glacial till
Qvr = Vashon recessional outwash
Qs = Skokomish gravel

N
W E
S

1,500 0 1,500
Feet

Reference: Topo map obtained from NGS_Topo_US_2D,
http://server.arcgisonline.com/arcgis/services (February 2009)
Geologic units digitized by GeoEngineers from the Washington State Department of Water Resources,
Water Supply Bulletin 29, Plate 1, "Geology of Southeastern Mason County, Washington" (date not shown).

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Geologic Map

Goose Lake Site
Shelton, Washington

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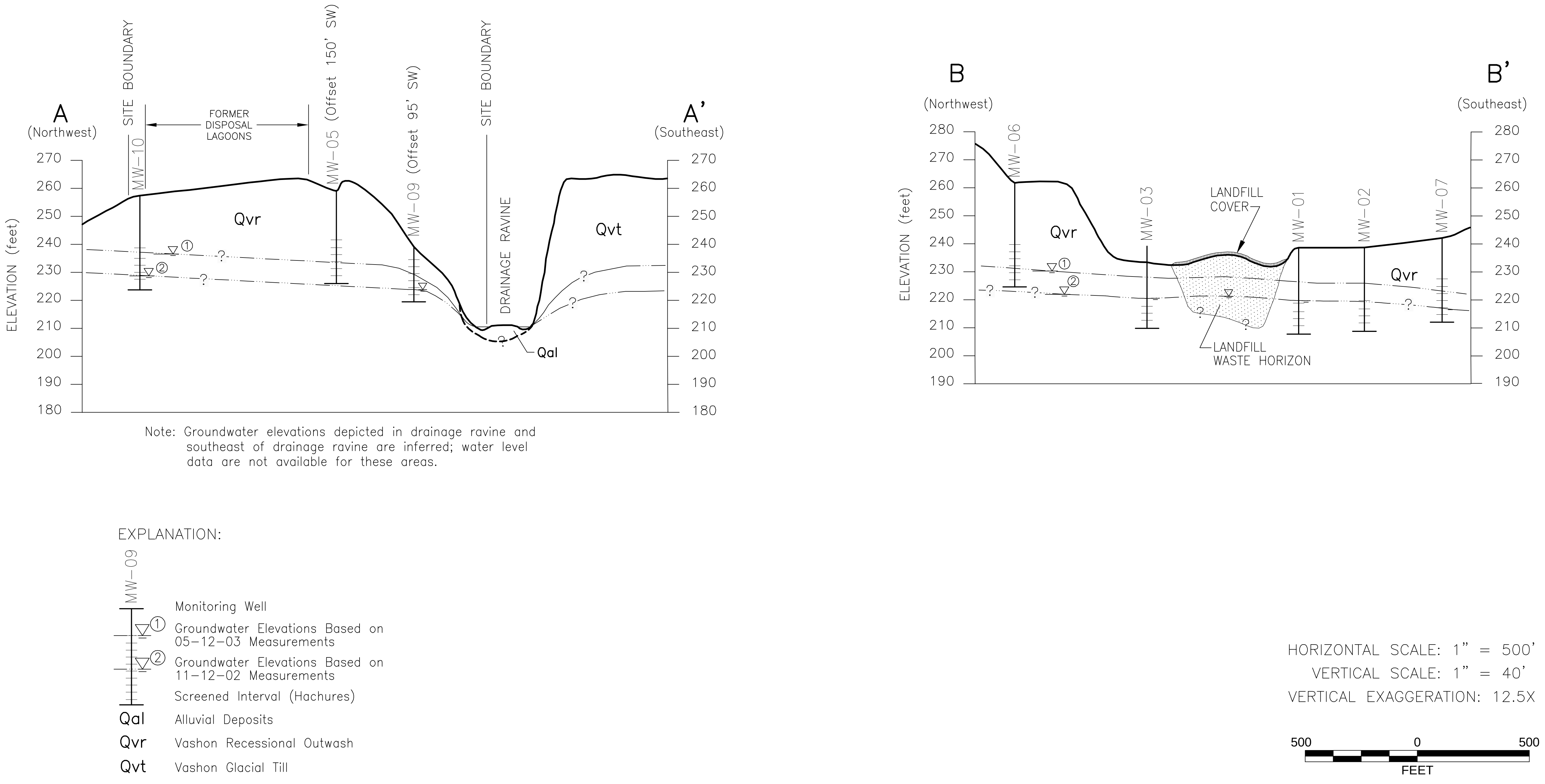
Figure 4

Path: \\sea\Projects\0\0137010\GIS\0137010GeologicMap.mxd Map Revised: 02 July 2012 amanza



Note: Groundwater elevations depicted in drainage ravine and southeast of drainage ravine are inferred; water level data are not available for these areas.

HORIZONTAL SCALE: 1" = 500'
VERTICAL SCALE: 1" = 40'
VERTICAL EXAGGERATION: 12.5X

Notes

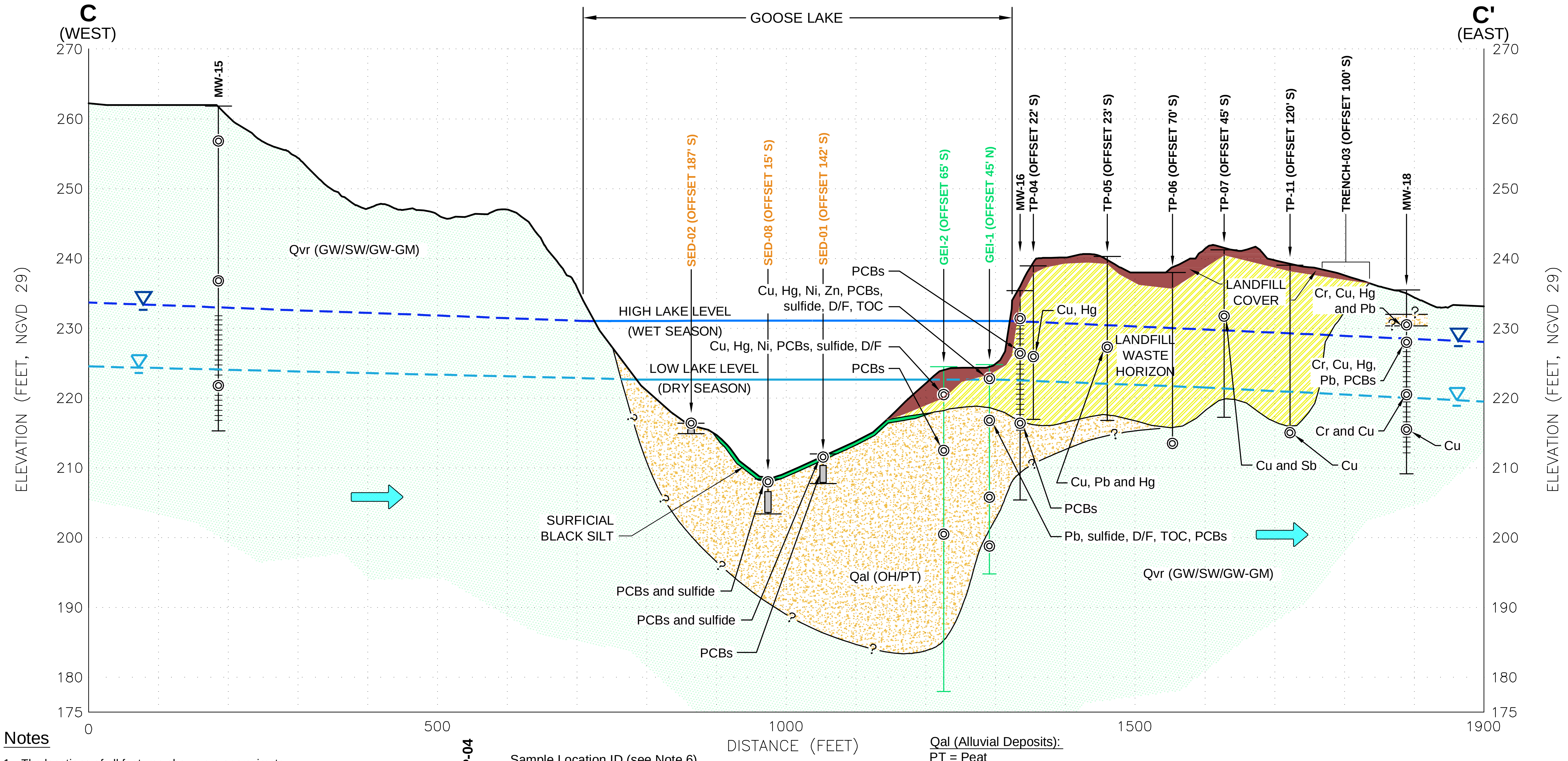
1. The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.
2. Refer to Figure 2 for location of Section A-A' and B-B'.
3. The locations of all features shown are approximate.
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.

Cross Section A-A' and B-B'

Goose Lake Site
Shelton, Washington

GEOENGINEERS

Figure 5



W:\Seattle\Projects\0\0137010\10\CAD\Task 300-06\013701010_T300-06 Fig 6 Xsection C.dwg\Tab:Figure 6 modified by sy1 on Jul 09, 2012 - 13:41

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.
3. Surface topography is based on 3-4-07 Barghausen Consulting Engineers/AeroMetric survey map created for Hall Equities. Vertical datum is NGVD29.
4. Goose Lake bathymetry has not been surveyed. Elevations of SED-01, SED-02 and SED-08 are based on depth to mudline measurements and an assumed lake elevation of 222' during the dry season, when the mudline measurements were taken.
5. High and low lake levels are highest and lowest surveyed lake levels from 2002 to 2010.
6. Black sample location IDs were compared to soil screening levels; orange sample location IDs were compared to sediment screening levels; green sample location IDs were compared to both sediment and soil screening levels.
7. Refer to Figure 2 for location of Section C-C'.

TP-04 Sample Location ID (see Note 6)

? Inferred Soil Contact

Groundwater Level

Discrete Soil or Sediment Sample
(Labels indicate constituents exceeding screening levels; no label = no exceedences)

Composite Sediment Sample (for Sediment Cores)
(Labels indicate constituents exceeding screening levels; no label = no exceedences)

OH Soil/Sediment Lithology Type

Monitoring Well Screen

Inferred Groundwater Flow Direction

Qal (Alluvial Deposits):
PT = Peat
OH = Organic Silt

Qvr (Vashon Recessional Outwash):
GW = Well Graded Gravel
SW = Well Graded Sand
GW-GM = Well Graded Gravel with Silt

Cr = Chromium
Cu = Copper
Hg = Mercury
Ni = Nickel
Zn = Zinc
Sb = Antimony
Pb = Lead
D/F = Dioxins/Furans
PCBs = Polychlorinated Biphenyls
TOC = Total Organic Carbon

HORIZONTAL SCALE: 1"= 150'
VERTICAL SCALE: 1"= 15'
VERTICAL EXAGGERATION: 10X

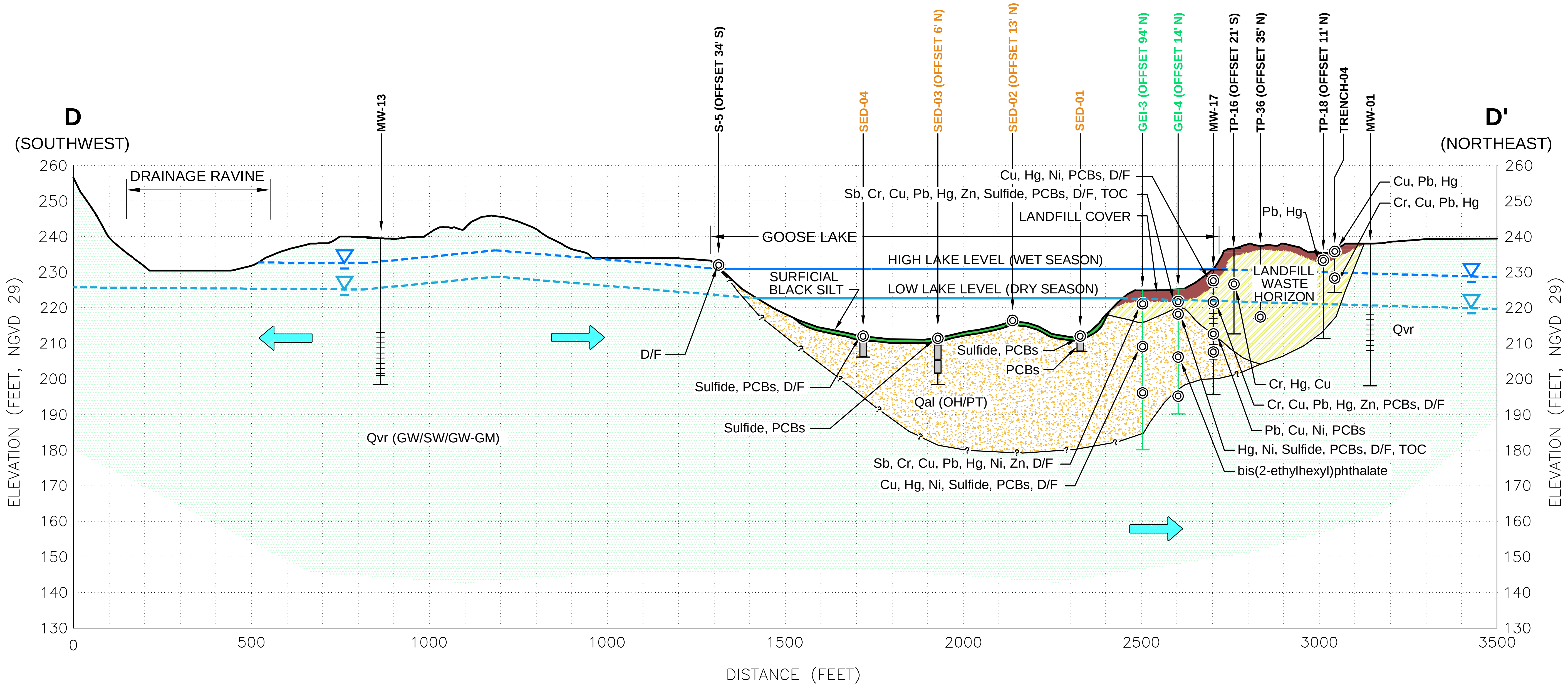
150 0 150
FEET

Cross-Section C-C'

Goose Lake Site
Shelton, Washington

GEOENGINEERS

Figure 6



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.
3. Surface topography is based on 3-4-07 Barghausen Consulting Engineers/AeroMetric survey map created for Hall Equities. Vertical datum is NGVD29.
4. Goose Lake bathymetry has not been surveyed. Elevations of SED-01 through SED-04 are based on depth to mudline measurements and an assumed lake elevation of 222' during the dry season, when the mudline measurements were taken.
5. High and low lake levels are highest and lowest surveyed lake levels from 2002 to 2010.
6. Black sample location IDs were compared to soil screening levels; orange sample location IDs were compared to sediment screening levels; green sample location IDs were compared to both sediment and soil screening levels.
7. Refer to Figure 2 for location of Section D-D'.

TP-04 Sample Location ID (see Note 6)

—?— Inferred Soil Contact

- - ▽ Groundwater Level

◎ Discrete Soil or Sediment Sample (Labels indicate constituents exceeding screening levels; no label = no exceedences)

▮ Composite Sediment Sample (for Sediment Cores) (Labels indicate constituents exceeding screening levels; no label = no exceedences)

OH Soil/Sediment Lithology Type

Monitoring Well Screen

➡ Inferred Groundwater Flow Direction

Qal (Alluvial Deposits):
PT = Peat
OH = Organic Silt

Qvr (Vashon Recessional Outwash):
GW = Well Graded Gravel
SW = Well Graded Sand
GW-GM = Well Graded Gravel with Silt

Cr = Chromium
Cu = Copper
Hg = Mercury
Ni = Nickel
Zn = Zinc
Pb = Lead
Sb = Antimony
D/F = Dioxins/Furans
PCBs = Polychlorinated Biphenyls
TOC = Total Organic Carbon

HORIZONTAL SCALE: 1"= 300'
VERTICAL SCALE: 1"= 30'
VERTICAL EXAGGERATION: 10X
300 0 300
FEET

Cross-Section D-D'

Goose Lake Site
Shelton, Washington

GEOENGINEERS

Figure 7

W:\SEATTLE\PROJECTS\0\0137010\10\CAD\TASK 300-06\0137010I0_T300-06 FIG 7 XSECTION D.DWG\TAB:F7 MODIFIED BY SYI ON JUL 09, 2012 - 14:23

Reference: Reference: 2011 Imagery from Bing Maps.
All other GIS layers created by GeoEngineers, Inc.

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.

Path: \\Sea\projects\0\0137010\GIS\0137010_T300-06_InactiveLandfillExplorations.mxd Map Revised: 05 July 2012 tward

Inactive Landfill Area Explorations

Goose Lake Site
Shelton, Washington

GEOENGINEERS

Figure 8

Reference: 2006 NAIP Imagery obtained from US Department of Agriculture, January 2009.
All other layers developed by GeoEngineers, Inc.

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.

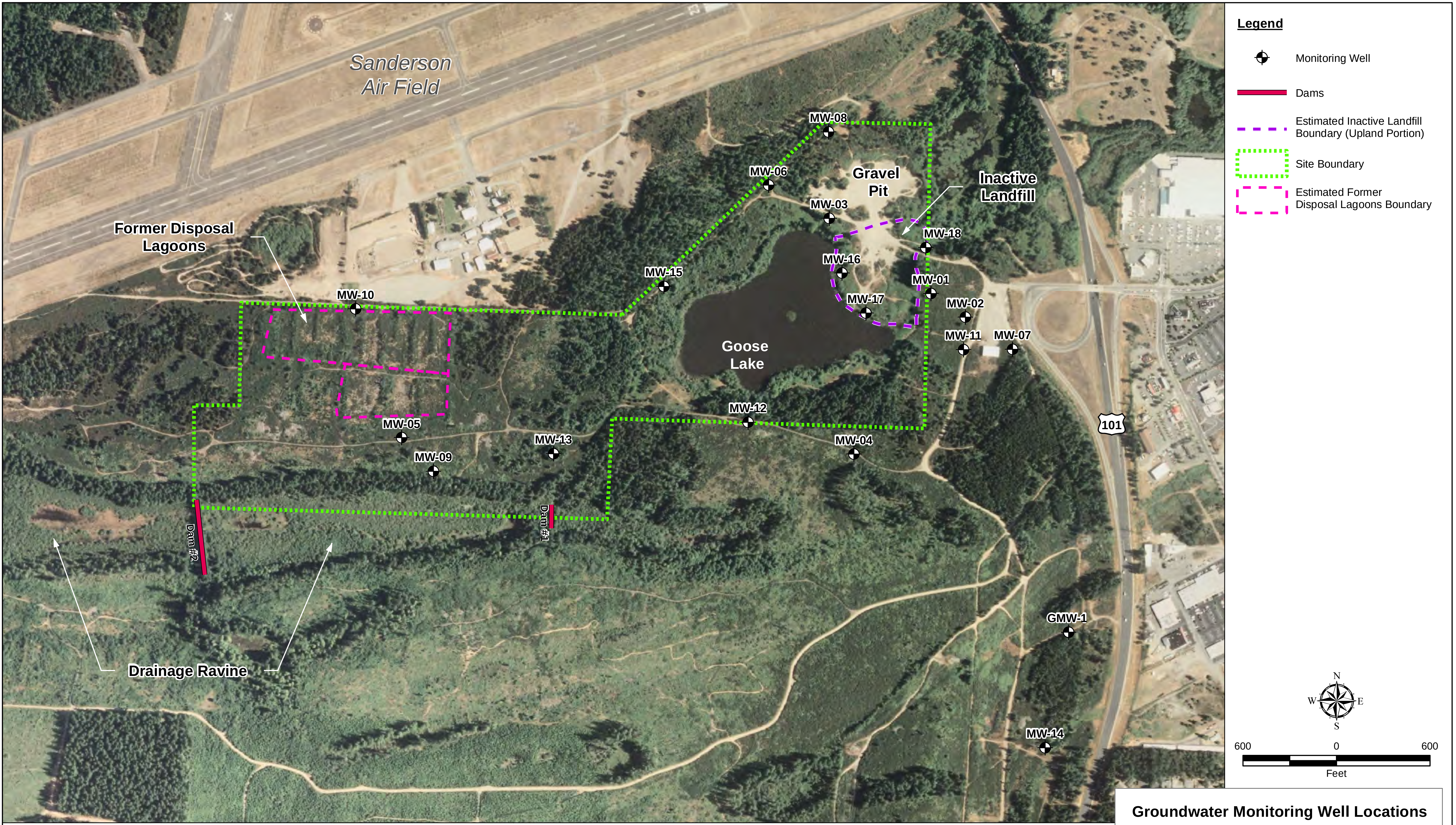
Path: \\sea\Projects\0\0137010\GIS\013701010_T300-06_FormerLagoonExplorations.mxd   Map Revised: 02 July 2012   amanza

Former Disposal Lagoon Area Explorations

Goose Lake Site
Shelton, Washington

GeoEngineers

Figure 9



Reference: 2006 NAIP Imagery obtained from US Department of Agriculture, January 2009.
All other layers developed by GeoEngineers, Inc.

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.

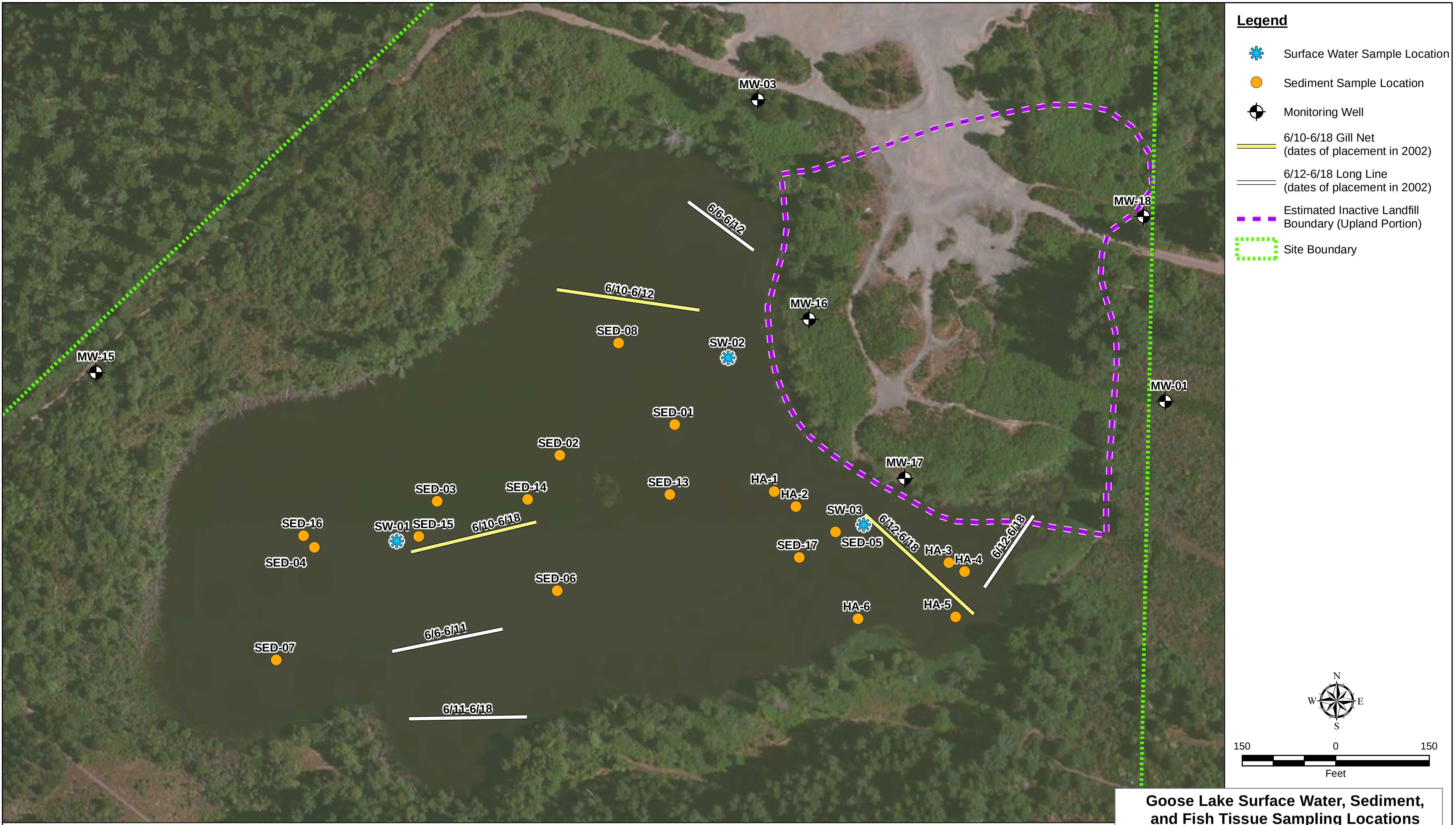
Groundwater Monitoring Well Locations

Goose Lake Site
Shelton, Washington

GeoEngineers

Figure 10

Path: \\sea\Projects\0\0137010\GIS\0137010_T300-06_GroundwaterMWLocations.mxd   Map Revised: 02 July 2012   amanza



Goose Lake Surface Water, Sediment, and Fish Tissue Sampling Locations

Goose Lake Site
Shelton, Washington

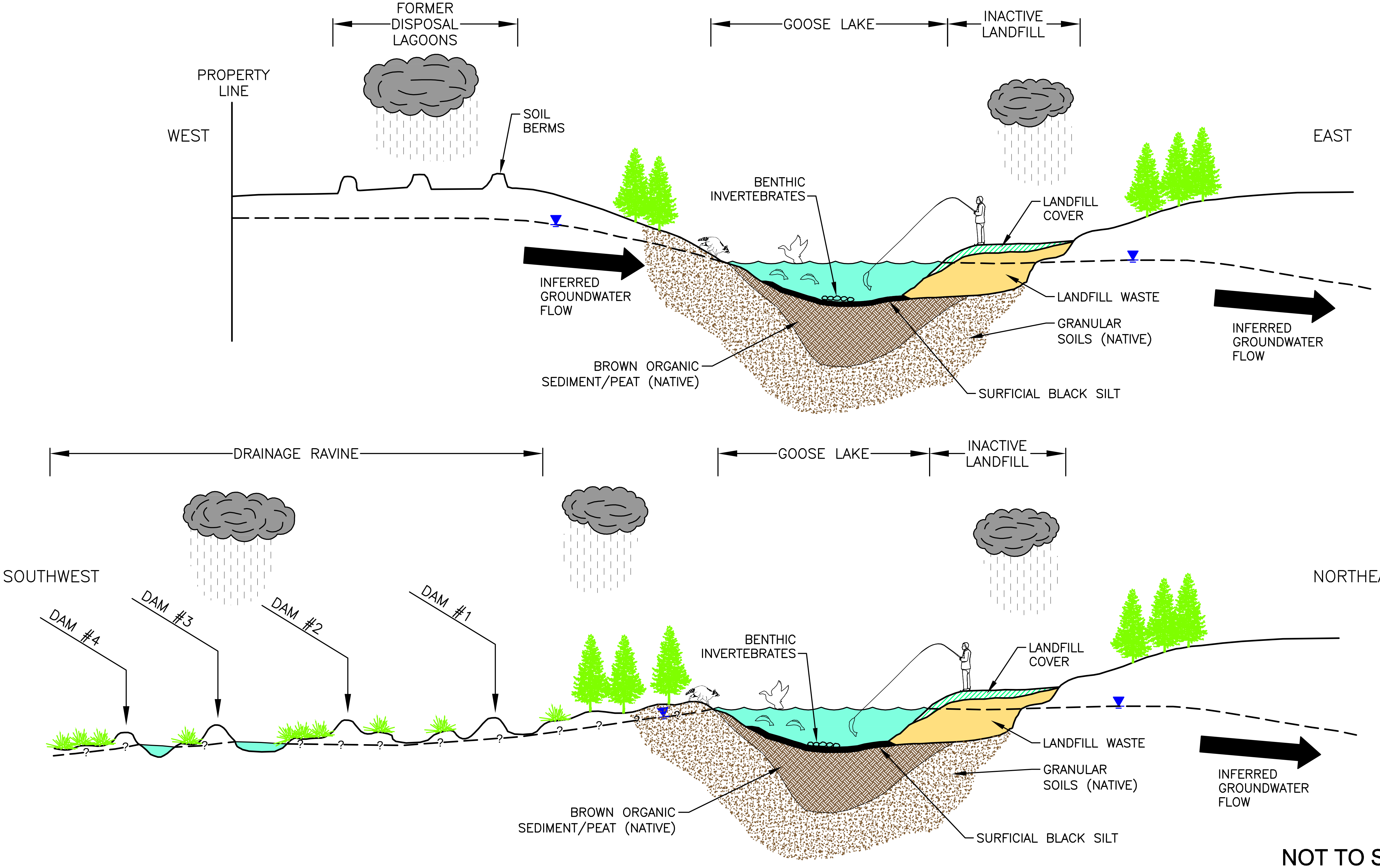
GeoEngineers

Figure 11

Reference: Bing Maps Aerial, 2011.
All other layers developed by GeoEngineers, Inc.

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.

Path: \\seal\Projects\0\0137010\GIS\013701010_T300-06_GooseLakeSampleLocations.mxd   Map Revised: 03 July 2012   amanza



NOT TO SCALE

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.

Conceptual Site Schematic

Goose Lake Site
Shelton, Washington

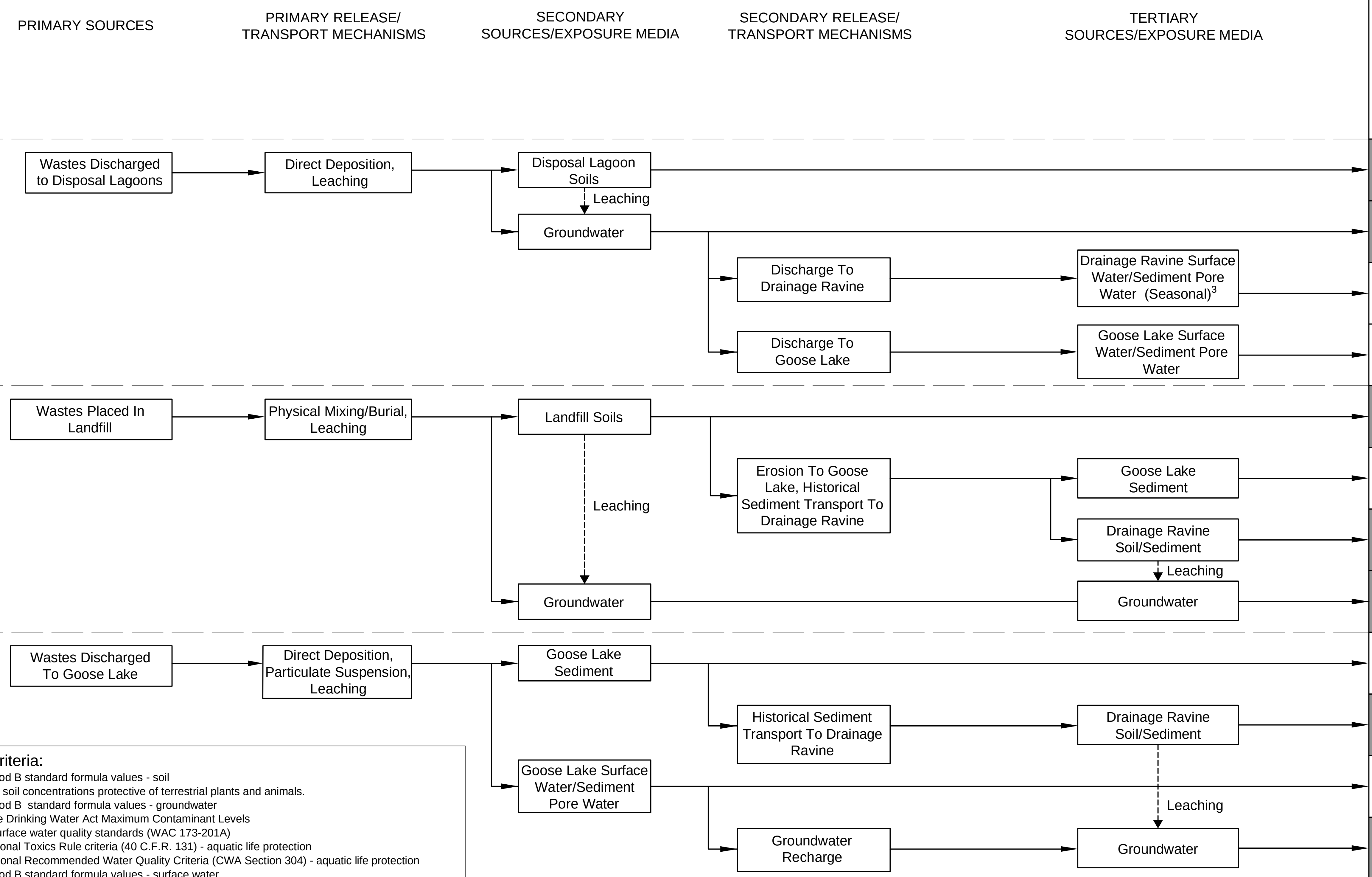
GEOENGINEERS

Figure 12

P:\0\0137010\10\CAD\Task 300-06\013701010_T300-06 Fig 12 Conceptual Xsection.dwg\TAB:F12 modified by tmichaud on Jul 03, 2012 - 10:48

PM ZAS

OFFICE:SEAT



POTENTIAL RECEPTORS/EXPOSURE ROUTES AND NUMERICAL CRITERIA USED TO DERIVE SCREENING LEVELS [2]

	Humans (Drinking Water Use)	Humans (Incidental Soil Ingestion)	Humans (Fish Consumption)	Soil Biota/Plants (Direct Contact)	Wildlife (Biota/Plant Consumption, Incidental Soil Ingestion)	Wildlife (Water Ingestion)	Wildlife (Fish and/or Benthic Invertebrate Consumption)	Benthic Invertebrates (Direct Contact)	Fish (Direct Contact and/or Benthic Invertebrate Consumption)
Disposal Lagoon Soils	m	a		b	b			n	n
Groundwater	c,d								
Drainage Ravine Surface Water/Sediment Pore Water (Seasonal)						NA	NA	e,f,g	
Goose Lake Surface Water/Sediment Pore Water			h,i,j			NA	NA	e,f,g	e,f,g
Landfill Soils	m	a		b	b			n^6	n^6
Goose Lake Sediment			NA				l^4	k	l^4
Drainage Ravine Soil/Sediment	m	a		b	b		$l^{4,5}$	k^5,n	n
Groundwater	c,d					NA^6	NA^6	e,f,g^6	e,f,g^6
Goose Lake Sediment			NA				l^4	k	l^4
Drainage Ravine Soil/Sediment	m	a		b	b		$l^{4,5}$	k^5,n	n
Goose Lake Surface Water/Sediment Pore Water			h,i,j			NA	NA	e,f,g	e,f,g
Groundwater	c,d					NA^6	NA^6	e,f,g^6	

Numerical Criteria:

a. MTCA Method B standard formula values - soil
b. Site-specific soil concentrations protective of terrestrial plants and animals.
c. MTCA Method B standard formula values - groundwater
d. Federal Safe Drinking Water Act Maximum Contaminant Levels
e. WA State surface water quality standards (WAC 173-201A)
f. Federal National Toxics Rule criteria (40 C.F.R. 131) - aquatic life protection
g. Federal National Recommended Water Quality Criteria (CWA Section 304) - aquatic life protection
h. MTCA Method B standard formula values - surface water
i. Federal National Toxics Rule criteria (40 C.F.R. 131) - human health protection (aquatic organism consumption)
j. Federal National Recommended Water Quality Criteria (CWA Section 304) - human health protection (aquatic organism consumption)
k. WA State freshwater sediment quality values (Ecology 2003)
l. Federal risk-based concentrations for 2,3,7,8-TCDD in sediment - aquatic life and associated wildlife protection (USEPA, 1993)
m. MTCA Method B values protective of groundwater as drinking water.
n. MTCA Method B values protective of groundwater as surface water.

"NA" = no criteria available; other criteria for this exposure pathway are assumed to be protective of this receptor/exposure route.

Notes:

1. This drawing is for information purposes. It is intended to assist in conveying information 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.
2. Grey-shaded cells indicate complete potential exposure pathways; unshaded (blank) cells indicate incomplete pathways. Numerical criteria (or "NA") are shown only for complete potential exposure pathways.
3. Drainage ravine surface water was not sampled during the RI.
4. Criteria applicable to dioxins/furans only.
5. Areas with seasonal standing water only.
6. Only sample locations near or upgradient of surface water were compared to criteria protective of surface water.

Reference: Drawing created from sketch provided by GeoEngineers' personnel.

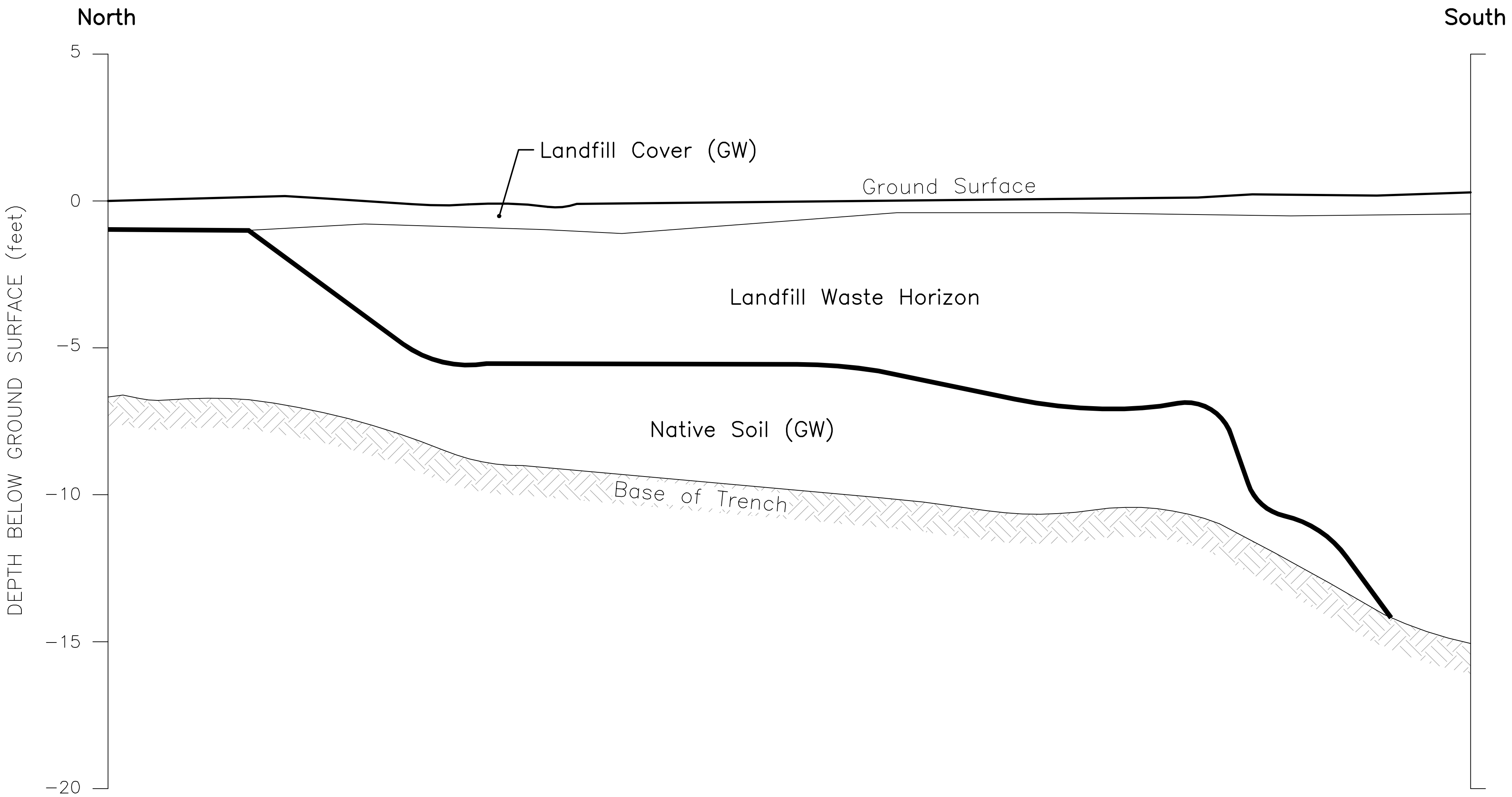
Conceptual Exposure Diagram

Goose Lake Site
Shelton, Washington

GEOENGINEERS

Figure 13

P:\0\0137010\10\CAD\Task 300-06\013701010_T300-06 Fig 13 Conceptual Exposure Diagram.dwg\TAB:F13 modified by tmichaud on Jul 03, 2012 - 10:50



EXPLANATION:

GW WELL–GRADED GRAVEL WITH SAND

5 0 5
FEET
(NO VERTICAL EXAGGERATION)

Notes

1. Ground surface topography was visually estimated.
2. Refer to Figure 8 for the location of Trench-01.
3. The landfill cover generally consisted of brown fine to coarse gravel with sand and trace silt.
4. The landfill waste horizon generally consisted of black char/clinker (possible spent cooking liquor), wood debris, asphalt debris, sand and gravel.
5. The native soil generally consisted of brown fine to coarse gravel with sand and a trace of silt.
6. The locations of all features shown are approximate.
7. 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.

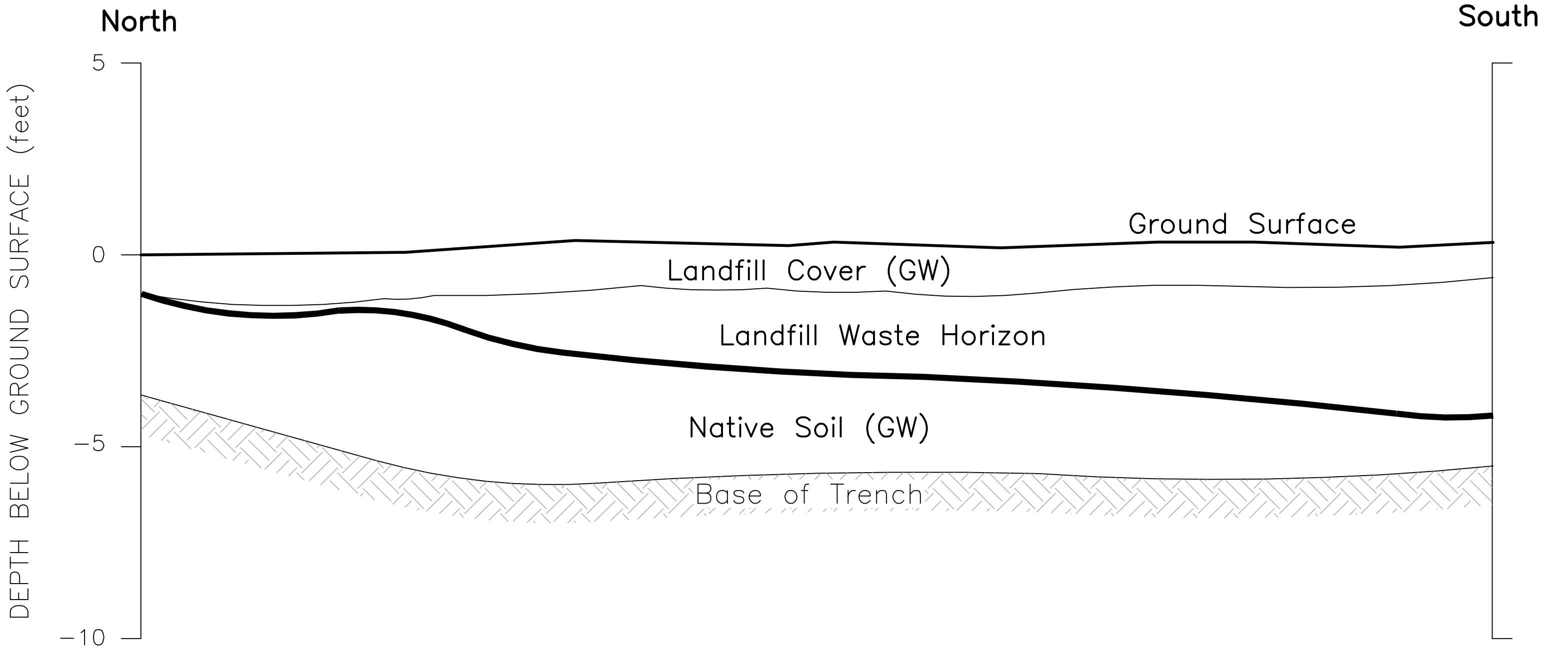
Profile of Trench-01

Goose Lake Site
Shelton, Washington

GEOENGINEERS

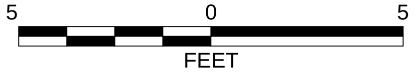
Figure 14

P:\0\0137010\10\CAD\TASK 300-06\0137010\10_T300-06 FIG 14 XSECTION TRENCH1.DWG\TAB:F14 MODIFIED BY TMICHAUD ON JUL 03, 2012 - 10:52



EXPLANATION:

GW WELL-GRADED GRAVEL WITH SAND



(NO VERTICAL EXAGGERATION)

Notes

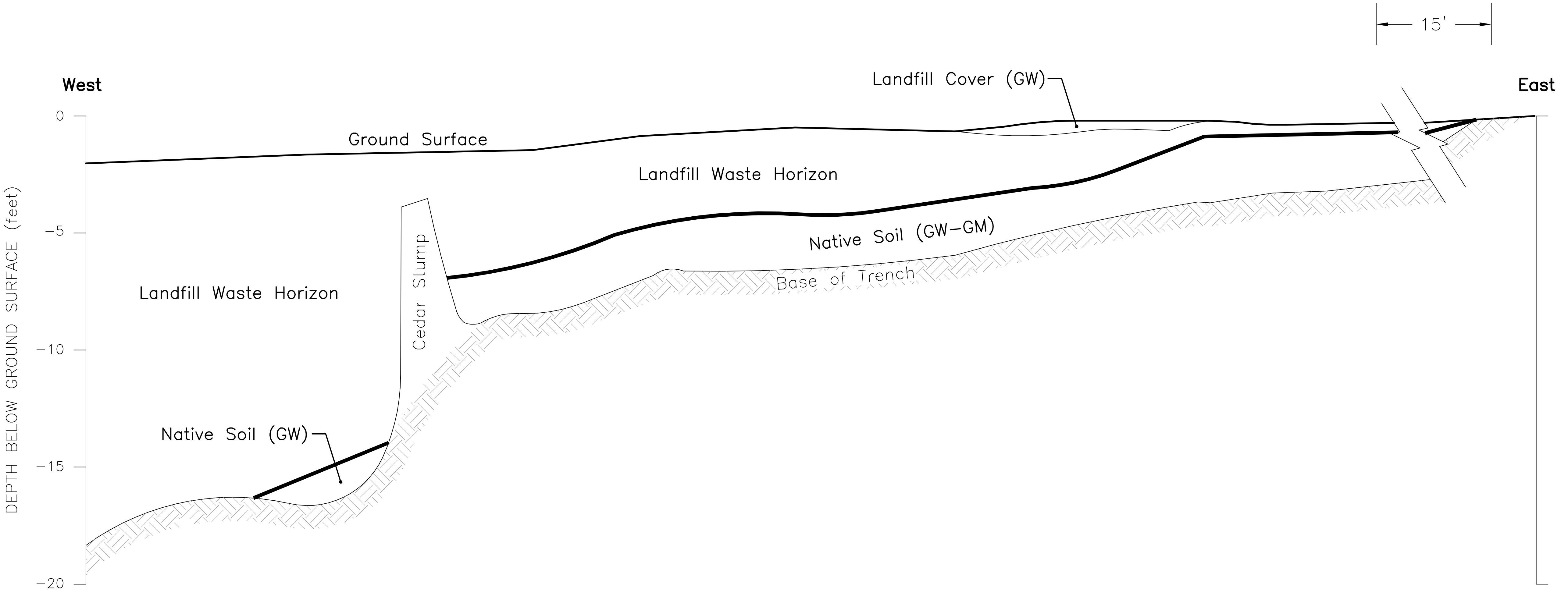
1. Ground surface topography was visually estimated.
2. Refer to Figure 8 for the location of Trench-02.
3. The landfill cover generally consisted of brown fine to coarse gravel with sand and a trace of silt.
4. The landfill waste horizon generally consisted of black char/clinker (possible spent cooking liquor), wood debris, and glass debris.
5. The native soil generally consisted of brown fine to coarse gravel with sand and a trace of silt.
6. The locations of all features shown are approximate.
7. 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.

Profile of Trench-02

Goose Lake Site
Shelton, Washington

GEOENGINEERS

Figure 15



EXPLANATION:

GW	WELL-GRADED GRAVEL WITH SAND
GW-GM	WELL-GRADED GRAVEL WITH SAND AND SILT

5 0 5
FEET
(NO VERTICAL EXAGGERATION)

Notes

1. Ground surface topography was visually estimated.
2. Refer to Figure 8 for the location of Trench-03.
3. The landfill cover generally consisted of brown fine to coarse gravel with sand and trace silt.
4. The landfill waste horizon generally consisted of black char/clinker (possible spent cooking liquor), and wood debris.
5. The native soil generally consisted of brown fine to coarse gravel with sand silt.
6. The locations of all features shown are approximate.
7. 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.

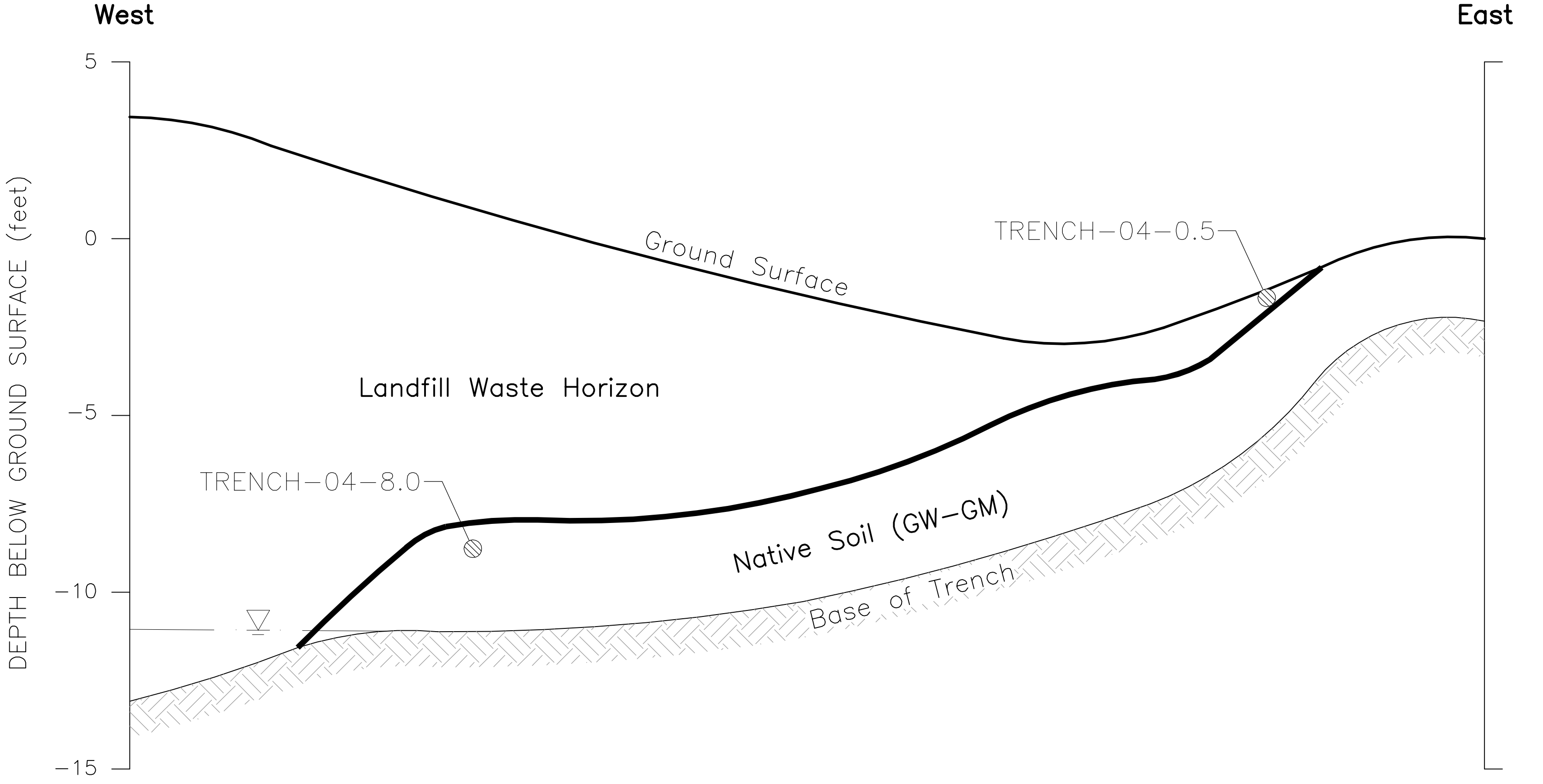
Profile of Trench-03

Goose Lake Site
Shelton, Washington

GEOENGINEERS

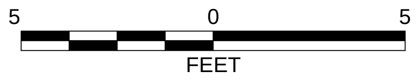
Figure 16

P:\0\0137010\10\CAD\Task 300-06\0137010010_T300-06 Fig 16 Xsection Trench3.dwg\TAB:F16 modified by tmichaud on Jul 03, 2012 - 10:57



EXPLANATION:

TRENCH−04−8.0 ⊘	SOIL SAMPLE
▽	GROUNDWATER LEVEL
GW−GM	WELL−GRADED GRAVEL WITH SAND AND SILT



(NO VERTICAL EXAGGERATION)

Notes

1. Ground surface topography was visually estimated.
2. Refer to Figure 8 for the location of Trench-04.
3. The landfill cover was not present in Trench-04.
4. The landfill waste horizon generally consisted of concrete, wood and glass debris, domestic refuse, and brown silty sand with gravel.
5. The native soil generally consisted of brown fine to coarse gravel with sand and silt.
6. The locations of all features shown are approximate.
7. 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.

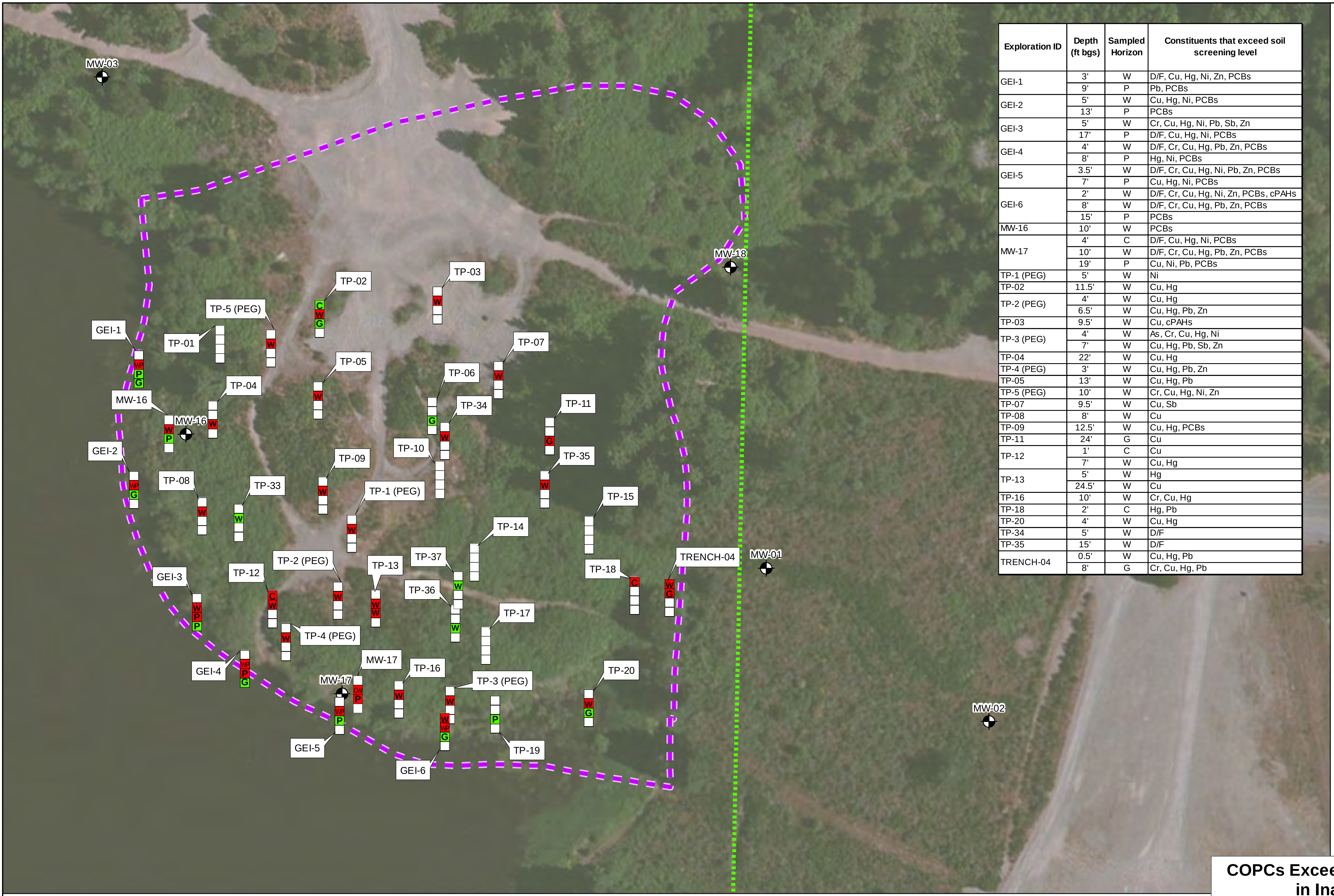
Profile of Trench-04

Goose Lake Site
Shelton, Washington

GEOENGINEERS

Figure 17

P:\0\0137010\10\CAD\Task 300-06\013701010_T300-06 Fig 17 Xsection Trench4.dwg\TAB:F17 modified by tmichaud on Jul 03, 2012 - 10:58



Exploration ID	Depth (ft bgs)	Sampled Horizon	Constituents that exceed soil screening level
GEI-1	3'	W	D/F, Cu, Hg, Ni, Zn, PCBs
	9'	P	Pb, PCBs
GEI-2	5'	W	Cu, Hg, Ni, PCBs
	13'	P	PCBs
GEI-3	5'	W	Cr, Cu, Hg, Ni, Pb, Sb, Zn
	17'	P	D/F, Cu, Hg, Ni, PCBs
GEI-4	4'	W	D/F, Cr, Cu, Hg, Pb, Zn, PCBs
	8'	P	Hg, Ni, PCBs
GEI-5	3.5'	W	D/F, Cr, Cu, Hg, Ni, Pb, Zn, PCBs
	7'	P	Cu, Hg, Ni, PCBs
GEI-6	2'	W	D/F, Cr, Cu, Hg, Ni, Zn, PCBs, cPAHs
	8'	W	D/F, Cr, Cu, Hg, Pb, Zn, PCBs
	15'	P	PCBs
MW-16	10'	W	PCBs
MW-17	4'	C	D/F, Cu, Hg, Ni, PCBs
	10'	W	D/F, Cr, Cu, Hg, Pb, Zn, PCBs
	19'	P	Cu, Ni, Pb, PCBs
TP-1 (PEG)	5'	W	Ni
TP-02	11.5'	W	Cu, Hg
TP-2 (PEG)	4'	W	Cu, Hg
	6.5'	W	Cu, Hg, Pb, Zn
TP-03	9.5'	W	Cu, cPAHs
TP-3 (PEG)	4'	W	As, Cr, Cu, Hg, Ni
	7'	W	Cu, Hg, Pb, Sb, Zn
TP-04	22'	W	Cu, Hg
TP-4 (PEG)	3'	W	Cu, Hg, Pb, Zn
TP-05	13'	W	Cu, Hg, Pb
TP-5 (PEG)	10'	W	Cr, Cu, Hg, Ni, Zn
TP-07	9.5'	W	Cu, Sb
TP-08	8'	W	Cu
TP-09	12.5'	W	Cu, Hg, PCBs
TP-11	24'	G	Cu
TP-12	1'	C	Cu
	7'	W	Cu, Hg
TP-13	5'	W	Hg
	24.5'	W	Cu
TP-16	10'	W	Cr, Cu, Hg
TP-18	2'	C	Hg, Pb
TP-20	4'	W	Cu, Hg
TP-34	5'	W	D/F
TP-35	15'	W	D/F
TRENCH-04	0.5'	W	Cu, Hg, Pb
	8'	G	Cr, Cu, Hg, Pb

Legend

C	Cover
W	Waste
P	Peat
G	Glacial Deposits

One or more constituents analyzed at this location and depth exceeded soil screening levels:

🟥	0 - 2 ft below ground surface (bgs)
🟥	>2 - 15 ft bgs
🟥	>15 - 25 ft bgs
🟥	>25 ft bgs

None of the constituents analyzed at this location and depth exceeded soil screening levels:

🟩	0 - 2 ft below ground surface (bgs)
🟩	>2 - 15 ft bgs
🟩	>15 - 25 ft bgs
🟩	>25 ft bgs

White squares indicate depth intervals that were not sampled

Site Boundary

Estimated Inactive Landfill Boundary (Upland Portion)

Monitoring Well

Reference: 2011 Imagery from Bing Maps.
All other GIS layers created by GeoEngineers, Inc.

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.

As = Arsenic
Cr = Chromium
Cu = Copper
Hg = Mercury
Ni = Nickel
Pb = Lead
Sb = Antimony
Zn = Zinc

D/F = Total Dioxins and/or Furans Toxicity Equivalency Quotient (exceeds for humans, mammals, and/or birds)

PCBs = Total Polychlorinated Biphenyls

cPAHs = Carcinogenic Polycyclic Aromatic Hydrocarbons Toxicity Equivalency Quotient

N
W E
S

0 100
Feet

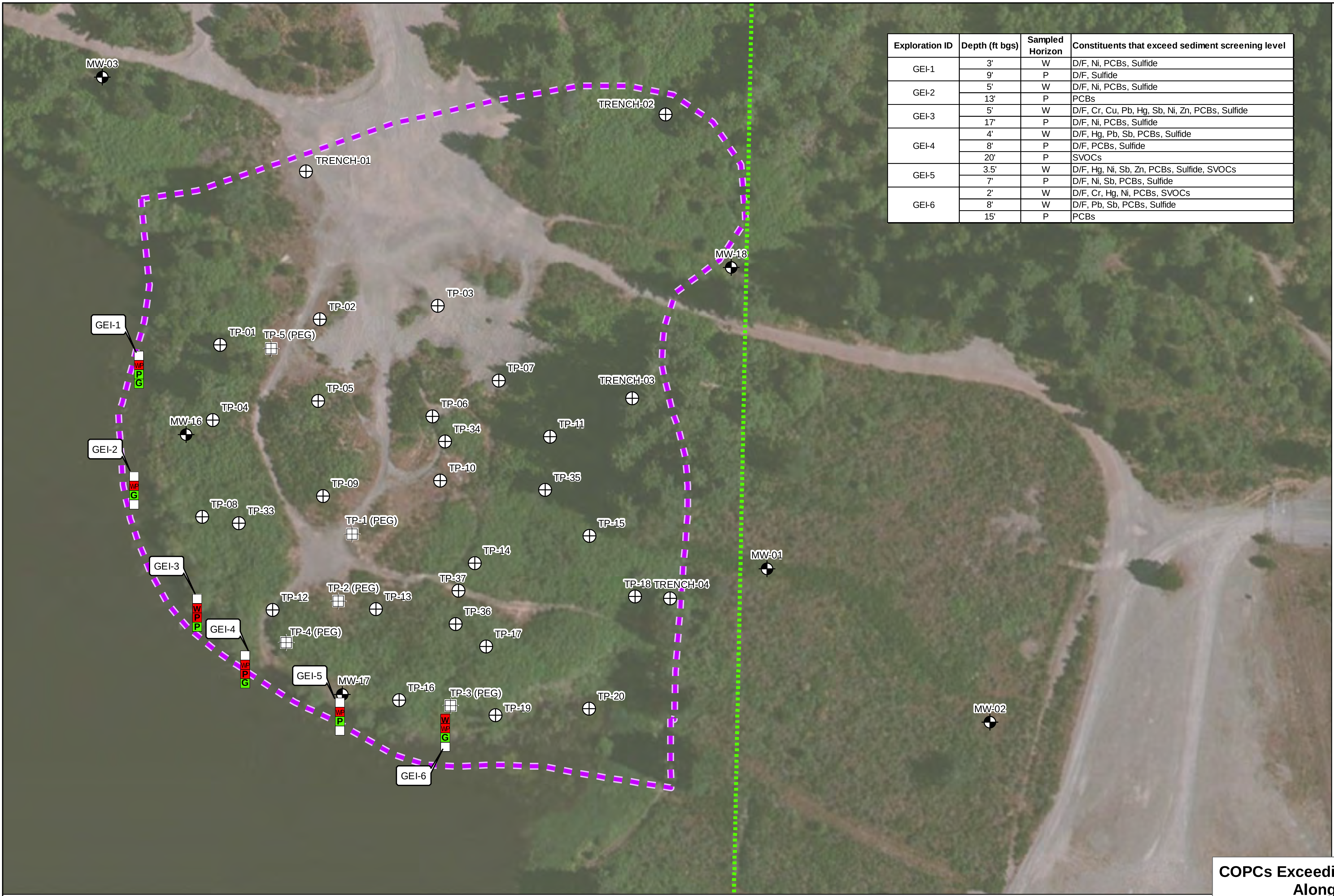
COPCs Exceeding Soil Screening Levels in Inactive Landfill Area

Goose Lake Site
Shelton, Washington

GEOENGINEERS

Figure 18

Path: \\sea\Projects\0\0137010\GIS\0137010010_T300-06_COPC_Landfill_Soil.mxd Map Revised: 12 July 2012 amanza



Exploration ID	Depth (ft bgs)	Sampled Horizon	Constituents that exceed sediment screening level
GEI-1	3'	W	D/F, Ni, PCBs, Sulfide
	9'	P	D/F, Sulfide
GEI-2	5'	W	D/F, Ni, PCBs, Sulfide
	13'	P	PCBs
GEI-3	5'	W	D/F, Cr, Cu, Pb, Hg, Sb, Ni, Zn, PCBs, Sulfide
	17'	P	D/F, Ni, PCBs, Sulfide
GEI-4	4'	W	D/F, Hg, Pb, Sb, PCBs, Sulfide
	8'	P	D/F, PCBs, Sulfide
	20'	P	SVOCs
GEI-5	3.5'	W	D/F, Hg, Ni, Sb, Zn, PCBs, Sulfide, SVOCs
	7'	P	D/F, Ni, Sb, PCBs, Sulfide
GEI-6	2'	W	D/F, Cr, Hg, Ni, PCBs, SVOCs
	8'	W	D/F, Pb, Sb, PCBs, Sulfide
	15'	P	PCBs

Legend

C Cover

W Waste

P Peat

G Glacial Deposits

One or more constituents analyzed at this location and depth exceeded sediment screening levels:

🟥 0 - 2 ft below ground surface (bgs)

🟥 >2 - 15 ft bgs

🟥 >15 - 25 ft bgs

🟥 >25 ft bgs

None of the constituents analyzed at this location and depth exceeded sediment screening levels:

🟩 0 - 2 ft below ground surface (bgs)

🟩 >2 - 15 ft bgs

🟩 >15 - 25 ft bgs

🟩 >25 ft bgs

White squares indicate depth intervals that were not sampled

Site Boundary

Estimated Inactive Landfill Boundary (Upland Portion)

⊕ RI Test Pit (2002) (results not compared to sediment screening levels)

⊞ 1997 Test Pit (results not compared to sediment screening levels)

Monitoring Well

Reference: 2011 Imagery from Bing Maps.
All other GIS layers created by GeoEngineers, Inc.

Notes:
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3. SVOC exceedances include acenaphthylene, bis(2-ethylhexyl)phthalate and dibenzofuran.

Cr = Chromium
Cu = Copper
Hg = Mercury
Ni = Nickel
Pb = Lead
Sb = Antimony
Zn = Zinc
Sulfide = Total Sulfides

D/F = Total Dioxins/Furans Toxicity Equivalency Quotient (exceeds for mammals, fish and/or birds)
PCBs = Total Polychlorinated Biphenyls
cPAHs = Carcinogenic Polycyclic Aromatic Hydrocarbons Toxicity Equivalency Quotient
SVOCs = Semivolatile Organic Compounds

N
W E
S

0 100
Feet

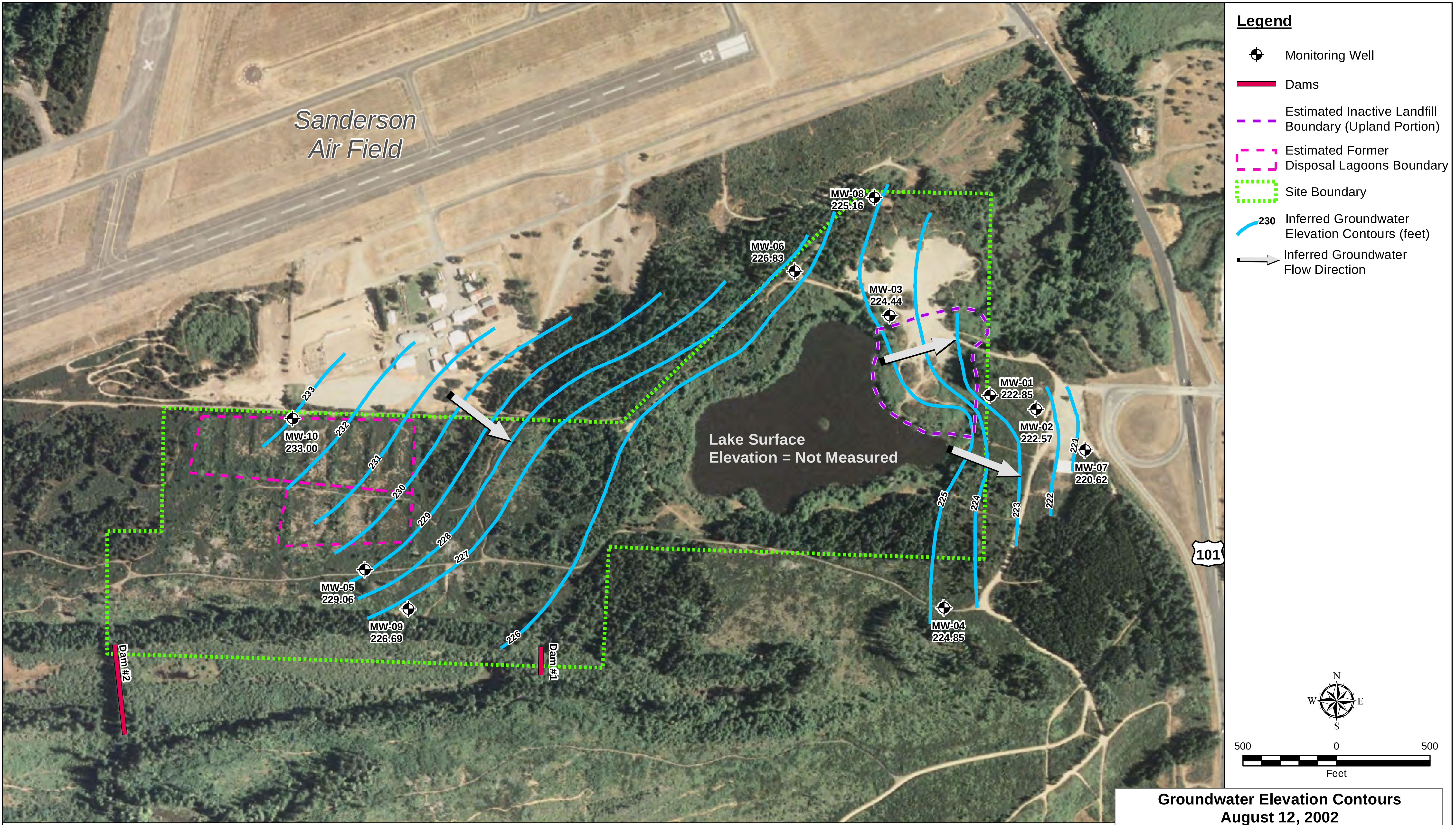
COPCs Exceeding Sediment Screening Levels Along Lake/Landfill Margin

Goose Lake Site
Shelton, Washington

GEOENGINEERS

Figure 19

Path: \\sea\Projects\0\0137010\GIS\013701010_T300-06_COPC_Landfill_Sediment.mxd Map Revised: 12 July 2012 amanza



Reference: 2006 NAIP Imagery obtained from US Department of Agriculture, January 2009.
All other layers developed by GeoEngineers, Inc.

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.

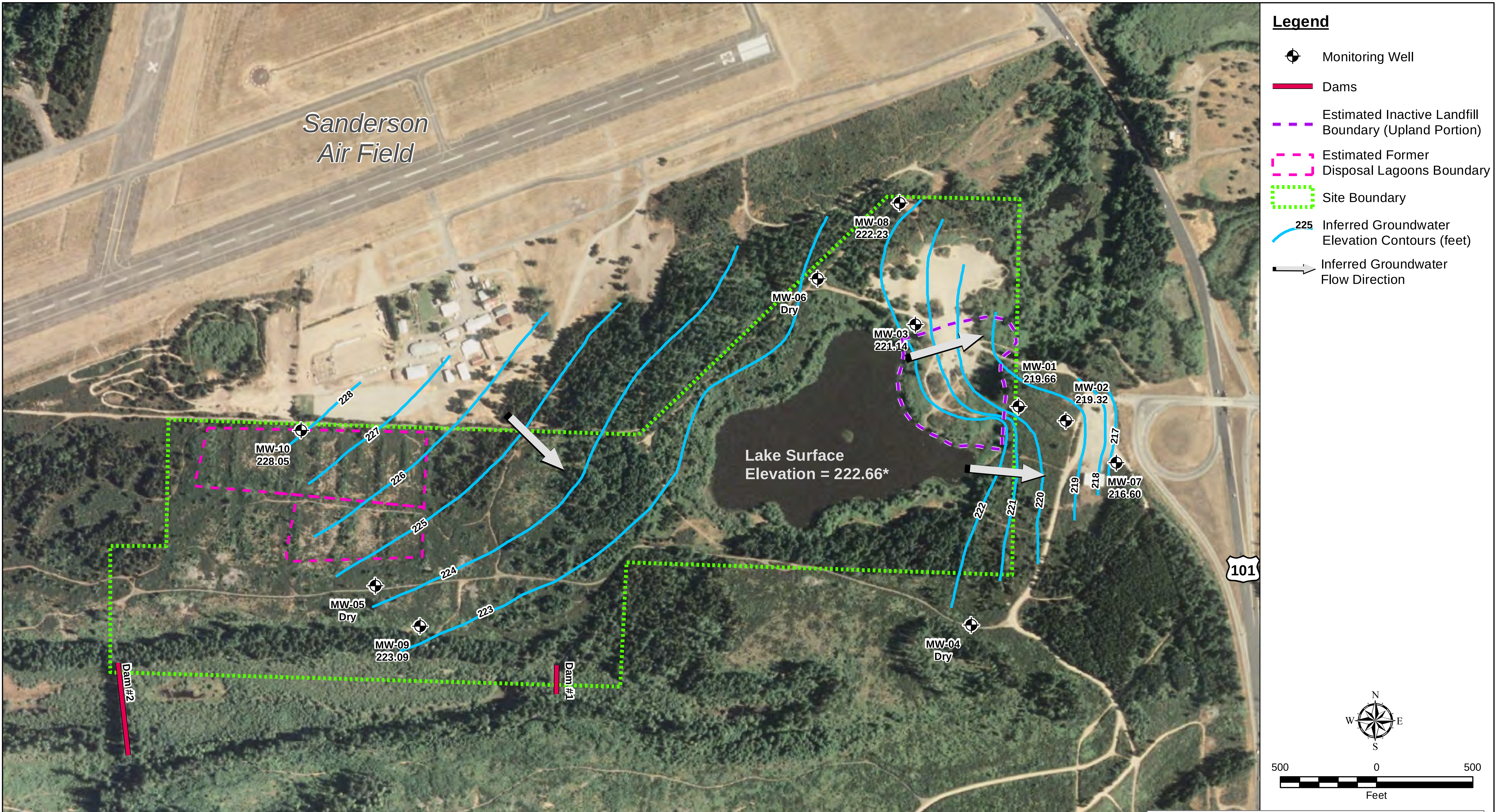
Groundwater Elevation Contours
August 12, 2002

Goose Lake Site
Shelton, Washington

GEOENGINEERS

Figure 20

Path: \\sea\Projects\0\0137010\GIS\013701010_T300-06_2002Aug_GWContours.mxd   Map Revised: 02 July 2012   amanza



Groundwater Elevation Contours
November 12, 2002

Goose Lake Site
Shelton, Washington

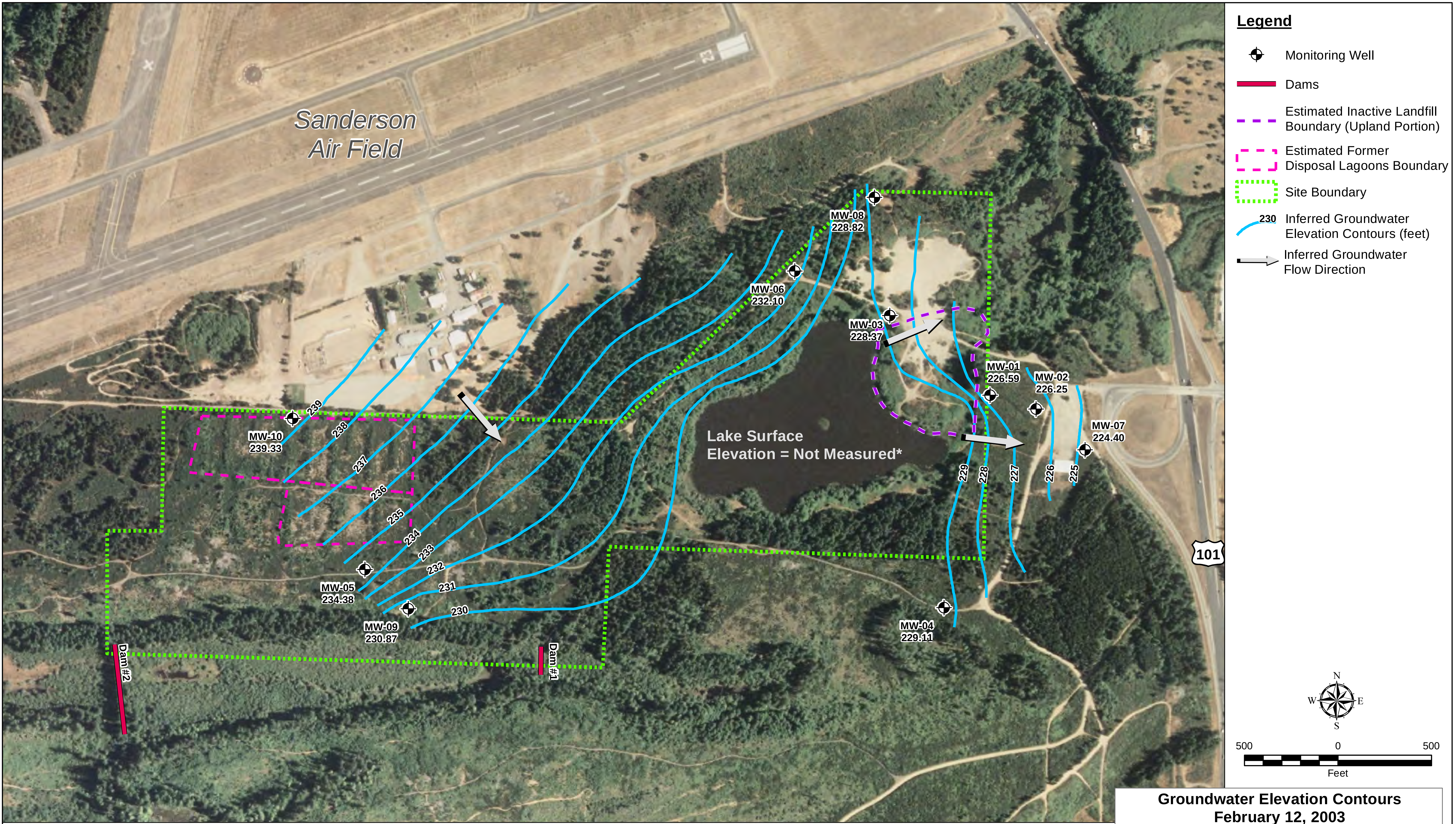
GeoEngineers

Figure 21

Reference: 2006 NAIP Imagery obtained from US Department of Agriculture, January 2009. All other layers developed by GeoEngineers, Inc.
* Measured relative to staff gage installed in November 2002 with surveyed elevation of 224.02 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. 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.

Path: \seaProjects\0\0137010\GIS\013701010_T300-06_2002Nov_GWContours.mxd Map Revised: 02 July 2012 amanza



Reference: 2006 NAIP Imagery obtained from US Department of Agriculture, January 2009. All other layers developed by GeoEngineers, Inc.
* Lake level above top of staff gage.

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.

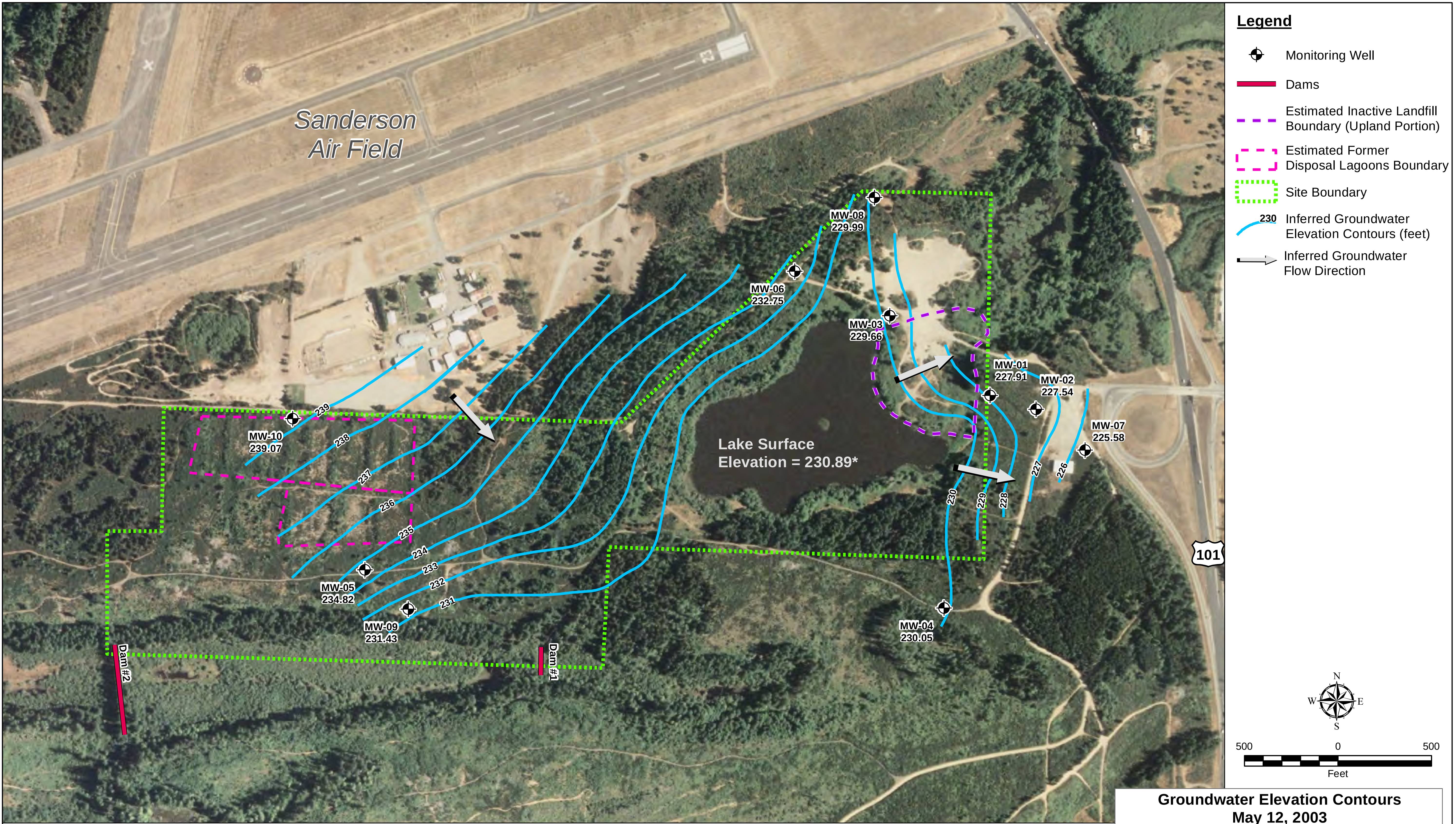
Groundwater Elevation Contours
February 12, 2003

Goose Lake Site
Shelton, Washington

GEOENGINEERS

Figure 22

Path: \\sea\Projects\0\0137010\GIS\013701010_T300-06_2003Feb_GWContours.mxd   Map Revised: 02 July 2012   amanza



Groundwater Elevation Contours
May 12, 2003

Goose Lake Site
Shelton, Washington

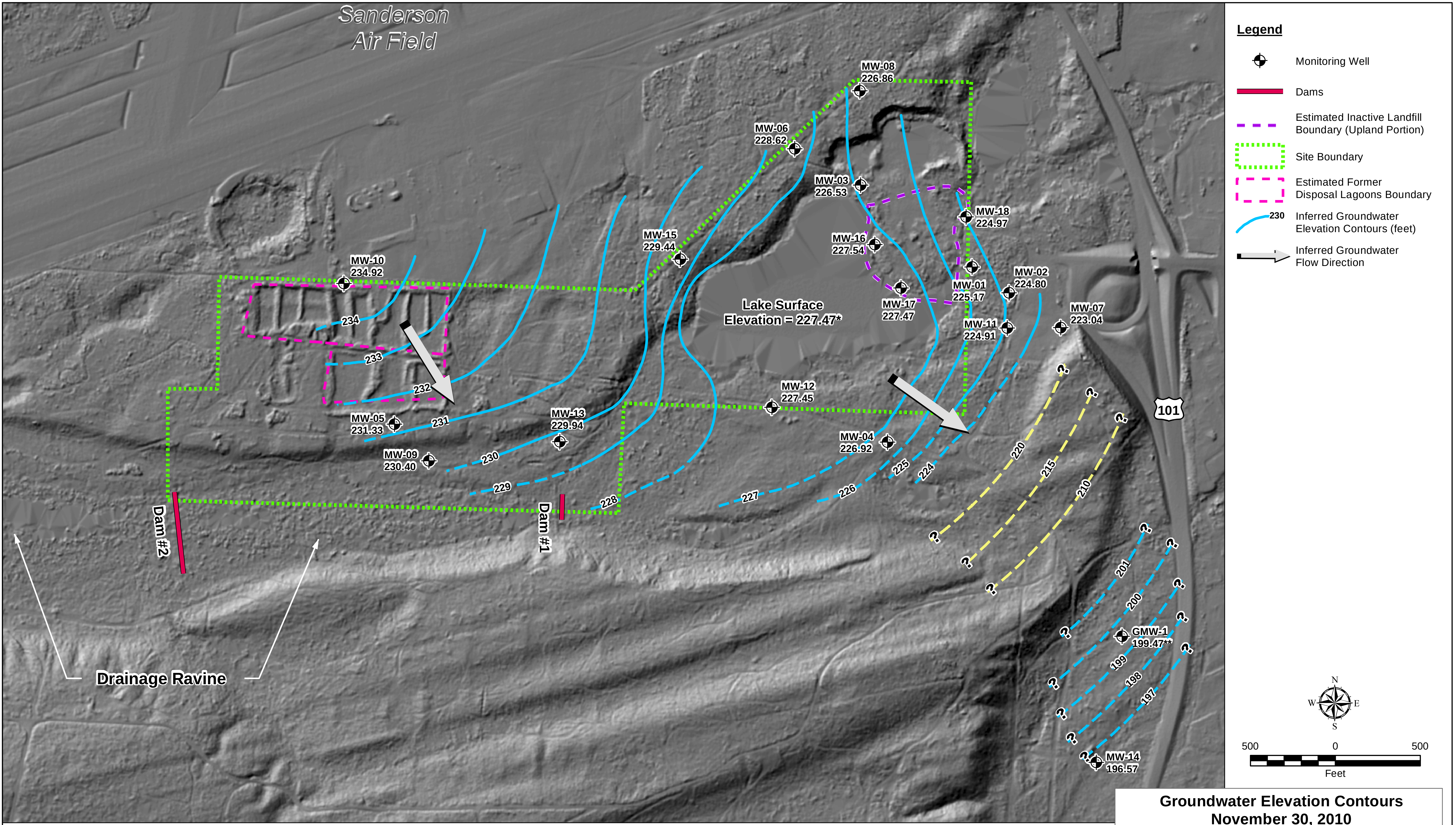
GEOENGINEERS

Figure 23

Reference: 2006 NAIP Imagery obtained from US Department of Agriculture, January 2009. All other layers developed by GeoEngineers, Inc.
* Measured relative to staff gage installed in May 2003 with surveyed elevation of 231.15 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. 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.

Path: \\sea\Projects\0\0137010\GIS\013701010_T300-06_2003May_GWContours.mxd Map Revised: 02 July 2012 amanza



Reference: Hillshade derived from LiDAR data obtained from Puget Sound LiDAR Consortium.
All other GIS layers created by GeoEngineers, Inc

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.
3. * = Measured relative to MW-17 using a laser level.
4. ** = GMW-1 groundwater elevation is inferred, based on measured groundwater elevation in MW-14 and transducer study relative difference between MW-14 and GMW-1 groundwater elevations (GeoEngineers, 2011b).

Path: \\sea\Projects\0\0137010\GIS\013701010_T300-06_2010Nov_GWContours.mxd Map Revised: 03 July 2012 amanza

Groundwater Elevation Contours
November 30, 2010

Goose Lake Site
Shelton, Washington

GEOENGINEERS

Figure 24

MW-8					
Date	Aug-02	Nov-02	Feb-03	May-03	Dec-10
As	0.0037	0.0005 U	0.003 U	0.001 U	0.000096
Cr	0.0838	0.0247	0.0023	0.003	--
Cu	0.107	0.0276	0.0033	0.0023	--
Pb	0.0062	0.0014	0.0005 U	0.0005 U	--
Hg	0.0002 U	0.0002 U	0.0002 U	0.0002 U	--
Aroclor-1254	0.0095 U	0.0095 U	0.0095 U	0.0094 U	--
PCBs	0.019 U	0.019 U	0.019 U	0.019 U	--
D/F	--	--	--	--	--

MW-3					
Date	Aug-02	Nov-02	Feb-03	May-03	Dec-10
As	0.001 U	0.00166	0.003 U	0.001 U	0.00007
Cr	0.0048 U	0.005 U	0.0031	0.0012	0.00014
Cu	0.0017	0.0106	0.0039	0.0015	0.0004
Pb	0.0008	0.00544	0.002	0.0005 U	0.000168
Hg	0.0002 U	0.0002 U	0.0002 U	0.0002 U	7.7E-07
Aroclor-1254	0.0095 U	0.0095 U	0.0095 U	0.0094 U	0.01 U
PCBs	0.019 U	0.019 U	0.019 U	0.019 U	0.01 U
D/F	--	--	--	--	--

MW-6				
Date	Aug-02	Feb-03	May-03	Dec-10
As	0.001 U	0.003 U	0.001 U	0.0001
Cr	0.001 U	0.001 U	0.0014	--
Cu	0.00159	0.0019	0.001 U	--
Pb	0.0005 U	0.0005 U	0.0005 U	--
Hg	0.0002 U	0.0002 U	0.0002 U	--
Aroclor-1254	0.00957 U	0.0095 U	0.0094 U	--
PCBs	0.0191 U	0.0189 U	0.019 U	--
D/F	--	--	--	--

MW-18	
Date	Dec-10
As	0.000061
Cr	0.00089
Cu	0.00706
Pb	0.000098
Hg	4.67E-06
Aroclor-1254	0.01 U
PCBs	0.01 U
D/F	0.618 J

MW-1					
Date	Aug-02	Nov-02	Feb-03	May-03	Nov-10
As	0.0018	0.00112	0.003 U	0.001 U	0.00171
Cr	0.0059 U	0.00933	0.0051	0.0028	0.00796
Cu	0.0221	0.0216	0.0116	0.0076	0.0247
Pb	0.0011	0.001	0.0006	0.0016	0.0104
Hg	0.0002 U	0.0002 U	0.0002 UJ	0.0002 U	0.0000139
Aroclor-1254	0.0095 UJ	0.0095 U	0.0095 U	0.0094 U	0.01 U
PCBs	0.019 UJ	0.0191 U	0.0191 U	0.019 U	0.01 U
D/F	--	--	--	--	--

MW-10						
Date	Aug-02	Nov-02	Feb-03	May-03	Dec-05	Nov-10
As	0.0015	0.00263	0.003 U	0.001 U	0.005 U	0.000016
Cr	0.0078	0.005 U	0.0017	0.0014	0.01 U	--
Cu	0.03	0.00598	0.0045	0.0015	--	--
Pb	0.0018	0.0005 U	0.0009	0.0005 U	0.002 U	--
Hg	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0005 U	--
Aroclor-1254	0.0095 U	0.0094 U	0.0095 U	0.0095 U	0.1 U	--
PCBs	0.019 U	0.019 U	0.0189 U	0.019 U	0.1 U	--
D/F	--	--	--	--	--	--

MW-2					
Date	Aug-02	Nov-02	Feb-03	May-03	Dec-10
As	0.0029	0.00632	0.0036	0.0032	0.00358
Cr	0.0042 U	0.0079	0.0066	0.0017	0.00275
Cu	0.0049	0.0289	0.0188	0.0026	0.00521
Pb	0.0006	0.00198	0.0007	0.0005 U	0.000421
Hg	0.0002 U	0.0002 U	0.0002 U	0.0002 U	2.76E-06
Aroclor-1254	0.0095 U	0.0095 U	0.0096 UJ	0.0094 U	0.01 U
PCBs	0.019 U	0.00257 J	0.0192 UJ	0.0189 U	0.01 U
D/F	--	--	--	--	--

MW-16	
Date	Dec-10
As	0.00009 U
Cr	0.0199
Cu	0.00754
Pb	0.00355
Hg	0.0000235
Aroclor-1254	0.039
PCBs	0.053
D/F	2.18 J

MW-15	
Date	Dec-10
As	0.000009 U
Cr	--
Cu	--
Pb	--
Hg	--
Aroclor-1254	--
PCBs	--
D/F	4.5

MW-17	
Date	Dec-10
As	0.00009 U
Cr	0.0417
Cu	0.00536
Pb	0.00488
Hg	0.0000589
Aroclor-1254	0.016
PCBs	0.016
D/F	1.72 J

MW-11		
Date	Dec-05	Dec-10
As	0.005 U	0.000033
Cr	0.02	0.00012
Cu	--	0.00073
Pb	0.002 U	0.000003 U
Hg	0.0005 U	1.03E-06
Aroclor-1254	0.1 U	0.01 U
PCBs	0.1 U	0.01 U
D/F	--	--

MW-7						
Date	Aug-02	Nov-02	Feb-03	May-03	Dec-05	Nov-10
As	0.001 U	0.0036	0.003 U	0.001 U	0.005 U	0.000009 J
Cr	0.0065	0.0508 J	0.0433	0.0011	0.01 U	0.00011
Cu	0.0107	0.0949 J	0.0763	0.001 U	--	0.00014
Pb	0.0008	0.0049 J	0.0082	0.0005 U	0.002 U	0.000007 J
Hg	0.0002 U	0.000113 U	0.0002 U	0.0002 U	0.0005 U	1.8E-07
Aroclor-1254	0.0094 U	0.0094 U	0.0096 U	0.0094 U	0.1 U	0.01 U
PCBs	0.019 U	0.019 U	0.0191 U	0.019 U	0.1 U	0.01 U
D/F	--	--	--	--	--	--

MW-5				
Date	Aug-02	Feb-03	May-03	Dec-05
As	0.001 U	0.003 U	0.001 U	0.005 U
Cr	0.0034 U	0.001 U	0.0033	0.01 U
Cu	0.0089	0.0111	0.0078	--
Pb	0.0005 U	0.0008	0.0005 U	0.002 U
Hg	0.0002 U	0.0002 U	0.0002 U	0.0005 U
Aroclor-1254	0.0094 U	0.0095 U	0.0094 U	0.1 U
PCBs	0.0189 U	0.019 U	0.019 U	0.1 U
D/F	--	--	--	--

MW-13	
Date	Nov-10
As	0.000304
Cr	0.00392
Cu	0.0308
Pb	0.00155
Hg	0.0000133
Aroclor-1254	0.01 U
PCBs	0.01 U
D/F	--

MW-12		
Date	Dec-05	Dec-10
As	0.005 U	0.000217
Cr	0.01	0.00055
Cu	--	0.00156
Pb	0.002 U	0.000087
Hg	0.0005 U	2.23E-06
Aroclor-1254	0.1 U	0.01 U
PCBs	0.1 U	0.01 U
D/F	--	1.13

MW-9				
Date	Aug-02	Nov-02	Feb-03	May-03
As	0.001 U	0.00185	0.003 U	0.0015
Cr	0.0102	0.0207	0.0042	0.0054
Cu	0.0236	0.0618	0.0166	0.0149
Pb	0.0014	0.00312	0.0023	0.0008
Hg	0.0002 U	0.0002 U	0.0002 U	0.0003
Aroclor-1254	0.0095 U	0.0095 U	0.0095 UJ	0.0095 U
PCBs	0.019 U	0.0191 U	0.019 UJ	0.0191 U
D/F	--	--	--	--

MW-4			
Date	Aug-02	Feb-03	May-03
As	0.0025	0.003 U	0.001 U
Cr	0.0304	0.0021	0.0021
Cu	0.0545	0.0025	0.0025
Pb	0.0036	0.0005 U	0.0005 U
Hg	0.0002 U	0.0002 U	0.0002 U
Aroclor-1254	0.0094 U	0.0097 U	0.0095 U
PCBs	0.019 U	0.0194 U	0.019 U
D/F	--	--	--

Legend

⊕ Monitoring Well

▬ Dams

▬ ▬ Estimated Inactive Landfill Boundary (Upland Portion)

⬚ Site Boundary

⬚ Estimated Former Disposal Lagoons Boundary

Metals and PCBs concentrations in µg/l = micrograms per liter

Dioxin/Furan concentrations in pg/l = picograms per liter

Metals results shown for Dec-05 are dissolved metals. All other metals results are total metals.

PCBs = Polychlorinated Biphenyls

D/F = Total Dioxins/Furans Toxicity Equivalency Quotient

As = Arsenic

Cr = Chromium

Cu = Copper

Pb = Lead

Hg = Mercury

U = Not detected above the posted practical quantitation limit (PQL)

J = Estimated concentration

NS = Not sampled

-- = Not analyzed

🟥 Value exceeds groundwater screening level protective of surface water. (See note 3)

🟨 Value exceeds groundwater screening level protective of drinking water. (See note 3)

🟦 PQL exceeds screening level.

N
W E
S

500 0 500
Feet

Reference: 2006 NAIP Imagery obtained from US Department of Agriculture, January 2009.
All other GIS layers created by GeoEngineers, Inc

Notes:
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3. Results from MW-3, MW-5, MW-6, MW-8, MW-9, MW-10, MW-13, MW-15, MW-16, and MW-17 were compared to screening levels protective of drinking water use and surface water due to the wells' proximity or upgradient position relative to Goose Lake or drainage ravine; results from other wells were compared to screening levels protective of drinking water use only.
4. Only COPCs that exceeded screening levels are shown on this figure.

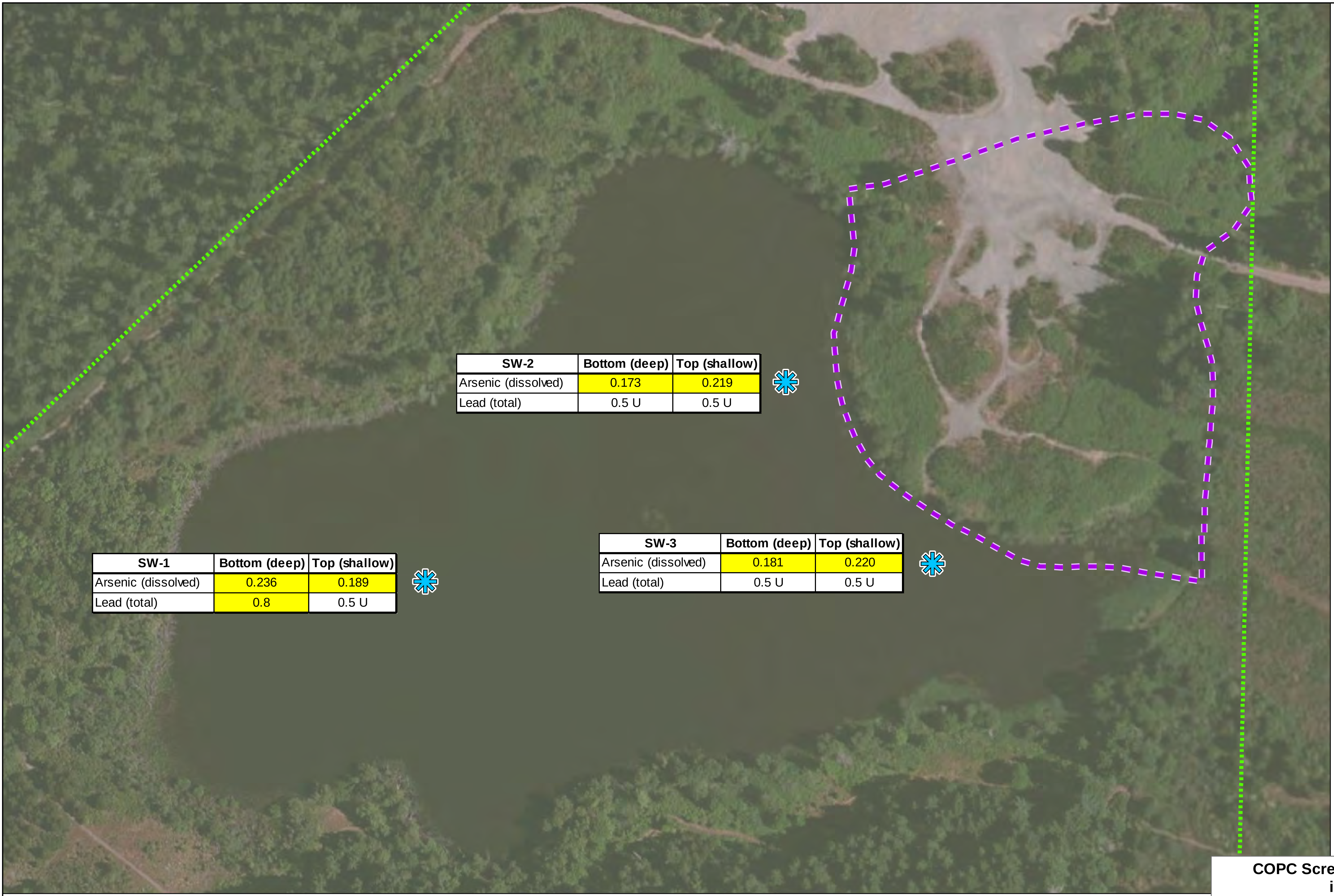
Groundwater Monitoring Results for COPCs Detected Above Screening Levels

Goose Lake Site
Shelton, Washington

GeoEngineers

Figure 25

Path: \\sea\Projects\0\0137010\GIS\013701010_T300-06_COPC_Groundwater.mxd Map Revised: 03 July 2012 amanza



SW-2	Bottom (deep)	Top (shallow)
Arsenic (dissolved)	0.173	0.219
Lead (total)	0.5 U	0.5 U

SW-1	Bottom (deep)	Top (shallow)
Arsenic (dissolved)	0.236	0.189
Lead (total)	0.8	0.5 U

SW-3	Bottom (deep)	Top (shallow)
Arsenic (dissolved)	0.181	0.220
Lead (total)	0.5 U	0.5 U

Legend

✳ Surface Water Sample Location

┅ Estimated Inactive Landfill Boundary (Upland Portion)

⬚ Site Boundary

Concentrations in µg/l = micrograms per liter

U = Not detected above the posted practical quantitation limit

🟨 Value exceeds screening level

COPC Screening Level Exceedances in Surface Water

Goose Lake Site
Shelton, Washington

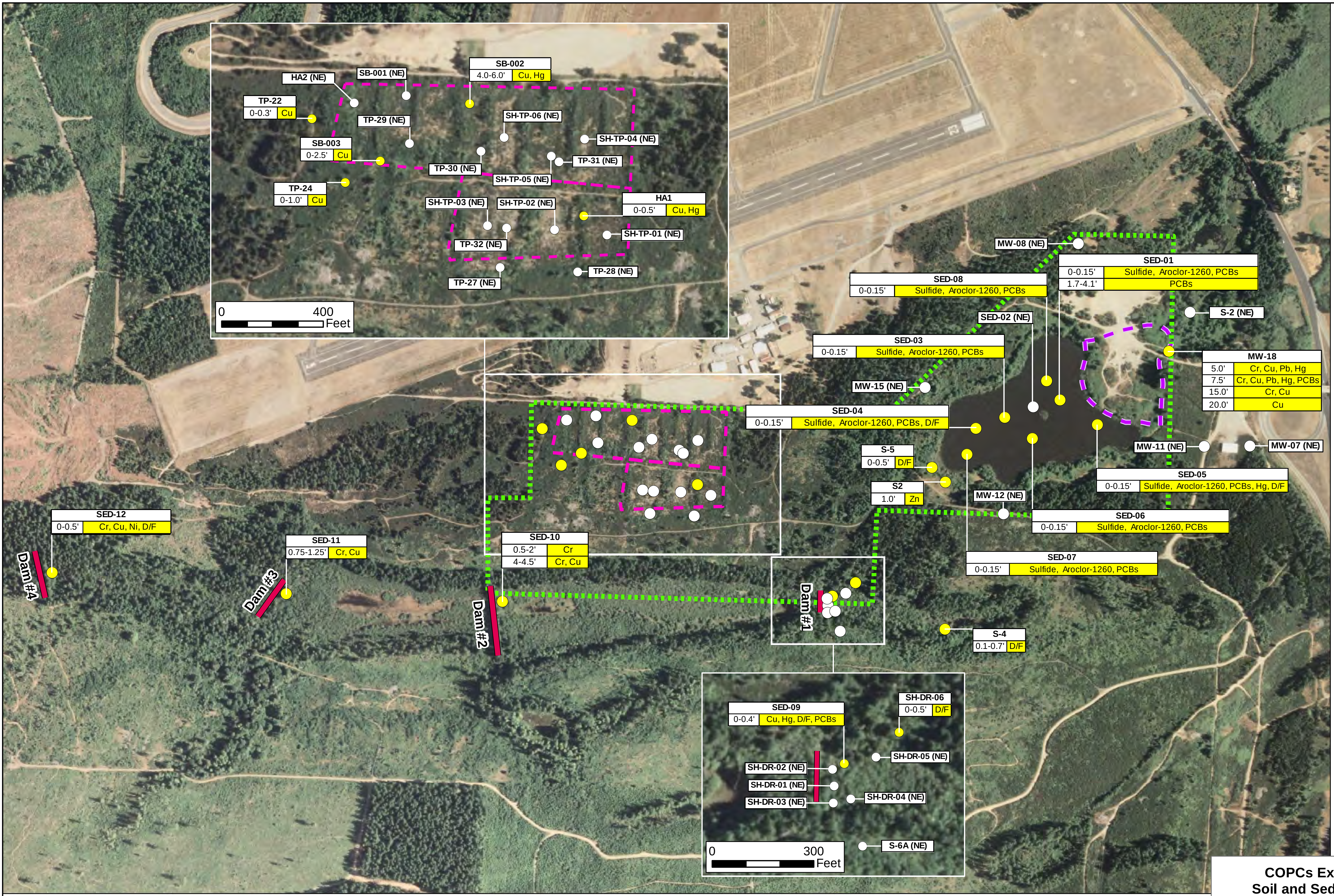
GEOENGINEERS

Figure 26

Reference: 2011 Imagery from Bing Maps.
All other GIS layers created by GeoEngineers, Inc.

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.

Path: \\seaProjects\0\0137010\GIS\013701010_T300-06_COPC_SurfaceWater.mxd Map Revised: 02 July 2012 amanza



Legend

○	Soil/Sediment Sample Location with No Exceedances
●	Soil/Sediment Sample Location with Exceedances
▬	Dams
- - -	Estimated Inactive Landfill Boundary (Upland Portion)
⋯	Site Boundary
▭	Estimated Former Disposal Lagoons Boundary

Key:

Sample Location	
Depth (ft bgs)	Constituents that exceed screening levels

NE = none of the constituents that were analyzed at this location exceeded the screening levels.

D/F = Total Dioxins and/or Furans Toxicity Equivalency Quotient

PCBs = Total Polychlorinated Biphenyls

Cr = Chromium

Cu = Copper

Pb = Lead

Hg = Mercury

Ni = Nickel

Zn = Zinc

Some sediment samples (SED-09 through SED-12; S-2; S-4; S-5) were collected from locations that are seasonally submerged, so they are compared to sediment and soil screening levels. Other sediment samples (SED-01 to SED-08) were collected from locations that are always submerged, so they are only compared to sediment screening levels. Exceedances of sediment and/or soil screening levels are shown on this figure.

N
W E
S

700 0 700
Feet

Reference: 2006 NAIP Imagery obtained from US Department of Agriculture, January 2009.
All other GIS layers created by GeoEngineers, Inc

Notes:
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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.

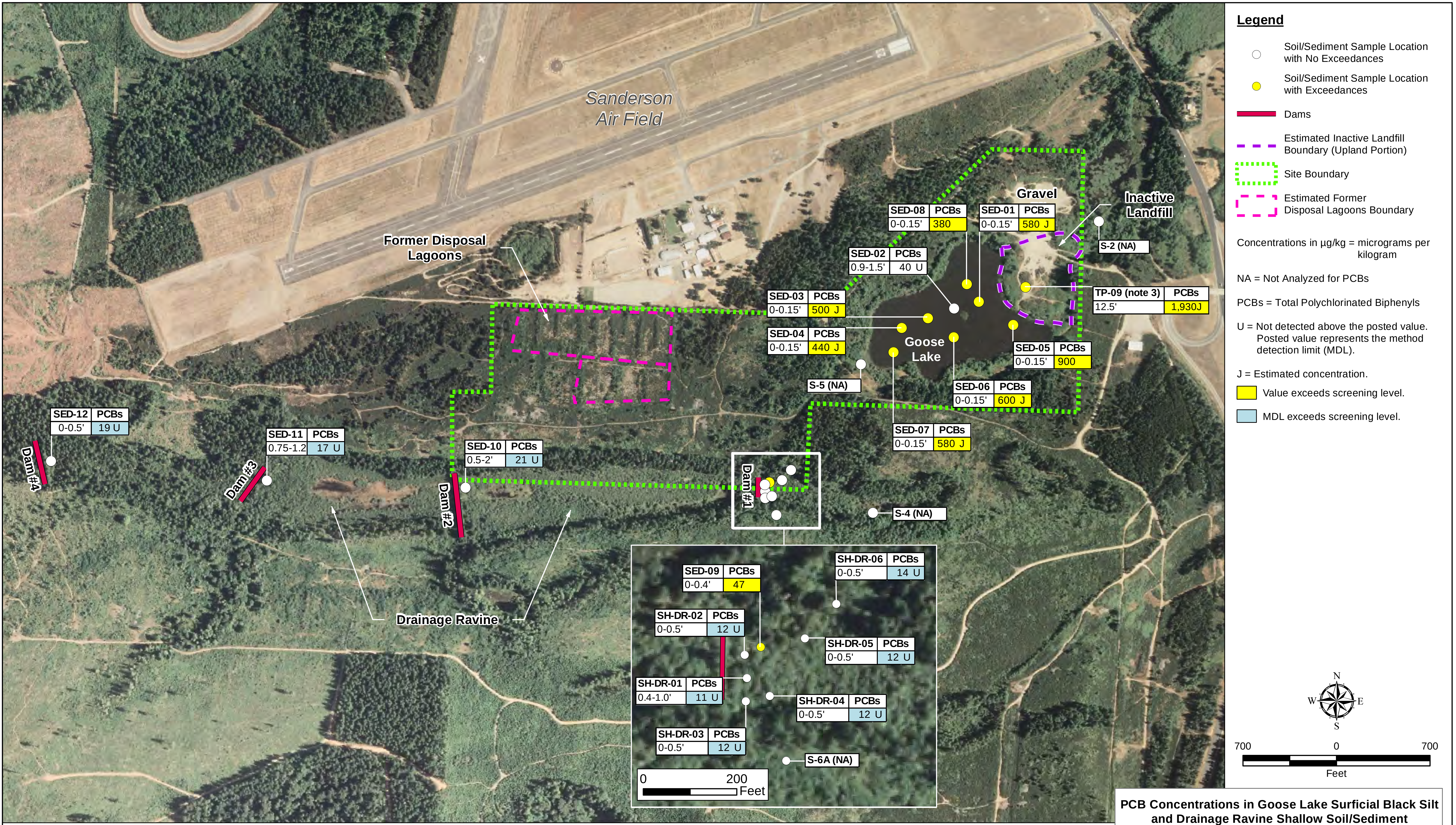
Path: \\sea\Projects\0\0137010\GIS\013701010_T300-06_COPC_OutsideLandfill.mxd Map Revised: 12 July 2012 amanza

COPCs Exceeding Screening Levels in Soil and Sediment Outside Inactive Landfill

Goose Lake Site
Shelton, Washington

GEOENGINEERS

Figure 27



Path: \\sea\Projects\0\0137010\GIS\013701010_T300-06_PCB_Results.mxd   Map Revised: 02 July 2012   amanza

Reference: 2006 NAIP Imagery obtained from US Department of Agriculture, January 2009.
All other GIS layers created by GeoEngineers, Inc

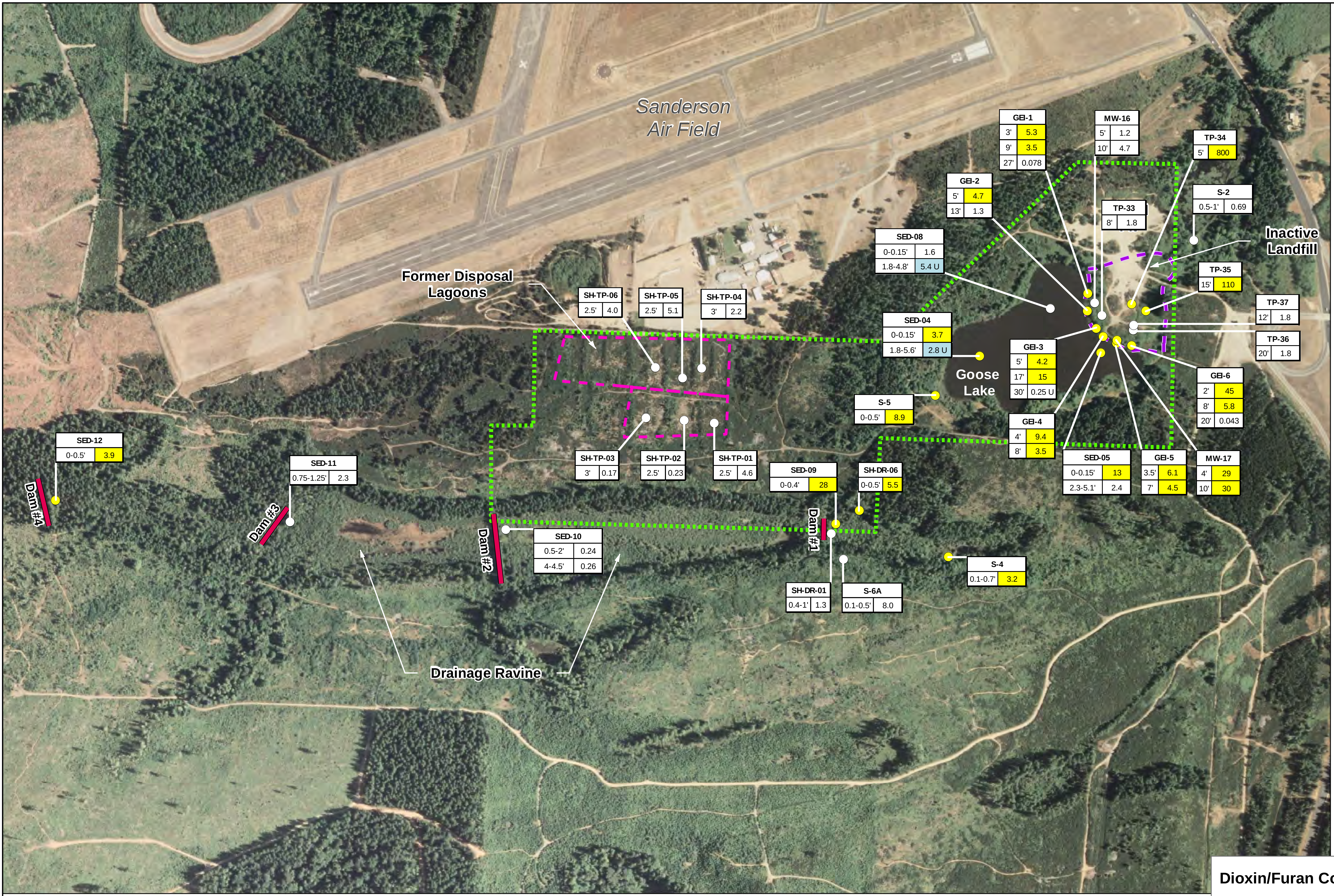
Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended
to assist in showing features discussed in an attached document.
GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files.
The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
3. TP-09-12.5 (obtained from 12.5' bgs) was the only sample in the inactive landfill where PCBs were detected, and is included in this figure for comparison.

PCB Concentrations in Goose Lake Surficial Black Silt and Drainage Ravine Shallow Soil/Sediment

Goose Lake Site
Shelton, Washington

GEOENGINEERS

Figure 28



Legend

○ Soil/Sediment Sample Location with No Exceedances

● Soil/Sediment Sample Location with Exceedances

▬ Dams

╌ Estimated Inactive Landfill Boundary (Upland Portion)

▨ Site Boundary

▭ Estimated Former Disposal Lagoons Boundary

Location ID	
Depth (feet below ground/ sediment surface)	D/F concentration

Concentrations in ng/kg = nanograms per kilogram

D/F = Total Dioxins/Furans Toxicity Equivalency Quotient (human or mammalian receptor)

U = Not detected above the posted practical quantitation limit (PQL)

🟨 Value exceeds screening level. (See note 4)

🟦 PQL exceeds screening level.

N
W E
S

700 0 700
Feet

Reference: 2006 NAIP Imagery obtained from US Department of Agriculture, January 2009.
All other GIS layers created by GeoEngineers, Inc

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.
3. Only locations tested for dioxins/furans are shown on this figure.
4. This figure depicts results relative to soil, sediment, or soil and sediment total D/F TEQ screening levels protective of human health and mammalian wildlife, depending on location. Results relative to screening levels protective of birds and fish are not depicted.

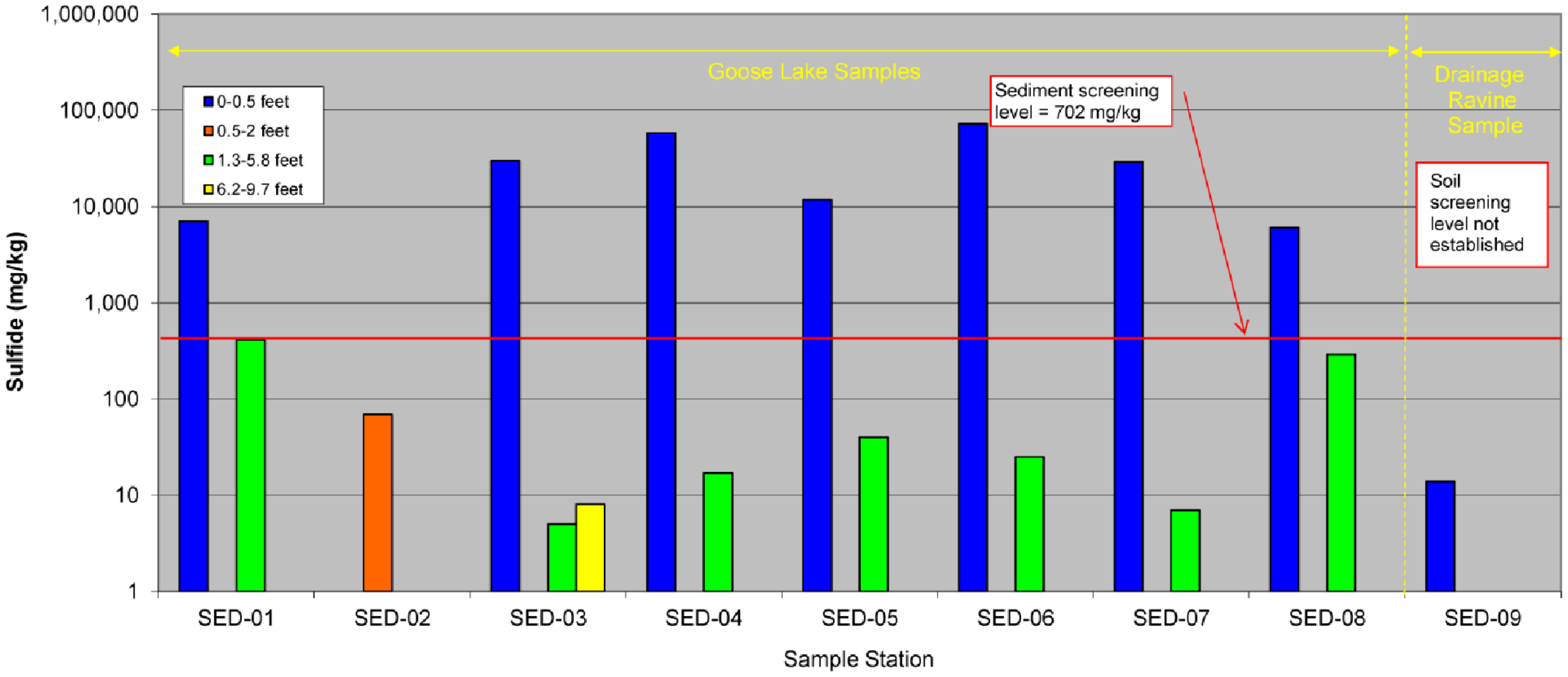
Dioxin/Furan Concentrations in Soil/Sediment

Goose Lake Site
Shelton, Washington

GEOENGINEERS

Figure 29

Path: \\sea\Projects\0\0137010\GIS\0137010010_T300-06_DioxinFuran_Results.mxd Map Revised: 03 July 2012 amanza



Notes

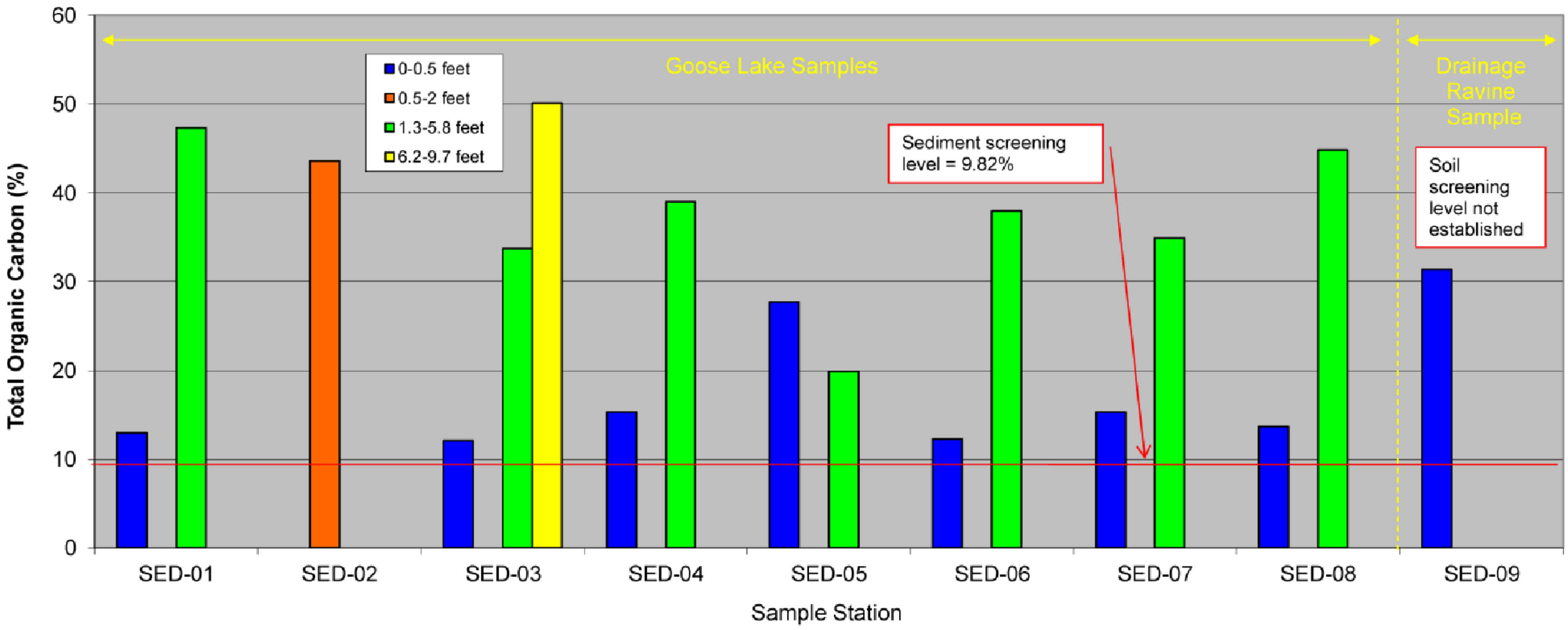
1. This drawing is for information purposes. It is intended to assist in conveying information discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
2. See Table 41 for tabulated values.
3. 2010 data for borings GEI1 to GEI6 are not included in this figure.

Sulfide in Goose Lake Sediment and Drainage Ravine Soil/Sediment

Goose Lake Site
Shelton, Washington

GeoEngineers

Figure 30



Notes

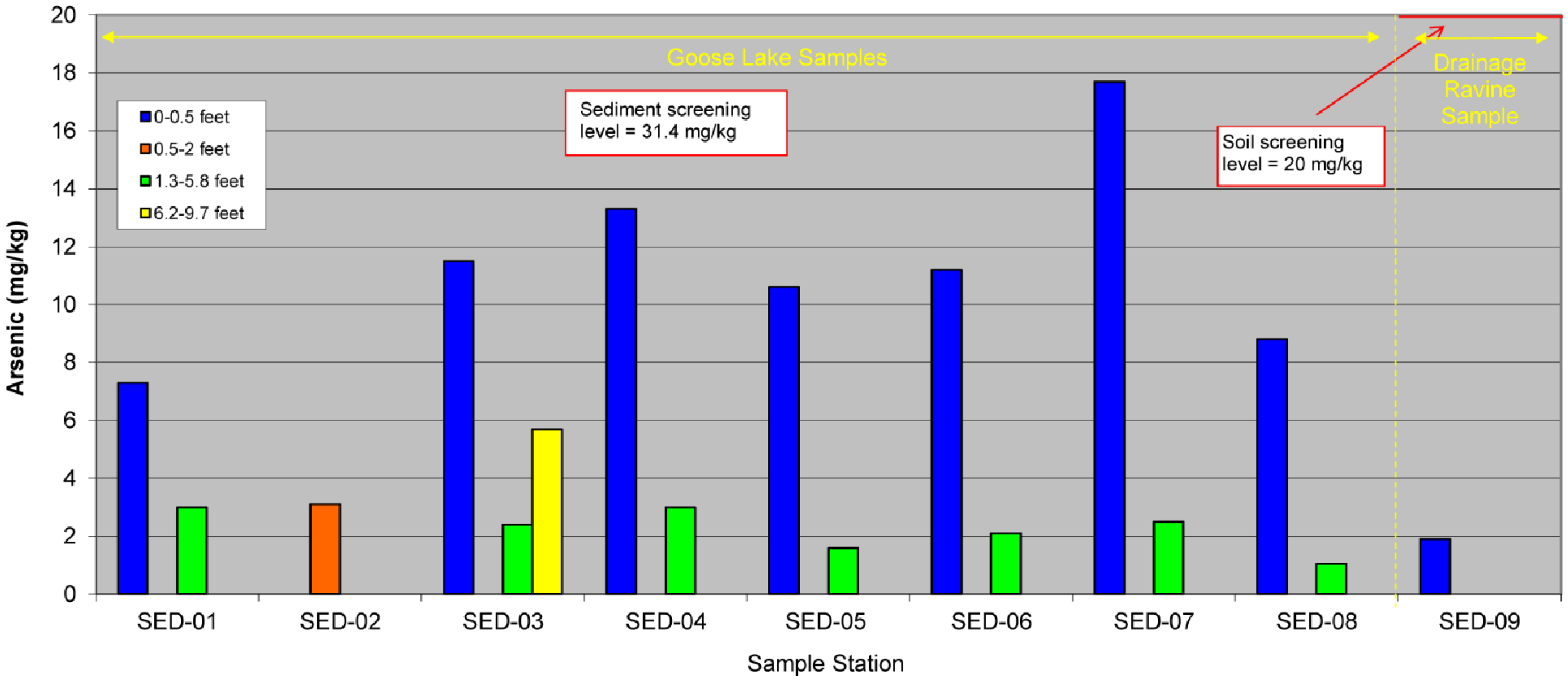
1. This drawing is for information purposes. It is intended to assist in conveying information discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
2. Total organic carbon is naturally occurring and therefore not considered a contaminant of potential concern.
3. See Table 41 for tabulated values.
4. 2010 data for borings GEI1 to GEI6 are not included in this figure.

Total Organic Carbon in Goose Lake Sediment and Drainage Ravine Soil/Sediment

Goose Lake Site
Shelton, Washington

GeoEngineers

Figure 31



Notes

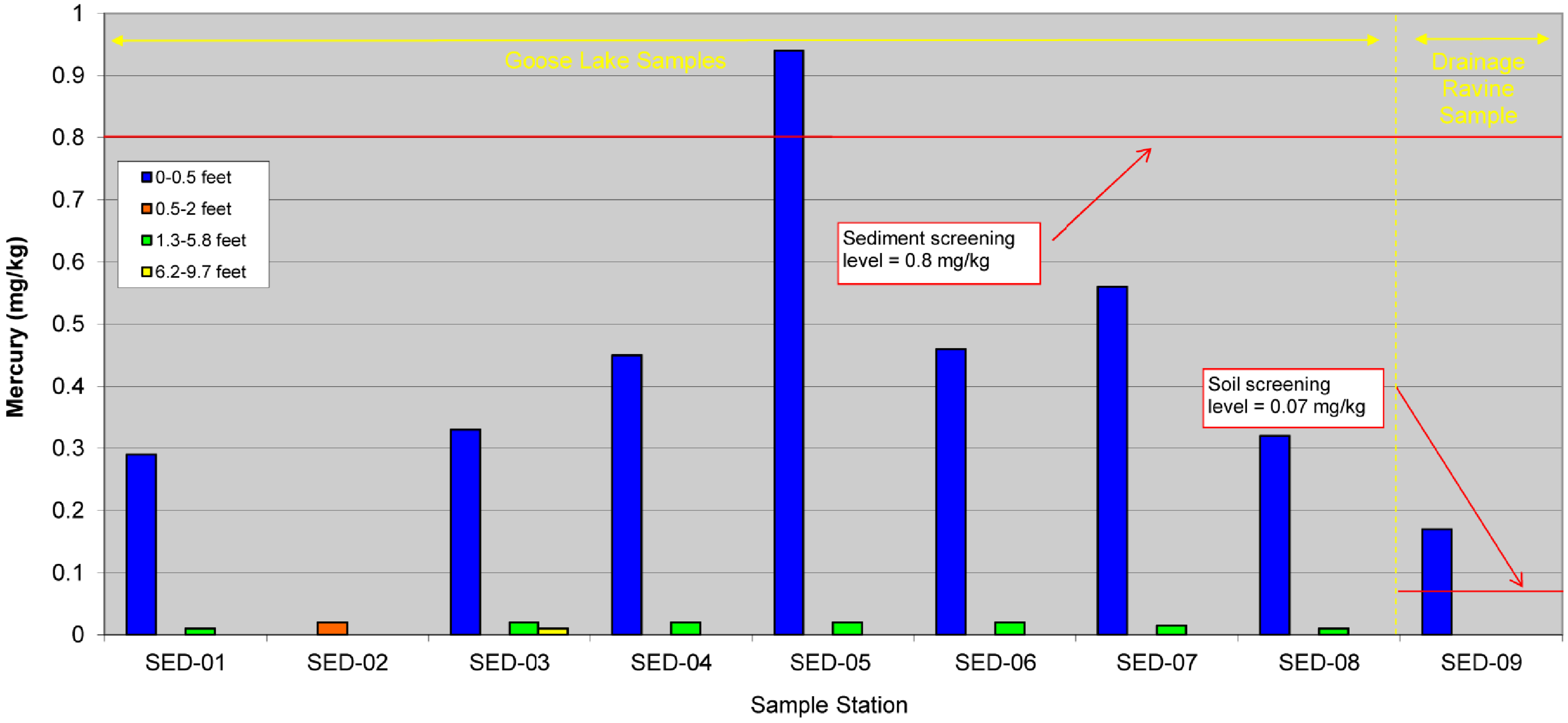
1. This drawing is for information purposes. It is intended to assist in conveying information discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
2. Both detected and non-detect results are shown in this figure. Non-detect results are shown as one-half the practical quantitation limit.
3. See Table 36 for tabulated values.
4. 2010 data for borings GEI1 to GEI6 are not included in this figure.

Arsenic in Goose Lake Sediment and Drainage Ravine Soil/Sediment

Goose Lake Site
Shelton, Washington

GeoEngineers

Figure 32



Notes

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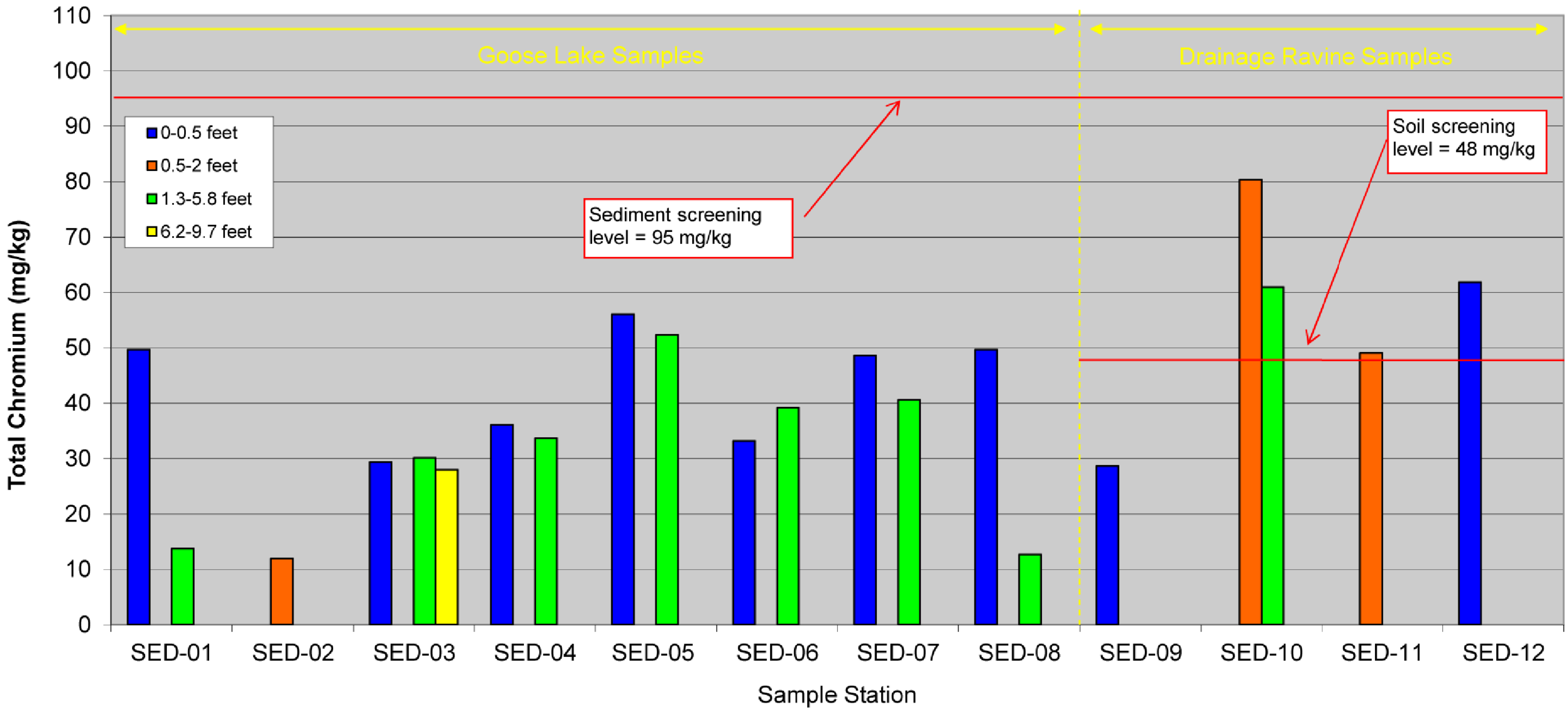
2. Both detected and non-detect results are shown in this figure. Non-detect results are shown as one-half the practical quantitation limit.
3. See Table 36 for tabulated values.
4. 2010 data for borings GEI1 to GEI6 are not included in this figure.

Mercury in Goose Lake Sediment and Drainage Ravine Soil/Sediment

Goose Lake Site
Shelton, Washington

GeoEngineers

Figure 33



Notes

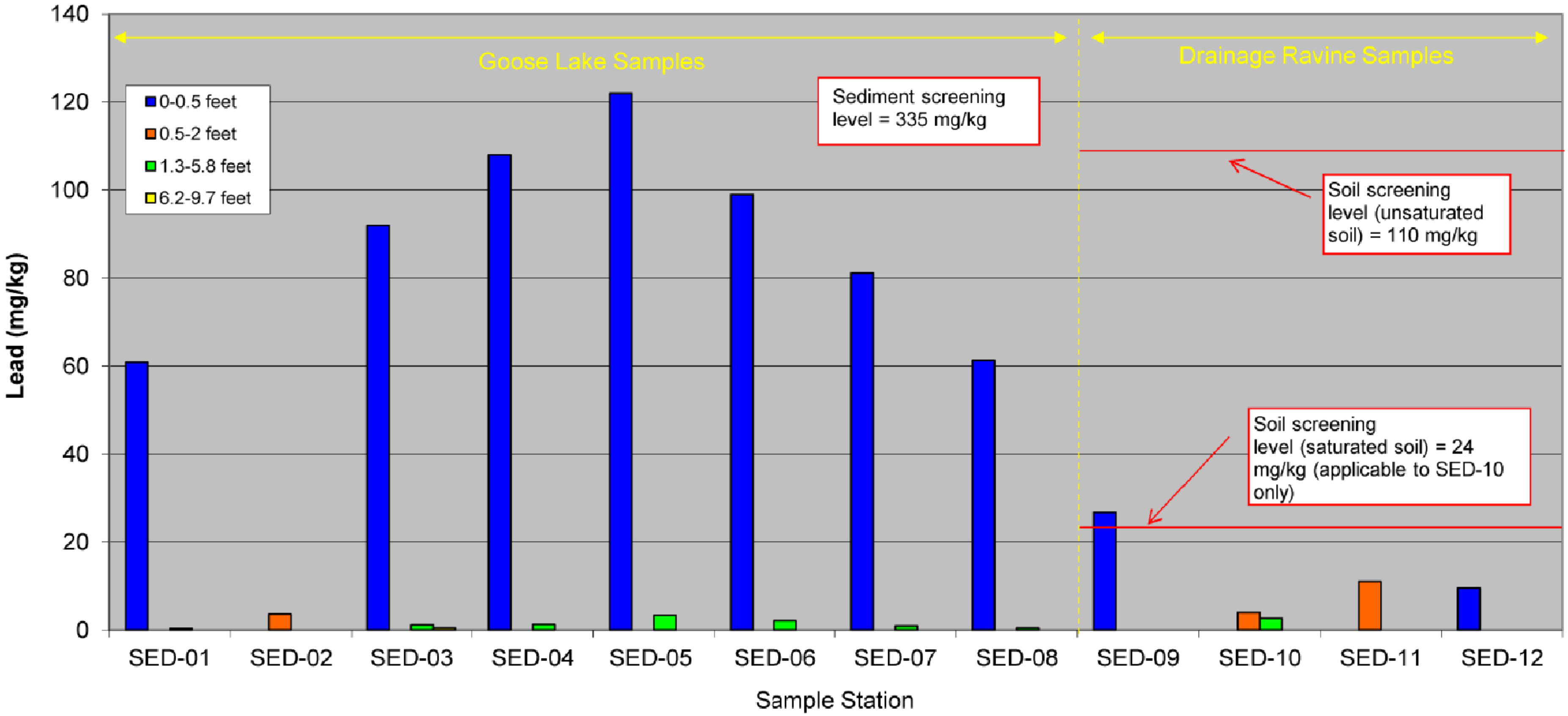
1. This drawing is for information purposes. It is intended to assist in conveying information discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
2. See Table 36 for tabulated values.
3. 2010 data for borings GEI1 to GEI6 are not included in this figure.

Total Chromium in Goose Lake Sediment and Drainage Ravine Soil/Sediment

Goose Lake Site
Shelton, Washington

GeoEngineers

Figure 34



Notes

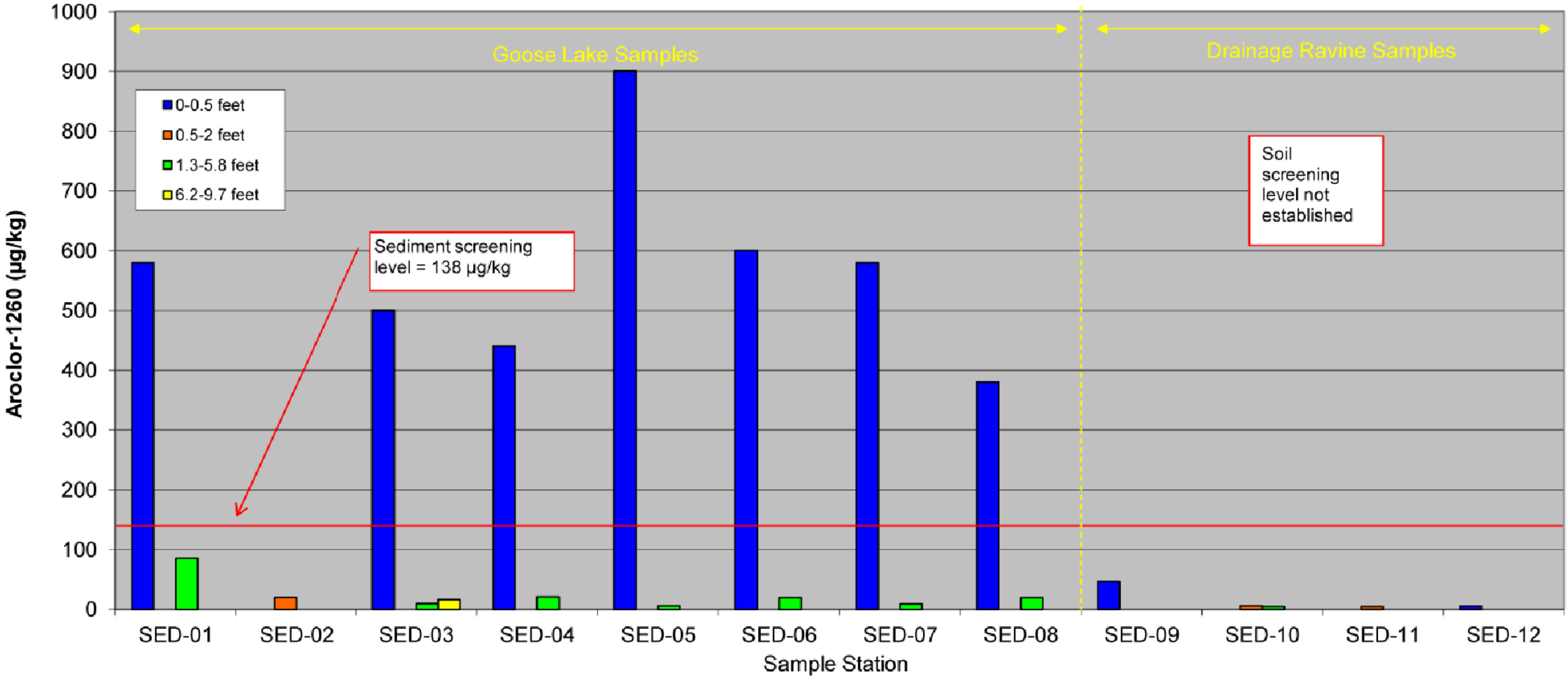
1. This drawing is for information purposes. It is intended to assist in conveying information discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
2. See Table 36 for tabulated values.
3. 2010 data for borings GEI1 to GEI6 are not included in this figure.

Lead in Goose Lake Sediment and Drainage Ravine Soil/Sediment

Goose Lake Site
Shelton, Washington

GEOENGINEERS

Figure 35



Notes

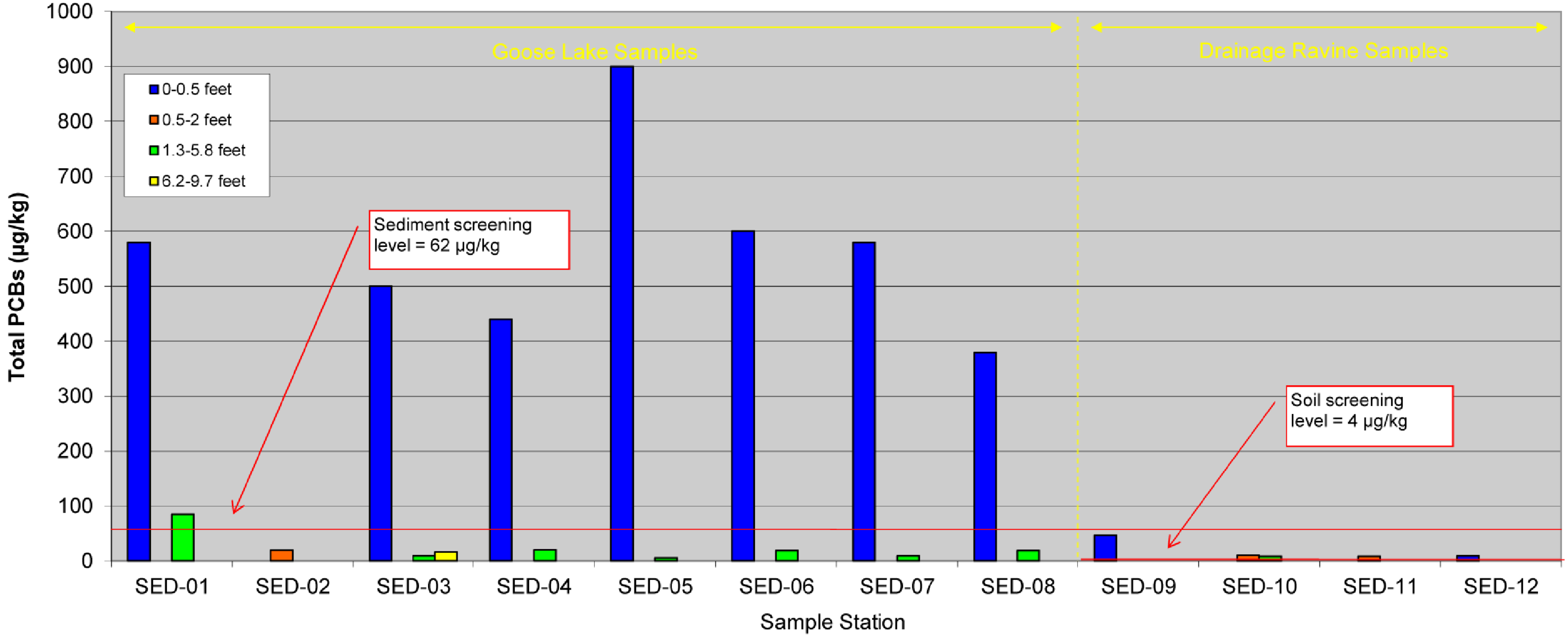
1. This drawing is for information purposes. It is intended to assist in conveying information discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
2. Both detected and non-detect results are shown in this figure. Non-detect results are shown as one-half the practical quantitation limit or method detection limit, as applicable.
3. See Table 38 for tabulated values.
4. 2008 and 2010 data for explorations SH-DR-01 to SH-DR-06, and GEI1 to GEI6 are not included in this figure.

Aroclor-1260 in Goose Lake Sediment and Drainage Ravine Soil/Sediment

Goose Lake Site
Shelton, Washington

GeoEngineers

Figure 36



Notes

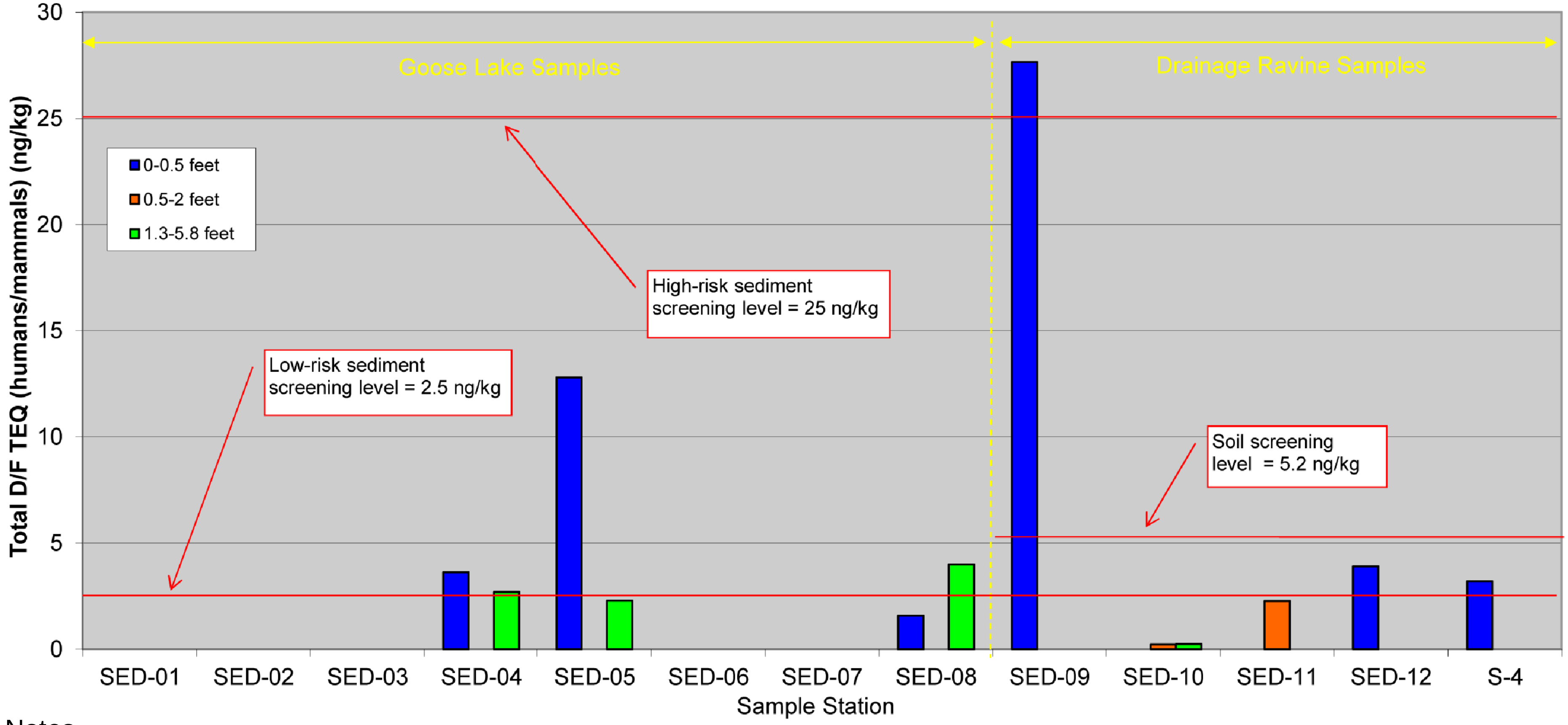
1. This drawing is for information purposes. It is intended to assist in conveying information discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
2. Both detected and non-detect results are shown in this figure. Non-detect results are shown as one-half the practical quantitation limit or method detection limit, as applicable.
3. See Table 38 for tabulated values.
4. 2008 and 2010 data for explorations SH-DR-01 to SH-DR-06, and GEI1 to GEI6 are not included in this figure.

Total PCBs in Goose Lake Sediment and Drainage Ravine Soil/Sediment

Goose Lake Site
Shelton, Washington

GeoEngineers

Figure 37



High-risk sediment screening level = 25 ng/kg

Low-risk sediment screening level = 2.5 ng/kg

Soil screening level = 5.2 ng/kg

Notes

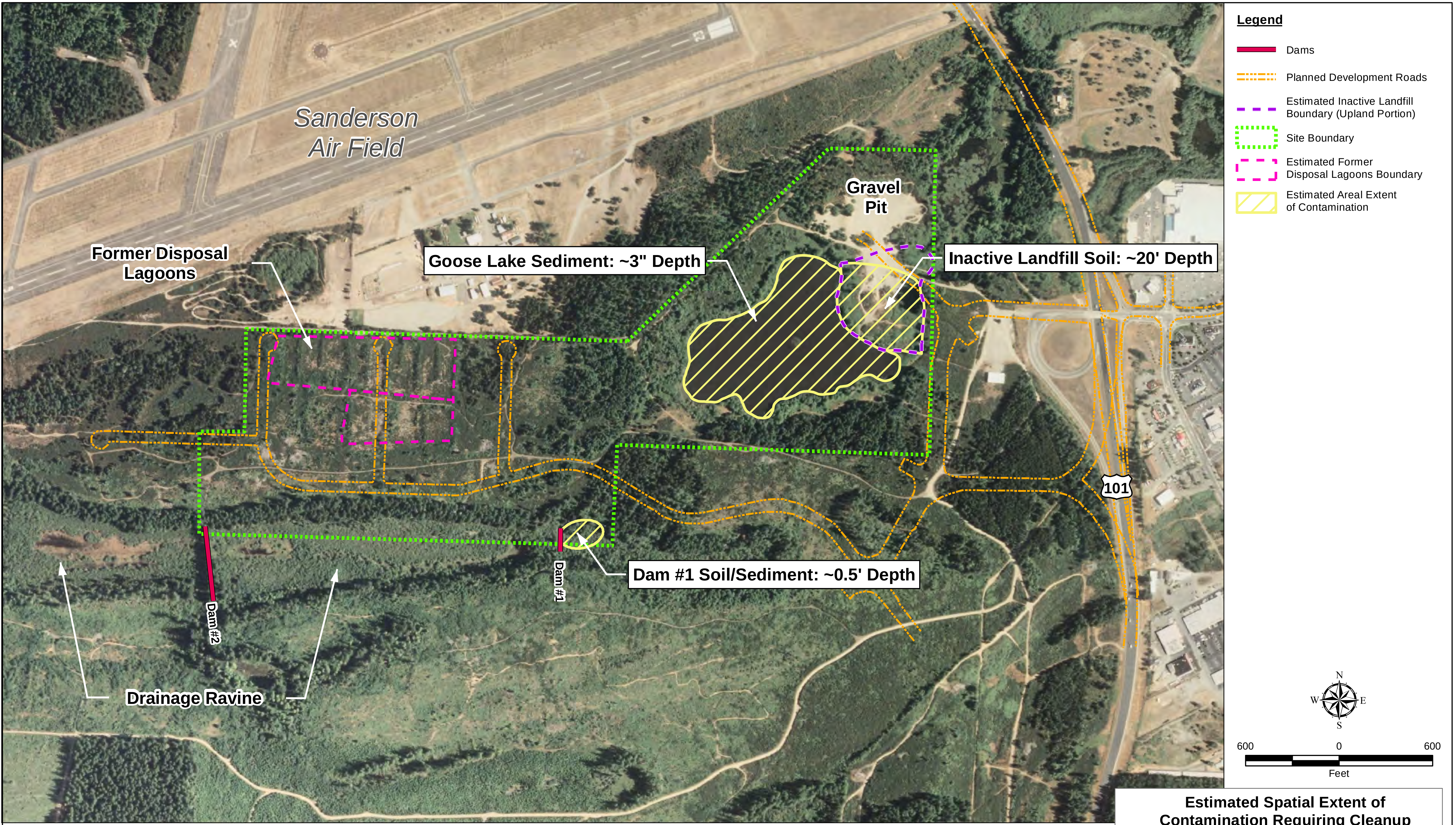
1. This drawing is for information purposes. It is intended to assist in conveying information discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
2. Both detected and non-detect results are shown in this figure.
3. Low-risk sediment screening level exceedences for SED-04 (1.3-5.8') and SED-08 (1.3-5.8') have no detected congeners, just elevated detection limits.
4. Stations SED-01, SED-02, SED-03, SED-06, and SED-07 were not analyzed for dioxins/furans.
5. See Tables 20 and 40 for tabulated values.
6. 2008 and 2010 data for explorations SH-DR-01 to SH-DR-06, and GEI1 to GEI6 are not included in this figure.

Total Dioxin/Furan Concentrations in Goose Lake Sediment and Drainage Ravine Soil/Sediment

Goose Lake Site
Shelton, Washington

GeoEngineers

Figure 38



Estimated Spatial Extent of Contamination Requiring Cleanup

Goose Lake Site
Shelton, Washington

GeoEngineers

Figure 39

Reference: 2006 NAIP Imagery obtained from US Department of Agriculture, January 2009.
All other GIS layers created by GeoEngineers, Inc

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.
3. This figure does not show smaller, isolated areas of exceedances.

Path: \\seaProjects\0\0137010\GIS\013701010_T300-06_ExtentofContamination.mxd   Map Revised: 03 July 2012   amanza

APPENDIX A1

Exploration Logs – Remedial Investigation

SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOL	GROUP NAME
COARSE GRAINED SOILS More Than 50% Retained on No. 200 Sieve	GRAVEL More Than 50% of Coarse Fraction Retained on No. 4 Sieve	CLEAN GRAVEL	GW	WELL-GRADED GRAVEL, FINE TO COARSE GRAVEL
			GP	POORLY-GRADED GRAVEL
		GRAVEL WITH FINES	GM	SILTY GRAVEL
			GC	CLAYEY GRAVEL
	SAND More Than 50% of Coarse Fraction Passes No. 4 Sieve	CLEAN SAND	SW	WELL-GRADED SAND, FINE TO COARSE SAND
			SP	POORLY-GRADED SAND
		SAND WITH FINES	SM	SILTY SAND
			SC	CLAYEY SAND
FINE GRAINED SOILS More Than 50% Passes No. 200 Sieve	SILT AND CLAY Liquid Limit Less Than 50	INORGANIC	ML	SILT
			CL	CLAY
		ORGANIC	OL	ORGANIC SILT, ORGANIC CLAY
	SILT AND CLAY Liquid Limit 50 or More	INORGANIC	MH	SILT OF HIGH PLASTICITY, ELASTIC SILT
			CH	CLAY OF HIGH PLASTICITY, FAT CLAY
		ORGANIC	OH	ORGANIC CLAY, ORGANIC SILT
HIGHLY ORGANIC SOILS			PT	PEAT

NOTES:

1. Field classification is based on visual examination of soil in general accordance with ASTM D2488-93.
2. Soil classification using laboratory tests is in general accordance with ASTM D2487-98.
3. Descriptions of soil density or consistency are based on interpretation of blow count data, visual appearance of soils, and/or test data.

SOIL MOISTURE MODIFIERS:

Dry -	Absence of moisture, dusty, dry to the touch
Moist -	Damp, but no visible water
Wet -	Visible free water or saturated, usually soil is obtained from below water table

Additional miscellaneous group symbols:

DUF = duff (root material)

LF = landfill waste horizon

GEOENGINEERS

SOIL CLASSIFICATION SYSTEM

FIGURE A-1

LABORATORY TESTS

AL	Atterberg limits
CA	Chemical analysis
CP	Compaction
CS	Consolidation
DS	Direct shear
GS	Sieve Analysis
%F	Percent fines
HA	Hydrometer analysis
SK	Permeability
SM	Moisture content
MD	Moisture and density
ST	Swelling test
TX	Triaxial compression
UC	Unconfined compression

FIELD SCREENING TESTS

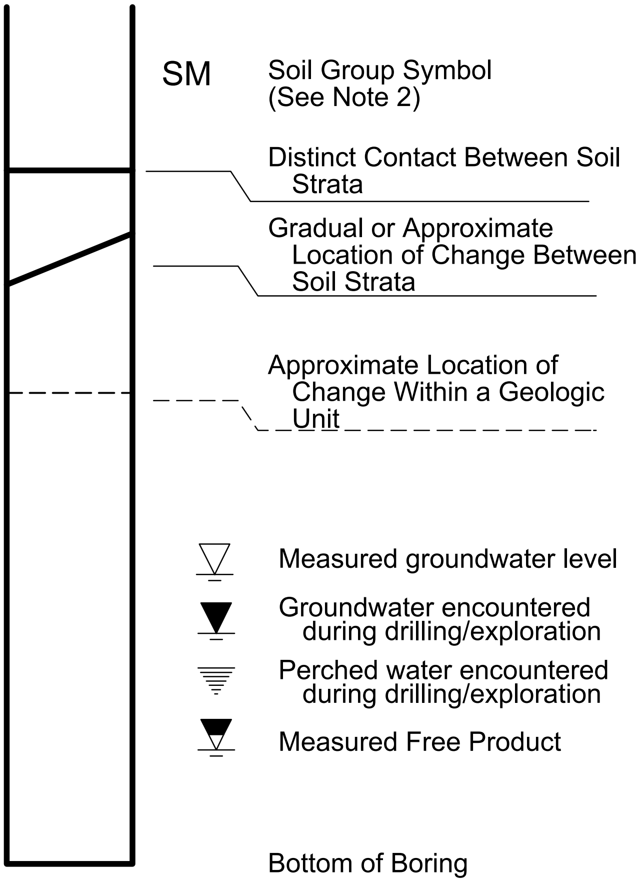
Visual Sheen Test Classifications

NS	No Visible Sheen
SS	Slight sheen
MS	Moderate sheen
HS	Heavy sheen
--	Not tested

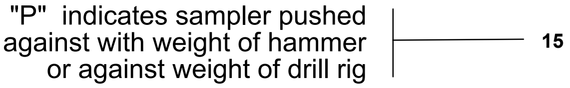
Vapor Measurements

TLV	TLV^{TM} sniffer
PID	Photo ionization detector
FID	Flame ionization detector
OVA	Organic vapor analyzer
--	Not tested

SOIL GRAPHICS



BLOW-COUNT



SAMPLE GRAPHICS

■	Location of sampling interval with relatively undisturbed recovery
☒	Location of sampling interval with disturbed recovery
☐	Location of sampling interval with no recovery

NOTES:

1. The reader must refer to the discussion in the report text, the Key to Log Symbols and the exploration logs for a proper understanding of subsurface conditions.

2. Soil classification system is summarized in Figure A-1.

KEY TO LOG SYMBOLS

GEOENGINEERS

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Figure: A-2
Sheet 1 of 1

Date Excavated: 07/11/02

Logged by: SLM/BPP

Equipment: John Deere 690 Trackhoe

Surface Elevation (ft):

Depth feet	Sample	Testing	Water	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)	NOTES
0					SM	Landfill cover horizon - Brown silty fine to coarse sand with gravel (dense, moist)	NS	0.0	
					LF	Landfill waste horizon - A variety of waste materials were observed in the landfill. The most prominent types of recognizable materials are described below.			
						Crushed rock/pea gravel Laboratory glassware			
5									
							NS	0.0	
						Glass debris			
						Black granular material (dry cooking liquor)			
10									
							NS	0.0	
			▽						
						Lumber debris			
15							NS	0.0	
						Yard waste/vegetation debris			
						Wood debris and wood chips			
20									
						Lumber debris			
							SS	0.2	
						Wood debris			
						Test pit completed at a depth of 23 feet due to practical refusal on 07/11/02 Rapid groundwater seepage observed at a depth of 12 feet No caving observed			

Note: See Figures A-1 and A-2 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 foot.

LOG OF TEST PIT TP-01

GEOENGINEERS

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Figure: A-3
Sheet 1 of 1

Date Excavated: 07/08/02

Logged by: SLM/BPP

Equipment: John Deere 690 Trackhoe

Surface Elevation (ft):

Depth feet	Sample	Testing	Water	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)	NOTES
0					SM	Landfill cover horizon - Brown silty fine to coarse sand with gravel (dense, moist)			
	☒	CA					SS	0.3	
					LF	Landfill waste horizon - A variety of waste materials were observed in the landfill. The most prominent types of recognizable materials are described below. Wood debris and Sawdust Wood debris, chips, and yard waste/vertation debris Sawdust and pulp fiber material			
5									
						Railroad tie and black granular material (dry cooking liquor)			
10						Foam rubber			
	☒	CA	▽			Heavy sheen on groundwater	MS	0.3	
						Black granular material (dry cooking liquor)			
15									
					GW	Brown fine to coarse gravel with sand, trace of silt (dense, wet) (native)			
					SP	Brown fine to medium sand, occasional gravel, trace of silt (dense, wet)			
20									
	☒	CA					NS	0.3	

Test pit completed at a depth of 22 feet on 07/08/02
Groundwater seepage observed at a depth of 11.5 feet
No caving observed

Note: See Figures A-1 and A-2 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 foot.

LOG OF TEST PIT TP-02

GEOENGINEERS

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Figure: A-4
Sheet 1 of 1

Date Excavated: 07/09/02

Logged by: SLM/BPP

Equipment: John Deere 690 Trackhoe

Surface Elevation (ft):

Depth feet	Sample	Testing	Water	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)	NOTES
0					SM	Landfill cover horizon - Brown silty fine to coarse sand with gravel (dense, moist)	NS	0.0	
5					LF	Landfill waste horizon - A variety of waste materials were observed in the landfill. The most prominent types of recognizable materials are described below. Wood debris and black granular material (dry cooking liquor) Yard waste/vegetation debris			
10	☒	CA				Black granular material (dry cooking liquor) Wood chips	NS	50.8	
			▽						
15					GW	Brown/black fine to coarse gravel with sand (dense, wet) (native)			
20					SW	Brown/black fine to coarse sand with gravel, trace of silt (dense, wet)	NS	1.2	

Test pit completed at a depth of 23 feet on 07/09/02
Groundwater seepage observed at a depth of 12 feet
No caving observed

Note: See Figures A-1 and A-2 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 foot.

LOG OF TEST PIT TP-03

GeoEngineers

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Figure: A-5
Sheet 1 of 1

Date Excavated: 07/11/02
Logged by: SLM/BPP
Equipment: John Deere 690 Trackhoe
Surface Elevation (ft):

Depth feet	Sample	Testing	Water	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)	NOTES
0				▨	SM	Landfill cover horizon - Brown silty fine to coarse sand with gravel (dense, moist)			
							NS	0.2	
					LF	Landfill waste horizon - A variety of waste materials were observed in the landfill. The most prominent types of recognizable materials are described below. Black granular material (dry cooking liquor)			
5							NS	0.6	
						Glass bottles			
10						Lumber debris, wood debris, and black granular material (dry cooking liquor)			
							NS	0.2	
			▽						
							NS	0.3	
15						Yard waste/vegetation debris			
						Black granular material (dry cooking liquor)	NS	0.6	
20						Lumber debris and yard waste/vegetation debris			
	☒	CA				Black granular material (dry cooking liquor) and wood debris			
							NS	0.2	

Test pit completed at a depth of 22 feet on 07/11/02
Groundwater seepage observed at a depth of 12 feet
No caving observed

Note: See Figures A-1 and A-2 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 foot.

LOG OF TEST PIT TP-04

GEOENGINEERS

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Figure: A-6
Sheet 1 of 1

Date Excavated: 07/08/02
Logged by: SLM/BPP
Equipment: John Deere 690 Trackhoe
Surface Elevation (ft):

Depth feet	Sample	Testing	Water	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)	NOTES
0					SM	Landfill cover horizon - Brown silty fine to coarse sand with gravel (dense, moist) (fill)	NS	0.0	
					LF	Landfill waste horizon - A variety of waste materials were observed in the landfill. The most prominent types of recognizable materials are described below. Wood debris Metal debris			
5						Wood chips Glass debris			
						Wood debris and black granular material (dry cooking liquor)			
10						Lumber debris and yard waste/vegetation debris Brick debris			
	☒	CA	▽			Lumber debris	SS	0.3	
15						Black granular material (dry cooking liquor) Lumber debris			
20						Concrete debris			
					PT	Peat (native). Brick fragments observed in this unit are interpreted to be from sloughing	SS	0.3	

Test pit completed at a depth of 23.5 feet on 07/08/02
Groundwater seepage observed at a depth of 13.5 feet
No caving observed

Note: See Figures A-1 and A-2 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 foot.

LOG OF TEST PIT TP-05

GEOENGINEERS

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Figure: A-7
Sheet 1 of 1

Date Excavated: 07/09/02

Logged by: SLM/BPP

Equipment: John Deere 690 Trackhoe

Surface Elevation (ft):

Depth feet	Sample	Testing	Water	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)	NOTES
0					SM	Landfill cover horizon - Brown silty fine to coarse sand with gravel (dense, moist)	SS	0.0	
					LF	Landfill waste horizon - A variety of waste materials were observed in the landfill. The most prominent types of recognizable materials are described below.			
5						Brick debris			
						Black granular material (dry cooking liquor)			
							NS	0.6	
						Pulp fiber material			
10									
			▽						
15									
20						Yard waste/vegetation debris			
						Lumber debris			
					GW	Black fine to coarse gravel with sand (dense, wet) (native)			
					SW	Brown fine to coarse sand with gravel, trace of silt (dense, wet)	NS	1.2	
	☒	CA							

Test pit completed at a depth of 24.5 feet on 07/08/02
Groundwater seepage observed at a depth of 14.5 feet
Severe caving observed at a depth of 24.5 feet

Note: See Figures A-1 and A-2 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 foot.

LOG OF TEST PIT TP-06

GeoEngineers

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Figure: A-8
Sheet 1 of 1

Date Excavated: 07/08/02
Logged by: SLM/BPP
Equipment: John Deere 690 Trackhoe
Surface Elevation (ft):

Depth feet	Sample	Testing	Water	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)	NOTES
0					SM	Landfill cover horizon - Brown silty fine to coarse gravel (dense, moist)	NS	0.0	
					LF	Landfill waste horizon - A variety of waste materials were observed in the landfill. The most prominent types of recognizable materials are described below. Wood debris			
5						Lumber debris, sawdust and yard waste/vegetation debris Railroad tie Wood chips Lumber debris, yard waste/vegetation debris, and black granular material (dry cooking liquor)			
10	☒	CA	▽				NS	5.5	
						Lumber debris			
15									
20									
					GW	Black fine to coarse gravel, trace of sandy silt (medium dense, wet) (native)			

Test pit completed at a depth of 24 feet on 07/08/02
Groundwater seepage observed at a depth of 9.5 feet
No caving observed

Note: See Figures A-1 and A-2 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 foot.

LOG OF TEST PIT TP-07

GeoEngineers

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Figure: A-9
Sheet 1 of 1

Date Excavated: 07/11/02
Logged by: SLM/BPP
Equipment: John Deere 690 Trackhoe
Surface Elevation (ft):

Depth feet	Sample	Testing	Water	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)	NOTES
0					SM	Landfill cover horizon - Silty fine to coarse sand (dense, moist)			
					LF	Landfill waste horizon - A variety of waste materials were observed in the landfill. The most prominent types of recognizable materials are described below.	NS	0.2	
						Plastic debris			
						Brick and vegetation debris			
5							NS	1.9	
						Black granular material (dry cooking liquor)			
	☒	CA					NS	39.4	
			▽						
10						Pulp fiber material			
						Black granular material (dry cooking liquor)			
15							NS	4.2	
						Pulp fiber material			
20									
						Wood chips			
					GW-GM	Brown fine to coarse gravel with sand and silt (dense, wet) (native) Metal debris observed in this unit is interpreted to be from sloughing	NS	2.4	
						Test pit completed at a depth of 24.0 feet on 07/11/02 Groundwater seepage observed at a depth of 10 feet No caving observed			

Note: See Figures A-1 and A-2 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 foot.

LOG OF TEST PIT TP-08

GeoEngineers

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Figure: A-10
Sheet 1 of 1

Date Excavated: 07/08/02

Equipment: John Deere 690 Trackhoe

Logged by: SLM/BPP

Surface Elevation (ft):

Depth feet	Sample	Testing	Water	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)	NOTES
0					SM	Landfill cover horiozon - Brown silty fine to coarse sand with gravel (dense, moist)	NS	0.2	
					LF	Landfill waste horizon - A variety of waste materials were observed in the landfill. The most prominent types of recognizable materials are described below.			
						Wood, glass and brick debris			
						Wood debris			
5									
						Black granular material (dry cooking liquor)			
						Lumber debris			
10									
			▽						
	☒	CA					SS	0.0	
15						Glass bottles			
						Black granular material (dry cooking liquor)			
20									
						Wood debris			
							NS	0.0	

Test pit completed at a depth of 24.5 feet on 07/08/02
Groundwater seepage observed at a depth of 12 feet
No caving observed

Note: See Figures A-1 and A-2 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 foot.

LOG OF TEST PIT TP-09

GEOENGINEERS

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Figure: A-11
Sheet 1 of 1

Date Excavated: 07/09/02

Logged by: SLM/BPP

Equipment: John Deere 690 Trackhoe

Surface Elevation (ft):

Depth feet	Sample	Testing	Water	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)	NOTES
0					SM	Landfill cover horizon - Brown silty fine to coarse sand with gravel (dense, moist)	NS	0.0	
5									
					LF	Landfill waste horizon - A variety of waste materials were observed in the landfill. The most prominent types of recognizable materials are described below. Concrete and asphalt debris			
10									
							NS	2.4	
						Lumber and yard waste/vegetation debris			
			▽						
15									
20						Pulp fiber material, lumber and yard waste/vegetation debris			
					GW	Brown fine to coarse gravel with sand, trace of silt (dense, wet) (native). Miscellaneous debris observed in this unit is interpreted to be from sloughing.	NS	1.6	

Test pit completed at a depth of 22 feet on 07/09/02
Moderate groundwater seepage observed at a depth of 14.5 feet
Moderate caving observed at a depth of 5 feet

Note: See Figures A-1 and A-2 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 foot.

LOG OF TEST PIT TP-10

GEOENGINEERS

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Figure: A-12
Sheet 1 of 1

Date Excavated: 07/10/02
Logged by: SLM/BPP
Equipment: John Deere 690 Trackhoe
Surface Elevation (ft):

Depth feet	Sample	Testing	Water	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)	NOTES
0					SM	Landfill cover horizon - Brown-gray silty fine to coarse sand with gravel (dense, moist)	NS	0.4	
					LF	Landfill waste horizon - A variety of waste materials were observed in the landfill. The most prominent types of recognizable materials are described below.			
						Wood debris			
						Black granular material (dry cooking liquor). Lumber and yard waste/vegetation debris			
						Wood chips			
5						Black granular material (dry cooking liquor)			
						Lumber debris			
							NS	0.6	
10						Pulp fiber material			
						Yard waste/vegetation debris			
15									
			▽						
20									
						Lumber and construction debris			
					GW	Black fine to coarse gravel with sand, trace of silt (dense, wet) (native)			
	☒	CA					NS	0.3	

Test pit completed at a depth of 24 feet on 07/10/02
Moderate groundwater seepage observed at a depth of 19.5 feet
No caving observed

Note: See Figures A-1 and A-2 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 foot.

LOG OF TEST PIT TP-11

GEOENGINEERS

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Figure: A-13
Sheet 1 of 1

Date Excavated: 07/11/02
Logged by: SLM/BPP
Equipment: John Deere 690 Trackhoe
Surface Elevation (ft):

Depth feet	Sample	Testing	Water	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)	NOTES
0					SM	Landfill cover horizon - Brown silty fine to coarse sand with gravel (dense, moist)	NS	0.2	
	☒	CA							
					SW-SM	Landfill cover horizon - Brown fine to coarse sand with silt			
					LF	Landfill waste horizon - A variety of waste materials were observed in the landfill. The most prominent types of recognizable materials are described below.	NS	0.2	
5						Brick, lumber, rubber, glass and plastic debris			
							NS	0.2	
	☒	CA				Black granular material (dry cooking liquor)	NS	0.5	
10			▽						
						Wood chips, pulp fiber material and black granular material (dry cooking liquor)			
							NS	0.0	
						Black granular material (dry cooking liquor)			
15							NS	0.0	
						Wood debris			
20							NS	0.0	
						Wood chips and pulp fiber material			
							NS	0.6	

Test pit completed at a depth of 24.5 feet on 07/11/02
Moderate groundwater seepage observed at a depth of 10 feet
No caving observed

Note: See Figures A-1 and A-2 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 foot.

LOG OF TEST PIT TP-12

GEOENGINEERS

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Figure: A-14
Sheet 1 of 1

Date Excavated: 07/08/02
Logged by: SLM/BPP
Equipment: John Deere 690 Trackhoe
Surface Elevation (ft):

Depth feet	Sample	Testing	Water	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)	NOTES
0					SM	Landfill cover horizon - Brown silty fine to coarse sand with gravel (dense, moist)	SS	0.2	
					LF	Landfill waste horizon - A variety of waste materials were observed in the landfill. The most prominent types of recognizable materials are described below. Lumber debris			
5	☒	CA				Wood and glass debris with oil-like coating and petroleum-like odor	HS	27.0	
						Glass debris			
10			▽						
						Wood debris			
15						Lumber debris			
						Wood debris			
20									
	☒	CA				Black granular material (dry cooking liquor)	NS	22.8	
						Test pit completed at a depth of 24.5 feet on 07/08/02 Moderate groundwater seepage observed at a depth of 11 feet No caving observed			

Note: See Figures A-1 and A-2 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 foot.

LOG OF TEST PIT TP-13

GEOENGINEERS

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Figure: A-15
Sheet 1 of 1

0137-010-03 GEI_ENVTESTPIT_2.1.0 P:\GINT TEMP DIR\SEATTLE\0137010T.GPJ GEIV2.GDT 2/12/04

Date Excavated: 07/09/02
Logged by: SLM/BPP
Equipment: John Deere 690 Trackhoe
Surface Elevation (ft):

Depth feet	Sample	Testing	Water	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)	NOTES
0					SM	Landfill cover horizon - Brown silty fine to coarse sand with gravel (dense, moist)	NS	0.2	
					LF	Landfill waste horizon - A variety of waste materials were observed in the landfill. The most prominent types of recognizable materials are described below.			
						Lumber and metal debris with black granular material (dry cooking liquor)			
5						Wood debris and pulp fiber material			
10						Wood debris			
						Lumber debris			
15						Concrete debris			
						Black granular material (dry cooking liquor) and pulp fiber material			
			▽			Lumber debris			
20							NS	5.4	
						Pulp fiber material			
					GW-GM	Gray fine to coarse gravel with sand and silt (dense, wet) (native). Metal debris observed in this unit is interpreted to be from sloughing.	NS	0.9	

Test pit completed at a depth of 24 feet on 07/09/02
Moderate groundwater seepage observed at a depth of 19.5 feet
No caving observed

Note: See Figures A-1 and A-2 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 foot.

LOG OF TEST PIT TP-14

GeoEngineers

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Figure: A-16
Sheet 1 of 1

Date Excavated: 07/10/02

Logged by: SLM/BPP

Equipment: John Deere 690 Trackhoe

Surface Elevation (ft):

Depth feet	Sample	Testing	Water	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)	NOTES
0					SM	Landfill cover horizon - Brown silty fine to medium sand with gravel (dense, moist)	NS	0.2	
					LF	Landfill waste horizon - A variety of waste materials were observed in the landfill. The most prominent types of recognizable materials are described below.			
						Pulp fiber material, sulfer fragments, lumber debris and laboratory glassware			
						Black granular material (dry cooking liquor)			
5						Lumber debris			
						Metal debris			
							NS	0.3	
						Tire			
						Black granular material (dry cooking liquor)			
10						Lumber debris			
			▽						
15									
						Wood chips			
20									
						Sulfur fragments			
						Wood chips			
					GW-GM	Brown fine to coarse gravel with sandy silt (dense, wet) (native)	NS	0.6	

Test pit completed at a depth of 24.5 feet on 07/10/02
Moderate groundwater seepage observed at a depth of 12.5 feet
No caving observed

Note: See Figures A-1 and A-2 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 foot.

LOG OF TEST PIT TP-15

GEOENGINEERS

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Figure: A-17
Sheet 1 of 1

Date Excavated: 07/08/02

Logged by: SLM/BPP

Equipment: John Deere 690 Trackhoe

Surface Elevation (ft):

Depth feet	Sample	Testing	Water	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)	NOTES
0				▨	SM	Landfill cover horizon - Brown silty fine to coarse sand with gravel (dense, moist)	NS	0.0	
					LF	Landfill waste horizon - A variety of waste materials were observed in the landfill. The most prominent types of recognizable materials are described below. Asphalt debris			
5						Lumber debris, pulp fiber material, glass and plastic debris Lumber debris and wood chips			
10	☒	CA	▽			Sulfur fragments Concrete and lumber debris	NS	20.2	
15						Peat-like material with wood chips			
20						Brick and tire debris	NS	8.4	
						Test pit completed at a depth of 24 feet on 07/08/02 Moderate groundwater seepage observed at a depth of 10 feet No caving observed			

Note: See Figures A-1 and A-2 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 foot.

LOG OF TEST PIT TP-16

GEOENGINEERS

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Date Excavated: 07/09/02

Logged by: SLM/BPP

Equipment: John Deere 690 Trackhoe

Surface Elevation (ft):

Depth feet	Sample	Testing	Water	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)	NOTES
0					SM	Landfill cover horizon - Brown silty fine to medium sand with gravel (dense, moist)			
					LF	Landfill waste horizon - A variety of waste materials were observed in the landfill. The most prominent types of recognizable materials are described below.			
						Black granular material (dry cooking liquor)	NS	0.4	
						Lumber debris			
						Concrete and yard waste/vegetation debris			
5									
						Pulp fiber material	NS	0.6	
10									
						Lumber debris and pulp fiber material			
15									
						Wood debris			
			▽			Pulp fiber material			
20									
						Tire and metal debris			
						Glass debris			
							NS	0.3	

Test pit completed at a depth of 24.5 feet on 07/08/02
Moderate groundwater seepage observed at a depth of 18.5 feet
Moderate caving observed at a depth of 8 feet

Note: See Figures A-1 and A-2 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 foot.

LOG OF TEST PIT TP-17

GeoEngineers

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Figure: A-19
Sheet 1 of 1

Date Excavated: 07/10/02

Logged by: SLM/BPP

Equipment: John Deere 690 Trackhoe

Surface Elevation (ft):

Depth feet	Sample	Testing	Water	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)	NOTES
0					SM	Landfill cover horizon - Brown silty fine to coarse sand with gravel (dense, moist)			
	☒	CA					NS	0.3	
					LF	Landfill waste horizon - A variety of waste materials were observed in the landfill. The most prominent types of recognizable materials are described below.			
5						Plastic debris Brick, lumber and yard waste/vegetation debris			
						Black granular material (dry cooking liquor)			
						Lumber debris			
10									
						Sulfur fragments	NS	2.4	
			▽						
15									
						Lumber debris, black granular material (dry cooking liquor) and wood chips			
20									
						Lumber debris			
					GW	Brown fine to coarse gravel with sand, trace of silt (dense, wet) (native)	NS	0.6	

Test pit completed at a depth of 24 feet on 07/10/02
Moderate groundwater seepage observed at a depth of 12 feet
Caving observed at a depth of 15 and 19 feet

Note: See Figures A-1 and A-2 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 foot.

LOG OF TEST PIT TP-18

GEOENGINEERS

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Figure: A-20
Sheet 1 of 1

Date Excavated: 07/10/02
Logged by: SLM/BPP
Equipment: John Deere 690 Trackhoe
Surface Elevation (ft):

Depth feet	Sample	Testing	Water	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)	NOTES
0					SM	Landfill cover horizon - Brown silty fine to coarse sand with gravel (dense, moist)	NS	0.2	
					LF	Landfill waste horizon - A variety of waste materials were observed in the landfill. The most prominent types of recognizable materials are described below. Glass, plastic and metal debris			
5									
						Wood chips, lumber and yard waste/vegetation debris			
10			▽			Black granular material (dry cooking liquor)	NS	0.3	
						Wood debris			
15						Glass bottles, lumber, and yard waste/vegetation debris			
						Wood and construction debris			
20									
					GW	Black fine to coarse gravel with sand, trace of silt (dense, wet) (native)			
					PT	Brown peat with vertical, grass-like fibers (soft, wet)			
25	☒	CA					NS	0.9	

Test pit completed at a depth of 25 feet on 07/10/02
Moderate groundwater seepage observed at a depth of 10.5 feet
No caving observed

Note: See Figures A-1 and A-2 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 foot.

LOG OF TEST PIT TP-19

GeoEngineers

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Figure: A-21
Sheet 1 of 1

Date Excavated: 07/10/02

Logged by: SLM/BPP

Equipment: John Deere 690 Trackhoe

Surface Elevation (ft):

Depth feet	Sample	Testing	Water	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)	NOTES
0					SM	Landfill cover horizon - Brown silty fine to coarse sand with silt and gravel (dense, moist)	NS	0.6	
					LF	Landfill waste horizon - A variety of waste materials were observed in the landfill. The most prominent types of recognizable materials are described below. Plastic bag containing unknown white powder Glass and plastic debris Concrete debris			
	☒	CA					NS	0.6	
5						Metal debris Black granular material (dry cooking liquor)			
						Lumber and wood debris			
10			▽			Metal and rubber debris	NS	0.9	
						Metal debris			
15						Wood debris Lumber and yard waste/vegetation debris			
20					GW	Brown-black fine to coarse gravel with sand, trace of silt (dense, wet) (native)	NS	1.2	
	☒	CA							
						Test pit completed at a depth of 25 feet on 07/10/02 Moderate groundwater seepage observed at a depth of 11.5 feet No caving observed			

Note: See Figures A-1 and A-2 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 foot.

LOG OF TEST PIT TP-20

GeoEngineers

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

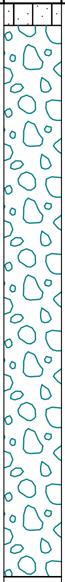
Figure: A-22
Sheet 1 of 1

Date Excavated: 08/12/02

Logged by: SLM

Equipment: Case 580 Backhoe

Surface Elevation (ft):

Depth feet	Sample	Testing	Water	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)	NOTES
0					SM	Brown silty fine to coarse sand, trace of gravel (dense, moist)	NS/SS	0.4	
					GW	Brown fine to coarse gravel with sand, trace of silt (dense, moist)			
							NS	0.0	
5									
							NS	0.2	
							NS	0.8	
10							NS	0.6	
							NS	1.3	

Test pit completed at a depth of 13 feet on 08/12/02
No groundwater seepage observed
No caving observed

Note: See Figures A-1 and A-2 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 foot.

LOG OF TEST PIT TP-21

GEOENGINEERS

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Figure: A-23
Sheet 1 of 1

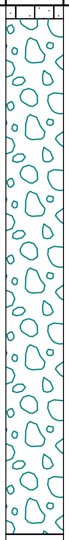
Date Excavated: 08/12/02

Logged by: SLM

Equipment: Case 580 Backhoe

Surface Elevation (ft):

Depth feet	Sample	Testing	Water	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)	NOTES
0	☒				SM	Brown silty fine to medium sand with gravel (medium dense, moist)	SS	0.4	
					GW	Brown-orange fine to coarse gravel with sand (dense, moist)			
							NS	0.6	
							NS	0.4	
5						Gray layer approximately 3 inches thick			
						Grades to brown	NS	0.8	
							NS	0.6	
10									
							NS	0.4	
							NS	0.2	



Test pit completed at a depth of 12 feet on 08/12/02
No groundwater seepage observed
No caving observed

Note: See Figures A-1 and A-2 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 foot.

LOG OF TEST PIT TP-22

GEOENGINEERS

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

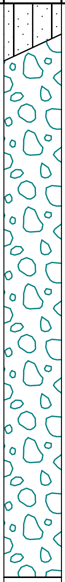
Figure: A-24
Sheet 1 of 1

Date Excavated: 08/12/02

Logged by: SLM

Equipment: Case 580 Backhoe

Surface Elevation (ft):



Depth feet	Sample	Testing	Water	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)	NOTES
0					SM	Brown-black silty fine to coarse sand with gravel (medium dense, moist)	NS	0.4	
					GW	Brown fine to coarse gravel with sand, trace of silt (dense, moist)			
							NS	0.6	
5							NS	0.4	
						Sand content slightly increases			
							NS	0.4	
10							NS	0.2	
							NS	0.4	

Test pit completed at a depth of 13 feet on 08/12/02
No groundwater seepage observed
No caving observed

Note: See Figures A-1 and A-2 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 foot.

LOG OF TEST PIT TP-23

GeoEngineers

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Figure: A-25
Sheet 1 of 1

Date Excavated: 07/12/02

Logged by: SLM/BPP

Equipment: John Deere 690 Trackhoe

Surface Elevation (ft):

Depth feet	Sample	Testing	Water	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)	NOTES
0					SM	Gray-brown fine to medium silty sand with gravel (dense, moist)			
	☒ CA				GW	Brown fine to coarse gravel with sand, trace of silt (dense, moist)	SS	2.3	
							NS	1.4	
							NS	3.4	
5									
							NS	2.1	
10							NS	1.4	

Test pit completed at a depth of 12 feet on 07/12/02
No groundwater seepage observed
No caving observed

Note: See Figures A-1 and A-2 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 foot.

LOG OF TEST PIT TP-24

GeoEngineers

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Figure: A-26
Sheet 1 of 1

Date Excavated: 07/12/02
Logged by: SLM/BPP
Equipment: John Deere 690 Trackhoe
Surface Elevation (ft):

Depth feet	Sample	Testing	Water	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)	NOTES
0					DUF	Approximately 3 inches of duff (root material with gravel and silt)	NS	0.6	
					GW	Brown fine to coarse gravel with sand (dense, moist)	NS	0.2	
							NS	1.9	
							NS	0.6	
5									
							NS	1.0	
							NS	1.4	
10									
							NS	1.4	

Test pit completed at a depth of 11 feet on 07/12/02
No groundwater seepage observed
No caving observed

Note: See Figures A-1 and A-2 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 foot.

LOG OF TEST PIT TP-25

GeoEngineers

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Figure: A-27
Sheet 1 of 1

Date Excavated: 07/12/02

Logged by: SLM/BPP

Equipment: John Deere 690 Trackhoe

Surface Elevation (ft):

Depth feet	Sample	Testing	Water	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)	NOTES
0					SM	Brown silty fine to coarse sand with gravel (medium dense, moist)			
							NS	0.4	
					GW	Brown fine to coarse gravel with sand, trace of silt (dense, moist)			
							NS	0.2	
5									
							NS	0.6	
							NS	3.8	
10									
							NS	0.3	

Test pit completed at a depth of 11 feet on 07/12/02
No groundwater seepage observed
No caving observed

Note: See Figures A-1 and A-2 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 foot.

LOG OF TEST PIT TP-26

GeoEngineers

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Figure: A-28
Sheet 1 of 1

Date Excavated: 07/12/02

Logged by: SLM/BPP

Equipment: John Deere 690 Trackhoe

Surface Elevation (ft):

Depth feet	Sample	Testing	Water	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)	NOTES
0					SM	Brown-gray silty fine to coarse sand with gravel (medium dense, moist)			
	☒	CA					SS	0.2	
					GW	Brown fine to coarse gravel with sand with cobbles, trace of silt (dense, moist)			
5									
						Iron-like staining	NS	1.0	
							NS	0.6	
10									
							NS	0.3	

Test pit completed at a depth of 12 feet on 07/12/02
No groundwater seepage observed
No caving observed

Note: See Figures A-1 and A-2 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 foot.

LOG OF TEST PIT TP-27

GeoEngineers

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

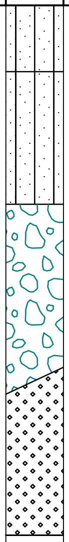
Figure: A-29
Sheet 1 of 1

Date Excavated: 07/12/02

Logged by: SLM/BPP

Equipment: John Deere 690 Trackhoe

Surface Elevation (ft):



Depth feet	Sample	Testing	Water	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)	NOTES
0					SM	Gray-black silty fine to coarse sand with gravel (medium dense, moist)			
	☒ CA								
					SM	Brown silty fine to coarse sand with gravel and cobbles (medium dense, moist)	SS	19.8	
							SS	0.6	
5					GW	Brown fine to coarse gravel with sand, trace of silt (dense, moist)			
							NS	0.2	
					SW	Brown fine to coarse sand with gravel, trace of silt (dense, moist)			
							NS	0.2	
10									
							NS	0.6	

Test pit completed at a depth of 12 feet on 07/12/02
No groundwater seepage observed
No caving observed

Note: See Figures A-1 and A-2 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 foot.

LOG OF TEST PIT TP-28

GeoEngineers

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Figure: A-30
Sheet 1 of 1

Date Excavated: 08/12/02

Logged by: SLM

Equipment: Case 580 Backhoe

Surface Elevation (ft):

Depth feet	Sample	Testing	Water	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)	NOTES
0					GW	Gray fine to coarse gravel with sand, trace of silt (dense, moist)			
	☒	CA					NS	0.8	
						Gray-black ash-like material in matrix	NS	0.8	
						Brown fine to coarse gravel with sand, trace of silt (dense, moist)	NS	1.3	

Test pit completed at a depth of 4.5 feet on 08/12/02
No groundwater seepage observed
No caving observed

Note: See Figures A-1 and A-2 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 foot.

LOG OF TEST PIT TP-29

GEOENGINEERS

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Figure: A-31
Sheet 1 of 1

Date Excavated: 08/12/02

Logged by: SLM

Equipment: Case 580 Backhoe

Surface Elevation (ft):

Depth feet	Sample	Testing	Water	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)	NOTES
0					GW	Gray fine to coarse gravel with sand, trace of silt (dense, moist)			
	☒	CA					SS	1.0	
							NS	0.6	
							NS	0.4	
						Brown fine to coarse gravel with sand, trace of silt (dense, moist)			
						Test pit completed at a depth of 4 feet on 08/12/02 No groundwater seepage observed No caving observed			

Note: See Figures A-1 and A-2 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 foot.

LOG OF TEST PIT TP-30

GeoEngineers

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Figure: A-32
Sheet 1 of 1

Date Excavated: 08/12/02

Logged by: SLM

Equipment: Case 580 Backhoe

Surface Elevation (ft):

Depth feet	Sample	Testing	Water	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)	NOTES
0					GW	Gray fine to coarse gravel with sand, trace of silt (dense, moist)			
	☒ CA								
							NS	0.8	
						Brown fine to coarse gravel with sand, trace of silt (dense, moist)	NS	0.4	
							NS	0.4	

Test pit completed at a depth of 4 feet on 08/12/02
No groundwater seepage observed
No caving observed

Note: See Figures A-1 and A-2 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 foot.

LOG OF TEST PIT TP-31

GeoEngineers

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Figure: A-33
Sheet 1 of 1

Date Excavated: 08/12/02

Logged by: SLM

Equipment: Case 580 Backhoe

Surface Elevation (ft):

Depth feet	Sample	Testing	Water	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)	NOTES
0					GW	Gray-brown fine to coarse gravel with sand, trace of silt (dense, moist)			
	☒	CA					NS	0.4	
						Brown fine to coarse gravel with sand, trace of silt (dense, moist)	NS	0.8	
							NS	0.8	

Test pit completed at a depth of 4 feet on 08/12/02
No groundwater seepage observed
No caving observed

Note: See Figures A-1 and A-2 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 foot.

LOG OF TEST PIT TP-32

GeoEngineers

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Date Excavated: 10/03/03
Logged by: SLM
Equipment: Landy V EX120 Trackhoe
Surface Elevation (ft):

Depth feet	Sample	Testing	Water	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)	NOTES
0					SM	Landfill cover horizon - Brown silty fine to medium sand with gravel			
					LF	Landfill waste horizon - A variety of waste materials were observed in the landfill. The most prominent types of recognizable materials are described below.	NS	0.0	
5						Glass debris and gravel			
						Concrete debris	NS	0.0	
	☒	CA				Black granular material (dry cooking liquor) Fine to medium sand with occasional concrete debris	NS	0.2	
10						Brown pulp fiber material	NS	7.3	
						Wood chips and lumber debris Construction debris, pulp fiber material and black granular material (dry cooking liquor)	NS	25.3	
15			∇						
						Black fibrous organic material	NS	7.8	
						Black granular material (dry cooking liquor)			

Test pit completed at a depth of 19 feet on 10/03/03
Moderate groundwater seepage observed at a depth of 15 feet

Note: See Figures A-1 and A-2 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 foot.

LOG OF TEST PIT TP-33

GEOENGINEERS

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Figure: A-35
Sheet 1 of 1

Date Excavated: 10/03/03

Logged by: SLM

Equipment: Landy V EX120 Trackhoe

Surface Elevation (ft):

Depth feet	Sample	Testing	Water	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)	NOTES
0					GW	Landfill cover horizon - Brown silty fine to coarse gravel with sand and trace silt			
					LF	Landfill waste horizon - A variety of waste materials were observed in the landfill. The most prominent types of recognizable materials are described below. Black granular material (dry cooking liquor)	NS	0.0	
5	☒ CA					Black granular material (dry cooking liquor) Concrete debris Brick debris	NS	0.3	
						Brown pulp fiber material	NS	0.3	
10									
						White pulp fiber material	NS	0.1	
15									
							NS	0.0	
			∇		GP	Brown fine to medium gravel with sand and silt (dense, wet) (native)			
						Test pit completed at a depth of 19 feet on 10/03/03 Moderate groundwater seepage observed at a depth of 18 feet			

Note: See Figures A-1 and A-2 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 foot.

LOG OF TEST PIT TP-34

GeoEngineers

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Figure: A-36
Sheet 1 of 1

Date Excavated: 10/03/03

Logged by: SLM

Equipment: Landy V EX120 Trackhoe

Surface Elevation (ft):

Depth feet	Sample	Testing	Water	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)	NOTES
0					SM	Landfill cover horizon - Brown silty fine to medium sand with gravel (medium dense, moist)			
					LF	Landfill waste horizon - A variety of waste materials were observed in the landfill. The most prominent types of recognizable materials are described below.	NS	0.2	
						Black granular material (dry cooking liquor)			
5									
						Brown/black pulp fiber material	NS	7.9	
						Black granular material (dry cooking liquor)	NS	9.9	
10						Wood/construction debris	NS	18.5	
						Wood debris			
15	☒ CA					Black fibrous wood chip debris	NS	16.4	
					GW-GM	Black silty gravel with sand (native)			

Test pit completed at a depth of 19 feet on 10/03/03
No groundwater seepage observed

Note: See Figures A-1 and A-2 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 foot.

LOG OF TEST PIT TP-35

GEOENGINEERS

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Date Excavated: 10/03/03

Logged by: SLM

Equipment: Landy V EX120 Trackhoe

Surface Elevation (ft):

Depth feet	Sample	Testing	Water	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)	NOTES
0					GW	Landfill cover horizon - Brown fine to coarse gravel with trace sand			
					LF	Landfill waste horizon - A variety of waste materials were observed in the landfill. The most prominent types of recognizable materials are described below.			
							NS	0.0	
						Black granular material (dry cooking liquor) and unidentified white powder.			
						Wood debris			
							NS	0.0	
5						Sulfur fragments			
						Black/brown fibrous organic material			
							NS	0.0	
						Sulfur fragments			
10						Gravel with black granular material (dry cooking liquor)			
							NS	0.0	
						Sulfur fragments			
							NS	9.9	
15									
			∇						
20	☒	CA				Black organic silt material with gravel and sand	NS	2.1	
						Test pit completed at a depth of 20.5 feet on 10/03/03 Moderate groundwater seepage observed at a depth of 18.5 feet			

Note: See Figures A-1 and A-2 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 foot.

LOG OF TEST PIT TP-36

GeoEngineers

Project: Rayonier - Goose Lake

Project Location: Shelton, Washington

Project Number: 0137-010-03

Figure: A-38

Sheet 1 of 1

Date Excavated: 10/03/03

Logged by: SLM

Equipment: Landy V EX120 Trackhoe

Surface Elevation (ft):

Depth feet	Sample	Testing	Water	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)	NOTES
0					GW-GM	Landfill cover horizon - Brown fine to coarse gravel with sand and silt (dense, moist)			
					LF	Landfill waste horizon - A variety of waste materials were observed in the landfill. The most prominent types of recognizable materials are described below.	NS	0.3	
						Black granular material (dry cooking liquor)	NS	1.2	
						Brown fibrous organic material			
5									
						Black fibrous organic material	NS	2.4	
10									
	☒	CA				Black fibrous wood chip debris	NS	22.4	
						Black granular material (dry cooking liquor)	NS	0.4	
15						Sulfur fragments			
20						Fibrous organic material, black granular material (dry cooking liquor), and brick/construction debris	NS	1.3	
						Test pit completed at a depth of 21 feet on 10/03/03 No groundwater seepage observed			

Note: See Figures A-1 and A-2 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 foot.

LOG OF TEST PIT TP-37

GEOENGINEERS

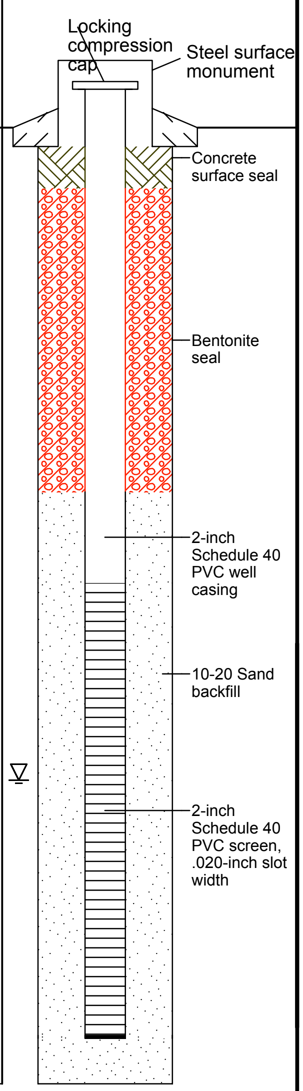
Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Figure: A-39
Sheet 1 of 1

Date(s) Drilled	7/23/02	Logged By	BPP	Checked By	BPP
Drilling Contractor	Holt Drilling	Drilling Method	HSA	Sampling Methods	Dames & Moore
Total Boring Depth (ft)	31.5	Hammer Data	300 (lb) hammer/ 30 (in) drop	Drilling Equipment	
Well Depth (ft)	30	Top of Well Elevation (ft)		Groundwater Level (ft. bgs)	21.5
System/ Datum					

Depth feet	SAMPLES Interval	Testing	Recovered (in)	Blows/foot	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)
0	⊠				GW	Brown fine to coarse gravel with occasional sand and organic matter (loose, moist)	NS	1.3
5	■		18	44		Brown fine to coarse gravel with fine to coarse sand (dense, moist)	NS	7.8
10	■		11	50		Becomes very dense	SS	5.0
15	■	CA	11	50			SS	6.8
20	■		16	86		Brown fine to coarse gravel with fine to coarse sand (very dense, moist) Becomes wet	SS	5.8
25	■		17	78			NS	14.6
30	■		16	89		Gray fine to coarse gravel with fine to coarse sand and silt (very dense, wet)	NS	7.8

WELL CONSTRUCTION



Note: See Figures A-1 and A-2 for explanation of symbols

LOG OF MONITORING WELL MW-7

GEOENGINEERS

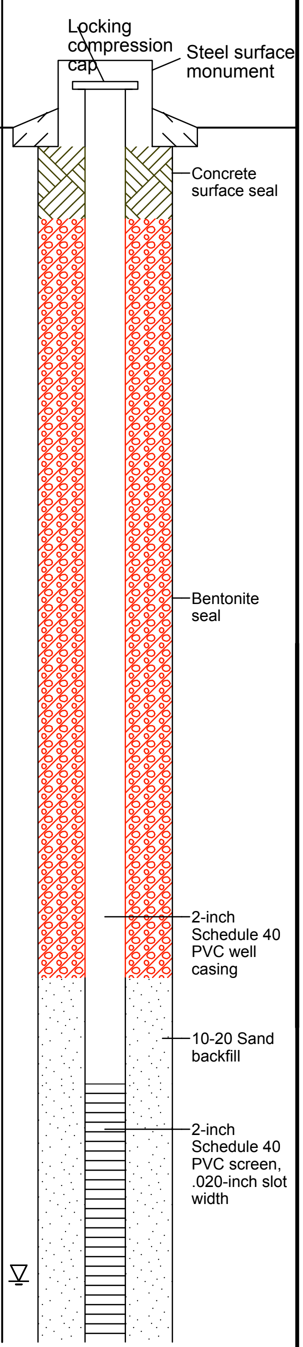
Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Figure: A-40
Sheet 1 of 1

Date(s) Drilled	7/22/02	Logged By	BPP	Checked By	BPP
Drilling Contractor	Holt Drilling	Drilling Method	HSA	Sampling Methods	Dames & Moore
Total Boring Depth (ft)	46.5	Hammer Data	300 (lb) hammer/ 30 (in) drop	Drilling Equipment	
Well Depth (ft)	46.5	Top of Well Elevation (ft)		Groundwater Level (ft. bgs)	38
System/ Datum					

Depth feet	SAMPLES Interval	Testing	Recovered (in)	Blows/foot	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)
0	☒					GW	Brown fine to coarse gravel with fine to coarse sand and silt and organic matter (dense, moist)	NS	3.5
5	■		6	42				NS	0.0
10	■		18	31			Brown fine to coarse gravel with fine to coarse sand (dense, moist)	SS	0.0
15	■		18	28				SS	0.0
20	■		18	75			Brown fine to coarse gravel with fine to coarse sand and trace silt (very dense, moist)	SS	0.0
25	■		18	40			Brown fine to coarse gravel with fine to coarse sand (dense, moist)	SS	0.0
30	■		18	26				SS	0.0
35	■	CA	18	77			Becomes very dense	SS	0.0
							Becomes wet		
40									

WELL CONSTRUCTION



Note: See Figures A-1 and A-2 for explanation of symbols

LOG OF MONITORING WELL MW-8

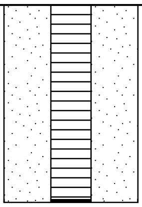
GEOENGINEERS

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Figure: A-41
Sheet 1 of 2

Depth feet	SAMPLES Interval	Testing	Recovered (in)	Blows/foot	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)
40	■		18	60		GW	Brown fine to coarse gravel with fine to coarse gravel and trace silt (very dense, wet)	NS	0.0
45	■		18	75			Brown fine to coarse gravel with fine to coarse sand and silt (very dense, wet)	NS	0.0

WELL CONSTRUCTION



LOG OF MONITORING WELL MW-8 (continued)

GeoEngineers

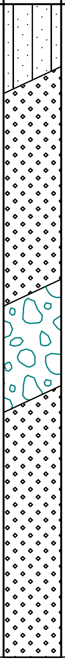
Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Figure: A-41
Sheet 2 of 2

Date(s) Drilled	7/23/02	Logged By	BPP	Checked By	BPP
Drilling Contractor	Holt Drilling	Drilling Method	HSA	Sampling Methods	Dames & Moore
Total Boring Depth (ft)	21.5	Hammer Data	300 (lb) hammer/ 30 (in) drop	Drilling Equipment	
Well Depth (ft)	20	Top of Well Elevation (ft)		Groundwater Level (ft. bgs)	10
System/ Datum					

Depth feet	SAMPLES Interval	SAMPLES Testing	SAMPLES Recovered (in)	SAMPLES Blows/foot	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)
0	☒				SM	Brown silty fine to coarse sand with occasional gravel and organic matter (loose, moist)	NS	0.0
					SW	Brown fine to coarse sand with gravel (medium dense, moist)		
5	■		18	23			NS	3.1
					GW	Brown fine to coarse gravel with fine to coarse sand (dense, wet)		
10	■		18	32			NS	0.0
					SW	Gray fine to coarse sand (medium dense, wet)		
15	■		18	20			NS	2.2
20	■		18	34		Gray fine to coarse sand with occasional gravel (wet, dense)	NS	0.0

Graphic Log



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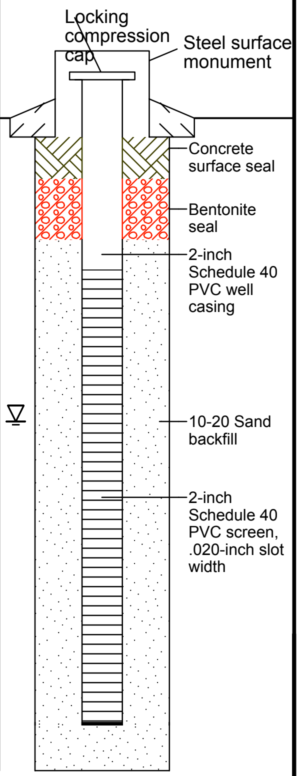


Note: See Figures A-1 and A-2 for explanation of symbols

LOG OF MONITORING WELL MW-9

GEOENGINEERS

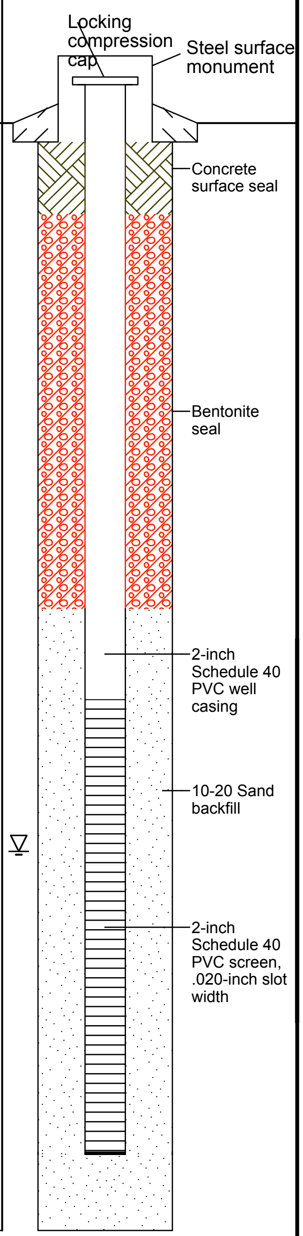
Project:	Rayonier - Goose Lake
Project Location:	Shelton, Washington
Project Number:	0137-010-03

Figure: A-42
Sheet 1 of 1

Date(s) Drilled	7/22/02	Logged By	BPP	Checked By	BPP
Drilling Contractor	Holt Drilling	Drilling Method	HSA	Sampling Methods	Dames & Moore
Total Boring Depth (ft)	36.5	Hammer Data	300 (lb) hammer/ 30 (in) drop	Drilling Equipment	
Well Depth (ft)	34	Top of Well Elevation (ft)		Groundwater Level (ft. bgs)	24
System/ Datum					

Depth feet	SAMPLES Interval	Testing	Recovered (in)	Blows/foot	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)
0	☒				GW	Brown fine to coarse gravel with fine to coarse sand and root debris and silt (dense, moist)	SS	0.0
5	■		5	41		Brown fine to coarse gravel with fine to coarse sand and trace silt (dense, moist)	SS	0.0
10	■		18	32		Brown fine to coarse gravel with fine to coarse sand (dense, moist)	SS	0.0
15	■		18	23		Brown fine to coarse gravel with fine to coarse sand (medium dense, moist)	SS	0.0
20	■		18	18			SS	0.0
					SP	Brown fine to medium sand with fine sand interbeds (dense, wet)		
25	■		18	35			NS	0.0
30	■		18	24		Gray-brown fine sand (medium dense, wet)	NS	0.0
35	■		18	11		Contains gray silt interbeds	NS	0.0

WELL CONSTRUCTION



Note: See Figures A-1 and A-2 for explanation of symbols

LOG OF MONITORING WELL MW-10

GEOENGINEERS

Project:	Rayonier - Goose Lake
Project Location:	Shelton, Washington
Project Number:	0137-010-03

Figure: A-43
Sheet 1 of 1

0137-010-03 GEI_ENVWELL_2.1.0 P:\0\0137010\03\FINALS\FORMAL~2\FORMAL~4\0137010M.GPJ GEIV2_2.GDT 2/12/04

Date(s) Drilled	06/25/02	Logged By	SLM	Checked By	SCW
Drilling Contractor	Marine Sampling Services	Drilling Method	Vibra Core	Sampling Methods	Vanveen/Continuous Aluminum Tube
Auger Data	N/A	Hammer Data		Drilling Equipment	
Total Depth (ft)	4.35	Surface Elevation (ft)		Ground Water Level (ft. bgs)	
Datum/ System				Depth to Mudline (ft. below lake surface)	10.0

Depth feet	SAMPLES Interval	Testing	Recovered (in)	Blows/foot	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor TLV(ppm)	NOTES
0	☒	CA					OH	Black organic silt (very soft, wet)			Vanveen sampler
							OH	Black and brown organic silt with sand and leaf and root debris (soft, wet)			Vibra Core sampler
							OH	Organic silt with fibrous wood material (soft, wet)			
	■	CA									
5											
10											

Note: See Figures A-1 and A-2 for explanation of symbols

LOG OF SEDIMENT CORE SED-01

GeoEngineers

Project: Rayonier - Goose Lake

Project Location: Shelton, Washington

Project Number: 0137-010-03

Figure: A-44

Sheet 1 of 1

Date(s) Drilled	06/25/02	Logged By	SLM	Checked By	SCW
Drilling Contractor	Marine Sampling Services	Drilling Method	Vibra Core	Sampling Methods	Continuous Aluminum Tube
Auger Data	N/A	Hammer Data		Drilling Equipment	
Total Depth (ft)	1.5	Surface Elevation (ft)		Ground Water Level (ft. bgs)	
Datum/ System				Depth to Mudline (ft. below lake surface)	5.6

Depth feet	SAMPLES Interval	SAMPLES Testing	SAMPLES Recovered (in)	SAMPLES Blows/foot	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor TLV(ppm)	NOTES
0							OH	Orangish-brown organic silt with vegetation material (soft, wet)			
	■	CA					OH	Black and brown silt with fibrous wood material. Vertically oriented in-place vegetation becomes more prevalent with depth (soft, wet)			
5											
10											

Note: See Figures A-1 and A-2 for explanation of symbols

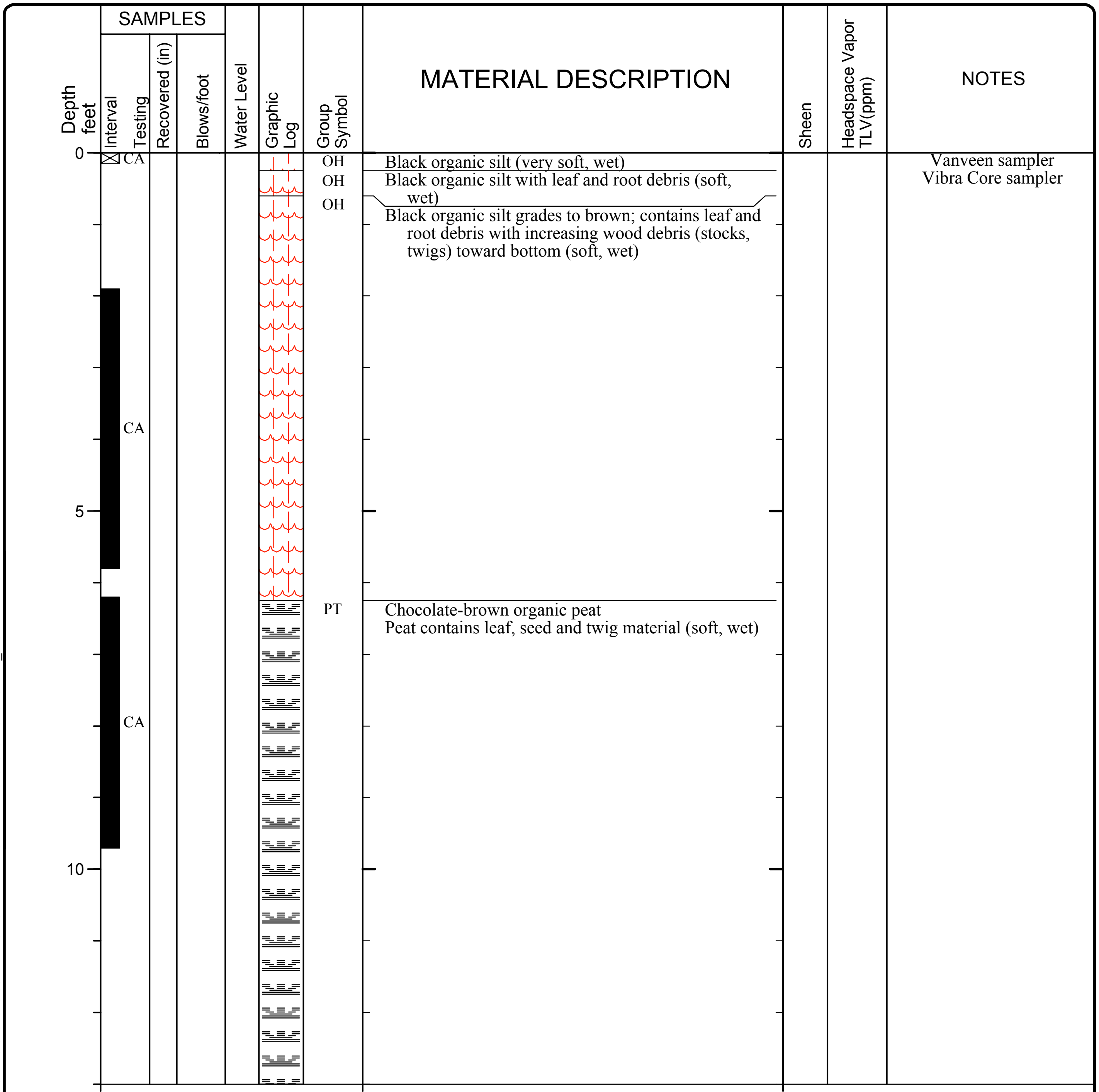
LOG OF SEDIMENT CORE SED-02

GeoEngineers

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Figure: A-45
Sheet 1 of 1

Date(s) Drilled	06/25/02	Logged By	SLM	Checked By	SCW
Drilling Contractor	Marine Sampling Services	Drilling Method	Vibra Core	Sampling Methods	Vanveen/Continuous Aluminum Tube
Auger Data	N/A	Hammer Data		Drilling Equipment	
Total Depth (ft)	13	Surface Elevation (ft)		Ground Water Level (ft. bgs)	
Datum/ System				Depth to Mudline (ft. below lake surface)	10.6



Group Symbol	MATERIAL DESCRIPTION	NOTES
OH	Black organic silt (very soft, wet)	Vanveen sampler Vibra Core sampler
OH	Black organic silt with leaf and root debris (soft, wet)	
OH	Black organic silt grades to brown; contains leaf and root debris with increasing wood debris (stocks, twigs) toward bottom (soft, wet)	
PT	Chocolate-brown organic peat Peat contains leaf, seed and twig material (soft, wet)	

Note: See Figures A-1 and A-2 for explanation of symbols

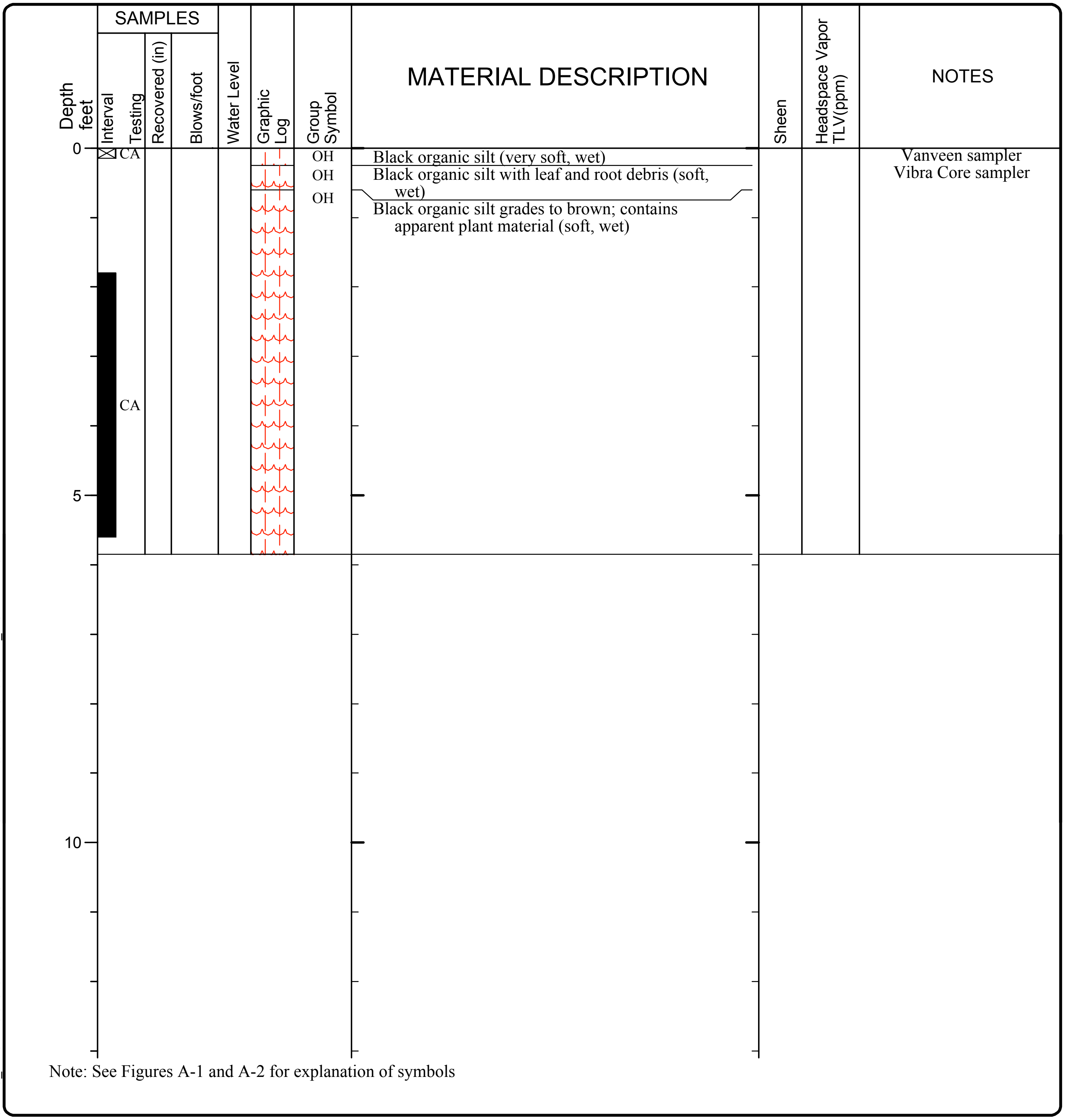
LOG OF SEDIMENT CORE SED-03

GeoEngineers

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Figure: A-46
Sheet 1 of 1

Date(s) Drilled	06/25/02	Logged By	SLM	Checked By	SCW
Drilling Contractor	Marine Sampling Services	Drilling Method	Vibra Core	Sampling Methods	Vanveen/Continuous Aluminum Tube
Auger Data	N/A	Hammer Data		Drilling Equipment	
Total Depth (ft)	5.85	Surface Elevation (ft)		Ground Water Level (ft. bgs)	
Datum/ System				Depth to Mudline (ft. below lake surface)	10.0



Depth feet	Group Symbol	MATERIAL DESCRIPTION	NOTES
0	OH	Black organic silt (very soft, wet)	Vanveen sampler Vibra Core sampler
	OH	Black organic silt with leaf and root debris (soft, wet)	
	OH	Black organic silt grades to brown; contains apparent plant material (soft, wet)	

Note: See Figures A-1 and A-2 for explanation of symbols

LOG OF SEDIMENT CORE SED-04

GeoEngineers

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Figure: A-47
Sheet 1 of 1

Date(s) Drilled	06/25/02	Logged By	SLM	Checked By	SCW
Drilling Contractor	Marine Sampling Services	Drilling Method	Vibra Core	Sampling Methods	Vanveen/Continuous Aluminum Tube
Auger Data	N/A	Hammer Data		Drilling Equipment	
Total Depth (ft)	5.85	Surface Elevation (ft)		Ground Water Level (ft. bgs)	
Datum/ System				Depth to Mudline (ft. below lake surface)	10.8

Depth feet	SAMPLES Interval	Testing	Recovered (in)	Blows/foot	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor TLV(ppm)	NOTES
0	☒	CA					OH	Black organic silt (very soft, wet)			Vanveen sampler Vibra Core sampler
							OH	Black organic silt with leaf and root debris (soft, wet)			
							OH	Black organic silt grades to brown; fibrous wood material in top portion of unit with plant material in lower portion of unit Minor amount of black viscous substance associated with some vegetation material (no sheen) (soft, wet)			
	■	CA									
5	■	CA					GM	Brown silty fine to coarse gravel with sand (soft, wet)			
10											

Note: See Figures A-1 and A-2 for explanation of symbols

0137-010-03 GEI_ENVBORING_2.1.0 P:\0\0137010\03\FINALS\FORMAL~2\FORMAL~4\0137010B.GPJ GEIV2_1.GDT 2/12/04

LOG OF SEDIMENT CORE SED-05

GeoEngineers

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Figure: A-48
Sheet 1 of 1

Date(s) Drilled	06/26/02	Logged By	SLM	Checked By	SCW
Drilling Contractor	Marine Sampling Services	Drilling Method	Vibra Core	Sampling Methods	Vanveen/Continuous Aluminum Tube
Auger Data	N/A	Hammer Data		Drilling Equipment	
Total Depth (ft)	5.25	Surface Elevation (ft)		Ground Water Level (ft. bgs)	
Datum/ System				Depth to Mudline (ft. below lake surface)	10.2

Depth feet	SAMPLES Interval	Testing	Recovered (in)	Blows/foot	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor TLV(ppm)	NOTES
0	☒	CA					OH	Black organic silt (very soft, wet)			Vanveen sampler
							OH	Black organic silt grades to brown; contains leaf and root debris. Decreasing vegetation material with depth (soft, wet)			Vibra Core sampler
	■	CA									
5											
10											

Note: See Figures A-1 and A-2 for explanation of symbols

LOG OF SEDIMENT CORE SED-06

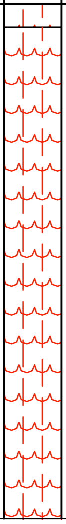
GeoEngineers

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Figure: A-49
Sheet 1 of 1

Date(s) Drilled	06/25/02	Logged By	SLM	Checked By	SCW
Drilling Contractor	Marine Sampling Services	Drilling Method	Vibra Core	Sampling Methods	Vanveen/Continuous Aluminum Tube
Auger Data	N/A	Hammer Data		Drilling Equipment	
Total Depth (ft)	5.55	Surface Elevation (ft)		Ground Water Level (ft. bgs)	
Datum/ System				Depth to Mudline (ft. below lake surface)	10.2

Depth feet	SAMPLES Interval	Testing	Recovered (in)	Blows/foot	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor TLV(ppm)	NOTES
0	☒	CA					OH	Black organic silt (very soft, wet)			Vanveen sampler
							OH	Black organic silt grades to brown; contains wood, leaf, root and plant material (soft, wet)			Vibra Core sampler
	■	CA									
5											
10											



Note: See Figures A-1 and A-2 for explanation of symbols

LOG OF SEDIMENT CORE SED-07

GEOENGINEERS

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Figure: A-50
Sheet 1 of 1

Date(s) Drilled	06/25/02	Logged By	SLM	Checked By	SCW
Drilling Contractor	Marine Sampling Services	Drilling Method	Vibra Core	Sampling Methods	Vanveen/Continuous Aluminum Tube
Auger Data	N/A	Hammer Data		Drilling Equipment	
Total Depth (ft)	5.05	Surface Elevation (ft)		Ground Water Level (ft. bgs)	
Datum/ System				Depth to Mudline (ft. below lake surface)	13.6

Depth feet	SAMPLES Interval	Testing	Recovered (in)	Blows/foot	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor TLV(ppm)	NOTES
0	☒	CA					OH	Black organic silt (very soft, wet)			Vanveen sampler
							OH	Black organic silt with leaf and root material (soft, wet)			Vibra Core sampler
							OH	Brown to black organic silt with fibrous wood material (soft, wet)			
	■	CA					OH	Grades to brown; fibrous wood material present throughout unit, but plant material increases (soft, wet)			
5											
10											

Note: See Figures A-1 and A-2 for explanation of symbols

LOG OF SEDIMENT CORE SED-08

GEOENGINEERS

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Figure: A-51
Sheet 1 of 1

Date(s) Drilled	07/12/02	Logged By	SLM/BPP	Checked By	SCW
Drilling Contractor		Drilling Method	Shovel	Sampling Methods	Gloved Hand
Auger Data		Hammer Data		Drilling Equipment	
Total Depth (ft)	1.5	Surface Elevation (ft)		Groundwater Level (ft. bgs)	1.0
Datum/ System					

Depth feet	SAMPLES Interval	Testing	Recovered (in)	Blows/foot	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)	NOTES
0	☒	CA				▩	DUF	Brown organic material (leaf-fall litter) (very soft, moist)			
						◌	GW	Gray fine to coarse gravel with sand and trace of silt (loose, moist to wet)	NS	1.9	
					▽	◌			NS	2.9	

Note: See Figures A-1 and A-2 for explanation of symbols

LOG OF SEDIMENT CORE SED-09

GeoEngineers

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Figure: A-52
Sheet 1 of 1

Date(s) Drilled	10/03/03	Logged By	PDR	Checked By	BPP
Drilling Contractor		Drilling Method	Shovel	Sampling Methods	Grab
Auger Data		Hammer Data		Drilling Equipment	
Total Depth (ft)	5	Surface Elevation (ft)		Ground Water Level (ft. bgs)	4.5
Datum/ System					

Depth feet	SAMPLES Interval	SAMPLES Testing	SAMPLES Recovered (in)	SAMPLES Blows/foot	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)	NOTES
0							OH	Dark brown organic silt with organics (loose, moist)			
							SM	Brown silty fine to coarse sand with occasional gravel (dense, moist)	NS	0.0	
		CA									
							SP-SM	Gray fine sand with silt (dense, wet)			
		CA			∇				NS	0.0	
5											
10											
15											

Note: See Figures A-1 and A-2 for explanation of symbols

LOG OF SEDIMENT CORE SED-10

GeoEngineers

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Figure: A-53
Sheet 1 of 1

Date(s) Drilled	10/03/03	Logged By	PDR	Checked By	BPP
Drilling Contractor		Drilling Method	Shovel	Sampling Methods	Grab
Auger Data		Hammer Data		Drilling Equipment	
Total Depth (ft)	2	Surface Elevation (ft)		Ground Water Level (ft. bgs)	N/A
Datum/ System					

Depth feet	SAMPLES Interval	Testing	Recovered (in)	Blows/foot	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)	NOTES
0							MH	Dark brown organic silt with organics (loose, moist)			
	☒	CA					SM	Brown silty fine to coarse sand with fine to coarse gravel (dense, moist)	NS	0.0	
5											
10											
15											

Note: See Figures A-1 and A-2 for explanation of symbols

LOG OF SEDIMENT CORE SED-11

GEOENGINEERS

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Figure: A-54
Sheet 1 of 1

Date(s) Drilled	10/03/03	Logged By	PDR	Checked By	BPP
Drilling Contractor		Drilling Method	Shovel	Sampling Methods	Grab
Auger Data		Hammer Data		Drilling Equipment	
Total Depth (ft)	1	Surface Elevation (ft)		Ground Water Level (ft. bgs)	N/A
Datum/ System					

Depth feet	SAMPLES Interval	Testing	Recovered (in)	Blows/foot	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)	NOTES
0	☒	CA					MH	Black organic silt with organics (loose, moist)	NS	0.0	
							SM	Brown silty fine to coarse sand with fine to coarse gravel (dense, moist)			
5											
10											
15											

Note: See Figures A-1 and A-2 for explanation of symbols

LOG OF SEDIMENT CORE SED-12

GeoEngineers

Project:	Rayonier - Goose Lake
Project Location:	Shelton, Washington
Project Number:	0137-010-03

Figure: A-55
Sheet 1 of 1

Date(s) Drilled	10/03/03	Logged By	PDR	Checked By	SCW
Drilling Contractor		Drilling Method	Shovel	Sampling Methods	Grab
Auger Data		Hammer Data		Drilling Equipment	
Total Depth (ft)	1	Surface Elevation (ft)		Ground Water Level (ft. bgs)	N/A
Datum/ System					

Depth feet	SAMPLES				Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)	NOTES
	Interval	Testing	Recovered (in)	Blows/foot							
0	☒	CA					MH SM	Black organic silt with organics brown silty fine to coarse sand with fine to coarse gravel (dense, moist)	NS	0.03	
5											
10											
15											

Note: See Figures A-1 and A-2 for explanation of symbols

LOG OF HAND BORING S-2

GeoEngineers

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Figure: A-56
Sheet 1 of 1

Date(s) Drilled	10/03/03	Logged By	BPP	Checked By	SCW
Drilling Contractor		Drilling Method	Shovel	Sampling Methods	Grab
Auger Data		Hammer Data		Drilling Equipment	
Total Depth (ft)	0.7	Surface Elevation (ft)		Ground Water Level (ft. bgs)	N/A
Datum/ System					

Depth feet	SAMPLES Interval	Testing	Recovered (in)	Blows/foot	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)	NOTES
0	☒	CA					DUF SM	Duff/leaf-fall litter Light brown silty sand with occasional gravel and organics	NS	0.0	
5											
10											
15											

Note: See Figures A-1 and A-2 for explanation of symbols

LOG OF HAND BORING S-4

GeoEngineers

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Figure: A-57
Sheet 1 of 1

Date(s) Drilled	10/03/03	Logged By	PDR	Checked By	SCW
Drilling Contractor		Drilling Method	Shovel	Sampling Methods	Grab
Auger Data		Hammer Data		Drilling Equipment	
Total Depth (ft)	1	Surface Elevation (ft)		Ground Water Level (ft. bgs)	N/A
Datum/ System					

Depth feet	SAMPLES				Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)	NOTES
	Interval	Testing	Recovered (in)	Blows/foot							
0	☒	CA					ML	Brown fine to medium sandy silt with occasional fine gravel (medium stiff, moist)	NS	0.0	
5											
10											
15											

Note: See Figures A-1 and A-2 for explanation of symbols

LOG OF HAND BORING S-5

GEOENGINEERS

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Figure: A-58
Sheet 1 of 1

Date(s) Drilled	10/15/03	Logged By	SLM	Checked By	SCW
Drilling Contractor		Drilling Method	Shovel	Sampling Methods	Grab
Auger Data		Hammer Data		Drilling Equipment	
Total Depth (ft)	0.6	Surface Elevation (ft)		Ground Water Level (ft. bgs)	N/A
Datum/ System					

Depth feet	SAMPLES Interval	Testing	Recovered (in)	Blows/foot	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor PID(ppm)	NOTES
0	☒	CA					DUF	Duff/leaf-fall litter	NS	0.0	
							GM	Brown silty gravel with sand			
5											
10											
15											

Note: See Figures A-1 and A-2 for explanation of symbols

LOG OF HAND BORING S-6A

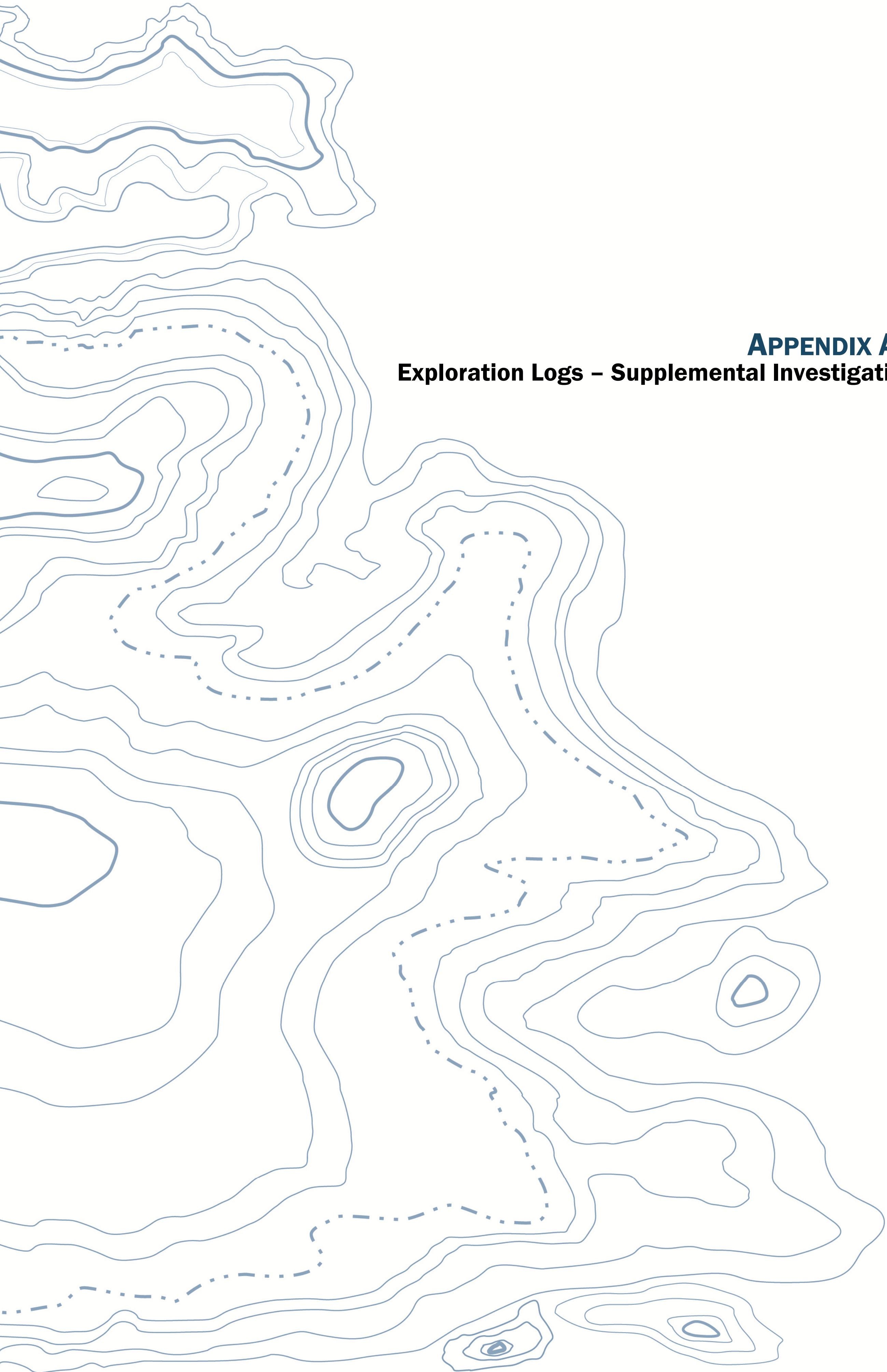
GeoEngineers

Project: Rayonier - Goose Lake
Project Location: Shelton, Washington
Project Number: 0137-010-03

Figure: A-59
Sheet 1 of 1

APPENDIX A2

Exploration Logs – Supplemental Investigation



SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS MORE THAN 50% RETAINED ON NO. 200 SIEVE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)	▨	GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES
			▨	GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	▨	GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
			▨	GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)	▨	SW	WELL-GRADED SANDS, GRAVELLY SANDS
			▨	SP	POORLY-GRADED SANDS, GRAVELLY SAND
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	▨	SM	SILTY SANDS, SAND - SILT MIXTURES
			▨	SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% PASSING NO. 200 SIEVE	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
	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		TYPICAL DESCRIPTIONS
GRAPH	LETTER	
■	AC	Asphalt Concrete
▨	CC	Cement Concrete
▨	CR	Crushed Rock/ Quarry Spalls
▨	TS	Topsoil/ Forest Duff/Sod

Groundwater Contact

▼	**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**
PPM	**Parts per million**
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 A-1

Drilled	Start 10/19/2010	End 10/19/2010	Total Depth (ft) 30	Logged By FK Checked By ZAS	Driller Cascade Drilling
Drilling Method	Direct Push				
Surface Elevation (ft) Vertical Datum	224.84 NGVD29	Hammer Data		Drilling Equipment	GeoProbe 7730
Easting (X) Northing (Y)	985837 703159	System Datum	NAD83/91		
Notes: 2-inch core diameter; 5-foot core length					

Groundwater

Date Measured	Depth to Water (ft)	Elevation (ft)
10/19/2010	23.0	201.8

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Water Level	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0	☒	12			1		SM	Brown silty fine to medium sand and vegetation debris (moist)	NS	PID = 0	No recovery, therefore hand augered No odor
		■	30									
					↕	2		XX	Black low density, clinker-like material with silt and wood debris (chips) (moist)	NS	PID = 0	Sulfide odor
220	5		30					Peat	Black/brown fine fibrous peat/woody material with trace roots (moist)			
					↕	3				NS	PID = 0	Sulfide odor
215	10		30									
								Peat	Brown fine peat (moist)			
					↕	4				NS	PID = 0	Sulfide odor
210	15		47									
					↕	5				NS	PID = 0	Sulfide odor
205	20		20									
							∇					
								GW-GM	Gray fine to coarse gravel with silt and sand (wet)			
200	25											

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

Log of Boring GEI-1

GEOENGINEERS

Project: Goose Lake Supplemental Investigation
Project Location: Seattle, Washington
Project Number: 0137-010-10

Figure A-2
Sheet 1 of 2

Elevation (feet)	Depth (feet)	FIELD DATA						Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
		Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Water Level						
	25	█	50		↕	6					NS	PID = 0	No odor
195	30												

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

Log of Boring GEI-1 (continued)

GEOENGINEERS

Project: Goose Lake Supplemental Investigation
Project Location: Seattle, Washington
Project Number: 0137-010-10

Figure A-2
Sheet 2 of 2

Drilled	Start 10/19/2010	End 10/19/2010	Total Depth (ft) 45	Logged By FK Checked By ZAS	Driller Cascade Drilling	Drilling Method Direct Push
Surface Elevation (ft) 224.58 Vertical Datum NGVD29		Hammer Data			Drilling Equipment GeoProbe 7730	
Easting (X) 985832 Northing (Y) 703041		System Datum NAD83/91			Groundwater	
Notes: 2-inch core diameter; 5-foot core length					Date Measured 10/19/2010	Depth to Water (ft) 39.8	Elevation (ft) 184.8

FIELD DATA

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0		12			1			SM	Brown silty fine to medium sand with vegetation and rootlets (moist)	NS	PID = 0	No recovery; therefore hand augered No odor.
			XX										
						2			XX	Black low density, clinker-like material with silt and trace roots (moist)	NS	PID = 0	Sulfide odor
220													
	5		22										
215													
	10		44										
						3			Peat	Brown fine fibrous peat/woody material (moist)	NS	PID = 0	Sulfide odor
210													
	15		38						Peat	Brown fine peat (moist)			
						4					NS	PID = 0	Sulfide odor
205													
	20		46										
						5					NS	PID = 0	Sulfide odor
200													
	25												

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

Seattle: Date:6/21/12 Path:C:\USERS\CVOSS\DESKTOP\01370101010.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_STANDARD

Log of Boring GEI-2

GEOENGINEERS

Project: Goose Lake Supplemental Investigation
Project Location: Seattle, Washington
Project Number: 0137-010-10

Figure A-3
Sheet 1 of 2

Elevation (feet)	Depth (feet)	FIELD DATA Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	25		48										
195													
	30		53										
190													
	35		49										
					↕	6					NS	PID = 0	Sulfide odor
185							∇						
	40		38						GW	Gray fine to coarse gravel (wet)			
					↕	7					NS	PID = 0	No odor
180													
	45												

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

Log of Boring GEI-2 (continued)

GEOENGINEERS

Project: Goose Lake Supplemental Investigation
Project Location: Seattle, Washington
Project Number: 0137-010-10

Figure A-3
Sheet 2 of 2

Seattle: Date:6/21/12 Path:C:\USERS\CVOSS\DESKTOP\013701010.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_STANDARD

Drilled	Start 10/18/2010	End 10/18/2010	Total Depth (ft) 45	Logged By FK Checked By ZAS	Driller Cascade Drilling	Drilling Method Direct Push

Surface Elevation (ft) Vertical Datum	225.13 NGVD29	Hammer Data	Drilling Equipment GeoProbe 7730
Easting (X) Northing (Y)	985894 702920	System Datum NAD83/91	

Notes: 2-inch core diameter; 5-foot core length

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
10/18/2010	39.5	185.6

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
225	0		30						SM	Brown silty fine to medium sand, roots and vegetation debris with occasional gravel (moist)			
						1					NS	PID = 0	No odor
									Wood	Brown wood debris (chips) (moist)			
									XX	Black low density, clinker-like material with silt and trace wood debris, plastic wrappers (moist)			
						2					NS	PID = 0	Sulfide odor
220	5		50										
									Peat	Black peat-like material with woody fragments (moist)			
215	10		39										
210	15		30										
										Grades to brown fine woody material fragments			
						3					NS	PID = 0	Sulfide odor
						4					NS	PID = 0	Sulfide odor
205	20		56										
									Peat	Brown fine peat (moist)			
						5					NS	PID = 0	Sulfide odor
	25												

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

Log of Boring GEI-3

GEOENGINEERS

Project: Goose Lake Supplemental Investigation

Project Location: Seattle, Washington

Project Number: 0137-010-10

Figure A-4
Sheet 1 of 2

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
		FIELD DATA											
200	25		54										
						6					NS	PID = 0	Sulfide odor
195	30		58										
190	35		54			7					NS	PID = 0	Sulfide odor
							∇						
185	40		30										
									GW-GM	Gray fine to coarse gravel with silt and sand (wet)			
						8					NS	PID = 0	No odor
	45												

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

Log of Boring GEI-3 (continued)

GEOENGINEERS

Project: Goose Lake Supplemental Investigation
Project Location: Seattle, Washington
Project Number: 0137-010-10

Drilled — Start: 10/18/2010 — End: 10/18/2010	Total Depth (ft): 35	Logged By: FK Checked By: ZAS	Driller: Cascade Drilling	Drilling Method: Direct Push
Surface Elevation (ft): 225.18 Vertical Datum: NGVD29	Hammer Data		Drilling Equipment: GeoProbe 7730	
Easting (X): 985941 Northing (Y): 702864	System Datum: NAD83/91		Groundwater	
Notes: 2-inch core diameter; 5-foot core length			Date Measured: 10/18/2010 Depth to Water (ft): 28.0 Elevation (ft): 197.2	

Elevation (feet)	Depth (feet)	FIELD DATA Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
225	0		30			1			SM	Brown silty fine to medium sand, vegetation and root debris (moist)	SS	PID = 0	No odor
						2			SM	Brown silty fine to medium sand with occasional gravel (moist)	NS	PID = 0	No odor
						3			XX	Black low density, clinker-like material with black silty sand (moist)	NS	PID = 0	Strong odor
220	5		50						Peat	Black peat-like material with woody debris (moist)			
						4					NS	PID = 0	No odor
215	10		40										
										Grades to brown with small roots			
						5					NS	PID = 0	Organic odor
210	15		52						Peat	Brown fine peat (moist)			
						6					NS	PID = 0	Sulfide odor
205	20		46										
						7					NS	PID = 0	Sulfide odor
	25												

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

Log of Boring GEI-4

GEOENGINEERS

Project: Goose Lake Supplemental Investigation
Project Location: Seattle, Washington
Project Number: 0137-010-10

Figure A-5
Sheet 1 of 2

		FIELD DATA											
Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
200	25	▮	44										
		▮					∇		GW-GM	Gray fine to coarse gravel with silt and sand (wet)			
195	30	▮	40		↕	8					NS	PID = 0	No odor
	35												

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

Log of Boring GEI-4 (continued)

GeoEngineers

Project: Goose Lake Supplemental Investigation
Project Location: Seattle, Washington
Project Number: 0137-010-10

Drilled	Start 10/18/2010	End 10/18/2010	Total Depth (ft) 35	Logged By FK Checked By ZAS	Driller Cascade Drilling	Drilling Method Direct Push
Surface Elevation (ft) 225.28 Vertical Datum NGVD29			Hammer Data		Drilling Equipment GeoProbe 7730
Easting (X) 986035 Northing (Y) 702818			System Datum NAD83/91		Groundwater
Notes: 2-inch core diameter; 5-foot core length					Date Measured 10/18/2010 Depth to Water (ft) 29.0 Elevation (ft) 196.3

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
225	0		30			1			SM	Brown silty fine to medium sand with trace vegetation and roots (moist)	NS	PID = 0	No odor
						2			XX	Black low density, clinker-like material with occasional gravel (moist)	NS	PID = 0	Sulfide odor
									Peat	Black peat-like material with woody fragments (moist)			
220	5		42										
						3					NS	PID = 0	Sulfide odor
215	10		54						Peat	Brown fine peat (moist)			
						4					NS	PID = 0	Sulfide odor
210	15		56										
						5					NS	PID = 0	Sulfide odor
205	20		52										
	25												

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

Log of Boring GEI-5

GEOENGINEERS

Project: Goose Lake Supplemental Investigation
Project Location: Seattle, Washington
Project Number: 0137-010-10

Figure A-6
Sheet 1 of 2

		FIELD DATA											
Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	**Collected Sample**	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
200	25		56			6					NS	PID = 0	Sulfide odor
							▼						
									SM	Gray silty fine to medium sand with occasional gravel (wet)			
195	30		54										
						7					NS	PID = 0	No odor
	35												

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

Seattle: Date:6/21/12 Path:C:\USERS\CVOSS\DESKTOP\013701010.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_STANDARD

Log of Boring GEI-5 (continued)

Project: Goose Lake Supplemental Investigation
Project Location: Seattle, Washington
Project Number: 0137-010-10

Figure A-6
Sheet 2 of 2

Drilled	Start 10/19/2010	End 10/19/2010	Total Depth (ft) 20	Logged By FK Checked By ZAS	Driller Cascade Drilling	Drilling Method Direct Push
Surface Elevation (ft) 225.3 Vertical Datum NGVD29			Hammer Data		Drilling Equipment GeoProbe 7730	
Easting (X) 986138 Northing (Y) 702802			System Datum NAD83/91		Groundwater	
					Date Measured	Depth to Water (ft)	Elevation (ft)
Notes: 2-inch core diameter; 5-foot core length					10/19/2010	18.0	207.3

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Water Level	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
225	0		30					SM	Brown silty fine to medium sand with occasional gravel and vegetation/root debris, glass (moist)			
						1				NS	PID = 0	No odor
220	5		41									
									Wood debris			
						2		XX	Black low density, clinker-like material with silt and woody debris (moist)	NS	PID = 0	Sulfide odor
								Peat	Black peat with woody material and trace roots (moist)			
215	10		18									
						3				NS	PID = 0	Organic odor
210	15		32									
							∇					
						4		GW-GM	Brown fine to coarse gravel with silt and sand (wet)	NS	PID = 0	No odor
	20											

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

Log of Boring GEI-6

GEOENGINEERS

Project: Goose Lake Supplemental Investigation
Project Location: Seattle, Washington
Project Number: 0137-010-10

Figure A-7
Sheet 1 of 1

Drilled	Start 10/21/2010	End 10/21/2010	Total Depth (ft) 46.5	Logged By FK Checked By ZAS	Driller Cascade Drilling	Drilling Method Hollow Stem Auger
Hammer Data	140 (lbs) / 30 (in) Drop		Drilling Equipment	CME-75 Limited Access Rig	
Surface Elevation (ft) Vertical Datum	261.8 NGVD29		Top of Casing Elevation (ft)	264.70	
Easting (X) Northing (Y)	984740 703009		Horizontal Datum	NAD83/91	

A 2 (in) well was installed on 10/21/2010 to a depth of 45 (ft).

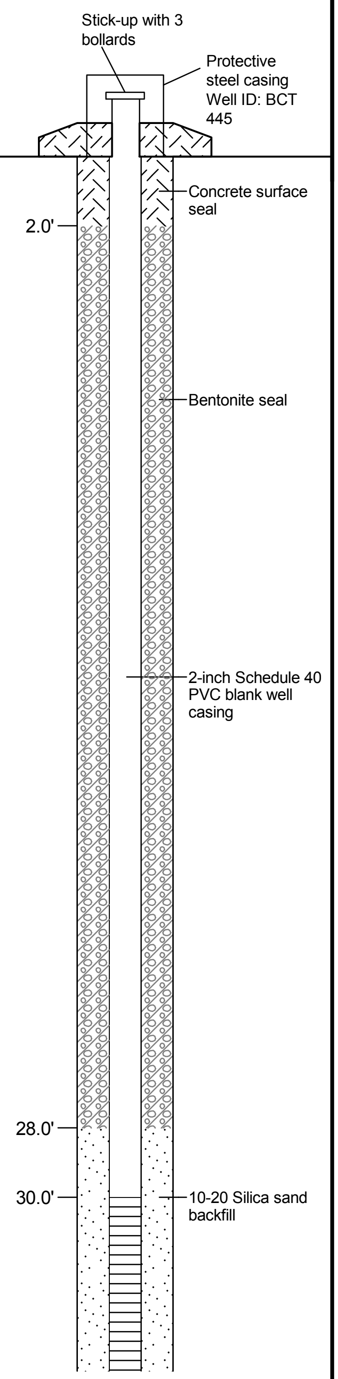
Groundwater

Date Measured	Depth to Water (ft)	Elevation (ft)
10/21/2010	35.5	226.30

Notes: 6-inch O.D.; 16-inch length split spoon

Elevation (feet)	Depth (feet)	FIELD DATA Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor
	0								SP-SM	Brown fine to coarse sand with silt and fine gravel (medium dense, moist)		
260												
	5	■	12	50		1			GW-GM	Brown fine to coarse gravel with silt and sand (very dense, moist) No odor	SS	PID = 0
255												
	10	■	8	50/6"		2				No odor	SS	PID = 0
250												
	15	■	8	50/6"		3				No odor	SS	PID = 0
245												
	20	■	6	50/6"		4				No odor	NS	PID = 0
240												
	25	■	8	50/6"		5				No odor	SS to MS	PID = 0
235												
	30	■	12	50/6"		6				No odor	NS	PID = 0
230												
	35						∇					

WELL LOG



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

Log of Monitoring Well MW-15

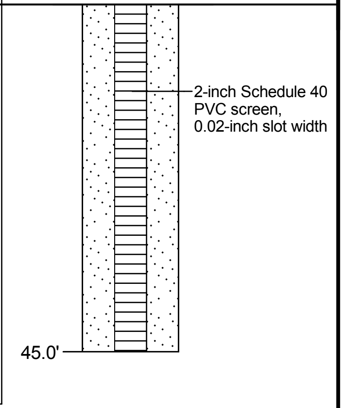
GEOENGINEERS

Project: Goose Lake Supplemental Investigation
Project Location: Seattle, Washington
Project Number: 0137-010-10

Figure A-8
Sheet 1 of 2

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor
	35	█	6	50/6"		7	▼			No odor	NS	PID = 0
225									SM	Gray silty fine to medium sand (very dense, wet)		
	40	█	10	50/6"		8			SM	Gray silty fine to medium sand with gravel (medium dense, wet) No odor	NS	PID = 0
220												
	45	█	16	38		9				No odor	NS	PID = 0

WELL LOG



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

Seattle: Date:6/21/12 Path:C:\USERS\CVOSS\DESKTOP\0137010010.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

Log of Monitoring Well MW-15 (continued)

GEOENGINEERS

Project: Goose Lake Supplemental Investigation
Project Location: Seattle, Washington
Project Number: 0137-010-10

Figure A-8
Sheet 2 of 2

Drilled	Start 10/19/2010	End 10/20/2010	Total Depth (ft)	30
Logged By	FK	Checked By	ZAS	
Driller	Cascade Drilling			
Drilling Method	Direct Push and Hollow Stem Auger			
Hammer Data				
Drilling Equipment	GeoProbe 7730 and CME-75 Limited Access Rig			
Surface Elevation (ft)	235.4			
Vertical Datum	NGVD29			
Top of Casing Elevation (ft)	238.10			
Easting (X)	985883			
Northing (Y)	703095			
Horizontal Datum	NAD83/91			

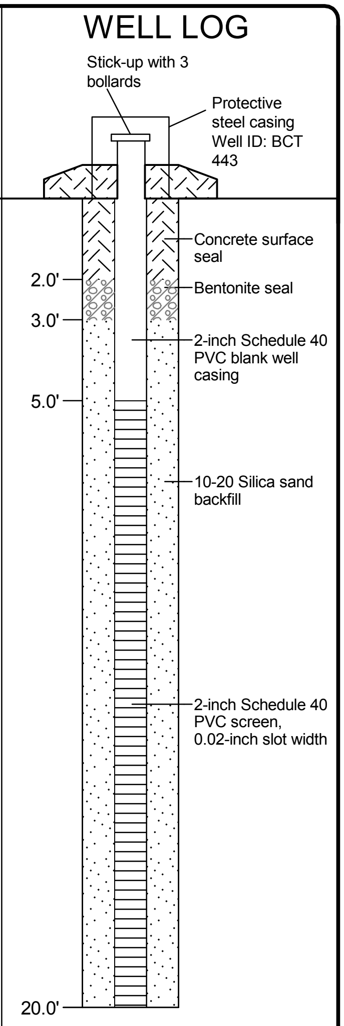
A 2 (in) well was installed on 10/20/2010 to a depth of 20 (ft).

Groundwater

Date Measured	Depth to Water (ft)	Elevation (ft)
10/19/2010	10.5	224.90

Notes: 2-inch core diameter; 5-foot core length. Boring sampled using geoprobe rig and well installed using limited access rig.

Elevation (feet)	Depth (feet)	Recovered (in)	Blows/foot	Sample Name	Water Level	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor
235	0	42		1		SM	Brown silty fine to medium sand with vegetation and root debris (moist) No odor	NS	PID = 0
						XX	Black low density, clinker-like material with silt (moist)		
				2			Sulfide odor	NS	PID = 0
230	5	33							
				3					
225	10	43			▼				
							Wood debris (chips)		
				4			Sulfide odor	NS	PID = 0
220	15	44							
						Peat	Brown fine peat (moist)		
				5			Sulfide odor	NS	PID = 0
215	20	36							
				6			Sulfide odor	NS	PID = 0
					▽				
210	25	52				GW-GM	Gray fine to coarse gravel with silt and sand (wet)		
				7			No odor	NS	PID = 0
	30								



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

Log of Monitoring Well MW-16

GEOENGINEERS

Project: Goose Lake Supplemental Investigation
Project Location: Seattle, Washington
Project Number: 0137-010-10

Figure A-9
Sheet 1 of 1

Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	10/19/2010	10/20/2010	35	FK	ZAS	Cascade Drilling	Direct Push and Hollow Stem Auger

Hammer Data

Drilling Equipment: GeoProbe 7730 and CME-75 Limited Access Rig

A 2 (in) well was installed on 10/20/2010 to a depth of 20 (ft).

Surface Elevation (ft): 230.6
Vertical Datum: NGVD29

Top of Casing Elevation (ft): 233.00

Easting (X): 986037
Northing (Y): 702839

Horizontal Datum: NAD83/91

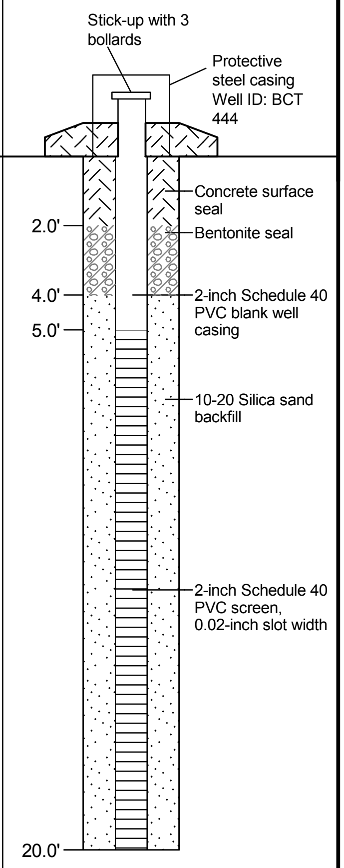
Groundwater

Date Measured	Depth to Water (ft)	Elevation (ft)
10/20/2010	31.2	199.40

Notes: 2-inch core diameter; 5-foot core length. Boring sampled using geoprobe rig and well installed using limited access rig.

Elevation (feet)	Depth (feet)	Recovered (in)	Blows/foot	Sample Name	Water Level	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor
230	0	24				SP	Brown/black fine to medium sand with gravel (moist)		
				1			No odor	NS	PID = 0
225	5	44				XX	Black low density, clinker-like material with silt (moist)		
				2			Sulfide odor	NS	PID = 0
220	10	54							
				3			Occasional gravel Sulfide odor	NS	PID = 0
				4			Wood chips Sulfide odor	NS	PID = 0
215	15	32							
				5		Peat	Black peat with woody material (moist) Sulfide odor	NS	PID = 0
210	20	42				Peat	Brown fine peat (moist)		
				6			Sulfide odor	NS	PID = 0
205	25	46					Grades to reddish-brown		
				7			Sulfide odor	NS	PID = 0
						ML	Gray sandy silt with occasional gravel (wet)		
200	30	42				GW-GM	Gray fine to coarse gravel with silt (wet)		
					▽				
				8			No odor	NS	PID = 0
	35								

WELL LOG



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

Log of Monitoring Well MW-17

GeoEngineers

Project: Goose Lake Supplemental Investigation
Project Location: Seattle, Washington
Project Number: 0137-010-10

Figure A-10
Sheet 1 of 1

Seattle: Date:6/21/12 Path:C:\USERS\CVOSS\DESKTOP\013701010.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

Drilled	Start 10/21/2010	End 10/21/2010	Total Depth (ft) 26	Logged By FK Checked By ZAS	Driller Cascade Drilling	Drilling Method Direct Push

Hammer Data		Drilling Equipment	CME-75 Limited Access Rig
Surface Elevation (ft) Vertical Datum	235.2 NGVD29	Top of Casing Elevation (ft)	236.50
Easting (X) Northing (Y)	986419 703259	Horizontal Datum	NAD83/91

A 2 (in) well was installed on 10/21/2010 to a depth of 25 (ft).

Groundwater

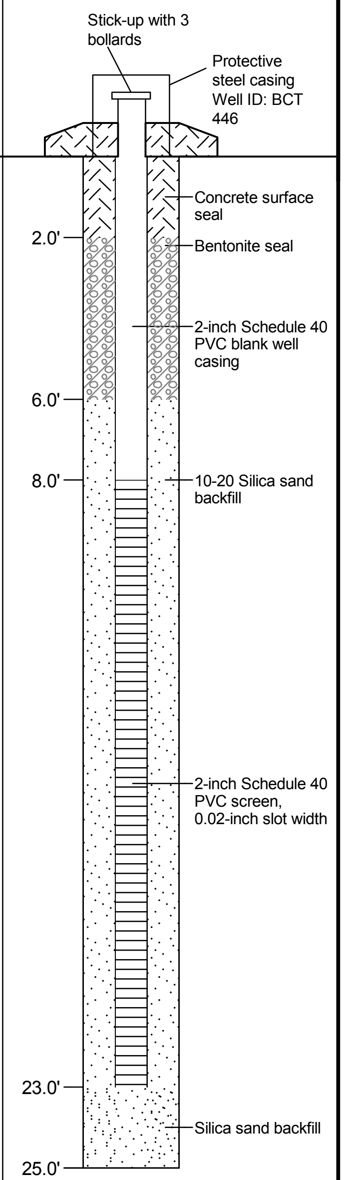
Date Measured	Depth to Water (ft)	Elevation (ft)
10/21/2010	12.1	223.10

Notes: 6-inch O.D.; 16-inch length split spoon

FIELD DATA

Elevation (feet)	Depth (feet)	Recovered (in)	Blows/foot	Sample Name	Water Level	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor
235	0					SM	Brown silty fine to medium sand with vegetation (medium dense, moist)		
		8	33	1				NS	PID = 0
						Peat	Black peat with wood and root debris (medium dense, moist) No odor		
230	5	10	38	2				NS	PID = 0
						SM	Brown/black silty fine to medium sand with vegetation debris (very dense, moist) No odor		
		12	50/5"	3			No odor	NS	PID = 0
						GW-GM	Brown fine to coarse gravel with silt and sand (very dense, moist)		
225	10	3	50/6"	4			No odor	NS	PID = 0
					▼				
		10	50/6"	5			No odor	NS	PID = 0
220	15	13	50/6"	6			Grades to gray No odor	NS	PID = 0
						SW	Gray fine to coarse sand with gravel (medium dense, wet) No odor		
		14	50	7				NS	PID = 0
						GW-GM	Gray fine to coarse gravel with silt and sand (very dense, wet)		
215	20	0	50/6"	8				NS	PID = 0
						SM	Gray silty fine to medium sand with fine gravel (medium dense, wet) No odor		
		6	42	9			No odor	NS	PID = 0
						GW-GM	Gray fine to coarse gravel with silt and sand (very dense, wet)		
210	25	10	50/6"	10			No odor	NS	PID = 0

WELL LOG



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

Seattle: Date:6/21/12 Path:C:\USERS\CVOSS\DESKTOP\013701010.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

Log of Monitoring Well MW-18

GeoEngineers

Project: Goose Lake Supplemental Investigation
Project Location: Seattle, Washington
Project Number: 0137-010-10

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Sheet 1 of 1

APPENDIX B1

Data Quality Assessment Reports – Remedial Investigation

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List of Tables

List of Attachments

APPENDIX B
DATA QUALITY ASSESSMENT REPORT

1.0 INTRODUCTION

This appendix summarizes the analytical data quality assessment for soil, sediment, groundwater, surface water, and fish tissue samples collected at the Goose Lake Site. Field activities took place from June 2002 to October 2003. Soil, surface water, and groundwater samples were submitted to Severn Trent Laboratory (STL) of Tacoma, Washington for analysis. Surface water samples were analyzed for polychlorinated biphenyls (PCBs), selected metals, and conventionals (alkalinity, hardness, and sulfide). In addition, selected surface water samples were measured for conductivity, pH, and turbidity. All groundwater samples were analyzed for PCBs, selected metals, and sulfide. Selected soil samples were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), PCBs, diesel- and heavy oil-range total petroleum hydrocarbons (TPH-Dx), selected metals, sulfide, and dioxins/furans.

Fish tissue and sediment samples were analyzed by Columbia Analytical Services, Inc. (CAS) of Kelso, Washington. Sediment samples were analyzed for PCBs, selected metals, SVOCs, oxidation-reduction potential (ORP), total organic carbon (TOC), ammonia, and dioxins/furans. Fish tissue samples were separated into whole-body and fillet samples and analyzed for lipids, selected metals, PCBs, and dioxin/furans. PCBs and dioxins/furans in fish tissue samples were analyzed for congeners. The number of samples collected by matrix (including field duplicates) is presented below:

- Soil – 41 samples
- Groundwater – 44 samples
- Surface water – 7 samples
- Sediment – 26 samples
- Fish Tissue – 8 samples

Details regarding the number and types of analyses, as well as detailed sample information, are provided in the main body of the Remedial Investigation (RI) report. This document focuses primarily on data quality issues.

It should be noted that analytical results packages (raw data) for the RI were provided to Ecology in May 2005 on a CD and are therefore not attached to this report.

1.1 PURPOSE

The purpose of this data quality assessment is to review laboratory analytical procedures and quality control (QC) results to assess the quality of data relative to project data quality objectives (DQOs) established in the RI work plan (GeoEngineers, 2002). DQOs were established to specify the quality of data needed to support decisions during remedial actions. DQOs define the QC criteria and methods to be used in the RI to ensure that:

- Samples are analyzed using well-defined and acceptable methods, and data quality is sufficient for assessing Site conditions relative to applicable or relevant and appropriate requirements (ARARs) and risk-based criteria, as well as for risk assessment and remedial design.
- The precision and accuracy of data are well defined and adequate to provide defensible data.

- Samples are collected using approved techniques and are representative of existing environmental conditions.
- Quality assurance (QA) and QC procedures for both field and laboratory procedures meet acceptable industry practices and standards.

The main QA objective of an investigation is to collect environmental monitoring data of known, acceptable, and documentable quality. An evaluation of QA procedures against established criteria is followed by a QC evaluation. If QA/QC procedures are followed correctly, then an investigation would produce data that are of an acceptable level of confidence, scientifically valid, of known and documented quality, and legally defensible for the stated purpose.

1.2 DATA ASSESSMENT CRITERIA

Data quality was assessed using guidance from *Remedial Investigation Work Plan for Goose Lake Site* (GeoEngineers, 2002), STL control limit criteria, CAS control limit criteria, *National Functional Guidelines for Inorganic Data Review* (United States Environmental Protection Agency [USEPA], 1994), and *National Functional Guidelines for Organic Data Review* (USEPA, 1999) for the following parameters; VOCs by USEPA 8260B, SVOCs by USEPA 8270C, TPH-Dx by Washington State Ecology Method NWTPH-Dx, PCBs by USEPA 8082, metals by USEPA 6010/6020/7000 Series, dioxins/furans by USEPA 8290, and conventionals by USEPA 100/300/9000 Series and Standard Methods 2320/2340. Additional references include *Methods for Chemical Analysis of Water and Wastes* (USEPA, 1983) and *Test Methods for Evaluating Solid Waste,* SW-846, 3rd Edition (USEPA, 1986). The data assessment included evaluation of holding times, method blanks, blank spike and matrix spike recoveries, laboratory control percent recoveries, and laboratory and field duplicate data. Additionally, a review and comparison between the electronic database and hard copy analytical reports was performed to verify correctness of reported results.

Laboratory Form-1 data and associated worksheets are stored with project files and were provided to Ecology in May 2005 on a CD. Associated QA worksheets are also stored with project files and can be provided upon request. A summary of laboratory analytical results for project samples is included in the main body of the RI report.

2.0 STANDARD METHODS ASSESSMENT

Standard methods data were evaluated against criteria identified in Section 1.2. Samples received by the laboratory were grouped into sample delivery groups (SDGs) and assigned an identification number. A summary of analytical data qualified as a result of the data quality assessment appears in Table 1.

2.1 HOLDING TIMES

If a sample exceeds a method-recommended holding time (extraction and/or analysis) for a specified method, then the results may be biased low. If holding times are grossly exceeded, then results may be qualified as unusable. Samples missing holding times by one to four days can still produce useable data, but may be biased low. All groundwater, surface water, soil, and fish-tissue samples were extracted and/or analyzed within recommended holding times for VOCs, SVOCs, TPH-Dx, PCBs, metals, and conventionals. All samples were submitted with the appropriate preservatives.

Sediment samples missed some holding times. Sulfide holding times were missed in sediments by three days due to re-analysis of all samples collected in June 2002. Holding times were missed due to the initial analyses exceeding control limits, and the samples were subsequently re-analyzed. Sulfide results for the aforementioned samples were qualified as estimated (“J” or “UJ” flag). The ammonia holding time was narrowly missed for sample SED-05-5.1-5.6. No further action was taken.

2.2 METHOD BLANKS

Method blanks are laboratory QC samples that consist of either a soil-like material having undergone a contaminant destruction process or reagent (contaminant-free) water. Method blanks are extracted and analyzed with each batch of environmental samples undergoing analysis. Method blanks are particularly useful during volatiles analysis since volatile compounds can be transported in the laboratory through the vapor phase. If a target analyte is found in the method blank then one (or all) of the following may have occurred:

- Analytical equipment or containers were not properly cleaned and contained the target analyte.
- Reagents used in the process were contaminated with the target analyte.
- The method blank was contaminated with the target analyte during preparation or analysis.

If method blank contamination occurs, it can be difficult to determine which of the scenarios above took place, and it is assumed that whatever affected the blanks probably also affected the project samples. When contaminants are detected in blank samples, data validation guidance assists in determining which analyte detections in project samples are considered Site-related, and which can be attributed to the analytical process. Furthermore, guidelines state: “…there may be instances where little or no contamination was present in the associated blank, but qualification of the sample is deemed necessary. Contamination introduced through dilution water is one example.” In the opinion of the data reviewer for the Goose Lake RI data quality assessment, besides the method blank review, no further review to assess possible laboratory sources of contamination was required.

Data assessment procedures concerning blanks followed guidelines provided in documents referenced in Section 1.2. The guidelines state: “Positive results [detections in samples] should be reported unless the concentration of the compound in the sample is less than or equal to 10 times (10x) the amount in any [associated] blank for the common laboratory contaminants . . . or 5 times (5x) the amount for other target compounds.”

Method blank detections were reported in several of the laboratory data packages. However, these detections did not adversely affect sample results nor did they indicate any pervasive laboratory QC issues. Sample results qualified due to method blank detections are summarized in Table 1.

There was considerable contamination in the method blank associated with analysis of SVOCs in sample SED-09-0-0.4. Many of the analytes detected in the blank were also detected in the sample, indicating possible laboratory contamination. Other QC criteria indicated matrix problems, thus associated results in this sample were rejected (“R” flag).

Several metals results from STL were qualified by the laboratory as “B2”, indicating that the analyte was detected in an associated method blank. However, associated method blank results in nearly all cases were actually not detected. Thus, the laboratory incorrectly assigned the qualifier “B2” in most instances, and the qualifier “B2” was removed where appropriate.

2.3 PRECISION AND ACCURACY

Data quality is also assessed by precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters that measure the reproducibility of analytical results, the representativeness of Site environmental conditions, the completeness of the sampling and analysis activities, and the consistency in the performance of the analytical methods. Precision and accuracy QC criteria measure the reproducibility of analytical results and the bias of a standard method, respectively. For this data quality assessment, only precision, accuracy, and completeness are addressed.

Precision is the measure of mutual agreement among replicate or duplicate measurements of the same analyte. The closer the numerical values of the measurements are to each other, the more precise the measurement. This allows immediate comparison of the precision of different results under the same method. Matrix spike/matrix spike duplicate (MS/MSD) and other duplicate analyses assist in measuring precision of a compound being analyzed. Precision for a single analyte is expressed as a relative percent difference (RPD) between results of primary (e.g., MS) and duplicate (e.g., MSD) samples, where:

$$RPD = \frac{(D1 - D2\,)}{(D1 \times D2)/2} \times 100$$

$$D1 = Primary\ Sample\ Result$$

$$D2 = Duplicate\ Sample\ Result$$

Typically, sample results are not qualified based on precision goals alone but rather are evaluated in conjunction with other QC criteria.

Accuracy is a measure of bias in the analytical process. The closer the value of the measurement agrees with the true value, the more accurate the measurement. Accuracy is evaluated by the percent recovery of an analyte from a surrogate or MS sample or from a standard reference material, where:

$$Surrogate\ Percent\ Recovery = \frac{(Sample\ Result)}{(Spike\ Amount)} \times 100$$

$$Spike\ Percent\ Recovery = \frac{(Spike\ Result - Sample\ Result)}{(Spike\ Amount)} \times 100$$

When accuracy and precision goals are not achieved, the sample(s) in question should be re-analyzed, if feasible. If the problem is due to matrix interferences with a particular sample or group of samples, this information should be noted in the report of results. The analysis of MS/MSD samples determines if matrix interference problems are present. The recovery of surrogate compounds from environmental samples and the results of standard additions in environmental samples also evaluate the presence of matrix interferences.

2.3.1 Surrogate Recoveries

The purpose of using a surrogate is to verify the accuracy of the instrument being used. Surrogates of known concentration are injected into the extract of the project samples and passed through the instrument, noting the surrogate recovery. Each surrogate has an acceptable range of percent recovery. If a surrogate recovery is low, sample results may be biased low and depending on the recovery value, a possibility of false negatives may exist. Conversely, when recoveries are above the specified range of acceptance a possibility of false positives exists, although non-detected results are considered accurate. All surrogate percent recoveries met QC criteria, with the following exceptions:

VOCs

The laboratory used five spiking compounds for VOC analyses. All surrogate percent recovery values were within the laboratory control limits with these exceptions:

- SDG 107254: Percent recoveries for three surrogates, dibromofluoromethane, toluene-d8, and bromofluorobenzene, were outside STL control limits for sample TP-03-9.5. Additionally, nine of the eleven MS percent recoveries for sample TP-03-9.5 were outside of STL control limits. Sample TP-03-9.5 results were qualified as estimated (J/UJ) due to both poor surrogate and matrix spike percent recoveries.
- SDG 107286: Two surrogates, ethylbenzene and bromofluorobenzene, had percent recoveries that were slightly outside STL control limits for sample TP-28-1.0. No action was taken on this basis; however, sample results are qualified as estimated (J/UJ) due to poor MS recovery. Refer to Section 2.3.2 on Matrix Spikes for further discussion.
- SDG 107974: Dibromofluoromethane percent recovery for sample Trench-04-0.5 was 70.2 percent, compared to STL control limits of 80 to 120 percent. No action was taken.

SVOCs

The laboratory used six surrogate spiking compounds for SVOC analysis. All surrogate percent recovery values were within the laboratory control limits, with two exceptions:

- SDG 107974: No surrogates were recovered from sample Trench-04-8.0 due, in part, to elevated concentrations of target analytes and a necessary 200X dilution. All SVOC results in sample Trench-0.4-8.0 were qualified as estimated (J/UJ). Surrogate recoveries in Trench-04-0.5 were not determined in the sample due to dilution. All SVOC results in sample Trench-04-0.5 were qualified as estimated (J/ UJ).

PCBs

The laboratory used tetrachloro-m-xylene (TCMX) and decachlorobiphenyl spiking compounds for PCB analyses. All surrogate percent recovery values were within the laboratory control limits, with three exceptions:

- SDG 107898: Percent recoveries for TCMX and decachlorobiphenyl surrogates in sample MW-06-02Q3 (597 percent and 463 percent, respectively) exceeded STL upper control limits due to an accidental laboratory overspike. According to notes in the case narrative, 10 times the usual amount of surrogate was added to the sample, but the sample was not diluted. A subsequent 10X dilution was performed with acceptable surrogate percent recoveries. Since practical quantitation limits (PQLs) for the diluted sample are elevated by a factor of 10, the original results are considered acceptable and the results from the 10X dilution were qualified as do not report (DNR).
- SDG 107914: Percent recoveries for TCMX and decachlorobiphenyl surrogates in sample MW-01-02q3 (15.6 percent and 21 percent, respectively) were below STL lower control limits. PCB results for sample MW-01-02q3 were qualified as estimated (UJ) due to low surrogate recovery.

- SDG 111883: Percent recoveries for the following surrogates in sample MW-02-03Q1 were below control limits: Tetrachloro-m-xylene (28.1 percent versus QC criteria of 42 percent to 108 percent); Decachlorobiphenyl (29.3 percent versus QC criteria of 45 percent to 136 percent). Percent recoveries for the following surrogates in sample MW-09-03Q1 were below control limits: Tetrachloro-m-xylene (0.402 percent versus QC criteria of 42 percent to 108 percent); Decachlorobiphenyl (1.17 percent versus QC criteria of 45 percent to 136 percent). The low surrogate recoveries in these samples were due to glass breakage during the analytical process. The non-detect sample results were qualified as estimated (UJ), biased low.
- Surrogates recoveries for sediment sample SED-01-0-0.15 were elevated, and one was above QC limits. Associated sample results were non-detect so no further action was required.

Diesel and Heavy Oil

The laboratory used o-terphenyl as a spiking compound for fuels analysis. All surrogate percent recoveries were within the laboratory control limits.

Dioxins/Furans

The laboratory used nine spiking compounds as surrogates, and the RI work plan specified recovery limits for two of these compounds. There were no instances where these spiked compounds were outside control limits.

2.3.2 Matrix Spikes/Matrix Spike Duplicates

MS/MSD samples are also used to evaluate accuracy (by determining if matrix conditions, rather than instrument error, influences results) and precision. Compounds of a known concentration are injected into the sample and passed through the instrument. In some instances laboratory control spikes and laboratory control spike duplicates (LCS/LCSD) and/or blank spikes and blank spike duplicates (BS/BSD) were analyzed along with or in place of MS/MSD samples. If the percent recovery does not fall within the acceptable range, the data may be flagged as estimated or unusable. All MS/MSD analyses met applicable QC criteria, with the following exceptions:

VOCs

The laboratory used five spiking compounds for VOC analyses. All MS/MSD percent recovery values were within the laboratory control limits, with the following exceptions:

- SDG 107286: Percent recoveries for all spiking compounds in sample TP-28-1.0 were below STL lower control limits. VOC results for sample TP-28-1.0 were qualified as estimated (J/UJ).

SVOCs

The laboratory used eleven spiking compounds (five acid and six base/neutral spiking compounds). All MS/MSD percent recovery values were within the laboratory control limits, with the following exceptions:

- SDG 107254: Spike analysis was performed on sample TP-03-9.5. Spike compound percent recoveries and RPD values were outside the laboratory control limits. SVOC results for sample TP-03-9.5 were qualified as estimated (J/UJ) due to poor RPD values and spike recoveries.
- SDG 107974: In sample Trench-04-0.5, MS and MSD percent recoveries for phenol and 2-chlorophenol were 0 percent. The MS and MSD percent recoveries for pyrene were high (137 percent and 193 percent, respectively). The MSD percent recovery for N-nitroso-di-n-propylamine was high (136 percent). The MSD percent recovery for 4-chloro-3-methylphenol

was low (21.2 percent). No action was taken on pyrene because of the relatively high concentration detected in the sample. It appears there was a matrix effect on the acid fraction of this sample and all results should be considered biased low. Results were qualified as estimated (J/UJ).

PCBs

The laboratory used Aroclor-1260 as a spiking compound for PCB analyses. All MS/MSD percent recovery values were within the laboratory control limits, with the following exception:

- SDG 111883: The MS/MSD recoveries for sample MW-01-03Q1 were 49.6 percent and 50.8 percent, respectively, compared to control limits of 59 percent to 138 percent. However, based on surrogate recoveries for this sample, no further action was taken.
- SDG K2204755: The MS/MSD percent recoveries were high, but no further action was taken because all sample results were non-detect.

Diesel and Heavy Oil

The laboratory used diesel and motor oil as spiking compound for fuels analysis. All spike percent recoveries were within the laboratory control limits.

Metals

MS/MSD results for all metals had acceptable percent recovery values, with the following exceptions:

- SDG 106426: Percent recovery for the mercury spike (dissolved) in sample SW-3-TOP (74 percent) was just below STL control limits (75 percent to 125 percent). No action was taken since the matrix spike percent recovery was only slightly below STL lower control limits.
- SDG 107254: Percent recovery for hexavalent chromium in sample TP-02-22.0 (8 percent) was below STL control limits (75 percent to 125 percent). Hexavalent chromium results for sample TP-02-22.0 were qualified as estimated (UJ) due to poor spike recovery in the sample.
- SDG 111883: The MS recovery for mercury in sample MW-01-03Q1 (66 percent) was below control limits (75 percent to 125 percent). The mercury result for sample MW-01-03Q1 was qualified as estimated (J), biased low due to possible matrix interference.
- SDG 108453: The MS recovery for mercury in sample TP-16-10 (15 percent) was below control limits (80 percent to 120 percent). The mercury result for sample TP-16-10 was qualified as rejected (R).

Dioxins/Furans

No MS/MSD results exceeded QC criteria.

Conventionals

MS/MSD analyses were performed using sulfide, with acceptable percent recovery values for all matrices other than sediment. Sulfide concentrations in most sediment samples were significantly greater than spiked amounts, thus “masking” the ability to recover spikes. No further action was taken. The MS recovery for ammonia in sample SED-02-0.9-1.5 was low, and the associated sample result was qualified as estimated (J).

2.3.3 Laboratory Control Spikes/Blank Spikes

LCS/LCSD and BS/BSD analyses are performed to check system performance and overall quality of analytical procedures. These are samples originating from a contaminant-free source (e.g., reagent water) and spiked with target compounds to evaluate recoveries. No exceptions to these QC samples were noted except the following:

SDG K2204755: Benzoic acid recoveries in the LCS and LCSD were 8 percent, which is below control limits. No action was taken based on LCS/LCSD results alone.

2.3.4 Laboratory Duplicates

Laboratory duplicate samples are used to assess overall precision. Refer to MS and/or field duplicate discussions for additional precision results.

VOCs
Laboratory duplicate RPDs met QC criteria, with the following exceptions:

- SDG 107974: RPDs in sample Trench-04-8.0 were as follows: benzene (18 versus QC criterion of <16); trichloroethene (16 versus QC criterion of <15); toluene (25 versus QC criterion of <20); and chlorobenzene (20 percent versus QC criterion of <17). No data were qualified based on these RPD results.

SVOCs
Laboratory duplicate RPDs met QC criteria, with the following exceptions:

- SDG 107974: RPDs in sample Trench-04-0.5 were as follows: 4-chloro-3-methylphenol (63 versus QC criterion of <36); pentachlorophenol (200 versus QC criterion of <47). No data were qualified based on these RPD results.

PCBs
Laboratory duplicate RPDs met QC criteria.

Diesel and Heavy Oil
Laboratory duplicate RPDs met QC criteria.

Metals
Laboratory duplicate RPDs met QC criteria, with the following exceptions:

- SDG 108453: RPD for hexavalent chromium in sample TP-16-10 was 47, versus QC criterion of <20. No qualification based on RPD; result rejected due to poor spike recoveries.
- SDG 111883: RPD for chromium in sample MW-01-09-03Q1 was 27, versus QC criterion of <20. No qualification based on RPD.
- SDG 113581: RPD for arsenic in sample MW-01-03Q2 was 110, versus QC criterion of <20. No qualification based on RPD due to low analyte concentration in sample.
- SDG 113600: RPD for arsenic in sample MW-02-03Q2 was 25, versus QC criterion of <20. No qualification based on RPD.
- SDG 109952: RPD for mercury in sample MW-07-02Q4 was 29, versus QC criterion of <20. No qualification based on RPD due to low analyte concentration in sample.

Multiple SDGs had laboratory duplicate RPDs that were elevated due to detections below or within 2X the PQLs. In some cases, sample and laboratory duplicate results below the PQLs were reported, whereas final results (Form 1's) for the subject sample were reported as Not Detected (ND). Additionally, the laboratory occasionally replaced "ND" with "0". Discussions with the laboratory indicated that they had experienced electronic reporting problems. Based on this review, non-detect results should be considered as "not detected at or greater than the PQL". Laboratory duplicate results reported below the PQLs should be referred to as non-detects to be consistent with the remainder of the report. No further action was taken other than to note this in the report.

Conventionals
Laboratory duplicate RPDs met QC criteria.

Dioxins/Furans
Laboratory duplicate RPDs met QC criteria.

3.0 FIELD QA/QC SAMPLES

3.1 FIELD DUPLICATE SAMPLES

Field duplicate samples are used to assess overall precision. Field duplicate samples are summarized in Table 2. The RPD is one method of evaluating field duplicates. If the difference between a primary and its duplicate was less than a factor of less than 5, the difference was considered acceptable. If the difference was a factor between 5 and 10, the difference was considered minor but notable. A factor of 10 times or greater was considered major. The data did not indicate major differences (i.e., a factor greater than 10) for any of the field duplicate results. The highest factor was 1.8 times for mercury in a sediment sample. Only six analytes had an RPD greater than 10 percent (versus a factor of 10, or 1,000 percent), up to a maximum of 80 percent.

Field Duplicate Samples

Primary Sample	Field Sample Duplicate
SW-3-TOP	SW-Dup
MW-02-02Q3	02Q3-DUP
SED-09-0-0.4	SED-09-0-0.4DUP
SED-01-1.7-4.1	SED-DUP-01
SED-08-1.8-4.8	SED-DUP-02
MW-08-02Q4	02Q4-DUP
MW-07-03Q1	03Q1-DUP
MW-01-03Q2	03Q2-DUP

3.2 RINSATES

Equipment rinsate samples indicate possible cross-contamination from sampling equipment or sample containers. Equipment rinsate samples for water (02Q3-GW-RINSATE and SW-RINSATE) were collected after equipment decontamination by pouring reagent-grade water over equipment directly into sample jars. Equipment rinsate samples for soil and sediment samples (SED-05-RINSATE, MW-07-RINSATE and TP-08-RINSATE) were collected by pouring reagent-grade water over soil sampling equipment after decontamination. Equipment rinsate samples were submitted for all analyses conducted on each respective matrix. QC exceptions and actions taken are summarized below.

3.2.1 Groundwater

SDG 107914 – Total chromium was detected in equipment rinsate blank 02Q3-GW-RINSATE at 0.00195 mg/L. Total chromium detections in associated samples MW-01-02Q3, MW-02-02Q3, MW-02-02Q3 Duplicate, MW-03-02Q3, and MW-05-02Q3 were qualified as not detected (U) at the reported concentration based on the rinsate blank detection.

3.2.2 Surface Water

SDG 106426 – Total chromium was detected in the equipment rinsate blank at 0.00887 mg/L. Total chromium detections in associated samples SW-1-bottom, SW-1-top, SW-2-bottom, SW-2-top, SW-3-bottom, SW-3-top, and SW-DUP (duplicate of SW-3-top) were qualified as not detected (U) at the reported concentration based on the rinsate blank detection.

3.2.3 Soils

SDG 107474 – Chromium, copper, and lead were detected in equipment rinsate blank MW-07-Rinsate at 0.00894 mg/L, 0.0609 mg/L, and 0.00579 mg/L, respectively. No action was necessary because the chromium, copper, and lead concentrations in associated samples were greater than the 5X action level. The SVOC analytes phenol, dimethyl phthalate, and diethyl phthalate were detected in rinsate blank MW-07-Rinsate. No action was necessary as none of these compounds was detected in associated soil samples. Sulfide was also detected in the equipment rinsate at 4 mg/L. Sulfide was not detected in the associated soil sample.

3.2.4 Sediment

The equipment rinsate blank SED-05-RINSATE contained arsenic at 0.0029 mg/L, chromium at 0.0008 mg/L, lead at 0.0014 mg/L, nickel at 0.0002 mg/L, silver at 0.0004 mg/L, and zinc at 327 mg/L. Phenol at 1.1 µg/L and diethyl phthalate at 2.26 µg/L also were detected. No action was necessary because the respective analytes in sample SED-05-0-0.15 were not present or above action limits.

3.2.5 Fish

No equipment rinsate blanks were collected for fish tissue samples.

3.3 FIELD BLANKS

Field blanks are samples created by opening and exposing sample containers filled with reagent-grade water to conditions where samples are being collected. These QC samples provide information regarding the potential for project sample cross-contamination from ambient atmospheric conditions at the Site and sample container contamination. One field blank was collected during the surface water sampling effort. The field blank was tested for PCBs, metals, and conventionals. No analytes were detected in the field blank.

4.0 LIMITATIONS AND COMPLETENESS

Limitations are conditions that interfere or limit analytical performance qualitatively or quantitatively. Every analytical method has quantitative limitations at a given statistical level of confidence that are often expressed as method detection limits (MDLs). Individual instruments often can detect but not accurately quantify compounds at lower concentrations. This is expressed as the instrument detection limit. Under ideal conditions these limits can be achieved, but certain factors affect an instrument's ability to reach these limits. This section describes important limitations and the effects on this project. Where possible, an evaluation of environmental samples affected by these limitations was performed.

4.1 SAMPLE INTEGRITY AND COMPLETENESS

Sample integrity refers to the sample temperature, sample preservation, and physical condition of the sample container upon arrival at the laboratory. Sample log-in sheets and cooler receipt forms from the laboratory record sample integrity.

The laboratory required samples to be preserved within specific pH ranges for selected analyses. All samples preserved with acids were labeled, indicating the type of preservative used and the pH of the sample. The sample log-in sheets were reviewed to insure preservation requirements were met. All samples were preserved properly.

Regulating sample temperature is an important part of the sample collection and analysis process, especially for organic compounds. Heat causes volatilization of many organic compounds and may increase degradation of a compound's structure. Heat can also increase chemical activity and the solubility of metals. For these reasons, standard sample preservation protocol (USEPA, 1983; 1986) calls for samples to be cooled to 4 degrees ±2 degrees Celsius after sampling and during transport to the laboratory. Cooler receipt forms from the laboratory indicated appropriate temperature preservation of received samples.

If a sample container is cracked or broken, the possibility of cross-contamination from other samples exists. A review of laboratory cooler receipt forms indicated no sample containers were cracked or broken. All chain of custody (COC) forms were signed and dated. No problems with sample receipt conditions were indicated on the field COC forms, and all samples listed on the COC forms were analyzed as requested. Copies of COC forms are attached to this report. Cooler receipt forms are stored in the project files and are available upon request. Anomalies associated with COC forms included:

SDG 106426: COC sample identification for an equipment rinsate blank was incorrectly identified as “blank (trip)” on the COC form. The electronic database was updated to reflect the correct sample identification. No action was taken on the hard copy report.

All samples referred to as “BKG-…” in the COC forms have been renamed “S-…”. For example, sample BKG-5-0-0.5 was renamed S-5-0-0.5.

4.2 MATRIX INTERFERENCES

Matrix interferences are conditions unique to a sample or sample matrix that hinder the analytical process and may increase the error in quantifying an analyte. An example of conditions that may cause matrix interference is a high clay fraction in soil samples (clay increases the difficulty of extracting certain compounds from the soil). Other possible sources of matrix interference that were reviewed are discussed below.

4.2.1 Extreme pH

The pH of a sample can affect analytical processes and cause biased results. The effect of pH varies between analytical methods and sample matrix. There were no known instances of extreme pH. Field measurements of pH in groundwater samples are summarized in Table 2.

4.2.2 Turbidity

Turbidity is an indirect means of measuring solids suspended in solution. Turbidity is measured by the amount of light transmitted through a liquid sample and is expressed in nephelometric turbidity units (NTU). Turbidity is inversely related to light transmission, the less light transmitted, the higher the turbidity. Since some compounds tend to adsorb to sediments and suspended media, results for turbid water samples can be biased high (USEPA, 1986). In addition, total metals samples are not filtered and since metals samples are preserved at a pH < 2, many inorganic salts and other materials tend to dissolve into solution. Therefore, any inorganic solids in a groundwater sample requiring acid preservation can bias metals results higher than actual concentrations. However, non-detect results are not affected. Samples with a turbidity greater than 5 NTU are possibly biased high, particularly for metals. Field measurements of turbidity in groundwater samples are summarized in Table 2.

4.2.3 Compound Interference

Determination of compound concentrations using gas chromatography/mass spectrometry (GC/MS) can be influenced by interference from other compounds. Interference may be caused by high concentrations that “mask” similar compounds, creating difficulties in distinguishing and quantifying between compounds.

4.2.4 Dilutions

Samples with analyte concentrations greater than a method's upper quantitation limits require instrument adjustment or dilutions to obtain quantifiable results.

Dilutions affect samples in several ways. Use of diluting solvents or additional measuring equipment reduces accuracy by increasing measurement error. Unless laboratory contamination is identified when diluting, contaminant compounds may be reported at artificially high concentrations. Dilution also effectively raises the MDL and PQL for all compounds of interest, including those not requiring dilutions. For example, a dilution factor of 100 would raise the PQL for an analyte from 10 parts per billion (ppb) to 1,000 ppb. Spike compounds used for QC control can also be diluted below MDLs and/or PQLs. Samples can be diluted by any of the following procedures:

- Use of smaller sample aliquots for analysis.
- Use of greater amounts of solvent for analyte extraction.
- Dilution of the extracted sample.
- Use of a medium-level analysis versus low-level analysis (the procedure for medium-level analysis implies dilution).

The risk of laboratory contamination may occur at each step in the dilution process. If laboratory contaminants affect the analytical process during or after dilution procedures, then detected contaminant results will appear at elevated levels and are not indicative of true environmental conditions. Dilutions were required for several analyses and impacts appear to be limited to low spike recoveries and elevated MDLs/PQLs. Typically surrogate spikes were diluted beyond their calibration range.

4.2.5 Other Interference Sources

Several analyses indicated possible matrix interference with no specific cause. In particular, several analyses of groundwater samples from well MW-01 experienced matrix problems. Groundwater analytical results from well MW-01 are considered useable but should not be solely relied upon for decision-making.

For some analyses, the reduction-oxidation (redox; also known as ORP) state of water can influence analytical results. For groundwater analyses, samples with negative redox readings have the greatest ability to be biased. For example, the mobility and availability of arsenic is influenced by reducing environments. The matrix problems for groundwater analytical results from well MW-01 may be partly due to the apparent reducing environment in this well (Table 2). Additionally, hexavalent chromium analyses in sediment may have been impacted by the reducing environment of the samples, although the potential impact was considered minimal since hexavalent chromium does not persist in such conditions in the environment.

4.3 COMPLETENESS

Completeness is assessed by comparing the number of valid sample results to the number of samples collected and the number of samples planned. Completeness is evaluated to assess whether the investigation provided enough valid data to meet the objectives of the investigation. A completeness value of 90 percent was the minimum acceptable standard, and was met for the Goose Lake RI. Overall project goals for soil and groundwater samples were exceeded. Field data completeness was assessed by calculating the ratio of samples analyzed to the total number of samples collected.

5.0 TOXICITY EQUIVALENCY CALCULATIONS

Potential effects associated with mixtures of dioxins/furans and carcinogenic polycyclic aromatic hydrocarbons (cPAHs) were evaluated using the Model Toxics Control Act toxic equivalent concentration (or toxicity equivalency quotient [TEQ]) approach described in Chapter 173-340-708[8][d] and 173-340-708[8][e] of the Washington Administrative Code (WAC). This approach is based on the use of toxicity equivalency factors (TEFs). TEFs are used to convert congener-specific dioxin/furan concentrations into 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) toxic equivalent concentrations (or TEQs), and individual cPAH constituent concentrations into benzo(a)pyrene TEQs. The approach involves multiplying dioxin/furan congener (or individual cPAH) results by their respective TEFs and then summing the individual TEQs to obtain a total dioxins/furans (or cPAHs) TEQ for each sample. The dioxin/furan TEFs used to calculate TEQs for humans and mammals were based on the updated TEFs developed by the World Health Organization (WHO) in 2005, as summarized in Van den Berg et al. (2006). The dioxin/furan TEFs used to calculate TEQs for birds and fish were based on the TEFs developed by the USEPA (USEPA, 2003). The cPAH TEFs used to calculate TEQs for humans were based on the TEFs developed by the California Environmental Protection Agency (Cal-EPA; 2005).

In calculating total TEQs for dioxins/furans and cPAHs, non-detect results for individual congeners/cPAHs were treated as zeros in the summation of individual TEQs if the subject congener or cPAH constituent was not detected in any soil or sediment sample collected during the RI. Otherwise, one-half the numerical value of individual non-detect results (e.g., one-half the PQL or MDL, as applicable) was used in calculating total TEQs.

6.0 SUMMARY AND CONCLUSIONS

In general, the analytical data obtained during this study are useable for defining the nature and extent of contamination, conducting risk assessments and feasibility studies, and other decision-making purposes. Analytical results were assessed relative to QC criteria for holding times, QC blanks, precision, and accuracy. In several cases QC results exceeding specific criteria were reviewed after comparison to other QC criteria. The following summarizes the findings of the data quality assessment:

- Samples exceeding holding times did not require additional qualification. Holding times for several sulfide analyses were missed because several sediment samples required reanalysis due to initial QC issues.
- Laboratory contamination was detected in some method blanks. In the majority of instances no qualification was required due to the associated sample analyte concentrations. Some detected results, however, were qualified as not detected (U). Rinsate blanks also contained detectable levels of metals and SVOCs, resulting in the qualification of some detected results as not detected.
- The laboratory reported significant interference and low spike recoveries during analysis of hexavalent chromium in sediments. ORP and pH tests indicated that the samples consisted of a reducing matrix. Chromium is unlikely to exist in the hexavalent form under such reducing conditions.
- The laboratory reported that the RPD for lead in one of the fish tissue duplicate sample pairs was outside the laboratory's normal QC limits. This was presumed to be due to the heterogeneous distribution of lead in the sample.
- PCB congener analysis in fish tissues resulted in several minor QC considerations. There were issues with spike recovery of the surrogate hexabromobiphenyl on one of the instrument columns used to separate the congeners. The PQL for one of the tissue samples was elevated because elevated concentrations of congeners in the sample required that a sample dilution. The matrix spike recovery for PCB congener 187 in four samples was outside the QC limits listed in the results summary.
- Dioxin/furan analysis in fish tissues resulted in one sample being qualified with a "K" flag (off-scale low results; actual values are known to be less than the values given). Consequently, the laboratory estimated the maximum possible dioxin/furan concentrations in this sample. Four tissue samples required reanalysis on a different instrument column to confirm 2,3,7,8-tetrachlorodibenzofuran concentrations.
- Several groundwater samples collected from monitoring well MW-01 were affected by possible matrix interference. The groundwater data from well MW-01 are useable for Site characterization purposes but should not be relied upon where decisions are based solely on results from this well.
- For some non-detect results, laboratory PQLs or MDLs were elevated due to necessary sample dilutions or high moisture content (low solids content) of the samples.

The approach used in this data quality assessment tended to be conservative, including rejecting data when uncertainty of results was unacceptably high. The data assessment was performed using best professional judgment. Data users may review and re-interpret data quality for specific uses.

6.1 SIGNIFICANT QUALIFICATION

Significant qualification refers to data qualification actions that can significantly impact data uses or interpretations; examples include qualifying detected results as non-detect, and rejecting data due to significant QC issues. Some detected results were qualified as non-detect based on method blank and rinsate blank detections. A limited number of sample results were rejected and should not be used for any purpose.

6.2 MINOR QUALIFICATION

Minor data qualification generally consisted of detected or non-detect results being qualified as estimated ("J" or "UJ" flag). Estimated results are statistically less certain than non-estimated results, and may be biased higher or lower than the analytical method would typically achieve. These qualifications reflect minor exceedances of specific QC criteria or a combination of QC criteria. Approximately 10 percent of the RI data were qualified as estimated. Although the qualified results are useable, some bias may be present. Data users may want to understand the bias direction in instances where a result is extremely close to an important numerical criterion.

TABLE B-1

ANALYTICAL RESULT QUALIFICATION

GOOSE LAKE SITE
SHELTON, WASHINGTON

Matrix Type	Sample Identification	Analyte	Data Qualifier	Reason
Groundwater	MW-01-02Q3	Chromium	U (not detected)	Rinsate contamination
Groundwater	MW-01-03Q1	Mercury	J (estimated)	Poor spike recovery
Groundwater	MW-02-02Q3	All PCB analytes	UJ (estimated value for non detects)	Poor surrogate recovery
Groundwater	MW-02-02Q3	Chromium	U	Rinsate contamination
Groundwater	MW-02-02Q3 Duplicate	Chromium	U	Rinsate contamination
Groundwater	MW-03-02Q3	Chromium	U	Rinsate contamination
Groundwater	MW-05-02Q3	Chromium	U	Rinsate contamination
Groundwater	MW-06-02Q3 (10X).	All PCB analytes	Do Not Report (DNR) 10X diluted results	Use 1X results (sample was accidentally overspiked)
Groundwater	MW-07-2Q4	Mercury	U	Blank contamination
Groundwater	MW-09-03Q1	All PCBs	J/UJ (estimated values for detects and non detects)	Poor surrogate recoveries
Sediment	SED-02-0.9-1.5	ammonia	J	Poor spike recovery
Sediment	SED-09-0-0.4	Benzoic acid	R (rejected)	Method blank, other QC anomalies
Sediment	SED-09-0-0.4	Benzyl butyl phthalate	R	Method blank, other QC anomalies
Sediment	SED-09-0-0.4	Bis(2-ethylhexyl) phthalate	R	Method blank, other QC anomalies
Sediment	SED-09-0-0.4	Hexavalent chromium	J	Poor spike recovery
Sediment	SED-09-0-0.4	Pentachlorophenol	R	Method blank, other QC anomalies
Sediment	SED-09-0-0.4	Phenol	R	Method blank, other QC anomalies
Soil	MW-07-15	Bis(2-ethylhexyl)phthalate	U	Method blank contamination
Soil	TP-02-22	Hexavalent Chrome	UJ	Poor spike recovery
Soil	TP-03-9.5	All SVOC analytes	J/UJ	Poor surrogate and spike recoveries
Soil	TP-03-9.5	All VOC analytes	J/UJ	Poor spike recoveries
Soil	TP-09-12.5	Aroclor 1260	J	Exceeds instrument linear range
Soil	TP-16-10	Hexavalent Chrome	R	Poor spike recovery
Soil	TP-28-1.0	All VOC analytes	J/UJ	Poor spike recovery
Soil	Trench 04-0.5	All acid fraction SVOC analytes	UJ	Poor spike recovery
Soil	Trench 04-8.0	All SVOC analytes	UJ/J	Poor surrogate recovery
Surface Water	SW-1-bottom	Chromium	U	Rinsate contamination
Surface Water	SW-1-top	Chromium	U	Rinsate contamination
Surface Water	SW-2-bottom	Chromium	U	Rinsate contamination
Surface Water	SW-2-top	Chromium	U	Rinsate contamination
Surface Water	SW-3-bottom (dup)	Chromium	U	Rinsate contamination
Surface Water	SW-3-bottom,	Chromium	U	Rinsate contamination
Surface Water	SW-3-top	Chromium	U	Rinsate contamination

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TABLE B-2

GROUNDWATER FIELD PARAMETERS SUMMARY

GOOSE LAKE SITE

SHELTON, WASHINGTON

		Field Parameters									
Monitor Well	**Date**	**Time**	**pH**	**Conductivity (mS/cm)**	**Turbidity (NTU)**	**Dissolved O_2 (mg/l)**	**Temperature (degrees C)**	**Total Disolved Solids (g/l)**	**RedOx (mV)**	**Salinity (%)**	**Sea Water Potential (σT)**
MW-1	8/13/2002	13:19	6.59	0.189	0.0	4.12	15.2	0.12	0.5	0.01	0
	11/12/2002	10:05	6.83	0.172	0.0	1.02	11.5	0.11	-14	0.00	0
	2/12/2003	15:51	6.64	0.150	5.2	7.44	10.7	0.10	-92	0.00	0
	5/12/2003	11:46	5.27	0.130	9.5	0.00	14.0	0.08	-45	0.00	0
MW-2	8/13/2002	14:17	6.56	0.143	20.8	3.64	13.7	0.09	23	0.01	0
	11/12/2002	9:27	6.69	0.178	5.4	0.76	13.2	0.12	37	0.00	0
	2/12/2003	16:28	6.69	0.137	0.5	7.91	12.3	0.09	-81	0.00	0
	5/12/2003	19:16	5.16	0.185	7.2	0.00	10.5	0.12	-39	0.00	0
MW-3	8/13/2002	15:56	6.15	0.110	6.5	3.84	19.2	0.07	173	0.00	0
	11/12/2002	8:48	6.58	0.158	5.4	0.78	14.0	0.11	75	0.00	0
	2/12/2003	18:54	6.26	0.099	9.2	2.69	11.4	0.06	8	0.00	0
	5/12/2003	18:21	5.21	0.132	6.3	0.00	13.0	0.09	50	0.00	0
MW-4	8/13/2002	12:13	5.40	0.156	30.2	7.34	11.7	0.10	239	0.01	0
	11/13/2002	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY
	2/12/2003	15:10	5.86	0.049	5.3	10.40	8.5	0.03	184	0.00	0
	5/12/2003	18:44	4.65	0.126	7.8	1.32	9.3	0.08	292	0.00	0
MW-5	8/13/2002	10:41	4.82	0.206	5.3	5.05	10.9	0.13	451	0.01	0
	11/12/2002	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY
	2/12/2003	12:44	4.95	0.174	6.3	8.54	10.8	0.11	214	0.00	0
	5/12/2003	15:58	4.43	0.145	10.2	5.63	10.5	0.09	354	0.00	0
MW-6	8/13/2002	9:44	6.22	0.095	0.0	7.04	13.9	0.06	379	0.00	0
	11/12/2002	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY
	2/12/2003	18:31	6.45	0.076	0.0	7.19	11.0	0.05	148	0.00	0
	5/12/2003	17:51	5.03	0.083	2.5	5.12	10.8	0.05	295	0.00	0
MW-7	8/12/2002	14:54	5.88	0.128	50.2	7.05	11.1	0.08	2.8	0.00	0
	11/13/2002	11:59	6.16	0.192	20.2	0.85	12.8	0.13	40	0.00	0
	2/12/2003	17:10	5.91	0.084	8.2	7.12	12.0	0.05	143	0.00	0
	5/12/2003	10:43	4.86	0.116	10.9	3.53	11.1	0.08	332	0.00	0
MW-8	8/12/2002	15:54	6.59	0.081	67.0	11.03	11.6	0.05	297	0.00	0
	11/12/2002	8:00	6.68	0.098	40.2	10.54	10.5	0.06	270	0.00	0
	2/12/2003	19:42	6.64	0.080	10.2	11.58	10.1	0.05	134	0.00	0
	5/12/2003	17:23	5.02	0.088	22.5	10.76	10.0	0.06	288	0.00	0
MW-9	8/13/2002	11:25	5.81	0.252	38.1	8.02	12.0	0.16	133	0.01	0
	11/12/2002	12:46	5.94	0.229	17.8	1.24	11.3	0.15	66	0.00	0
	2/12/2003	12:18	5.66	0.304	62.2	7.54	10.6	0.20	40	0.00	0
	5/12/2003	15:25	4.90	0.307	20.5	0.00	11.6	0.20	11	0.00	0
MW-10	8/12/2002	13:55	6.05	0.165	44.9	4.35	12.8	0.11	46	0.01	0
	11/12/2002	14:20	6.45	0.383	10.4	0.89	10.4	0.25	-16	0.00	0
	2/12/2003	13:53	5.60	0.025	7.8	8.41	10.3	0.05	195	0.00	0
	5/12/2003	16:31	4.65	0.058	11.2	3.39	9.7	0.04	257	0.00	0

SEAT:\0\0137010\07\Finals\Draft Final RI\App B Data Quality Assessment\013700103 B-T2.xls

Chain of Custody Record

STL-8274 (0102)

STL Seattle
5755 8th Street E.
Tacoma, WA 98424
Tel. 253-922-2310
Fax 253-922-5047
www.stl-inc.com

B4

SEVERN TRENT SERVICES

Severn Trent Laboratories, Inc.

106426

Client: ENTRIX	Project Manager: Jeff Fisher	Date: 6-4-02	Chain of Custody Number: 2571
Address: 148 Rogers St	Telephone Number (Area Code)/Fax Number: (360) 352- 3235	Lab Number:	Page 1 of 4
City: Olympia · State: WA · Zip Code: 98502	Site Contact: Jeff Fisher · Lab Contact: Don		
Project Name and Location (State): Gooselake, WA	Carrier/Waybill Number:		
Contract/Purchase Order/Quote No.			

Sample I.D. and Location/Description (Containers for each sample may be combined on one line)	Date	Time	Matrix					Containers & Preservatives							Analysis (Attach list if more space is needed)												Special Instructions/ Conditions of Receipt
			Air	Aqueous	Sed.	Soil		Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH		Turbidity ✓	conductivity ✓	pH ✓	PCB ✓	Hardness ✓								
SW-2 - bottom -4 ~~8~~ F	6-4-02	1500		X				X							X	X	X										
SW-3- top -5F	6-4-02	1545		X				X							X	X	X										
- blank (trip) 8E	6-4-02	1020		X				X										X									
- dup (top) -7E	6-4-02	1600		X				X										X									
SW-3 - bottom -6E	6-4-02	1620		X				X										X									
SW-3- top -5E	6-4-02	1545		X				X										X									
SW-2- bottom -4E	6-4-02	1500		X				X										X									
SW-2- top -3E	6-4-02	1440		X				X										X									
SW-1 - bottom -2E	6-4-02	1345		X				X										X									
SW-1- top -1E	6-4-02	1305		X				X										X									
- blank (trip 8B	6-4-02	1020		X					X										X								
- dup (top) 7B	6-4-02	1600		X					X										X								

Cooler: ☒ Yes ☐ No Cooler Temp: ______

Possible Hazard Identification: ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☒ Unknown

Sample Disposal: ☐ Return To Client ☒ Disposal By Lab ☐ Archive For ______ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required (business days): ☐ 24 Hours ☐ 48 Hours ☐ 5 Days ☐ 10 Days ☐ 15 Days ☒ Other Standard

QC Requirements (Specify)

1. Relinquished By	Date: 6/5/02	Time: 10:30	1. Received By: Dawn Mc[illegible]	Date: 6-5-02	Time: 10:30
2. Relinquished By	Date	Time	2. Received By	Date	Time
3. Relinquished By	Date	Time	3. Received By	Date	Time

Comments

DISTRIBUTION: WHITE - Stays with the Samples; CANARY - Returned to Client with Report; PINK - Field Copy

Chain of Custody Record

STL-8274 (0102)

STL Seattle
5755 8th Street E.
Tacoma, WA 98424
Tel. 253-922-2310
Fax 253-922-5047
www.stl-inc.com

SEVERN TRENT SERVICES

Severn Trent Laboratories, Inc.

106426

Client: ENTRIX
Project Manager: Jeff Fisher
Date: 6-4-02
Chain of Custody Number: 2572
Address: 148 Rogers St
Telephone Number (Area Code)/Fax Number: (360) 352-3225
Lab Number:
Page 2 of 4
City: Olympia
State: WA
Zip Code: 98502
Site Contact: Jeff Fisher
Lab Contact: Don
Project Name and Location (State): Gooselake, WA
Carrier/Waybill Number:
Contract/Purchase Order/Quote No.:

Analysis (Attach list if more space is needed)

Sample I.D. and Location/Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH		Hardness ✓	Hexavalent-Cr	Special Instructions/ Conditions of Receipt
SW-3-bottom -6B	6-4-02	1620		X				X						X		
SW-3-top -5B	↓	1545		X				X						X		
SW-2-bottom -4B		1500		X				X						X		
SW-2-top -3B		1440		X				X						X		
SW-1-bottom -2B		1345		X				X						X		
SW-1-top -1B		1305		X				X						X		
- blank (trip) -8A		1020		X			X								X	
- dup (top) -7A		1600		X			X								X	
SW-3-bottom -6A		1620		X			X								X	
SW-3-top -5A		1545		X			X						~~X~~		X	
SW-2-bottom -4A		1500		X			X						~~X~~		X	
SW-2-top -3A	↓	1440		X			X						~~X~~		X	

Cooler: ☒ Yes ☐ ~~No~~ Cooler Temp: ________

Possible Hazard Identification: ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☒ Unknown

Sample Disposal: ☐ Return To Client ☒ Disposal By Lab ☐ Archive For ______ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required (business days): ~~☒ 24 Hours~~ ☐ 48 Hours ☐ 5 Days ☐ 10 Days ☐ 15 Days ☒ Other Standard

6-5-02

QC Requirements (Specify)

1. Relinquished By: | Date: 6/5/02 | Time: 10:30
1. Received By: Dawn M. Ullman | Date: 6-5-02 | Time: 10:30
2. Relinquished By: | Date: | Time:
2. Received By: | Date: | Time:
3. Relinquished By: | Date: | Time:
3. Received By: | Date: | Time:

Comments

DISTRIBUTION: WHITE - Stays with the Samples; CANARY - Returned to Client with Report; PINK - Field Copy

Chain of Custody Record

STL-8274 (0102)

STL Seattle
5755 8th Street E.
Tacoma, WA 98424
Tel. 253-922-2310
Fax 253-922-5047
www.stl-inc.com

SEVERN TRENT SERVICES

Severn Trent Laboratories, Inc.

106426

Client: ENTRIX

Project Manager: Jeff Fisher

Date: 6-4-02

Chain of Custody Number: 2573

Address: 148 Rogers St NW

Telephone Number (Area Code)/Fax Number: (360) 352-3225

Lab Number:

Page 3 of 4

City: Olympia State: WA Zip Code: 98502

Site Contact: Jeff Fisher

Lab Contact: Don

Project Name and Location (State): Gooselake, WA

Carrier/Waybill Number:

Contract/Purchase Order/Quote No.:

Special Instructions/ Conditions of Receipt

Sample I.D. and Location/Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil		Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH		Analysis: Hexavalent-Cr	Sulfide	As	Pb	Cr	Hg
SW-1- bottom -2A	6-4-02	1345		X				X							X					
SW-1- top -1A		1305		X				X							X					
- blank -8D		1020		X									X			X				
- dup (top) -7D		1600		X									X			X				
SW-3- bottom -6D		1620		X									X			X				
SW-3- top -5D		1545		X									X			X				
SW-2- bottom -4D		1500		X									X			X				
SW-2- top -3D		1440		X									X			X				
SW-1- bottom -2D		1345		X									X			X				
SW-1- top -1D		1305		X									X			X				
- blank (trip) -8D		1020		X						X							X	X	X	X
- dup (top) -7D	↓	1600		X						X							X	X	X	X

Cooler: ☒ Yes ☐ No Cooler Temp: ____

Possible Hazard Identification: ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☒ Unknown

Sample Disposal: ☐ Return To Client ☒ Disposal By Lab ☐ Archive For ____ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required (business days): ☐ 24 Hours ☐ 48 Hours ☐ 5 Days ☐ 10 Days ☐ 15 Days ☒ Other Standard

QC Requirements (Specify):

1. Relinquished By: Date 6/5/02 Time 10:30

1. Received By: Dawn M. Weaver Date 6-5-02 Time 10:30

2. Relinquished By: Date Time

2. Received By: Date Time

3. Relinquished By: Date Time

3. Received By: Date Time

Comments:

DISTRIBUTION: WHITE - Stays with the Samples; CANARY - Returned to Client with Report; PINK - Field Copy

[redacted]

Chain of Custody Record

STL-8274 (0102)

STL Seattle
5755 8th Street E.
Tacoma, WA 98424
Tel: 253-922-2310
Fax 253-922-5047
www.stl-inc.com

SEVERN TRENT SERVICES

Severn Trent Laboratories, Inc.

106426

Client: ENTRIX

Address: 148 Rogers St

City: Olympia State: WA Zip Code: 98502

Project Name and Location (State): Gooselake, WA

Contract/Purchase Order/Quote No.:

Project Manager: Jeff Fisher

Telephone Number (Area Code)/Fax Number: (360) 352-3225

Site Contact: Jeff Fisher Lab Contact: Don

Carrier/Waybill Number:

Date: 6-4-02

Lab Number:

Chain of Custody Number: 2574

Page 4 of 4

[redacted]

Sample I.D. and Location/Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil		Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH		Analysis: As	Pb	Cr	Hg	PCBs	Hardness	Hexavalent-Cr	Sulfide					Special Instructions/ Conditions of Receipt
SW-3 bottom -4C	6-4-02	1620		X						X					X	X	X	X									
SW-3 top -5C	↓	1545		X						X					X	X	X	X									
SW-2 bottom -4C		1500		X						X					X	X	X	X									
SW-2 top -3C		1440		X						X					X	X	X	X									
SW-1 bottom -2C		1345		X						X					X	X	X	X									
SW-1 top -1C		1305		X						X					X	X	X	X									
rinsate -9C	6-4-02	1430		X						X					X	X	X	X									
rinsate -9E	↓	↓		X				X											X								
rinsate -9				X					X											X							MISSING
rinsate -9A				X				X													X						
rinsate -9D				X									X									X					

Cooler ☒ Yes ☐ No Cooler Temp: ______

Possible Hazard Identification ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☒ Unknown

Sample Disposal ☐ Return To Client ☒ Disposal By Lab ☐ Archive For ______ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required (business days)

☐ 24 Hours ☐ 48 Hours ☐ 5 Days ☐ 10 Days ☐ 15 Days ☒ Other Standard

QC Requirements (Specify)

1. Relinquished By Date 6/5/02 Time 10:30
1. Received By Dawn M. [illegible] Date 6-5-02 Time 10:30
2. Relinquished By Date Time
2. Received By Date Time
3. Relinquished By Date Time
3. Received By Date Time

Comments

DISTRIBUTION: WHITE - Stays with the Samples; CANARY - Returned to Client with Report; PINK - Field Copy

CHAIN OF CUSTODY RECORD

GEOENGINEERS, INC.
1101 FAWCETT, SUITE 200
TACOMA, WASHINGTON 98402
(206) 383-4940

COC 062502.001
DATE 6-25-02
PAGE 1 OF 1
LAB CAS
LAB NO.

PROJECT NAME/LOCATION Rayonier - Goose Lake
PROJECT NUMBER 0137-010-02 Task 4
PROJECT MANAGER Steve Woodward
SAMPLED BY Brian Peterka

SAMPLE IDENTIFICATION		SAMPLE COLLECTION			# OF JARS	④ANALYSIS REQUIRED												NOTES/COMMENTS (Preserved, filtered, etc.)
LAB	GEOENGINEERS	DATE	TIME	MATRIX		Metals ①	Metals ②	PCBs ③	Conventionals	SVOCs 8270c	Dioxin/Furans	PCB Congeners ⑤						2 oz. jars for Total Sulfides preserved with zinc acetate.
8	SED-01-1.7-4.1	6-25-02	1640	SED	4	X	X	X	X	X	■	X						1x2oz, 1x8oz, 1x16oz, 1x32oz
9	SED-DUP-01	6-25-02	1740	SED	4	X	X	X	X	X	■	X						1x2oz, 1x8oz, 1x16oz, 1x32 oz
10	SED-03-1.9-5.8	6-25-02	1715	SED	4		X	X	X		■	X						1x2oz, 1x8oz, 1x16oz, 1x32oz

NOTE ■ = Don't Analyze - will have extra 8 oz. jar-

RELINQUISHED BY SIGNATURE PRINTED NAME Brian Peterka DATE 6-26-02	FIRM GB TIME 1645	RELINQUISHED BY SIGNATURE PRINTED NAME DATE TIME	FIRM RELINQUISHED BY SIGNATURE PRINTED NAME DATE TIME
RECEIVED BY SIGNATURE Black PRINTED NAME Black DATE 6/27/02	FIRM CAS TIME 0900	RECEIVED BY SIGNATURE PRINTED NAME DATE TIME	FIRM RECEIVED BY SIGNATURE PRINTED NAME DATE TIME

ADDITIONAL COMMENTS: ① Cu, Ni, Ag, Zn (all by 6010B) + Sb and Cd (by 6020) +
② Total Cr (by 6010B) + As and Pb (by 6020) + Hex Cr (by 7195) + Hg (by 7471 A).
③ Arochlor 1016, 1221, 1232, 1242, 1248, 1254, 1260 (by 8082).
④ Total Solids (PSEP) + Grain size (Plumb 1981) + PH + TOC (9060) + Ammonia (Plumb 1981) + Total sulfide (9030 B).
⑤ Archive only.

GEOENGINEERS, INC.
1101 FAWCETT, SUITE 200
TACOMA, WASHINGTON 98402
(206) 383-4940

CHAIN OF CUSTODY RECORD

GeoEngineers

COC 062502.002
DATE 6-25-02
PAGE 1 OF 1
LAB CAS
LAB NO.

PROJECT NAME/LOCATION Rayonier - Goose Lake
PROJECT NUMBER Steve Woodward
PROJECT MANAGER 0137-010-02 Task 4
SAMPLED BY Brian Peterka

SAMPLE IDENTIFICATION		SAMPLE COLLECTION			# OF	ANALYSIS REQUIRED												NOTES/COMMENTS (Preserved, filtered, etc.)
LAB	GEOENGINEERS	DATE	TIME	MATRIX	JARS	Metals ①	Metals ②	PCBs ③	Convent's ④	SVOCs 8270C	Dioxins/Furans 8290A	PCB Congeners ⑤	Use for MS/MSD also					2 oz. jars for total, sulfides preserved with zinc acetate.
BP 6-26-02	~~SED-08-1.8-4.8~~	~~6-25-02~~	~~1815~~	~~SED~~	~~4~~		~~X~~	~~X~~	~~X~~		[redacted]	~~X~~						~~1x2oz, 1x8oz, 1x16oz, 1x32oz~~
11	SED-DUP-02	6-25-02	1800	SED	1						X							1x8oz
12	SED-04-1.8-5,6	6-26-02	0945	SED	12	X	X	X	X	X	X	X	X					3x2oz, 3x8oz, 3x16oz, 3x32oz
BP 6-26-02	~~SED 05~~	~~6-26-02~~	~~1245~~	~~SED~~	~~4~~	BP 6-26-02												
13	SED-08-1.8-4.8	6-25-02	1815	SED	4		X	X	X		X	X						1x2oz, 1x8oz, 1x16oz, 1x32oz

Note [redacted] don't analyze - will have extra 8oz jar.

RELINQUISHED BY FIRM GEI SIGNATURE PRINTED NAME Brian Peterka DATE 6-26-02 TIME 1645	RELINQUISHED BY FIRM SIGNATURE PRINTED NAME DATE TIME	RELINQUISHED BY FIRM SIGNATURE PRINTED NAME DATE TIME
RECEIVED BY FIRM CAS SIGNATURE Tracy Black PRINTED NAME Black DATE 6/27/02 TIME 0900	RECEIVED BY FIRM SIGNATURE PRINTED NAME DATE TIME	RECEIVED BY FIRM SIGNATURE PRINTED NAME DATE TIME

ADDITIONAL COMMENTS: ① Cu, Ni, Ag, Zn (6010B) + Sb and Cd (6020).
② Total Cr (6010B) + As and Pb (6020) + Hex Cr (7195) + Hg (7471A).
③ Arochlor 1016, 1221, 1232, 1242, 1248, 1254, 1260 (8082).
④ Total solids (PSEP) + Grain size (Plumb 1981) + pH + TOC (9060) + Ammonia (Plumb 1981) + Total Sulfide (9030B).
⑤ Archive only.

5

CHAIN OF CUSTODY RECORD

GEOENGINEERS, INC.
1101 FAWCETT, SUITE 200
TACOMA, WASHINGTON 98402
(206) 383-4940

GeoEngineers

COC 062602.003
DATE 6-26-02
PAGE OF
LAB CAS
LAB NO.

PROJECT NAME/LOCATION Rayonier - Goose Lake
PROJECT NUMBER 0137-010-02 Task 4
PROJECT MANAGER Steve Woodward
SAMPLED BY Brian Peterka

SAMPLE IDENTIFICATION		SAMPLE COLLECTION			# OF JARS	ANALYSIS REQUIRED							NOTES/COMMENTS (Preserved, filtered, etc.)
LAB	GEOENGINEERS	DATE	TIME	MATRIX		Metals ①	Metals ②	PCBs ③	Convents ④	SVOCs 8270c	Dioxins/Furans 8290A	PCB Congeners ⑤	2 oz. jars for total Sulfides preserved with zinc acetate.
5	SED-01-0-0.15	6-26-02	1200	SED	4	X	X	X	X	X	■	X	1x2oz, 1x8oz, 1x16oz, 1x32oz
6	SED-03-0-0.15	6-26-02	1230	SED	4		X	X	X		■	X	1x2oz, 1x8oz, 1x16oz, 1x32oz
~~BPP 6-26-02~~	~~SED-05-0-0.15~~	~~6-26-02~~	~~1245~~	~~SED~~	~~4~~		~~X~~	~~X~~	~~X~~		■	~~X~~	~~1x2oz, 1x8oz, 1x16oz, 1x32oz~~
7	SED-06-0-0.15	6-26-02	1300	SED	4		X	X	X		■	X	1x2oz, 1x8oz, 1x16oz, 1x32oz

NOTE ■ Do not analyze – will have extra 8 oz jar.

RELINQUISHED BY FIRM GEI
SIGNATURE BP
PRINTED NAME Brian Peterka
DATE 6-26-02 TIME 1645

RECEIVED BY FIRM CAS
SIGNATURE Fran Black
PRINTED NAME Black
DATE 6/27/02 TIME 0900

RELINQUISHED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

RECEIVED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

RELINQUISHED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

RECEIVED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

ADDITIONAL COMMENTS: ① Cu, Ni, Ag, Zn (6010B) + Sb and Cd (6020).
② Total Cr (6010B) + As and Pb (6020) + Hex Cr (7195) + Hg (7471A).
③ Arochlor 1016, 1221, 1232, 1242, 1248 1254, 1260 (8082).
④ Total Solids (PSEP) + Grain Size (Plumb 1981) + pH + TOC (9060) + Ammonia (Plumb 1981) + Total Sulfide (9030B).
⑤ Archive only.

K2204286

CHAIN OF CUSTODY RECORD

COC 062602.004

GEOENGINEERS, INC.
1101 FAWCETT, SUITE 200
TACOMA, WASHINGTON 98402
(206) 383-4940

GeoEngineers

DATE 6-26-04
PAGE 1 OF 1
LAB CAS
LAB NO.

PROJECT NAME/LOCATION Rayonier - Goose Lake
PROJECT NUMBER 0137-010-02 Task 4
PROJECT MANAGER Steve Woodward
SAMPLED BY Brian Peterka

SAMPLE IDENTIFICATION		SAMPLE COLLECTION			# OF JARS	ANALYSIS REQUIRED											NOTES/COMMENTS (Preserved, filtered, etc.)
LAB	GEOENGINEERS	DATE	TIME	MATRIX		metals ①	metals ②	PCBs ③	Conventionals ④	SVOCs 8270C	Dioxins/furans 8290A	PCB Congeners	~~ARCHIVE~~ Hold BP 6-28-02				2oz jars for total sulfides preserved with zinc acetate.
1	SED-05-2.3-5.1	6-26-02	1250	SED	4		X	X	X		X	X					1x2oz, 1x8oz, 1x16oz, 1x32oz
2	SED-07-0-0.15	6-26-02	1325	SED	4		X	X	X		■	X					1x2oz, 1x8oz, 1x16oz, 1x32oz
3	SED-05-5.1-5.6	6-26-02	1350	SED	2								X				1x4oz, 1x16oz
4	SED-04-0-0.15	6-26-02	1445	SED	4	X	X	X	X	X	X	X					1x2oz, 1x8oz, 1x16oz, 1x32oz
						with 6/27/02				with 6/27/02 per Brian Peterka							

NOTE ■ = Do nt Analyze - will have one extra 8 oz jar.

RELINQUISHED BY		RELINQUISHED BY		RELINQUISHED BY	
SIGNATURE	FIRM GEI	SIGNATURE	FIRM	SIGNATURE	FIRM
PRINTED NAME Brian Peterka		PRINTED NAME		PRINTED NAME	
DATE 6-26-02	TIME 1645	DATE	TIME	DATE	TIME
RECEIVED BY		**RECEIVED BY**		**RECEIVED BY**	
SIGNATURE Fran Black	FIRM CAS	SIGNATURE	FIRM	SIGNATURE	FIRM
PRINTED NAME Black		PRINTED NAME		PRINTED NAME	
DATE 6/27/02	TIME 0900	DATE	TIME	DATE	TIME

ADDITIONAL COMMENTS: ① Cu, Ni, Ag, Zn (6010B) + Sb and Cd (6020).
② Total Cr (6010B) + As and Pb (6020) + Hex Cr (7195) + Hg (7471A).
③ Arochlor 1016, 1221, 1232, 1242, 1248, 1254, 1260 (8082).
④ Total solids (PSEP) + Grain Size (Plumb 1981) + pH + TOC (9060) + Ammonia (Plumb 1981) + Total Sulfide (9030B).
⑤ Archive only.

K2204359c

CHAIN OF CUSTODY RECORD

GEOENGINEERS, INC.
1101 FAWCETT, SUITE 200
TACOMA, WASHINGTON 98402
(206) 383-4940

GeoEngineers

COC 062602.005
DATE 6-26-02
PAGE 1 OF 1
LAB CAS
LAB NO.

PROJECT NAME/LOCATION Rayonier - Goose Lake
PROJECT NUMBER 037-010-02 Task 4
PROJECT MANAGER Steve Woodward
SAMPLED BY Brian Peterka

SAMPLE IDENTIFICATION		SAMPLE COLLECTION			# OF JARS	ANALYSIS REQUIRED												NOTES/COMMENTS (Preserved, filtered, etc.) 2 oz jars for total sulfides preserved with zinc acetate.
LAB	GEOENGINEERS	DATE	TIME	MATRIX		Metals ①	Metals ②	PCBs ③	Conventionals ④	SVOCs 8270c	Dioxins/Furans 8290A	PCB Congeners ⑤						
1	SED-02-0.9-1.5	6-26-02	1500	SED	4		☒	☒	☒		■	☒						1x2oz, 1x8oz, 1x16oz, 1x32 oz
2	SED-08-0-0.15	6-26-02	1505	SED	4		☒	☒	☒		☒	☒						1x2oz, 1x8oz, 1x16oz, 1x32oz
3	SED-05-0-0.15	6-26-02	1600	SED	4		☒	☒	☒		☒	☒						1x2oz, 1x8oz, 1x16oz, 1x32oz

RELINQUISHED BY FIRM GEI
SIGNATURE Tonya C Kauhi
PRINTED NAME Tonya C Kauhi
DATE 6/27/02 TIME 1500

RECEIVED BY FIRM CAS
SIGNATURE
PRINTED NAME KMonrow
DATE 6/28/02 TIME 1400

RELINQUISHED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

RECEIVED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

RELINQUISHED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

RECEIVED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

ADDITIONAL COMMENTS: ~~[illegible]~~ BP ① Cu, Ni, Ag, Zn (6010B) + Sb and Cd (6020).
② Total Cr (6010B) + As and Pb (6020) + Hex Cr (7195) + Hg (7471A).
③ Arochlor 1016, 1221, 1232, 1242, 1248, 1254, 1260 (8082).
④ Total sulfides (PSEP) + Grain Size (Plumb 1981) + pH + TOC (9060) + Ammonia (Plumb 1981) + Total sulfide (9030B).
⑤ Archive only.

K2204359.

CHAIN OF CUSTODY RECORD

GEOENGINEERS, INC.
1101 FAWCETT, SUITE 200
TACOMA, WASHINGTON 98402
(206) 383-4940

GeoEngineers

COC 062602.006
DATE 6-26-02
PAGE 1 OF 1
LAB CAS
LAB NO.

PROJECT NAME/LOCATION Rayonier-Goose Lake
PROJECT NUMBER 0137-010-02 Task 4
PROJECT MANAGER Steve Woodward
SAMPLED BY Brian Peterka

SAMPLE IDENTIFICATION		SAMPLE COLLECTION			# OF JARS	ANALYSIS REQUIRED												NOTES/COMMENTS (Preserved, filtered, etc.) 2 oz. jars for total sulfides preserved with zinc acetate.
LAB	GEOENGINEERS	DATE	TIME	MATRIX		metals ①	metals ②	PCBs ③	Conventionals ④	SVOCs 8270C	Dioxins/furans 8290A	PCB congeners ⑤	Hold					
4	SED-07-2.0-5.3	6-26-02	1635	SED	4		X	X	X			X						1x2oz, 1x8oz, 1x16oz, 1x32oz
5	SED-06-1.3-5.0	6-26-02	1730	SED	4		X	X	X			X						" " " " 8oz
6	SED-03-6.2-9.7	6-26-02	1845	SED	4								X					NOTE: there ~~are~~ is one
																		extra 8oz jar for
																		each sample from
																		SED-07-2,0-5,3 and
																		SED-06-1,3-5,0,

RELINQUISHED BY
SIGNATURE Tonya C. Kauki
PRINTED NAME Tonya C. Kauki
FIRM GEI
DATE 6/27/02 TIME 1500

RECEIVED BY
SIGNATURE K Morrow
PRINTED NAME K Morrow
FIRM CAS
DATE 6/28/02 TIME 1400

RELINQUISHED BY
SIGNATURE
PRINTED NAME
FIRM
DATE TIME

RECEIVED BY
SIGNATURE
PRINTED NAME
FIRM
DATE TIME

RELINQUISHED BY
SIGNATURE
PRINTED NAME
FIRM
DATE TIME

RECEIVED BY
SIGNATURE
PRINTED NAME
FIRM
DATE TIME

ADDITIONAL COMMENTS: ① Cu, Ni, Ag, Zn (6010B) + Sb and Cd (6020).
② Total Cr (6010 B) + As and Pb (6020) + Hex Cr (7195) + Hg (7471A).
③ Arochlor 1016, 1221, 1232, 1242, 1248, 1254, 1260 (8082).
④ Total sulfides (PSEP) + Grain size (Plumb 1981) + pH + TOC (9060) + Ammonia (Plumb 1981) + Total sulfide (9030B).
⑤ Archive only.

106446

CHAIN OF CUSTODY RECORD

GEOENGINEERS, INC.
1101 FAWCETT, SUITE 200
TACOMA, WASHINGTON 98402
(206) 383-4940

GeoEngineers

COC 062602.007
DATE 6-26-02
PAGE 1 OF 1
LAB STL
LAB NO.

PROJECT NAME/LOCATION Rayonier - Goose Lake
PROJECT NUMBER 0137-010-02 TASK 4
PROJECT MANAGER Steve Wood Ward
SAMPLED BY Brian Peterka

SAMPLE IDENTIFICATION		SAMPLE COLLECTION			# OF JARS	ANALYSIS REQUIRED							NOTES/COMMENTS (Preserved, filtered, etc.)
LAB	GEOENGINEERS	DATE	TIME	MATRIX		Metals ① A	~~Metals ②~~	Ammonia B	Sulfide C	Hex.Chrome D	PCBs E	SVOCs F	See bottle labels for preservative info.
106946-1	SED-05-RINSATE	6-26-02	1635	WATER	6	X		X	X	X	X	X	

RELINQUISHED BY	RELINQUISHED BY	RELINQUISHED BY
FIRM GGI	FIRM	FIRM
SIGNATURE Tonya C. Kauhi	SIGNATURE	SIGNATURE
PRINTED NAME Tonya C. Kauhi	PRINTED NAME	PRINTED NAME
DATE 6/27/02 TIME 0900	DATE TIME	DATE TIME

RECEIVED BY	RECEIVED BY	RECEIVED BY
FIRM Stl	FIRM	FIRM
SIGNATURE KPresley	SIGNATURE	SIGNATURE
PRINTED NAME KPresley	PRINTED NAME	PRINTED NAME
DATE 6/27/02 TIME 9:00	DATE TIME	DATE TIME

ADDITIONAL COMMENTS: ① Total Chromium, Copper, Nickel, Silver, Zinc, Antimony, Arsenic, Cadmium, Lead, and Mercury: Lowest Detection Limits
② Metals - 7195

101204

CHAIN OF CUSTODY RECORD

GEOENGINEERS, INC.
1101 FAWCETT, SUITE 200
TACOMA, WASHINGTON 98402
(206) 383-4940

GeoEngineers

COC 070802.008

DATE 7-8-02
PAGE 1 OF 1
LAB STL
LAB NO.

PROJECT NAME/LOCATION Rayonier - Goose Lake
PROJECT NUMBER 0137-040-02 T.5
PROJECT MANAGER Steve Woodward
SAMPLED BY Brian Peterka

SAMPLE IDENTIFICATION		SAMPLE COLLECTION			# OF JARS	ANALYSIS REQUIRED												NOTES/COMMENTS (Preserved, filtered, etc.)
LAB	GEOENGINEERS	DATE	TIME	MATRIX		Metals ①	TCLP ②	PCBs ③	SVOCs 8270C	Total Sulfide 9030B	VOCs 8260A	Hold						
1	TP-02-1.0	7-8-02	1000	S	1	X												1x8 oz.
2	TP-02-22.0	7-8-02	1035		1	X												1x8oz
3	TP-02-11.5		1050		2	X		X										1x8oz, 1x4oz
4	TP-05-23A		1220		1							X						1x8oz
5	TP-05-23B		1225		1							X						1x8oz
6	TP-05-13		1230		2	X												1x8oz, 1x4oz
7	TP-09-24.5		1415		1							X						1x8oz
8	TP-09-12.5		1425		2	X		X										1x8oz, 1x4oz
9	TP-13-24.5		1530		1	X		X										1x8oz
10	TP-13-5.0	↓	1535	↓	2	X		X	X	X	X							1x8oz, 1x4oz

RELINQUISHED BY FIRM GEI
SIGNATURE
PRINTED NAME Brian Peterka
DATE 1500 on 7-9-02 TIME 1500

RECEIVED BY FIRM GEI
SIGNATURE
PRINTED NAME Rob Smith
DATE 7-9-02 TIME 1630

RELINQUISHED BY FIRM GEI
SIGNATURE Tonya C Kauhi.
PRINTED NAME Tonya C. Kauhi
DATE 7/12/02 TIME 0830

RECEIVED BY FIRM
SIGNATURE SRoy
PRINTED NAME Roy
DATE 7-12-02 TIME 830AM

RELINQUISHED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

RECEIVED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

ADDITIONAL COMMENTS:

① total chromium + copper (6010B), As + Pb (6020), hex chromium (7195), Hg-soil/sed (7471A)
② to be determined based on metals results
③ Arochlors 1016, 1221, 1232, 1242, 1248, 1254, 1260 (8082)

107254

COC 070802,009

CHAIN OF CUSTODY RECORD

GEOENGINEERS, INC.
1101 FAWCETT, SUITE 200
TACOMA, WASHINGTON 98402
(206) 383-4940

GeoEngineers

DATE 7-8-02
PAGE 1 OF 1
LAB STL
LAB NO.

PROJECT NAME/LOCATION Rayonier-Goose Lake
PROJECT NUMBER 0137-010-02 T.S.
PROJECT MANAGER Steve Woodward
SAMPLED BY Brian Peterka

SAMPLE IDENTIFICATION		SAMPLE COLLECTION			# OF JARS	ANALYSIS REQUIRED												NOTES/COMMENTS (Preserved, filtered, etc.)
LAB	GEOENGINEERS	DATE	TIME	MATRIX		Metals ①	TCLP ②	PCBs ③	SVOCs 8270C	Total Sulfide 9030	VOCs 8260A	Hold						
11	TP-16-24.0	7-8-02	1640	S	1							X						1x8oz
12	TP-16-10	↓	1645	↓	2	X			X		X							1x8oz, 1x4oz
13	TP-07-9.5	↓	1810	↓	2	X				X								1x8oz, 1x4oz

RELINQUISHED BY FIRM GEI
SIGNATURE
PRINTED NAME Brian Peterka
DATE 7-9-02 TIME 1500

RECEIVED BY FIRM GEI
SIGNATURE
PRINTED NAME Rob Smith RAS 1630
DATE ~~7-10-02~~ 7-9-02 TIME ~~[illegible]~~

RELINQUISHED BY FIRM GEI
SIGNATURE Tonya C Kauhi
PRINTED NAME Tonya C. Kauhi
DATE 7/12/02 TIME 0830

RECEIVED BY FIRM
SIGNATURE SRay
PRINTED NAME Ray
DATE 7-12-02 TIME 830

RELINQUISHED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

RECEIVED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

ADDITIONAL COMMENTS:

① Total Cr + Cu (6010B), As + Pb (6020), hex Cr (7195), Hg-Soil/Sed (7471A)

② To be determined based on metals results

③ Arochlors 1016, 1221, 1232, 1242, 1248, 1254, 1260 (8082)

107254

CHAIN OF COUSTODY RECORD

GEOENGINEERS, INC.
1101 FAWCETT, SUITE 200
TACOMA, WASHINGTON 98402
(206) 383-4940

GeoEngineers

COC 070902.010
DATE 7-9-02
PAGE 1 OF 1
LAB STL
LAB NO.

PROJECT NAME/LOCATION Rayonier - Goose Lake
PROJECT NUMBER 0137-010-02 T.5
PROJECT MANAGER Steve Woodward
SAMPLED BY Brian Peterka

SAMPLE IDENTIFICATION		SAMPLE COLLECTION			# OF JARS	ANALYSIS REQUIRED													NOTES/COMMENTS (Preserved, filtered, etc.)
LAB	GEOENGINEERS	DATE	TIME	MATRIX		metals ①	TCLP ②	PCBs ③	SVOCs 8270C	Total Sulfide 9030B	VOCs 8260A	Hold							
14	TP-03-23.0	7-9-02	1220	S	1							X							1x8oz
15	TP-06-24.5		1320		1	X													1x8oz
16	TP-03-9.5		1240		2	X			X	X	X								1x8oz, 1x4oz
17	TP-06-7.0		1330		2							X							1x8oz, 1x4oz
18	TP-10-22.0		1440		1							X							1x8oz
19	TP-10-13.0		1445		2							X							1x8oz, 1x4oz
20	TP-14-19.0		1615		2							X							1x8oz, 1x4oz
21	TP-14-24.5		1610		1							X							1x8oz
22	TP-17-24.0		1710		1							X							1x8oz
23	TP-17-8.0	↓	1715	↓	2							X							1x8oz, 1x4oz

RELINQUISHED BY FIRM GEI
SIGNATURE
PRINTED NAME Brian Peterka
DATE 7-10-02 TIME 1000

RECEIVED BY FIRM GEI
SIGNATURE
PRINTED NAME Rob Smith
DATE 7-10-02 TIME 1200

RELINQUISHED BY FIRM GEI
SIGNATURE Tonya C Kanki
PRINTED NAME Tonya C Kanki
DATE 7/12/02 TIME 0830

RECEIVED BY FIRM
SIGNATURE SRoy
PRINTED NAME Roy
DATE 7-12-02 TIME 0830AM

RELINQUISHED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

RECEIVED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

ADDITIONAL COMMENTS:
① Total Cr + Cu (6010B), As + Pb (6020); hex Cr (7195), Hg - Soil/Sed (7471A)
② To be determined based on metals results
③ Arochlors 1016, 1221, 1232, 1242, 1248, 1254, 1260 (8082)

64

107254

CHAIN OF CUSTODY RECORD

GEOENGINEERS, INC.
1101 FAWCETT, SUITE 200
TACOMA, WASHINGTON 98402
(206) 383-4940

GeoEngineers

COC 071002,011
DATE 7-10-02
PAGE 1 OF 1
LAB STL
LAB NO.

PROJECT NAME/LOCATION Rayonier - Goose Lake
PROJECT NUMBER 0137-010-02 T.5
PROJECT MANAGER Steve Woodward
SAMPLED BY Brian Peterka

SAMPLE IDENTIFICATION		SAMPLE COLLECTION			# OF JARS	ANALYSIS REQUIRED												NOTES/COMMENTS (Preserved, filtered, etc.)
LAB	GEOENGINEERS	DATE	TIME	MATRIX		Metals ①	TCLP ②	PCBs ③	SVOCs 8270C	Total sulfate 9030B	VOCs 8260A	Hold						
24	TP-11-24.0	7-10-02	1020	S	1	X												1x8oz
25	TP-11-8.5		1025		2							X						1x8oz, 1x4oz
26	TP-15-24.5		1250		1							X						1x8oz
27	TP-15-6.5		1300		2							X						1x8oz, 1x4oz
28	TP-18-22.0		1415		1							X						1x8oz
29	TP-18-10.0		1430		2							X						1x8oz, 1x4oz
30	TP-18-2.0		1350		1	X												1x8oz
31	TP-20-BAG-2.0		1600		1							X						1x8oz
32	TP-20-4.0		1610		2	X												1x8oz, 1x4oz
33	TP-20-24.5		1650		2	X												1x8oz, 1x4oz
34	TP-20-11.5	↓	1700	↓	2							X						1x8oz, 1x4oz

RELINQUISHED BY FIRM GEI
SIGNATURE
PRINTED NAME Brian Peterka
DATE 7-11-02 TIME 1300

RECEIVED BY FIRM GEI
SIGNATURE Rob Smith
PRINTED NAME Rob Smith
DATE 7-11-02 TIME 1500

RELINQUISHED BY ~~RAS~~ FIRM ~~GEI~~ RAS 7-12
SIGNATURE Tonya C Kani
PRINTED NAME Tonya C Kani
DATE 7/12/02 TIME 0830

RECEIVED BY FIRM STL
SIGNATURE SRoy
PRINTED NAME Roy
DATE 7/12/02 TIME 830

RELINQUISHED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

RECEIVED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

ADDITIONAL COMMENTS:
① Total Cr + Cu (6010B), As + Pb (6020), hex Cr (7195), Hg-soil/sed (7471A)
② To be determined based on metals results
③ Arochlors 1016, 1221, 1232, 1242, 1248, 1254, 1260 (8082)

Chain of Custody Record

STL-8274 (0102)

STL Seattle
5755 8th Street E.
Tacoma, WA 98424
Tel. 253-922-2310
Fax 253-922-5047
www.stl-inc.com

SEVERN TRENT SERVICES

Severn Trent Laboratories, Inc.

COC 071002.012 10/234

Client: GeoEngineers
Project Manager: Steve Woodward
Date: 7-10-02
Chain of Custody Number: 2341
Address: 600 Stewart St., Ste 1420
Telephone Number (Area Code)/Fax Number: 206.728.2674
Lab Number:
City: Seattle State: WA Zip Code: 98101
Site Contact: Brian Peterka
Lab Contact:
Page 1 of 1
Project Name and Location (State): Rayonier – Goose Lake
Carrier/Waybill Number:
Contract/Purchase Order/Quote No.: 0137-010-02 T.5

	Sample I.D. and Location/Description (Containers for each sample may be combined on one line)	Date	Time	Matrix					Containers & Preservatives							Analysis (Attach list if more space is needed)												Special Instructions/ Conditions of Receipt
				Air	Aqueous	Sed.	Soil		Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH		Metals ①	TCLP ②	PCBs ③	SVOCs 8270C	Total Sulfides 9030B	VOCs 8260A	Hold						
35	TP-19-25.0	7-10-02	1745				X		X							X												1x8oz, 1x4oz
36	TP-19-10.0	↓	1800				X		X													X						1x8oz, 1x4oz
37	TP-19 Water		1805		X				X													X						2x40ml
BPP 7-11-02	~~TP-08 Rinsate~~	~~7-11-02~~	~~1000~~		X											X		X										BPP 7-11-02
38	TP-08-Rinsate	7-11-02	1230		X											X		X	X	X	X							7 bottles/voas with preservatives labeled

Cooler: ☒ Yes ☐ No Cooler Temp: ______

Possible Hazard Identification: ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☒ Unknown

Sample Disposal: ☐ Return To Client ☐ Disposal By Lab ☒ Archive For ______ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required (business days): ☐ 24 Hours ☐ 48 Hours ☐ 5 Days ☐ 10 Days ☐ 15 Days ☐ Other Standard

QC Requirements (Specify):

1. Relinquished By: GeoEngineers Date: 7-11-02 Time: 1300
1. Received By: Rob Smith GeoEngineers Date: 7-11-02 Time: 1500
2. Relinquished By: Tonya C. Kauhi / Tonya C Kauhi GEI Date: 7/12/02 Time: 0820
2. Received By: Date: 7-12-02 Time: 0830
3. Relinquished By: Date: Time:
3. Received By: Date: Time:

Comments: ① Total Cr + Cu (6010B), As + Pb (6020), hex chrome (7195), Hg-soil/sed (7471A).
② To be determined based on metals results. ③ Aroclors 1016, 1221, 1232, 1242, 1248, 1254, 1260 (8082).

DISTRIBUTION: WHITE - Stays with the Samples; CANARY - Returned to Client with Report; PINK - Field Copy

Chain of Custody Record

STL-8274 (0102)

STL Seattle
5755 8th Street E.
Tacoma, WA 98424
Tel. 253-922-2310
Fax 253-922-5047
www.stl-inc.com

SEVERN TRENT SERVICES

Severn Trent Laboratories, Inc.

COC 071102.013

Client: GeoEngineers
Address: 600 Stewart St., Ste. 1420
City: Seattle State: WA Zip Code: 98101
Project Manager: Steve Woodward
Telephone Number (Area Code)/Fax Number: 206-728-2674
Site Contact: Brian Peterka
Lab Contact:
Carrier/Waybill Number:
Project Name and Location (State): Rayonier-Goose Lake
Contract/Purchase Order/Quote No.: 0137-018-02 T.5
Date: 7-11-02
Lab Number: 107285
Chain of Custody Number: 2339
Page 1 of 1

	Sample I.D. and Location/Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil		Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH		Analysis: Metals ①	TCLP ②	PCBs ③	SVOCs 8270C	Total Sulfides 9030B	VOCs 8260A	Hold	Archive ④	Hold ④				Special Instructions/ Conditions of Receipt
1	TP-01-11.0	7-11-02	0900				X		X													X						1x8oz, 1x4oz
2 ✓	TP-04-22.0		0945													X												1x8oz
3	TP-04-11.0		0950																			X						1x8oz, 1x4oz
4	TP-08-~~2~~24.0		1505																			X						1x8oz, 1x4oz
5 ✓	TP-08-8.0		1130													X		X	X	X	X							1x8oz, 1x4oz
6	TP-08-Water		1330		X																	X						2x1 Liter, 1x2 Liter
7	TP-12-24.5		1545				X															X						1x8oz, 1x4oz
8 ✓	TP-12-7.0		1550													X				X			X	X				2x8oz, 1x4oz
9	TP-12-6.0		1600																			X						1x8oz, 1x4oz
10 ✓	TP-12-1.0		1610													X												1x8oz

Cooler: ☒ Yes ☐ No Cooler Temp: 2.1

Possible Hazard Identification: ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☒ Unknown

Sample Disposal: ☐ Return To Client ☐ Disposal By Lab ☒ Archive For ____ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required (business days): ☐ 24 Hours ☐ 48 Hours ☐ 5 Days ☐ 10 Days ☐ 15 Days ☑ Other Standard

QC Requirements (Specify)

1. Relinquished By: GEOENGINEERS Date: 7-12-02 Time: 1900
1. Received By: GeoEngineers Date: 7/12/02 Time: 1900
2. Relinquished By: Date: 7/15/02 Time: 1210
2. Received By: Date: 7/15/02 Time: 12:10
3. Relinquished By: Date: Time:
3. Received By: Date: Time:

Comments: ① Total Cr - Cu (6010B), As + Pb (6020), hex Cr (7195), Hg - Soil/Sed (7471A).
② To be determined based on metals results.
③ Aroclors: 1016, 1221, 1232, 1242, 1248, 1254, 1260 (8082)
④ for potential future analysis of dioxin/furans

DISTRIBUTION: WHITE - Stays with the Samples; CANARY - Returned to Client with Report; PINK - Field Copy

[redacted]

Chain of Custody Record

STL-8274 (0102)

STL Seattle
5755 8th Street E.
Tacoma, WA 98424
Tel. 253-922-2310
Fax 253-922-5047
www.stl-inc.com

COC 071202.014

Severn Trent Laboratories, Inc.

Client: GeoEngineers		Project Manager: Steve Woodward	Date: 7-12-02	Chain of Custody Number: 2222
Address: 600 Stewart St., Ste 1420		Telephone Number (Area Code)/Fax Number: 206 728-2674	Lab Number: 107286	Page 1 of 1
City: Seattle	State: WA Zip Code: 98101	Site Contact: Brian Peterka	Lab Contact:	
Project Name and Location (State): Rayonier – Goose Lake		Carrier/Waybill Number:		
Contract/Purchase Order/Quote No.: 0137-010-02 T.5				

Sample I.D. and Location/Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil		Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH		Analysis: Metals ①	TCLP ②	PCBs ③	Total Sulfides 9030B	VOCs 8260B	Arsenic 6020	Hold						Special Instructions/Conditions of Receipt
1 TP-28-1.0	7-12-02	0900				X		X							X		X	X	X								8oz + 4oz
2 TP-28-3.0	↓	0905				↓		↓													X						↓
3 TP-28-12.0		0910																			X						
4 TP-27-2.0		0950													X		X	X									
5 TP-27-6.0		0955																			X						
6 TP-26-1.5		1040																			X						
7 TP-26-8.0		1045																			X						
8 TP-25-2.0		1115																			X						
9 TP-25-10.0		1120																			X						
10 TP-24-10		1230													X		X	X									
11 TP-24-4.5		1235																			X						

Cooler: ☒ Yes ☐ No Cooler Temp: 3.2

Possible Hazard Identification: ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☒ Unknown

Sample Disposal: ☐ Return To Client ☒ Disposal By Lab ☒ Archive For ____ Months (A fee may be assessed if samples are retained longer than 1 month).

Turn Around Time Required (business days): ☐ 24 Hours ☐ 48 Hours ☐ 5 Days ☐ 10 Days ☐ 15 Days ☒ Other Standard

QC Requirements (Specify):

1. Relinquished By: GeoEngineers	Date: ~~1900~~ 7-12-02	Time:	1. Received By: GeoEngineers	Date: 7/12/02	Time: 1900
2. Relinquished By:	Date: 7/15/02	Time: 1210	2. Received By:	Date: 7/15/02	Time: 12:10
3. Relinquished By:	Date:	Time:	3. Received By:	Date:	Time:

Comments: ① Total Cr + Co (6010B), As + Pb (6020), Hex Cr (7195), Hg-Soil/Sed (7471A).
② To be determined based on metals analysis results. ③ Arochlors 1016, 1221, 1232, 1242, 1248, 1254, 1260 (8082).

DISTRIBUTION: WHITE - Stays with the Samples; CANARY - Returned to Client with Report; PINK - Field Copy

[redacted]

Chain of Custody Record

STL-8274 (0102)

STL Seattle
5755 8th Street E.
Tacoma, WA 98424
Tel. 253-922-2310
Fax 253-922-5047
www.stl-inc.com

SEVERN TRENT SERVICES
Severn Trent Laboratories, Inc.

COC 071002.0

Client: GeoEngineers
Address: 600 Stewart St., Ste. 1420
City: Seattle State: WA Zip Code: 98101
Project Name and Location (State): Rayonier – Goose Lake
Contract/Purchase Order/Quote No.: 0137-010-02 T.5

Project Manager: Steve Woodward
Telephone Number (Area Code)/Fax Number: 206. 728. 2674
Site Contact: Brian Peterka
Lab Contact:
Carrier/Waybill Number:

Date: 7-10-02
Lab Number:
Chain of Custody Number: 2341
Page 1 of 1

Sample I.D. and Location/Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Analysis: Metals ①	TCLP ②	PCBs ③	SVOCs 8270	Total Sulfides	VOCs 8260	Hold	Special Instructions/ Conditions of Receipt
TP-19-25.0	7-10-02	1745				X	X						X							1x 8oz, 1x 4oz
TP-19-10.0	↓	1800				X	X												X	~~1x8oz~~, 1x 4oz
TP-19 Water		1805		X			X												X	2 x 40 ml
BPP 7-11-02 ~~TP-04 Rinsate~~	~~7-11-02~~	~~1000~~		~~X~~									~~X~~		~~X~~					BPP 7-11-02
TP-08-Rinsate	7-11-02	1230		X									X		X	X	X	X		7 bottles/vials
																				with preservatives labeled

Cooler: ☒ Yes ☐ No Cooler Temp: ______

Possible Hazard Identification: ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☒ Unknown

Sample Disposal: ☐ Return To Client ☐ Disposal By Lab ☒ Archive For ______ Months (A fee may be assessed if samples are retained longer than 1 month).

Turn Around Time Required (business days): ☐ 24 Hours ☐ 48 Hours ☐ 5 Days ☐ 10 Days ☐ 15 Days ☐ Other Standard

QC Requirements (Specify):

1. Relinquished By: GeoEngineers Date: 7-11-02 Time: 1300
1. Received By: Rob Smith GeoEngineers Date: 7-11-02 Time: 1500
2. Relinquished By: Tonya C. Kouhi GEI Date: 7/12/02 Time: 0830
2. Received By: Date: 7-12-02 Time: 08.30
3. Relinquished By: Date: Time:
3. Received By: Date: Time:

Comments: ① Total Cr + Cu (6010B), As + Pb (6020), hex chrome (7195), Hg-soil/sed (7471A).
② To be determined based on metals results. ③ Arochlors 1016, 1221, 1232, 1242, 1248, 1254, 1260 (8082).

DISTRIBUTION: WHITE - Stays with the Samples; CANARY - Returned to Client with Report; PINK - Field Copy

CHAIN OF COUSTODY RECORD

GEOENGINEERS, INC.
1101 FAWCETT, SUITE 200
TACOMA, WASHINGTON 98402
(206) 383-4940

GeoEngineers

COC 072202.016

DATE 7-22-02
PAGE 1 OF 1
LAB STL
LAB NO.

PROJECT NAME/LOCATION Rayonier – Goose Lake
PROJECT NUMBER 0137-010-02 Task 6
PROJECT MANAGER Steve Woodward
SAMPLED BY Brian Peterka

SAMPLE IDENTIFICATION		SAMPLE COLLECTION			# OF JARS	ANALYSIS REQUIRED												NOTES/COMMENTS (Preserved, filtered, etc.)
LAB	GEOENGINEERS	DATE	TIME	MATRIX		Metals ①	PCBs ②	SVOCs 8270c	Total Sulfide 9030	VOCs 8260A	Hold							standard TAT
	MW-10-0.5	7.22.02	0925	S	2						X							1x8oz, 1x4oz
	MW-10-5		0930								X							
	MW-10-10		0940								X							
	MW-10-15		1000								X							
	MW-10-20		1010								X							
	MW-10-25		1020								X							
	MW-10-30		1030								X							
	MW-10-35		1040								X							
	MW-08-0.5		1350								X							
	MW08-5		1400		1						X							1x8oz
	MW08-10		1410		2						X							1x8oz, 1x4oz

RELINQUISHED BY FIRM GEI
SIGNATURE
PRINTED NAME Brian Peterka
DATE 7-23-02 TIME 2000

RELINQUISHED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

RELINQUISHED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

RECEIVED BY FIRM STL
SIGNATURE
PRINTED NAME M. NEWBY
DATE 7-24-02 TIME 15:00

RECEIVED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

RECEIVED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

ADDITIONAL COMMENTS:
① Total Cr, Cu (6010B), AS + Pb (6020), hex cr (7195), Hg (soil/sed -7471A).
② Arochlors 1016, 1221, 1232, 1242, 1248, 1254, 1260

L2 10(201)

CHAIN OF CUSTODY RECORD

GEOENGINEERS, INC.
1101 FAWCETT, SUITE 200
TACOMA, WASHINGTON 98402
(206) 383-4940

GeoEngineers

COC 072202.07
DATE 7.22.02
PAGE 1 OF 1
LAB STL
LAB NO.

PROJECT NAME/LOCATION Rayonier - Goose Lake
PROJECT NUMBER 0137-010-02 TG
PROJECT MANAGER Steve Woodward
SAMPLED BY Brian Peterka

SAMPLE IDENTIFICATION		SAMPLE COLLECTION			# OF JARS	ANALYSIS REQUIRED												NOTES/COMMENTS (Preserved, filtered, etc.)
LAB	GEOENGINEERS	DATE	TIME	MATRIX		Metals ①	PCBs ②	SVOCs 8270C	Total Sulfides 9030B	VOCs 8260A	Hold	NWTPH-Dx ③	WITH SILICA GEL CLEAN UP					Standard TAT
	MW-08-15	7-22-02	1420	S	2						X							1x8oz, 1x4oz
	MW-08-20		1430								X							
	MW-08-25		1435								X							
	MW-08-30		1440								X							
-2	MW-08-35		1450			X	X	X	X	X		X						
	MW-08-40		1500								X							
	MW-08-45	↓	1530	↓	↓						X							↓
	MW-07-30	7-23-02	1240	S	2						X							1x8oz, 1x4oz

RELINQUISHED BY
SIGNATURE
PRINTED NAME Brian Peterka
FIRM GEI
DATE 7-23-02 TIME 2000

RECEIVED BY (7-23-02)
SIGNATURE
PRINTED NAME M. NEWBY
FIRM STL
DATE 7-24-02 TIME 15:00

RELINQUISHED BY
SIGNATURE
PRINTED NAME
FIRM
DATE TIME

RECEIVED BY
SIGNATURE
PRINTED NAME
FIRM
DATE TIME

RELINQUISHED BY
SIGNATURE
PRINTED NAME
FIRM
DATE TIME

RECEIVED BY
SIGNATURE
PRINTED NAME
FIRM
DATE TIME

ADDITIONAL COMMENTS:
① Total Cr, Cu (6010B), As + Pb (6020), hex Cr (7195), Hg (Soil/Sed - 7471A).
② Arochlors 1016, 1221, 1232, 1242, 1248, 1254, 1260.
③ WITH SILICA GEL CLEAN UP

L2 107521

CHAIN OF CUSTODY RECORD

GEOENGINEERS, INC.
1101 FAWCETT, SUITE 200
TACOMA, WASHINGTON 98402
(206) 383-4940

Geo Engineers

[redacted]

COC 072302.018
DATE 7-23-02
PAGE 1 OF 1
LAB STL
LAB NO.

PROJECT NAME/LOCATION Rayonier - Goose Lake
PROJECT NUMBER 0137-010-02 T.6
PROJECT MANAGER Steve Woodward
SAMPLED BY Brian Peterka

SAMPLE IDENTIFICATION		SAMPLE COLLECTION			# OF JARS	ANALYSIS REQUIRED												NOTES/COMMENTS (Preserved, filtered, etc.)
LAB	GEOENGINEERS	DATE	TIME	MATRIX		Metals ①	PCBs ②	SVOCs 8270C	Total Sulfides 9030B	VOCs 8260A	Hold	NWTPH-Dx ③	w/ silica gel clean up					Standard TAT
	MW-09-0.5	7-23-02	0900	S	2						X							1x8oz, 1x4oz jars
	MW-09-5	↓	0905	↓	↓						X							↓
	MW-09-10	↓	0910	↓	↓						X							↓
	MW-09-15	↓	0915	↓	↓						X							↓
	MW-09-20	↓	0920	↓	↓						X							↓
	MW-07-0.5	↓	1115	↓	↓						X							↓
	MW-07-5	↓	1120	↓	↓						X							↓
	MW-07-10	↓	1130	↓	↓						X							↓
-1	MW-07-15	↓	1140	↓	↓	X	X	X	X	X		X						↓
	MW-07-20	↓	1200	↓	↓						X							↓
	MW-07-25	↓	1210	↓	↓						X							↓

RELINQUISHED BY FIRM GSI
SIGNATURE
PRINTED NAME Brian Peterka
DATE 7-23-02 TIME 2000

RELINQUISHED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

RELINQUISHED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

RECEIVED BY FIRM STL
SIGNATURE
PRINTED NAME M NEWBY
DATE 7-24-02 TIME 15:00

RECEIVED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

RECEIVED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

ADDITIONAL COMMENTS:
① Total Cr, Cu (6010B), As+Pb (6020), hex Cr (7195), Hg (soil/sed - 7471A).
② Arochlors 1016, 1221, 1232, 1242, 1248, 1254, 1260.
(3) WITH SILICA GEL CLEANUP

J4 101474

CHAIN OF CUSTODY RECORD

GEOENGINEERS, INC.
1101 FAWCETT, SUITE 200
TACOMA, WASHINGTON 98402
(206) 383-4940

GeoEngineers

COC 072302.019
DATE 7-23-02
PAGE 1 OF 1
LAB STL
LAB NO.

PROJECT NAME/LOCATION Rayonier – Goose Lake
PROJECT NUMBER 0137-010-02 T.6
PROJECT MANAGER Steve Woodward
SAMPLED BY Brian Peterka

SAMPLE IDENTIFICATION		SAMPLE COLLECTION			# OF JARS	ANALYSIS REQUIRED												NOTES/COMMENTS (Preserved, filtered, etc.)
LAB	GEOENGINEERS	DATE	TIME	MATRIX		Metals ①	PCBs ②	SVOCs 8270c	Total sulfides 9030B	VOCs 8260A	Hold	HEXAVALENT Cr						Standard TAT
BPP-7-23-02	~~MW-07-30~~	~~7-23-02~~	~~1240~~	~~Soil~~	~~2~~													~~1x8oz, 1x4oz jar~~
	MW-07-Rinsate	↓	1230	water	7	X	X	X	X	X		X						7 bottles w/preservatives shown
BPP 7-23-02	~~Pump Rinsate~~	↓		~~water~~	~~7~~													on the bottles. " "

RELINQUISHED BY SIGNATURE	FIRM GEI	RELINQUISHED BY SIGNATURE	FIRM	RELINQUISHED BY SIGNATURE	FIRM
PRINTED NAME Brian Peterka		PRINTED NAME		PRINTED NAME	
DATE 7-23-02	TIME 2000	DATE	TIME	DATE	TIME
RECEIVED BY SIGNATURE	FIRM STL	RECEIVED BY SIGNATURE	FIRM	RECEIVED BY SIGNATURE	FIRM
PRINTED NAME M. NEWBY		PRINTED NAME		PRINTED NAME	
DATE 7-24-02	TIME 9:30 Am	DATE	TIME	DATE	TIME

ADDITIONAL COMMENTS:
① Total Cr/Cu (6010B), As + Pb (6020), hex Cr (7195), Hg (Soil/Sed-7471A).
② ARochlors 1016, 1221, 1232, 1242, 1248, 1254, 1260.

33

CHAIN OF CUSTODY RECORD

COC 081202.020

GEOENGINEERS, INC.
1101 FAWCETT, SUITE 200
TACOMA, WASHINGTON 98402
(206) 383-4940

DATE 8-12-02
PAGE 1 OF 1
LAB STL
LAB NO.

PROJECT NAME/LOCATION Rayonier - Goose Lake
PROJECT NUMBER 0137-010-02 T.5
PROJECT MANAGER Steve Woodward
SAMPLED BY Brian Peterka

SAMPLE IDENTIFICATION		SAMPLE COLLECTION				ANALYSIS REQUIRED												NOTES/COMMENTS (Preserved, filtered, etc.)
LAB	GEOENGINEERS	DATE	TIME	MATRIX	# OF JARS	Metals ①	PCBs ②	Total Sulfide 9030B	VOCs 8260A	Arsenic 6020							Hold	Normal TAT
	TP-21-0.5	8-12-02	1005	S	2												X	1x8oz, 1x4oz
	TP-21-2.0		1010														X	
	TP-22-0.3		1050			X	X	X										
	TP-22-2.0		1055														X	
	TP-23-0.5		1135														X	
	TP-23-3.0		1140														X	
	TP-30-1.0		1210							X								
	TP-30-4.0		1215														X	
	TP-29-1.0		1325							X								
	TP-29-3.5		1330														X	
	TP-31-1.0	↓	1355	↓	↓					X								↓

RELINQUISHED BY FIRM GEI SIGNATURE PRINTED NAME Brian Peterka DATE 8-13-02 TIME 1100	RELINQUISHED BY FIRM GEI SIGNATURE PRINTED NAME Scott MacDonald DATE 8/15/02 TIME 1130	RELINQUISHED BY FIRM SIGNATURE PRINTED NAME DATE TIME
RECEIVED BY FIRM GEI SIGNATURE PRINTED NAME Scott MacDonald DATE 8/13/02 TIME 1800	RECEIVED BY FIRM STL SIGNATURE PRINTED NAME M. NEWBY DATE 8-15-02 TIME 11:30	RECEIVED BY FIRM SIGNATURE PRINTED NAME DATE TIME

ADDITIONAL COMMENTS: 8-17-02

① Total Cr, Cu, [illegible] (6010B) As Pb (6020), Hex Cr (7195), Hg - Soil/sed (7471A), TCLP followup to be determined
② Arochlors 1016, 1221, 1232, 1242, 1248, 1254, 1260 (8082)

10'1474

CHAIN OF CUSTODY RECORD

GEOENGINEERS, INC.
1101 FAWCETT, SUITE 200
TACOMA, WASHINGTON 98402
(206) 383-4940

GeoEngineers

COC081202.021
DATE 8-12-02
PAGE 1 OF 1
LAB STL
LAB NO.

PROJECT NAME/LOCATION Rayonier - Goose Lake
PROJECT NUMBER 0137-010-02 T-5
PROJECT MANAGER Steve Woodward
SAMPLED BY Brian Peterka

NOTES/COMMENTS (Preserved, filtered, etc.): Normal TAT

SAMPLE IDENTIFICATION LAB	SAMPLE IDENTIFICATION GEOENGINEERS	SAMPLE COLLECTION DATE	SAMPLE COLLECTION TIME	MATRIX	# OF JARS	Metals ①	PCBs ②	Total Sulfide 9030B	VOCs 8260A	SVOCs 8270C	Arsenic 6020							Hold	NOTES/COMMENTS
	TP-31-4.0	8-12-02	1400	S	2													X	1x8oz, 1x4oz
- 5	TP-32-1.0		1500								X								
	TP-32-4.0		1505															X	
	TRENCH-01-5.5		1800															X	
	TRENCH-01-7.5		1850															X	
	TRENCH-01-12.0	↓	1830															X	
	TRENCH-02-5.0	8-13-02	1200															X	
	TRENCH-02-3.5		1100															X	
	TRENCH-02-2.5		1130															X	
	TRENCH-03-4.0		1420															X	
	TRENCH-03-7.0	↓	1430	↓	↓													X	↓

RELINQUISHED BY
SIGNATURE BPK
PRINTED NAME Brian Peterka
DATE 8-13-02 TIME 1800
FIRM GEI

RECEIVED BY
SIGNATURE
PRINTED NAME Scott MacDonald
DATE 8/13/02 TIME 1800
FIRM GEI

RELINQUISHED BY
SIGNATURE
PRINTED NAME ~~M. NEWBY~~
DATE ~~8~~ TIME
FIRM ~~STL~~

RECEIVED BY
SIGNATURE
PRINTED NAME
DATE TIME
FIRM

RELINQUISHED BY
SIGNATURE
PRINTED NAME Scott MacDonald
DATE 8/15/02 TIME 1130
FIRM GEI

RECEIVED BY
SIGNATURE
PRINTED NAME M. NEWBY
DATE 8-15-02 TIME 11:30
FIRM STL

ADDITIONAL COMMENTS:

① Total Cr, Cu (6010B), As, Pb (6020), HexCr (7195), Hg - soil/sed (7471A), TCLP followup to be determined
② Arochlors 1016, 1221, 1232, 1242, 1248, 1254, 1260 (8082).

CHAIN OF CUSTODY RECORD

GEOENGINEERS, INC.
1101 FAWCETT, SUITE 200
TACOMA, WASHINGTON 98402
(206) 383-4940

GeoEngineers

COC 081202.022

DATE 8-12-02
PAGE 1 OF 1
LAB STL
LAB NO.

4.7°C

107898

PROJECT NAME/LOCATION Rayonier-Goose Lake
PROJECT NUMBER 0137-010-02 T.7
PROJECT MANAGER Steve Woodward
SAMPLED BY Brian Anderson

NOTES/COMMENTS (Preserved, filtered, etc.)

Normal TAT
(preservatives shown on bottle labels)

SAMPLE IDENTIFICATION		SAMPLE COLLECTION			# OF JARS	ANALYSIS REQUIRED		
LAB	GEOENGINEERS	DATE	TIME	MATRIX		Metals ① A/B	PCBs ② C	Total Sulfide 9030 D
	MW-10-02q3	8-12-02	1355	W	4	X	X	X
	MW-07-02q3	↓	1454	↓	↓	X	X	X
	MW-08-02q3	↓	1554	↓	↓	X	X	X
	MW-06-02q3	8-13-02	0944	↓	↓	X	X	X

RELINQUISHED BY FIRM GEI
SIGNATURE
PRINTED NAME Brian Peterka
DATE 8-13-02 TIME 1000

RECEIVED BY FIRM STL
SIGNATURE KPresley
PRINTED NAME K Presley
DATE 8/13/02 TIME 12:15pm

RELINQUISHED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

RECEIVED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

RELINQUISHED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

RECEIVED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

ADDITIONAL COMMENTS:

① Total Cr, Cu, As, Pb (6020), Hg (7470A), Hex Cr (7195) A
② Arochlors 1016, 1221, 1232, 1242, 1248, 1254, 1260 (8082)
2

10'7'74

CHAIN OF CUSTODY RECORD

GEOENGINEERS, INC.
1101 FAWCETT, SUITE 200
TACOMA, WASHINGTON 98402
(206) 383-4940

GeoEngineers

COC 081302.023
DATE 8-13-02
PAGE 1 OF 1
LAB STL
LAB NO.

PROJECT NAME/LOCATION Rayonier – Goose Lake
PROJECT NUMBER 0137-010-02 T.5
PROJECT MANAGER Steve Woodward
SAMPLED BY Brian Peterka

ANALYSIS REQUIRED

NOTES/COMMENTS (Preserved, filtered, etc.)

Normal TAT

	SAMPLE IDENTIFICATION LAB	GEOENGINEERS	SAMPLE COLLECTION DATE	TIME	MATRIX	# OF JARS	Metals ①	PCBs ②	Total Sulfide 9030B	VOCs 8260A	SVOCs 8270C							Hold PER EXTENDED Rob 8-20-02	NOTES/COMMENTS
0 *		~~TRENCH-04-0.5~~	8-13-02	1610	S	2	X			X	X							X	1 x 8oz, 1 x 4oz
		~~TRENCH-04-1.0~~	↓	1600	↓	↓												X	
1 *		~~TRENCH-04-8.0~~	↓	1620	↓	↓	X			X	X							X	↓

RELINQUISHED BY FIRM GEI
SIGNATURE BPH
PRINTED NAME Brian Peterka
DATE 8-13-02 TIME 1800

RECEIVED BY FIRM GEI
SIGNATURE
PRINTED NAME Scott MacDonald
DATE 8/13/02 TIME 1800

~~RELINQUISHED BY~~ FIRM STL
~~SIGNATURE~~ Wrong 8-15-02
~~PRINTED NAME M. NEWBY~~
~~DATE 8-15-02 TIME 11:30 AM~~

RECEIVED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

RELINQUISHED BY FIRM GEI
SIGNATURE
PRINTED NAME Scott MacDonald
DATE 8/15/02 TIME 1130

RECEIVED BY FIRM STL
SIGNATURE
PRINTED NAME M. NEWBY
DATE 8-15-02 TIME 11:30

ADDITIONAL COMMENTS:
① Total Cr, Cu (6010B), As, Pb (6020), Hex Cr (7195), Hg - Soil/Sed (7471A),
② Arochlors 1016, 1221, 1232, 1242, 1248, 1254, 1260 (8082)

107714

7

CHAIN OF CUSTODY RECORD

GEOENGINEERS, INC.
1101 FAWCETT, SUITE 200
TACOMA, WASHINGTON 98402
(206) 383-4940

GeoEngineers

COC081302.024
DATE 8-13-02
PAGE 1 OF 1
LAB STL
LAB NO.

PROJECT NAME/LOCATION Rayonier-Goose Lake
PROJECT NUMBER 0137-010-02 T.7
PROJECT MANAGER Steve Woodward
SAMPLED BY Brian Anderson

SAMPLE IDENTIFICATION		SAMPLE COLLECTION			# OF JARS	ANALYSIS REQUIRED											
LAB	GEOENGINEERS	DATE	TIME	MATRIX		Metals ①	PCBs ②	Total Sulfide 9030B									
-1	MW-05-02q3	8-13-02	1041	W	4	X	X	X									
2	MW-09-02q3		1125														
3	MW-04-02q3		1213														
4	MW-01-02q3		1319														
5	MW-02-02q3		~~1555~~ 1417														
6	MW-03-02q3		1556														
7	02q3-DUP		0800														
8	02q3-GW-RINSATE		1455	↓	↓	↓	↓	↓									

NOTES/COMMENTS
(Preserved, filtered, etc.)

Normal TAT
(See labels for preservatives)

RELINQUISHED BY FIRM GEI SIGNATURE PRINTED NAME Brian Peterka DATE 8-13-02 TIME 1800	RELINQUISHED BY FIRM GEI SIGNATURE PRINTED NAME Scott MacDonald DATE 8-14-02 TIME 0810	RELINQUISHED BY FIRM SIGNATURE PRINTED NAME DATE TIME
RECEIVED BY FIRM GEI SIGNATURE PRINTED NAME Scott MacDonald DATE 8/13/02 TIME 1800	RECEIVED BY FIRM STL SIGNATURE PRINTED NAME M. NEWBY DATE 8-14-02 TIME 8:10AM	RECEIVED BY FIRM SIGNATURE PRINTED NAME DATE TIME

ADDITIONAL COMMENTS:

① Total Cr, Cu, As, Pb (6020), Hg (7470A), Hex Cr (7195)
② Aroclors 1016, 1221, 1232, 1242, 1248, 1254, 1260

CHAIN OF CUSTODY RECORD

COC:111202-025

GEOENGINEERS, INC.
8410 154TH AVENUE N.E.
REDMOND, WASHINGTON 98052
(425) 861-6000

GeoEngineers

DATE 11-12-02
PAGE 1 OF 1
LAB STL
LAB NO.

PROJECT NAME/LOCATION RAYONIER - GOOSE LAKE
PROJECT NUMBER 0137-010-02
PROJECT MANAGER STEVE WOODWARD
SAMPLED BY BRIAN ANDERSON

SAMPLE IDENTIFICATION		SAMPLE COLLECTION			# OF JARS	ANALYSIS REQUIRED												NOTES/COMMENTS (Preserved, filtered, etc.)
LAB	GEOENGINEERS	DATE	TIME	MATRIX		METALS ①	PCBS ②	TOTAL SULFIDE 9030B										STANDARD TURN AROUND TIME.
-1	MW-01-MSDS-0204	11-12-02	0958	W	8													
2	0204-DUP	11-1202	0745	W	4													
3	MW-01-0204	11-1202	1005	W	4													
4	MW-02-0204	11-12-02	0927	W	4													
5	MW-03-0204	11-1202	0848	W	4													
6	MW-08-0204	11-12-02	0800	W	4													
7	MW-09-0204	11-1202	1246	W	4													
8	MW-10-0204	11-1202	[illegible]	W	4													

RELINQUISHED BY FIRM GEI
SIGNATURE Brian Anderson
PRINTED NAME BRIAN ANDERSON
DATE 11-12-02 TIME

RECEIVED BY FIRM STL
SIGNATURE
PRINTED NAME M. NEWBY
DATE 11-12-02 TIME 4:55

RELINQUISHED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

RECEIVED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

RELINQUISHED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

RECEIVED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

ADDITIONAL COMMENTS:

① TOTAL Cr, Cu, As, Pb (6020), Hg (7470A), Hex Cr (7195)
② AROCHLORS 1016, 1221, 1232, 1242, 1248, 1254, 1260 (8082)

COC 111302-1021

CHAIN OF CUSTODY RECORD

GEOENGINEERS, INC.
8410 154TH AVENUE N.E.
REDMOND, WASHINGTON 98052
(425) 861-6000

GeoEngineers

109952

DATE 11-13-02
PAGE 1 OF 1
LAB STL
LAB NO.

PROJECT NAME/LOCATION RAYONIER GOOSE LK.
PROJECT NUMBER 0137-010-02 T7
PROJECT MANAGER STEVE WOODWARD
SAMPLED BY BRIAN ANDERSON

SAMPLE IDENTIFICATION		SAMPLE COLLECTION			# OF JARS	ANALYSIS REQUIRED			NOTES/COMMENTS (Preserved, filtered, etc.)
LAB	GEOENGINEERS	DATE	TIME	MATRIX		METALS ① A	PCBs ② B	TOTAL SULFIDE 9030B C	NORMAL TAT HNO3 - PRESERVATIVE NAOH - PRESERVATIVE
	MW-07-0204	11-1302	1159	W	4	X	X	X	

need to indicate which analyses/bottles got which preservatives in future

RELINQUISHED BY
SIGNATURE Brian Anderson
FIRM GEI
PRINTED NAME BRIAN ANDERSON
DATE 11-13-02 TIME 1200

RECEIVED BY
SIGNATURE K. Presley
FIRM
PRINTED NAME KPresley
DATE 11/13/02 TIME 2:25 P

RELINQUISHED BY
SIGNATURE
FIRM
PRINTED NAME
DATE TIME

RECEIVED BY
SIGNATURE
FIRM
PRINTED NAME
DATE TIME

RELINQUISHED BY
SIGNATURE
FIRM
PRINTED NAME
DATE TIME

RECEIVED BY
SIGNATURE
FIRM
PRINTED NAME
DATE TIME

ADDITIONAL COMMENTS:
① TOTAL CR, CU, AS, Pb (6020), Hg (7470A), HEX CR (7195)
② AROCHLORS 1016, 1221, 1232, 1242, 1248, 1254, 1260 (8082

COC 021203.027

CHAIN OF CUSTODY RECORD

GEOENGINEERS, INC.
8410 154TH AVENUE N.E.
REDMOND, WASHINGTON 98052
(425) 861-6000

GeoEngineers

DATE 2-13-03
PAGE 1 OF 1
LAB STL
LAB NO.

PROJECT NAME/LOCATION RAYONIER GOOSE LK.
PROJECT NUMBER 0137-010-02
PROJECT MANAGER STEVE WOODWARD
SAMPLED BY BRIAN ANDERSON

SAMPLE IDENTIFICATION		SAMPLE COLLECTION			# OF JARS	ANALYSIS REQUIRED												NOTES/COMMENTS (Preserved, filtered, etc.)
LAB	GEOENGINEERS	DATE	TIME	MATRIX		METALS ①	PCB'S ②	TOTAL SULFIDE 9030B										
1	MW-01-03Q1	2-12-03		W	12	X	X	X										③ USE FOR MS/MSD
2	MW-02-03Q1				4	X	X	X										③
3	MW-03-03Q1					X	X	X										③
4	MW-04-03Q1					X	X	X										③
5	MW-05-03Q1					X	X	X										③
6	MW-06-03Q1					X	X	X										③
7	MW-07-03Q1					X	X	X										③
8	MW-08-03Q1					X	X	X										③
9	MW-09-03Q1					X	X	X										③
10	MW10-03Q1	↓		↓	↓	X	X	X										③
11	03Q1-DUP	2-12-03		W	4	X	X	X										③

RELINQUISHED BY FIRM G.E.
SIGNATURE Brian Anderson
PRINTED NAME BRIAN ANDERSON
DATE 2-13-03 TIME 0800

RECEIVED BY FIRM STL
SIGNATURE
PRINTED NAME M. AAEWEY
DATE 2-13-03 TIME 9:00

RELINQUISHED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

RECEIVED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

RELINQUISHED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

RECEIVED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

ADDITIONAL COMMENTS:
① TOTAL Cr, Cu, As, Pb (6020), Hg (7470A), Hex Cr (7195)
② AROCHLORS 1016, 1221, 1232, 1242, 1248, 1254, 1260 (8082)
③ PRESERVATIVES = UNPRES. FOR HEX Cr, HNO3 FOR OTHER METALS, UNP FOR PCB'S, NaOH FOR TOTAL SULFIDES.

115581

COC 051203.028

CHAIN OF CUSTODY RECORD

GEOENGINEERS, INC.
8410 154TH AVENUE N.E.
REDMOND, WASHINGTON 98052
(425) 861-6000

62

GeoEngineers

DATE 5-12-03
PAGE 1 OF 1
LAB STL
LAB NO.

PROJECT NAME/LOCATION RAYONIER GOOSE LK.
PROJECT NUMBER 0137-010-02
PROJECT MANAGER STEVE WOODWARD/BRIAN PETERKA
SAMPLED BY BRIAN ANDERSON

SAMPLE IDENTIFICATION		SAMPLE COLLECTION			# OF JARS	ANALYSIS REQUIRED												NOTES/COMMENTS (Preserved, filtered, etc.)
LAB	GEOENGINEERS	DATE	TIME	MATRIX		METALS ①	PCB's ②	TOTAL SULFIDE 9030 B										NORMAL TAT.
	MW-01-03Q2	5-12	1146	W	4	X	X	X										③
	MW-07-03Q2	5-12	1043	W	4	X	X	X										③
	03Q2-DUP	5-12	1215	W	4	X	X	X										③

RELINQUISHED BY FIRM GE
SIGNATURE Brian Anderson
PRINTED NAME BRIAN ANDERSON
DATE 5-12-03 TIME 1245

RECEIVED BY FIRM STL
SIGNATURE
PRINTED NAME D Sahlberg
DATE 5.12.03 TIME 12:45

RELINQUISHED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

RECEIVED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

RELINQUISHED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

RECEIVED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

ADDITIONAL COMMENTS:

① TOTAL Cr, Cu, As, Pb (6020), Hg (7470A), Hex Cr (7195).
② AROCHLORS 1016, 1221, 1232, 1242, 1248, 1254, 1260, (8082).
③ PRESERVATIVES: UNPRESERVED FOR HEXCHROME, HNO3 FOR OTHER METALS, UNPRES. FOR PCB's, NaOH FOR TOTAL SULFIDES.

COC 051203.029

CHAIN OF CUSTODY RECORD

GEOENGINEERS, INC.
8410 154TH AVENUE N.E.
REDMOND, WASHINGTON 98052
(425) 861-6000

113600

DATE 05/12/03
PAGE 1 OF 1
LAB STL
LAB NO.

PROJECT NAME/LOCATION RAYONIER - GOOSE LAKE
PROJECT NUMBER 0137-010-02
PROJECT MANAGER STEVE WOODWARD / BRIAN PETERKA
SAMPLED BY BRIAN ANDERSON

NOTES/COMMENTS (Preserved, filtered, etc.)
NORMAL TAT

SAMPLE IDENTIFICATION		SAMPLE COLLECTION			# OF JARS	ANALYSIS REQUIRED			NOTES/COMMENTS
LAB	GEOENGINEERS	DATE	TIME	MATRIX		C METALS ①	B PCBs ②	B TOTAL SULFIDE 9030B	
1	MW-02-03Q2	5-12-03	1916	W	4	X	X	X	③
2	MW-03-03Q2		1821	W	4	X	X	X	③
3	MW-04-03Q2		1844	W	4	X	X	X	③
4	MW-05-03Q2		1558	W	4	X	X	X	③
5	MW-06-03Q2		1751	W	4	X	X	X	③
6	MW-08-03Q2		1723	W	4	X	X	X	③
7	MW-09-03Q2		1525	W	4	X	X	X	③
8	MW-10-03Q2	5-12-03	1631	W	4	X	X	X	③

RELINQUISHED BY FIRM GEI
SIGNATURE Brian Anderson
PRINTED NAME BRIAN ANDERSON
DATE 5-13-03 TIME 1140

RECEIVED BY FIRM STL
SIGNATURE K Presley
PRINTED NAME K Presley
DATE 5/13/03 TIME 1140

RELINQUISHED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

RECEIVED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

RELINQUISHED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

RECEIVED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

ADDITIONAL COMMENTS:
① TOTAL Cr, Cu, As, Pb, (6020), Hg (7470A), Hex Cr (7195)
② Arochlors 1016, 1221, 1232, 1242, 1248, 1254, 1260, (8082)
③ PRESERVATIVES: UNPRES. FOR HEX Cr, HNO3 FOR OTHER METALS, UNPRES. FOR PCBS, NaOH FOR TOTAL SULFIDES.

K2307801

CHAIN OF CUSTODY RECORD

COC 100303.30

GEOENGINEERS, INC.
1101 FAWCETT, SUITE 200
TACOMA, WASHINGTON 98402
(206) 383-4940

GeoEngineers

DATE 10/03/03
PAGE 1 OF 3
LAB
LAB NO.

PROJECT NAME/LOCATION Gooselake – Rayonier
PROJECT NUMBER 0137-010-03
PROJECT MANAGER Steve Woodward
SAMPLED BY BPP/SLM/PDR

NOTES/COMMENTS
(Preserved, filtered, etc.)
Analytical Request to be faxed

SAMPLE IDENTIFICATION		SAMPLE COLLECTION			# OF JARS	ANALYSIS REQUIRED											
LAB	GEOENGINEERS	DATE	TIME	MATRIX		Dioxins/Furans 8290											Archive
1	TP-33-8	10/03/03	0945	Soil	1	X											
2	TP-33-10.5	10/03/03	0950	Soil	1												X
3	TP-34-5	10/03/03	1030	Soil	1	X											
4	TP-35-10	10/03/03	1125	Soil	1												X
5	TP-35-15	10/03/03	1120	Soil	1	X											
6	TP-36-4	10/03/03	1145	Soil	1												X
7	TP-36-10	10/03/03	1150	Soil	1												X
8	TP-36-20	10/03/03	1140	Soil	1	X											
9	TP-37-8	10/03/03	1240	Soil	1												X
10	TP-37-12	10/03/03	1245	Soil	1	X											
11	TP-37-19	10/03/03	1255	Soil	1												X

RELINQUISHED BY
FIRM GEI
SIGNATURE Scott MacDonald
PRINTED NAME Scott MacDonald
DATE 10/07/03
TIME 0930

RELINQUISHED BY
FIRM
SIGNATURE
PRINTED NAME
DATE
TIME

RELINQUISHED BY
FIRM
SIGNATURE
PRINTED NAME
DATE
TIME

RECEIVED BY
FIRM CAS
SIGNATURE KMowon
PRINTED NAME KMowon
DATE 10/7/03
TIME 1600

RECEIVED BY
FIRM
SIGNATURE
PRINTED NAME
DATE
TIME

RECEIVED BY
FIRM
SIGNATURE
PRINTED NAME
DATE
TIME

ADDITIONAL COMMENTS:

AK2307801

CHAIN OF CUSTODY RECORD

COC100303.31

GEOENGINEERS, INC.
1101 FAWCETT, SUITE 200
TACOMA, WASHINGTON 98402
(206) 383-4940

GeoEngineers

DATE 10/03/03
PAGE 2 OF 3
LAB
LAB NO.

PROJECT NAME/LOCATION Goose Lake Rayonier
PROJECT NUMBER 0137-010-03
PROJECT MANAGER Steve Woodward
SAMPLED BY BPP/SLM/PDR

SAMPLE IDENTIFICATION		SAMPLE COLLECTION			# OF JARS	ANALYSIS REQUIRED												NOTES/COMMENTS (Preserved, filtered, etc.)
LAB	GEOENGINEERS	DATE	TIME	MATRIX		Dioxins/Furans 8290	PCB's (8082)	Metals ①									Archive	Analytical Requests to be faxed
12	TP-37-21	10/03/03	~~1335~~ 1300	Soil	1												X	
13	Sed-10-0.5-2	10/03/03	1030	Soil	2	X	X	X										
14	Sed-10-4-4.5	10/03/03	1025	Soil	2	X	X	X										
15	Sed-12-0-0.5	10/03/03	1150	Soil	2	X	X	X										
16	Sed-11-~~1-1.5~~ 0.75	10/03/03	1240	Soil	2	X	X	X										
17	BKG-1-0.5-1	10/03/03	1600	Soil	1												X	
18	BKG-2-0.5-1	10/03/03	1530	Soil	1	X												
19	BKG-3-0.2-0.8	10/03/03	1625	Soil	1												X	
20	BKG-4-[illegible]-0.7	10/03/03	1715	Soil	1	X												
21	BKG-5-0-0.5	10/03/03	1630	Soil	1	X												
X	BKG-6-0.1-0.5	10/03/03	1720	Soil	1	X												Did not receive, Km.

RELINQUISHED BY
SIGNATURE
PRINTED NAME Scott
DATE 10/07/03 TIME 0930
FIRM

RECEIVED BY
SIGNATURE KMarwon
PRINTED NAME KMarwon
DATE 10/7/03 TIME 1600
FIRM CAS

RELINQUISHED BY
SIGNATURE
PRINTED NAME
DATE TIME
FIRM

RECEIVED BY
SIGNATURE
PRINTED NAME
DATE TIME
FIRM

RELINQUISHED BY
SIGNATURE
PRINTED NAME
DATE TIME
FIRM

RECEIVED BY
SIGNATURE
PRINTED NAME
DATE TIME
FIRM

ADDITIONAL COMMENTS: ① Chromium, Copper, Nickel By 6010B / lead - By 200.8

K2307801

CHAIN OF CUSTODY RECORD

COC 100303.32

GEOENGINEERS, INC.
1101 FAWCETT, SUITE 200
TACOMA, WASHINGTON 98402
(206) 383-4940

GeoEngineers

DATE 10/03/03
PAGE 3 OF 3
LAB CAS
LAB NO.

PROJECT NAME/LOCATION
PROJECT NUMBER
PROJECT MANAGER
SAMPLED BY

SAMPLE IDENTIFICATION		SAMPLE COLLECTION			# OF JARS	ANALYSIS REQUIRED												NOTES/COMMENTS (Preserved, filtered, etc.)
LAB	GEOENGINEERS	DATE	TIME	MATRIX													Archive	Analytical Requests to be faxed
72	BKG-7-0.1-0.7	10/03/03	1815	Soil	1												X	

RELINQUISHED BY		RELINQUISHED BY		RELINQUISHED BY	
SIGNATURE	FIRM GGI	SIGNATURE	FIRM	SIGNATURE	FIRM
PRINTED NAME Scott MacDonald		PRINTED NAME		PRINTED NAME	
DATE 10/07/03	TIME 0920	DATE	TIME	DATE	TIME
RECEIVED BY		RECEIVED BY		RECEIVED BY	
SIGNATURE	FIRM CAS	SIGNATURE	FIRM	SIGNATURE	FIRM
PRINTED NAME K Manow		PRINTED NAME		PRINTED NAME	
DATE 10/7/03	TIME 1600	DATE	TIME	DATE	TIME

ADDITIONAL COMMENTS:

CHAIN OF CUSTODY RECORD

GEOENGINEERS, INC.
1101 FAWCETT, SUITE 200
TACOMA, WASHINGTON 98402
(~~206~~ 253) 383-4940

GeoEngineers

DATE 10-15-03
PAGE 1 OF 1
LAB CAS
LAB NO.

PROJECT NAME/LOCATION Goose Lake - Rayonier
PROJECT NUMBER 0137-010-03
PROJECT MANAGER Steve Woodward
SAMPLED BY SLM

SAMPLE IDENTIFICATION		SAMPLE COLLECTION			# OF JARS	ANALYSIS REQUIRED												NOTES/COMMENTS (Preserved, filtered, etc.)
LAB	GEOENGINEERS	DATE	TIME	MATRIX		Dioxins/Furans 8290												K230 8199
	BKG-6A-0.1-0.5	10/15/03	0715	Soil	1	X												

RELINQUISHED BY FIRM GEE
SIGNATURE Scott MacDonald
PRINTED NAME Scott MacDonald
DATE 10/17/03 TIME 0845

RECEIVED BY FIRM CAS
SIGNATURE
PRINTED NAME [illegible]
DATE 10/18/03 TIME 0930

RELINQUISHED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

RECEIVED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

RELINQUISHED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

RECEIVED BY FIRM
SIGNATURE
PRINTED NAME
DATE TIME

ADDITIONAL COMMENTS:

APPENDIX B2

Data Quality Assessment Reports – Supplemental Investigation

DATA QUALITY ASSESSMENT SUMMARY
2010 SUPPLEMENTAL INVESTIGATION

TPH BY NWTPH-HCID,
DIOXINS/FURANS BY EPA METHOD 1613,
SEMIVOLATILES BY EPA METHOD SW8270, CPAHS BY EPA METHOD SW8270D,
PCBS BY EPA METHOD SW8082,
TOTAL METALS (INCLUDING MERCURY) BY EPA METHODS 6010, 7471A, 200.8, 1631, AND 1632,
SULFIDES BY EPA METHODS 160.3 AND SW9030M, AND
TOTAL ORGANIC CARBON BY METHOD PLUMB 1981

Laboratory SDG	Samples Validated
ARI RS38	**GEI-3-29.0-30.0-10182010, GEI-4-19.0-20.0-10182010, GEI-5-19.0-20.0-10182010**
ARI RS63	**GEI-3-4.0-5.0-10182010, GEI-3-16.0-17.0-10182010, GEI-3-29.0-30.0-10182010, GEI-4-3.5-4.0-10182010, GEI-4-7.0-8.0-10182010, GEI-4-19.0-20.0-10182010, GEI-5-2.5-3.5-10182010, GEI-5-6.0-7.0-10182010, and GEI-5-19.0-20.0-10182010**
ARI RS72	**GEI-1-19.0-20.0-10192010, GEI-2-24.0-25.0-10192010, GEI-6-14.0-15.0-10192010, MW-16-4.0-5.0-10192010, MW-17-3.0-4.0-10192010**
ARI RS80	**GEI-1-2.0-3.0-10192010, GEI-1-8.0-9.0-10192010, GEI-1-19.0-20.0-10192010, GEI-2-4.0-5.0-10192010, GEI-2-12.0-13.0-10192010, GEI-2-24.0-25.0-10192010, GEI-6-1.0-2.0-10192010, GEI-6-7.0-8.0-10192010, GEI-6-14.0-15.0-10192010, MW-16-4.0-5.0-10192010, MW-16-9.0-10.0-10192010, MW-16-19.0-20.0-10192010, MW-17-3.0-4.0-10192010, MW-17-9.0-10.0-10192010, MW-17-18.0-19.0-10192010**
ARI SB10	**GEI-4-30.0-32.0-10192010, GEI-1-26.0-27.0-10192010, GEI-6-19.0-20.0-10192010**
ARI RT18	**MW-15-25.0-102102010**
ARI RT24	**Rinsate-1-10212010, MW-18-5.0-10212010, MW-18-7.5-10212010, MW-18-15.0-10212010, MW-15-5.0-10212010, MW-15-40.0-10212010**
ARI RY96, RY97	**MW-12-12012010, MW-13-12012010, MW-16-12012010, MW-17-12012010, MW-18-12012010, DUP-1-12012010**
ARI RZ61	**GEI-3-29.0-30.0-10182010, MW-17-23.0-24.0-10192010**
ARI SC43	**MW-1-11302010, MW-2-12012010, MW-3-12012010, MW-7-11302010, MW-11-12012010, MW-15-12012010**
ARI RY32	**MW-15-5.0-10212010, MW-15-40.0-10212010, MW-18-5.0-10212010, MW-18-7.5-10212010, MW-18-15.0-10212010, MW-18-20.0-10212010,**
ARI SB13	**MW-18-12012010**

ARI SE01	**MW-12-12012010**
Frontier 1012024	**MW-1-11302010, MW-2-12012010, MW-3-12012010, MW-7-11302010, MW-11-12012010, MW-12-12012010, MW-13-11302010, MW-16-12012010, MW-17-12012010, MW-18-12012010, DUP-1-12012010, MW-6-12012010, MW-8-12012010, MW-10-11302010, MW-15-11302010**

PROJECT: GOOSE LAKE (00137-010-10)

This report documents the results of an EPA level II-B data validation of analytical data from the analyses of soil and groundwater samples and the associated laboratory quality control (QC) samples. This standard review normally includes 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)
- 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. Frontier Global Sciences, located in Seattle, Washington, was also sub-contracted for labwork. The 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), theUSEPA Contract Laboratory Program *National Functional Guidelines for Organic Data Review* (USEPA 2008), and the USEPA *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 these sampling events.

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 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. A labeled compound also acts as a surrogate, but it is incorporated into the actual concentration calculation of the analytes of interest. Labeled compounds, like surrogates, have specific quality control limits which are provided in the National Functional Guidelines.

All surrogate/labeled compound recoveries for field samples were within the laboratory control limits, with the exceptions below:

SDG RS80 (Semivolatiles): The percent recovery (%R) for three out of four base-neutral surrogates were less than the laboratory lower control limits in Sample MW-17-18.0-19.0-10192010. This sample was re-extracted and re-analyzed 20 days outside of the holding time, with all surrogate recoveries within their respective criteria. In general, the positive results in the second analysis were significantly lower than the positive results in the original analysis. For this reason, only the original data was used for the purposes of reporting. The re-extracted data was labeled as Do-Not-Report (DNR) in the database. The positive results and reporting limits for all of the base-neutral compounds in the original sample were qualified as estimated (J/UJ) in this sample.

SDG RS80 (PCBs): The %R for decachlorobiphenyl was greater than the laboratory control limits in Sample GEI-6-1.0-2.0-10192010. The %R value for the surrogate tetrachlorometaxylene was within the control limits, so no action was required.

SDG RT24 (PCBs): The %R for decachlorobiphenyl was greater than the laboratory control limits in Samples MW-18-5.0-10212010 and MW-18-7.5-10212010. In both cases, the %R values for the surrogate tetrachlorometaxylene were within the control limits, so no action was required.

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.

In several cases the Dioxin/Furan method blank contamination was found to be an Estimated Maximum Possible Concentration (EMPC). In all cases, the method blank results were viewed as "Not Detected" by the validator.

None of the analytes of interest were detected above the reporting limits in any of the method blanks, with the exceptions below:

SDG SB10 (Dioxins): The method blank analyzed on 12/21/10 reported positive detections for 2,3,4,7,8-PeCDF, 1,2,3,4,6,7,8-HpCDD, and OCDD at levels below the reporting limits. The positive results for 2,3,4,7,8-PeCDF were qualified as not-detected (U) in Samples GEI-6-19.0-20.0-10192010 and GEI-1-26.0-27.0-10192010. The positive result for 1,2,3,4,6,7,8-HpCDD was qualified as not-detected (U) in Sample GEI-1-26.0-27.0-10192010.

SDG RY97 (Dioxins): The method blank analyzed on 12/6/10 reported positive detections for 2,3,4,7,8-PeCDF, and OCDD at levels below the reporting limits. The positive results for 2,3,4,7,8-PeCDF were qualified as not-detected (U) in Samples MW-16-12012010 and MW-17-12012010.

No qualification of OCDD was necessary as the National Functional Guidelines state that this congener can be within 3 times the CRQL in the method blank.

SDG SE01 (Dioxins): The method blank analyzed on 1/11/11 reported positive detections for 1,2,3,4,6,7,8-HpCDD, 1,2,3,4,6,7,8-HpCDF, OCDF, and OCDD at levels below the reporting limits. The positive results for 1,2,3,4,6,7,8-HpCDD and 1,2,3,4,6,7,8-HpCDF were qualified as not-detected (U) in Sample MW-12-12012010.

No qualification of OCDD or OCDF was necessary as the National Functional Guidelines state that these congeners can be within 3 times the reporting limit in the method blank.

SDG RS63 (Semivolatiles): The method blank extracted on 11/1/10 reported a positive detection for 1,4-dichlorobenzene at a level greater than the reporting limits. The positive results for this compound were qualified as not-detected (U) in Samples GEI-1-2.0-3.0-10192010, GEI-2-4.0-5.0-10192010, GEI-3-16.0-17.0-10182010, GEI-4-3.5-4.0-10182010, GEI-4-7.0-8.0-10182010, GEI-5-6.0-7.0-10182010, GEI-6-1.0-2.0-10192010, GEI-6-14.0-15.0-10192010, MW-16-4.0-5.0-10192010, MW-16-9.0-10.0-10192010, MW-17-18.0-19.0-10192010, and MW-17-9.0-10.0-10192010.

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: Rinsate-1-10212010.

None of the analytes of interest were detected above the reporting limits in any of the equipment rinsate 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, then 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 RS63 and RS80 (Semivolatiles): Two matrix spike/matrix spike duplicate sample sets were performed on Samples GEI-5-6.0-7.0-10182010 and MW-17-9.0-10.0-10192010. In both cases, several %R and RPD values exceeded the laboratory control limits.

In the first sample set, one or more of the %R values in the MS/MSD were less than 10% for the following compounds: 3,3'-dichlorobenzidine, 4-chloroaniline, benzidine, dibutyl phthalate, and hexachlorocyclopentadiene. There were no positive results for these compounds in Sample GEI-5-6.0-7.0-10182010, therefore the reporting limits were rejected in the parent sample only. There were also ten cases where the %R values were less than the laboratory control limits in both the MS and MSD: 1,2-diphenylhydrazine, 2,4-dinitrotoluene, 2,6-dinitrotoluene, aniline, azobenzene, benzo(a)pyrene, di-N-octyl phthalate, dibenzo(a,h)anthracene, hexachlorobenzene, and hexachloroethane. In these cases, the parent sample reporting limits were qualified (UJ) for these compounds.

In the second sample set, one or more of the %R values in the MS/MSD were less than 10% for the following compounds: 2,4-dimethylphenol, 2,4-dinitrophenol, 3,3'-dichlorobenzidine, benzidine, benzoic acid, and pyridine. There were no positive results for these compounds in Sample MW-17-9.0-10.0-10192010, therefore the reporting limits were rejected in the parent sample only. There were also five cases where the %R values were less than the laboratory control limits in both the MS and MSD: 2,4-dinitrotoluene, 4-chloroaniline, aniline, hexachlorocyclopentadiene, and pentachlorophenol. In these cases, the parent sample reporting limits were qualified (UJ) for these compounds.

SDG RS63 and RS80 (Metals): Two matrix spike sample sets were performed on Samples GEI-3-16.0-17.0-10182010 and GEI-1-2.0-3.0-10192010.

In the first sample set, the %R values for antimony and copper were less than the lower control limits of 75%. For this reason, the positive results and reporting limits for these elements were qualified as estimated (J/UJ) in Samples GEI-3-4.0-5.0-10182010, GEI-3-16.0-17.0-10182010, GEI-3-29.0-30.0-10182010, GEI-4-3.5-4.0-10182010, GEI-4-7.0-8.0-10182010, GEI-4-19.0-20.0-10182010, GEI-5-2.5-3.5-10182010, GEI-5-6.0-7.0-10182010, GEI-5-19.0-20.0-10182010, MW-18-5.0-10212010, MW-18-7.5-10212010, and MW-18-15.0-10212010.

In the second sample set, the %R values for antimony were less than the lower control limits of 75%. For this reason, the positive results and reporting limits for this element were qualified as estimated (J/UJ) in Samples GEI-1-2.0-3.0-10192010, GEI-1-8.0-9.0-10192010, GEI-1-19.0-20.0-10192010, GEI-2-4.0-5.0-10192010, GEI-2-12.0-13.0-10192010, GEI-2-24.0-25.0-10192010, GEI-6-1.0-2.0-10192010, GEI-6-

7.0-8.0-10192010, GEI-6-14.0-15.0-10192010, MW-16-4.0-5.0-10192010, MW-16-9.0-10.0-10192010, MW-16-19.0-20.0-10192010, MW-17-3.0-4.0-10192010, MW-17-9.0-10.0-10192010, and MW-17-18.0-19.0-10192010.

SDG RT24 (Metals): One matrix spike sample set was performed on Sample MW-18-5.0-10212010. The %R values for lead and mercury were outside than the lower control limits of 75% to 125%. For this reason, the positive results and reporting limits for mercury were qualified as estimated (J/UJ) in the samples below. Only the positive results for lead were qualified as estimated (J/UJ) because this outlier was indicative of a high bias: Samples MW-18-5.0-10212010, MW-18-7.5-10212010, MW-18-15.0-10212010.

SDG RS63 and RS80 (Conventionals): A matrix spike sample set was performed on Sample GEI-3-16.0-17.0-10182010. The %R value for total sulfides was less than the control limit of 75%. The parent sample concentration was greater than twice the concentration spike into the QC sample. For this reason, no action was taken.

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 RS63 and RS80 (Semivolatiles): There was no recovery for spiked benzidine in the two laboratory control samples (LCS) extracted on 11/1/10. There were no positive results for benzidine in any of the laboratory associated samples. Therefore, all benzidine results were rejected (R) in the following 24 samples: GEI-1-2.0-3.0-10192010, GEI-1-8.0-9.0-10192010, GEI-1-19.0-20.0-10192010, GEI-2-4.0-5.0-10192010, GEI-2-12.0-13.0-10192010, GEI-2-12.0-13.0-10192010, GEI-3-4.0-5.0-10182010, GEI-3-16.0-17.0-10182010, GEI-3-29.0-30.0-10182010, GEI-4-3.5-4.0-10182010, GEI-4-7.0-8.0-10182010, GEI-4-19.0-20.0-10182010, GEI-5-2.5-3.5-10182010, GEI-5-6.0-7.0-10182010, GEI-5-19.0-20.0-10182010, GEI-6-1.0-2.0-10192010, GEI-6-7.0-8.0-10192010, GEI-6-14.0-15.0-10192010, MW-16-4.0-5.0-10192010, MW-16-9.0-10.0-10192010, MW-16-19.0-20.0-10192010, MW-17-3.0-4.0-10192010, MW-17-9.0-10.0-10192010, and MW-17-18.0-19.0-10192010.

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.

SDG RS63 and RS80 (Metals): A laboratory duplicate sample set was performed on Sample GEI-3-16.0-17.0-10182010. The RPD value for nickel exceeded the control limits of 20% in this sample set. For this reason, the positive results for nickel were qualified as estimated (J) in Samples GEI-3-4.0-

5.0-10182010, GEI-3-16.0-17.0-10182010, GEI-4-3.5-4.0-10182010, GEI-4-7.0-8.0-10182010, GEI-5-2.5-3.5-10182010, GEI-5-6.0-7.0-10182010, and GEI-5-19.0-20.0-10182010.

A laboratory duplicate sample set was also performed on Sample GEI-1-2.0-3.0-10192010. The RPD value for chromium exceeded the control limits of 20% in this sample set. For this reason, the positive results for chromium were qualified as estimated (J) in Samples GEI-1-2.0-3.0-10192010, GEI-1-8.0-9.0-10192010, GEI-1-19.0-20.0-10192010, GEI-2-4.0-5.0-10192010, GEI-2-12.0-13.0-10192010, GEI-2-24.0-25.0-10192010, GEI-6-1.0-2.0-10192010, GEI-6-7.0-8.0-10192010, GEI-6-14.0-15.0-10192010, MW-16-4.0-5.0-10192010, MW-16-9.0-10.0-10192010, MW-16-19.0-20.0-10192010, MW-17-3.0-4.0-10192010, MW-17-9.0-10.0-10192010, and MW-17-18.0-19.0-10192010.

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: 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.

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 RY97:

One set of field duplicates, MW-16-12012010 & DUP-1-12012010, were submitted with this SDG. In this sample set, all RPD/absolute difference values were within the parameters described above, with the following exception:

In this sample set, the RPD/absolute difference value for 1,2,3,4,6,7,8-HpCDF, OCDD, and OCDF exceeded the control limits. These results were qualified as estimated (J) in both samples.

Internal Standards

SDG RS63 and RS80 (Semivolatiles): The recovery for the internal standard perylene-d12 was greater than the control limits of 200% in Samples GEI-3-29.0-30.0-10182010, GEI-1-8.0-9.0-10192010, and GEI-2-12.0-13.0-10192010. There were no positive detections for the associated compounds that used this particular internal standard for quantitation. No action was required.

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 RT24 (Semivolatiles): The percent difference (%D) values for 2,4-dinitrotoluene, benzidine, and indeno(1,2,3-cd)pyrene were less than the control limits of ±25% in the continuing calibration (CCAL) standard analyzed on 11/4/10. The reporting limits for these compounds were qualified as estimated (UJ) in Samples: MW-18-5.0-10212010, MW-18-7.5-10212010, and MW-18-15.0-10212010.

SDG RS63 and RS80 (Semivolatiles): The %D value for 2,4-dinitrotoluene was less than the control limits of ±25% in the continuing calibration (CCAL) standard analyzed on 11/10/10. The reporting limits for this compound was qualified as estimated (UJ) in Samples: GEI-1-2.0-3.0-10192010, GEI-1-8.0-9.0-10192010, GEI-1-19.0-20.0-10192010, GEI-2-4.0-5.0-10192010, GEI-2-12.0-13.0-10192010, GEI-2-24.0-25.0-10192010, GEI-6-1.0-2.0-10192010, GEI-6-7.0-8.0-10192010, GEI-6-14.0-15.0-10192010, MW-16-4.0-5.0-10192010, MW-16-9.0-10.0-10192010, MW-16-19.0-20.0-10192010, MW-17-3.0-4.0-10192010, and MW-17-18.0-19.0-10192010.

The %D values for benzyl alcohol, 2,4-dinitrophenol, and 2,4-dinitrotoluene were less than the control limits of ±25% in the continuing calibration (CCAL) standard analyzed on 11/11/10. The reporting limits for these compounds were qualified as estimated (UJ) in Samples: GEI-3-4.0-5.0-10182010, GEI-3-16.0-17.0-10182010, GEI-3-29.0-30.0-10182010, GEI-4-3.5-4.0-10182010, GEI-4-7.0-8.0-10182010, GEI-4-19.0-20.0-10182010, GEI-5-2.5-3.5-10182010, GEI-5-6.0-7.0-10182010, GEI-5-19.0-20.0-10182010, and MW-17-9.0-10.0-10192010.

The %D values for benzyl alcohol, 2,4-dinitrophenol, 2,4-dinitrotoluene, 4-nitroaniline, pentachlorophenol, and carbazole were less than the control limits of ±25% in the continuing calibration (CCAL) standards analyzed on 11/15/10. The only sample that was associated with this calibration was not used for the purposes of this report.

SDG RY96 (Semivolatiles): The %D values for benzyl alcohol, 4-nitrophenol, and 4-nitroaniline were greater than the control limits of ±25% in the continuing calibration (CCAL) standard analyzed on 12/3/10. In each case, these outliers were indicative of a high bias. There were no positive results for these compounds in any of the associated samples, so no action was required.

SDG SB10 (Semivolatiles): The %D values for benzyl alcohol and 4-nitrophenol were less than the control limits of ±25% in the continuing calibration (CCAL) standard analyzed on 12/23/10. The reporting limits for these compounds were qualified as estimated (UJ) in Sample GEI-4-30.0-32.0-10182010.

Additional Data Quality Issues

The laboratory flagged several results with a “Y” (signal to noise ratio in excess of 2.5) or an “X” (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
GEI-1-2.0-3.0-10192010	1,2,3,7,8,9-HxCDF, 2,3,7,8-TCDD
GEI-1-8.0-9.0-10192010	2,3,7,8-TCDD, 1,2,3,7,8,9-HxCDF, 2,3,4,6,7,8-HxCDF,
GEI-2-4.0-5.0-10192010	2,3,7,8-TCDD, 2,3,7,8-TCDF, 1,2,3,7,8,9-HxCDF

GEI-2-12.0-13.0-10192010	2,3,7,8-TCDD, 1,2,3,7,8-PeCDF, 2,3,4,7,8-PeCDF, 1,2,3,6,7,8-HxCDD
GEI-3-4.0-5.0-10182010	2,3,7,8-TCDD, 1,2,3,4,7,8,9-HpCDF
GEI-3-16.0-17.0-10182010	2,3,7,8-TCDD
GEI-4-3.5-4.0-10182010	2,3,7,8-TCDD
GEI-4-7.0-8.0-10182010	2,3,7,8-TCDD
GEI-5-2.5-3.5-10182010	2,3,7,8-TCDD
GEI-5-6.0-7.0-10182010	2,3,7,8-TCDD
GEI-6-7.0-8.0-10192010	2,3,7,8-TCDD, 1,2,3,4,7,8-HxCDD
MW-16-4.0-5.0-10192010	1,2,3,7,8-PeCDD, 1,2,3,6,7,8-HxCDF, 1,2,3,4,7,8-HxCDD
MW-16-9.0-10.0-10192010	2,3,7,8-TCDD, 1,2,3,7,8,9-HxCDF
MW-16-12012010	1,2,3,7,8-PeCDF
MW-17-12012010	2,3,7,8-TCDF
DUP-1-12012010	1,2,3,4,7,8-HxCDF
MW-15-12012010	2,3,7,8-TCDD, 2,3,4,7,8-PeCDF, 1,2,3,7,8,9-HxCDD, 1,2,3,4,7,8-HxCDF
MW-18-12012010	1,2,3,4,6,7,8-HpCDD
MW-12-12012010	2,3,7,8-TCDD, 1,2,3,7,8-PeCDD

Miscellaneous

SDG RS63 and RS80 (Semivolatiles): The compounds phenanthrene, fluoranthene, and pyrene exceeded the linear range of the instrument in Sample GEI-6-1.0-2.0-10192010. For this reason, this sample was diluted by the laboratory and re-analyzed. Both sets of data were reported. The initial reported results for phenanthrene, fluoranthene, and pyrene were qualified as “Not reportable” in the database. Also, the diluted reporting limits for all target analytes except these compounds 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.

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.

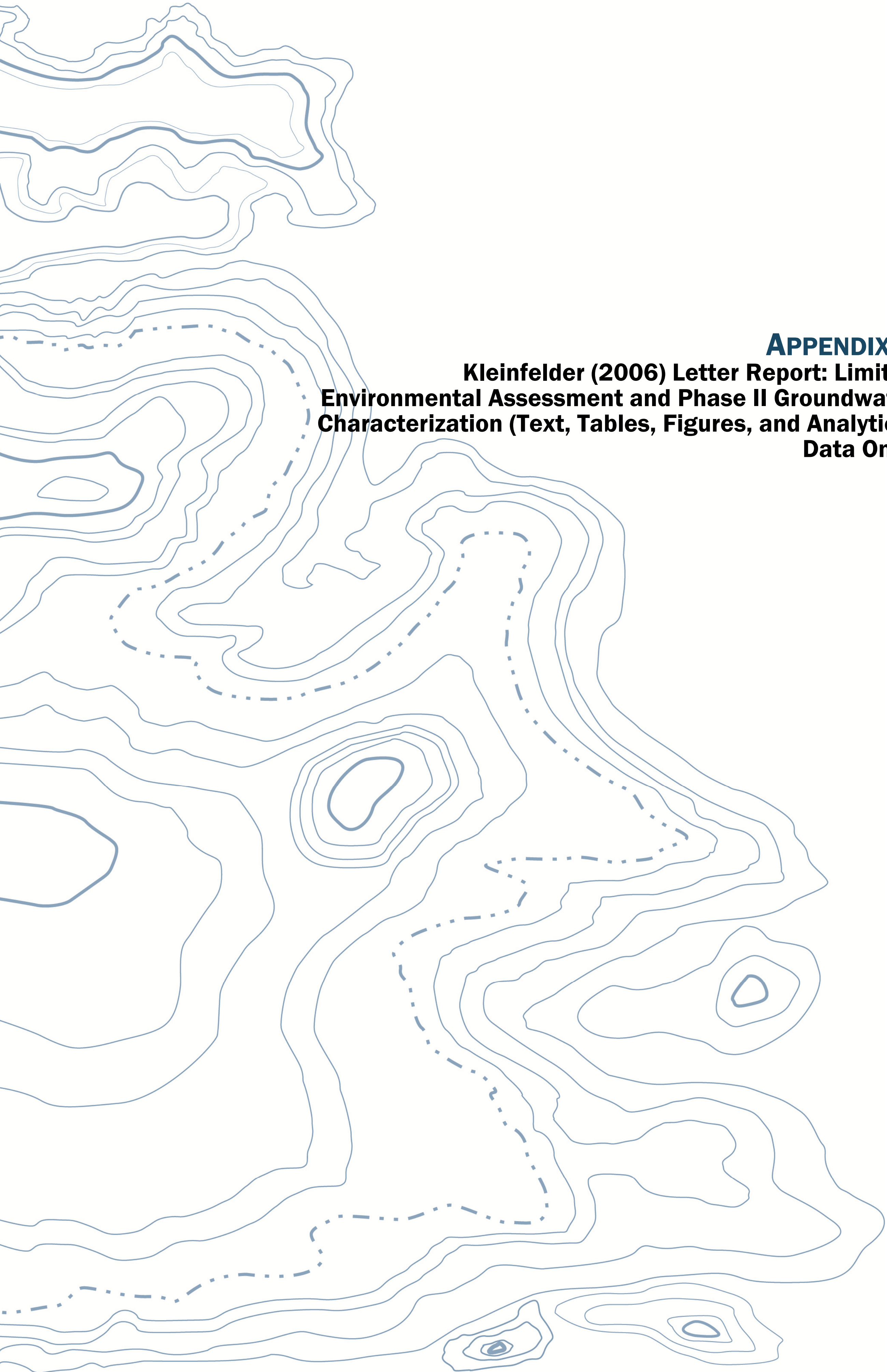
Data were qualified because of surrogate %R, matrix spike %R, laboratory duplicate and field duplicate precision, and continuing calibration %D outliers.

Data were qualified as not detected because of method blank contamination and HR/MS interference.

Data were rejected because of no recovery in the matrix spike.

Data were labeled as Do-Not-Report in order to avoid confusion over multiple reportings for the same sample by the laboratory.

In general, the data are acceptable for use as qualified.



APPENDIX C

Kleinfelder (2006) Letter Report: Limited Environmental Assessment and Phase II Groundwater Characterization (Text, Tables, Figures, and Analytical Data Only)

KLEINFELDER

January 26, 2005
Kleinfelder Project No.64399

Mr. Mark Hall, President
Hall Equities Group
1855 Olympic Blvd. Suite 250
Walnut Creek, CA 94596

Subject: **Limited Environmental Assessment and
Phase II Groundwater Characterization
Proposed 672-Acres Mixed-Use Development
Southwest of Highway 101 and West Wallace-Kneeland Blvd.
Shelton, Washington**

Dear Mr. Hall:

INTRODUCTION AND BACKGROUND

Kleinfelder is pleased to present this report presenting the findings of a Limited Environmental Assessment and Phase II Groundwater Characterization performed for the above-referenced subject property. We understand that Hall Equities Group is considering purchasing the overall property for future development as a mixed-use facility. The environmental assessment and groundwater sampling program described herein was intended to conduct a preliminary evaluation of the existing environmental conditions of the subject property as well as the potential impact of neighboring properties on the subject property.

Based upon State of Washington Department of Ecology (Ecology) records and other available information, a series of environmental studies were conducted on 170-acre property, which is located on a portion of the subject property as well as the neighboring up-gradient property. The studies focused on environmental issues associated with the Goose Lake area owned in part by Rayonier, Inc. Rayonier operated a calcium sulfite pulp mill located in nearby Shelton from the early 1930s through the mid-1970s. During that period, a variety of liquid waste generated from the Rayonier operations was periodically disposed of into Goose Lake and nearby upland disposal lagoons. In addition, Rayonier reportedly disposed of solid waste generated from its Research Center offices and laboratory into a landfill located adjacent to the east side of Goose Lake from 1936 through 1974.

In June 1997, Ecology contracted SAIC to assess the potential hazards of the Goose Lake area. The investigation revealed the presence of high concentrations of sulfides in lake sediments. Elevated levels of mercury and the presence of polychlorinated biphenyl (PCBs) were also present in sediments. Groundwater results collected in the vicinity of the landfill detected the presence of chromium and arsenic. It should be noted that chromium was detected in soil and groundwater at the Sanderson Air Field, which is located upgradient of Goose Lake, disposal lagoons and landfill. Soil analytical results also indicated the presence of arsenic and polycyclic aromatic hydrocarbons (PAHs) in the former disposal lagoons. SAIC recommended additional investigations to further assess the nature and extent of on-site contaminants.

In 1997 and 1998, Pacific Environmental Group conducted additional investigations and reported arsenic, chromium and lead in the groundwater downgradient from the landfill.

In 2001, Ecology entered into an Agreed Order with Rayonier Inc. and Peninsula Holding Company, LLC to conduct a remedial investigation/feasibility study (RI/FS) on the 172 acres. The following areas of concern were identified:

- Groundwater
- Disposal Lagoons
- Inactive Landfill
- Goose Lake Sediments
- Drainage Ravine Sediment

In 2002 and 2003, GeoEngineers developed a work plan and conducted fieldwork on behalf of Rayonier. The remedial investigation (RI) field program consisted of multiple test pits, soil borings, groundwater monitoring wells, lake water and core sediment samples in Goose Lake, disposal lagoons, and landfill areas. Representative fish samples were also collected from Goose Lake for bioassay testing.

In 2003 prior to GeoEngineers issuing the RI report, AMEC conducted a Phase I Environmental Site Assessment on the 672-acres for the Confederated Tribes of Grand Ronde. The Phase I identified the Goose Lake area as a potential area of environmental concern and recommended Phase II sampling. AMEC also recommended that additional research should be performed to further assess the extent of previous sampling conducted on the subject property.

In 2004, a Draft Final RI report was completed and forwarded to Ecology for review. Evidence of impacted sediments was identified in Goose Lake and downgradient in the drainage ravine. Low levels of heavy metals were detected in the disposal lagoons and landfill. In addition, low levels of heavy metals (arsenic and chromium) were detected in groundwater. The remedial investigation recommended that the former disposal lagoons required no further assessment. Further assessment of Goose Lake, inactive landfill, drainage ravine and groundwater was recommended. Future work should include development of a more fully developed conceptual site model (CSM) to further assess the nature, extent and impacts of the low levels of contaminants.

It should be noted that although the inactive landfill and Goose Lake areas are not located within the 672-acre proposed mixed-use development, they are located upgradient and adjacent to the proposed developed and thus may be impacting groundwater quality beneath the proposed mixed-use development. The former disposal lagoons, drainage ravine sediments and groundwater are within the proposed mixed-use development area. Potential contaminants of concerns (COC) included: heavy metals (arsenic, chromium, mercury and lead), cPAHs, PCBs, and dioxins.

PURPOSE AND SCOPE OF SERVICES

The objectives of the project described herein was to: (1) evaluate the environmental condition on the up-gradient Goose Lake area and neighboring properties with respect to potential impacts on the subject property, (2) assess the potential impacts of on-site contaminants on the subject property, and (3) provide recommendations for addressing on-site contaminants with respect to the proposed site redevelopment and obtaining regulatory closure from Ecology.

To accomplish the project objectives, we conducted the following scope of services:

- Conducted a review of previous environmental reports and other pertinent information conducted on the Goose Lake area and subject property.
- Conducted a preliminary risk assessment evaluation of existing data presented in the previous Remedial Investigation Report, prepared by GeoEngineers/Entrix and dated March 19, 2004.
- Performed a site reconnaissance at the subject property and observe changed conditions and use patterns since the completion of the previous Phase I ESA.

- Obtained an updated EDR report to review federal, state, and local regulatory agency lists and databases regarding facilities that use, store, and/or generate hazardous materials on and nearby the subject property.
- Prepared a Work Plan outlining the proposed field program to install two new groundwater monitoring wells (MW-11 and MW-12) and associated groundwater sampling program.
- Provided the equipment and labor to install and develop two new groundwater monitoring wells (MW-11 and MW-12) on the subject property.
- Provided the labor and equipment to sample the newly installed wells (MW-11 and MW-12) and the existing on-site wells (MW-5, MW-7 and MW-10). Each well was analyzed for TPH (as gasoline/BTEX, diesel and heavy oil) by Ecology Methods NWTPH-Gx and NWTPH-Dx, SVOCs, PCBs, total and dissolved heavy metals by applicable EPA Methods. Groundwater elevations were also collected to assess the groundwater elevations.
- Conducted one meeting with Ecology representatives to review the existing environmental data and overall approach for obtaining site closure.
- Prepared this report describing the assessment activities and presenting our findings and opinions regarding recognized environmental conditions at the subject property and summarizing the subsurface testing results with respect to Ecology's MTCA Methods A and B cleanup levels.

GENERAL SITE SETTING AND OBSERVATIONS

On December 22 and 28, 2005, Kleinfelder conducted a site reconnaissance to assess the existing environmental conditions of the subject property. The subject property was primarily undeveloped, with a 6,000 square foot steel prefabricated building located on the northwest corner of the property. The building was vacant and access to the interior portions of the building was not made available. No significant changes were noted from information presented in the previous Phase I ESA conducted by AMEC in April 2003. No evidence of underground storage tanks (USTs) or aboveground storage tanks (ASTs) was noted on the subject property. Several 55-gallon DOT-approved steel drums, containing purged groundwater, were observed adjacent to several groundwater monitoring wells. No evidence of storage and/or disposal of hazardous materials were observed on the portions of property that we were able to access during the site visit. Due to limited access caused by dense brush and forest throughout the subject property, our site visit was limited to access roads and by foot throughout portions of the subject property.

Similar to AMEC, we observed evidence of several test pits conducted throughout the subject property. We suspect these test are associated with the previous sampling conducted by GeoEngineers as part of the RI. In addition, we attempted to locate the groundwater monitoring wells installed on-site as part of the RI. Due to the dense brush, we were only able to locate groundwater monitoring wells (MW-5, MW-7 and MW-10). No visual signs of soil staining, hazardous material spills, stressed vegetation, or chemical odors and pools of liquids which, (if present), can indicate the presence of contamination were noted during our site visit.

Kleinfelder conducted a drive-by survey of the parcels adjoining the site on the same days as the site reconnaissance. Port of Shelton Industrial Park, Fair Grounds and Airport occupy the adjacent properties located to the north. Highway 101 borders the subject property to the east and undeveloped properties to the south and west.

Soil conditions have been described as fine to coarse-grained sand with gravel. Groundwater has been reported at depths varying from 8 to 35 feet below ground surface (bgs). The newly installed wells (MW-11 and MW-12) encountered groundwater at depths 13 to 19 feet bgs. Although the groundwater gradient has been reported to be south to southeast; Ecology believes there is a moderate potential for a fair amount of variation in groundwater flow direction beneath the subject property.

INTERVIEWS

As part of the review of environmental information, Kleinfelder and Hall Equities Group representatives met with Ecology Regional Unit Manger Mr. Bob Warren, PEG, PHG, and Sediment Specialist Russ McMillan at the Toxics Cleanup Program Southwest Regional Office in Olympia, Washington. Both Mr. Warren and McMillan stressed the importance that additional remedial investigations will be required in order to thoroughly assess the nature and extent of contaminants previously detected on the subject property. Specific areas that Ecology expressed will require additional assessment include:

<u>Disposal Lagoons Area</u>:

- Collection and testing of deeper soil samples through the base of the disposal lagoon to assess the presence of residual contaminants that may have infiltrated through the shallow more permeable soil into the deeper less permeable soils.
- Collection and testing of additional soil samples around the perimeter of the disposal ponds to assess the potential presence of soil that may have been formerly removed from the base of the ponds and discarded nearby.

- Collection and testing of deeper groundwater samples through the base of the former disposal lagoons

Inactive Landfill Area:

- Collection and testing of deeper soil samples through the base of the inactive landfill to further assess the presence of residual contaminants that may have infiltrated into the deeper less permeable soils.
- Collection and testing of additional soil samples on the west side of the inactive landfill situated between Landfill and Goose Lake to assess the potential migration of contaminants from the landfill into the lake sediments.
- Collection and testing of deep groundwater samples adjacent to the inactive landfill to further assess groundwater quality beneath the landfill.

Goose Lake Sediment Areas:

- Collection and testing of sediment samples around the southern shoreline of the lake to further assess the presence of contaminants in this area.
- Collection and testing of sediments to further assess the vertical distribution in shallow lake sediments.

Drainage Ravine Area:

- Collection and testing of shallow and deep soil and sediments samples in the drainage ravine to assess the horizontal and lateral extent of contaminants previously detected at Station 1.
- Collection and testing of additional sediment and soil samples between the Drainage Ravine Station 1 and Goose Lake to assess potential residual contaminants associated with former surface runoff from the lake.
- Collection and testing of additional surface water and groundwater samples in the vicinity of the drainage ravine to assess the migration of contaminants detected in the drainage ravine sediments.

Area-Wide Groundwater Assessment:

- Install and develop additional groundwater monitoring wells to further assess the vertical and horizontal distribution of heavy metals previously detected in shallow groundwater beneath the subject property.
- Compile all groundwater and geologic information beneath the study area to accurately assess the lithology, groundwater aquifers and gradient in the site vicinity.
- Obtain and compile additional information regarding potential upgradient sources and receptors of groundwater contaminants in the site vicinity.

A summary of Ecology's comments concerning the Goose Lake RI activities and draft report is presented in Attachment A for your review.

In summary, Ecology will require additional subsurface soil, sediment and groundwater sampling be performed to fully characterize the nature and extent of on-site contaminants. More specifically, additional soil and groundwater sampling will need to be performed in the areas of the drainage ravine and disposal lagoons, which are located within the proposed mixed-use development area. Additional sampling will be required in Goose Lake and the inactive landfill. A Response Letter prepared by Rayonier to address Ecology's comments is also presented in Attachment A.

REGULATORY AGENCY DATABASE REVIEW

The purpose of the records review was to obtain and review records that could be used to evaluate recognized environmental conditions of potential concern in connection with the subject property and surrounding properties since the completion of previous Phase I ESA report (April, 2003).

Federal, state, and local regulatory agencies publish databases or "lists" of businesses and properties that handle hazardous materials or hazardous waste, or are the known location of a release of hazardous substances to soil and/or groundwater. These databases are available for review and/or purchase at the regulatory agencies, or the information may be obtained through a commercial database service. Kleinfelder retained a commercial database service; Environmental Data Resources, Inc. (EDR), to review the regulatory agency lists for references to the subject property and other off-site listings within the appropriate ASTM minimum search distances. The EDR database search results for the subject site and for other nearby facilities are included in Attachment B. The federal and state databases reviewed along with the number of sites plotted in each database category are summarized in Table 1 (see below).

TABLE 1
RECORDS REVIEW-SEARCH DISTANCE-FINDINGS

FEDERAL		Total Number of Facilities Listed	Number of Upgradient or Adjacent Facilities Listed	Site Listed
NPL (National Priority List)	Site & 1 Mile	0	0	No
CERCLIS (Comprehensive Environmental Response, Compensation, and Liability Act Information System)	Site & 0.5 Mile	0	0	No
CERCLIS NFRAP (No Further Remedial Action Planned)	Site & 0.25 Mile	0	0	No
RCRA (Resource Conservation and Recovery Act) **CORRACTS** (Corrective Actions Sites)	Site & 1 Mile	1	0	No
RCRA non-CORRACTS TSD (Transfer Storage and Disposal Sites)	Site & 0.5 Mile	0	0	No
RCRA GENERATORS	Site & 0.25 Mile	5	0	No
ERNS (Emergency Response Notification System Listings)	Site	0	0	No
STATE				
CSCSL (Confirmed and Suspected Contaminated Sites List)	Site & 1 Mile	4	1	yes
State Landfill Sites	Site & 0.5 Mile	0	0	No
LUST (Leaking Underground Storage Tank Sites)	Site & 0.5 Mile	2	0	No
WA ICR (Washington State Independent Cleanup Reports)	Site & 0.5 Mile	2	0	No
VCP (Voluntary Cleanup Program Sites)	Site & 0.5 Mile	1	0	No
UST (Registered Underground Storage Tank Sites)	Site & 0.25 Mile	6	0	No

Subject Site

Although the subject property is not listed on the EDR database, portions of the subject site are currently part of an Agreed Order between Rayonier Inc. and Peninsula Holding Co. LLC. and Ecology. As part of the Agreed Order, a RI is currently being conducted on portions of the subject property. As discussed above, a preliminary remedial investigation has been completed in the Goose Lake area. According to Ecology representatives, additional remedial investigations like be required. In addition, a cleanup action plan will be required.

Off-Site Facilities

According to EDR's database report, one potentially upgradient release site (Port of Shelton All Star Aero site), located approximately 0.2-mile north of the subject property, is a recorded CSCSL site. Available information contained in the EDR database report indicated that the Port of Shelton All Star Aero site had impacted soil and groundwater with elevated levels of halogenated organic compounds, heavy metals, and possibly petroleum hydrocarbons. Reportedly, remediation is currently underway and includes capping of soil impacted with heavy metals; however, given that the Port of Shelton All Star Aero site is located upgradient with respect to the subject property, there exists the potential that the subject property may have been impacted by heavy metals associated with this site.

The Goose Lake and adjacent inactive landfill associated with the former Rayonier operations borders the proposed mixed-use development to the north. Information regarding the environmental concerns associated with these areas is presented above.

The remaining off-site release incidents identified in the EDR database report have a low probability to impact the subject property, since they are located hydraulically cross- to down-gradient with respect to the subject property.

LIMITED PHASE II GROUNDWATER CHARACTERIZATION

On December 28, 2005, Kleinfelder installed and developed two groundwater monitoring wells (MW-11 and MW-12) to further assess the groundwater quality down-gradient of Goose Lake, disposal lagoons and inactive landfill. Groundwater well MW-11 was completed to a depth of approximately 35 feet bgs. Groundwater was encountered at a depth of approximately 19 feet bgs. Groundwater well MW-12 was completed to a depth of approximately 25 feet bgs. Groundwater was encountered at a depth of approximately 13 feet bgs.

The wells were installed and sampled in accordance with EPA and Ecology established protocols. A qualified Kleinfelder geologist was present during the drilling and soil sampling to observe and document soil conditions and groundwater elevations. All soil samples were visually observed for identifiable sights of petroleum-related contamination and screened for the presence of volatile organic compounds (VOCs) using a photo-ionization detector (PID). After geologic logging, selected soil samples were placed into sterile jars, labeled, and placed into a chilled cooler for transport to the analytical laboratory for chemical analysis. The sampling equipment was decontaminated with soapy water and double rinsed after collecting each sample. Soil samples were submitted to Advanced Analytical, Inc., a Washington State-certified laboratory for analytical testing.

The five-foot sample interval from each borehole was analyzed for total petroleum hydrocarbons (TPH) as diesel and heavy oil by Ecology method NWTPH-Dx, and semi-volatile organic compounds (SVOCs) and PCBs by EPA Methods 8270, and 8082, respectively. No elevated PIDS readings were noted. Analytical results indicated no detectable concentrations of TPH (as diesel and heavy oil), SVOCs or PCBs. Copies of the Laboratory Analytical Reports are presented in Attachment C.

On December 30, 2005, groundwater samples were collected from the newly installed wells MW-11 and MW-12 and existing groundwater monitoring wells MW-5, MW-7 and MW-10. Representative groundwater samples were analyzed for TPH (as diesel and heavy oil) by Ecology method NWTPH-Dx. Groundwater samples were also analyzed for volatile organic compounds (VOCs), SVOCs, PCBs, and heavy metals (arsenic, cadmium, chromium, lead, and mercury) by EPA Methods 8260, 8270, 8082, and 7010, respectively.

Analytical results revealed no detectable levels of TPH (as diesel and heavy oil), VOCs, SVOCs, and PCBs. Trace levels of dissolved chromium were detected in groundwater wells MW-11 (20 ug/l) and MW-12 (10 ug/l). The reported chromium levels are below Ecology's Model Toxics Control Act (MTCA) Method A cleanup level of 50 ug/l. The remaining heavy metals concentrations were below the reported detection limits for each test and thus well below the MTCA Method A cleanup levels.

CONCLUSIONS AND RECOMMENDATIONS

This Limited Environmental Assessment and Phase II Groundwater Characterization were performed for Hall Equities Group to identify environmental issues associated with the proposed 672-acre mixed-use development project in Shelton, Washington. A complete Phase I ESA was completed on the proposed development property by AMEC in April 2003. The environmental assessment and groundwater sampling program described herein was intended to conduct a preliminary evaluation of the existing environmental conditions of the subject property as well as the potential impact of neighboring properties on the subject property.

Based upon available information, Kleinfelder has confirmed that a substantial amount of environmental investigations have been conducted on a portion of the proposed mixed-use property as well as the neighboring property to the north. In 2001, Ecology entered into an Agreed Order with Rayonier Inc. and Peninsula Holding Company, LLC to conduct a remedial investigation/feasibility study (RI/FS) on the 172 acres. The following areas of concern were identified:

- Regional Groundwater,
- Former Disposal Lagoons,
- Inactive Landfill,
- Goose Lake Sediments, and
- Drainage Ravine Sediment and Surface Water.

In 2002 and 2003 Rayonier designed and implemented a remedial investigation, which consisted of multiple test pits, soil borings, groundwater monitoring wells, lake water and core sediment samples in Goose Lake, the former disposal lagoons, and inactive landfill areas. Evidence of impacted sediments was identified in Goose Lake and downgradient in the drainage ravine. The presence of heavy metals was detected in the inactive disposal lagoons and inactive landfill. In addition, low levels of heavy metals (arsenic and chromium) were detected in groundwater. It should be noted that although the inactive landfill and Goose Lake areas are not located within the 672-acre proposed mixed-use development area, they are located upgradient and adjacent to the proposed development and thus pose a significant threat to impact groundwater quality beneath the proposed mixed-use development.

The former disposal lagoons, drainage ravine sediments and groundwater are located within the proposed mixed-use development area. Potential contaminants of concerns

(COC) included: heavy metals (arsenic, chromium, mercury and lead), cPAHs, PCBs, and dioxins. Based upon these findings, Ecology has requested that additional work be conducted to further assess the nature and extent of on-site contaminants. Ecology has also expressed that some level of remedial action will be required to address the contaminants located in Goose Lake, drainage ravine and the inactive landfill.

Kleinfelder installed two new groundwater monitoring wells (MW-11 and MW-12) to further assess the groundwater quality beneath the proposed development. Representative soil sample were collected during the well installation process and tested for TPH (as diesel and heavy oil), SVOCs, and PCBs. No detectable levels of TPH, SVOCs or PCBs were reported. Groundwater samples were collected from the newly installed wells MW-11 and MW-12 and existing groundwater monitoring wells MW-5, MW-7 and MW-10. Representative groundwater samples were analyzed for TPH (as diesel and heavy oil), VOCs, SVOCs, PCBs, and heavy metals (arsenic, cadmium, chromium, lead, and mercury). Analytical results revealed no detectable levels of TPH (as diesel and heavy oil), VOCs, SVOCs, and PCBs. Trace levels of dissolved chromium were detected in groundwater wells MW-11 (20 ug/l) and MW-12 (10 ug/l), which are well below Ecology's Model Toxics Control Act (MTCA) Method A cleanup level of 50 ug/l. The remaining heavy metals concentrations were below the reported detection limits for each test and thus well below the MTCA Method A cleanup levels.

Although the reported contaminants levels are fairly low, Ecology will require additional soil and groundwater testing in the area of Goose Lake, drainage ravine, disposal ponds and inactive landfill to ascertain the potential source areas. Some level of remedial action will be required in the Goose Lake, drainage ravine and inactive landfill. At this time it is uncertain whether they will require remedial action in the area of the former disposal lagoons.

In order to further assess the nature and extent of contaminants located on the proposed mixed-use development area, additional sampling and testing of sediments should be performed in the drainage ravine and southern side of Goose Lake. In addition, deeper soil samples and groundwater samples should be collected and tested in the area of the former disposal lagoons. Groundwater samples should also be collected from all existing groundwater monitoring wells. Prior to any additional sampling, a Work Plan should be developed and reviewed by Ecology to ensure their data requirements are met.

LIMITATIONS

The limited environmental assessment and Phase II groundwater characterization are non-comprehensive by nature and are unlikely to identify all environmental problems or eliminate all risk. This report is a qualitative assessment. Kleinfelder offers a range of investigative and engineering services to suit the needs of our clients, including more quantitative investigations. Although risk can never be eliminated, more detailed and extensive investigations yield more information, which may help you understand and better manage your risks. Since such detailed services involve greater expense, we ask our clients to participate in identifying the level of service, which will provide them with an acceptable level of risk. Please contact the signatories of this report if you would like to discuss this issue of risk further.

Kleinfelder performed the limited environmental assessment and Phase II groundwater characterization in accordance with our contract proposal. No warranty, either express or implied is made. Environmental issues not specifically addressed in the report were beyond the scope of our work and not included in our evaluation.

Land use, site conditions (both on-site and off-site) and other factors will change over time. Since site activities and regulations beyond our control could change at any time after the completion of this report, our observations, findings and opinions can be considered valid only as of the date of the site visit.

An evaluation of business environmental risk associated with the parcel(s) was not included in Kleinfelder's scope of work. The ESA Update does not incorporate non-scope considerations, such as radon, lead-based paint, lead in drinking water, wetlands, regulatory compliance, cultural and historic resources, industrial hygiene, health and safety, ecological resources, endangered species, indoor air quality, and high voltage powerlines.

Any party other than the client who would like to use this report shall notify Kleinfelder of such intended use by executing the "Application for Authorization to Use" attached to this document. Based on the intended use of the report, Kleinfelder may require that additional work be performed and that an updated report be issued. Non-compliance with any of these requirements by the client or anyone else will release Kleinfelder from any liability resulting from the use of this report by any unauthorized party.

CLOSING

We appreciate the opportunity to be of service to you. If you have questions or require additional assistance, please do not hesitate to contact us at (425) 562-4200.

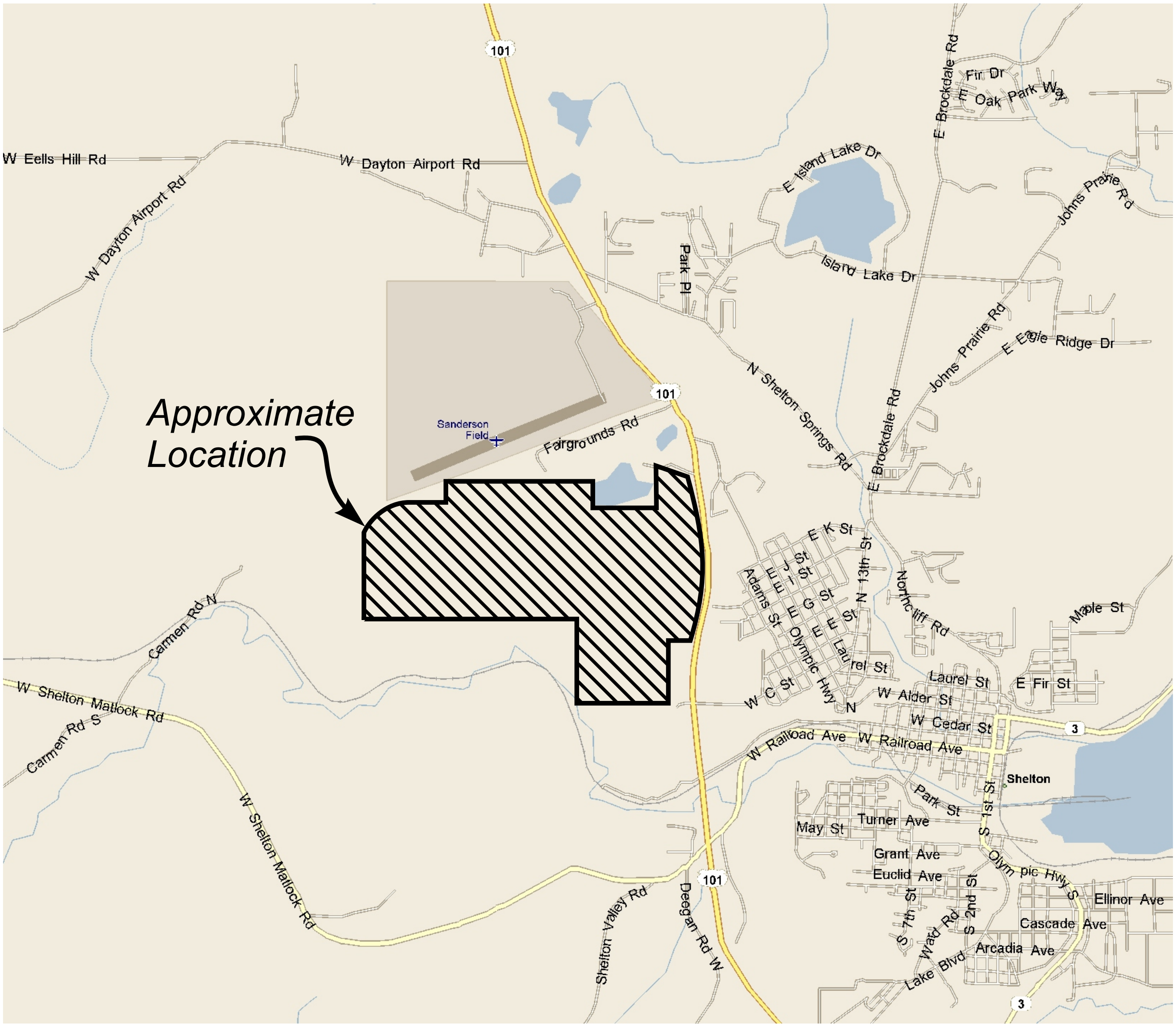
Respectfully submitted,

KLEINFELDER, INC.

D. J. O'Neill

Dennis O'Neill, LEG, LHG
Senior Project Manager

Attachments: A: Department of Ecology RI Report Comments and Rayonier Response
B: EDR Regulatory Agency Database Report
C: Laboratory Analytical Report
D: References



N

Not to Scale

KLEINFELDER

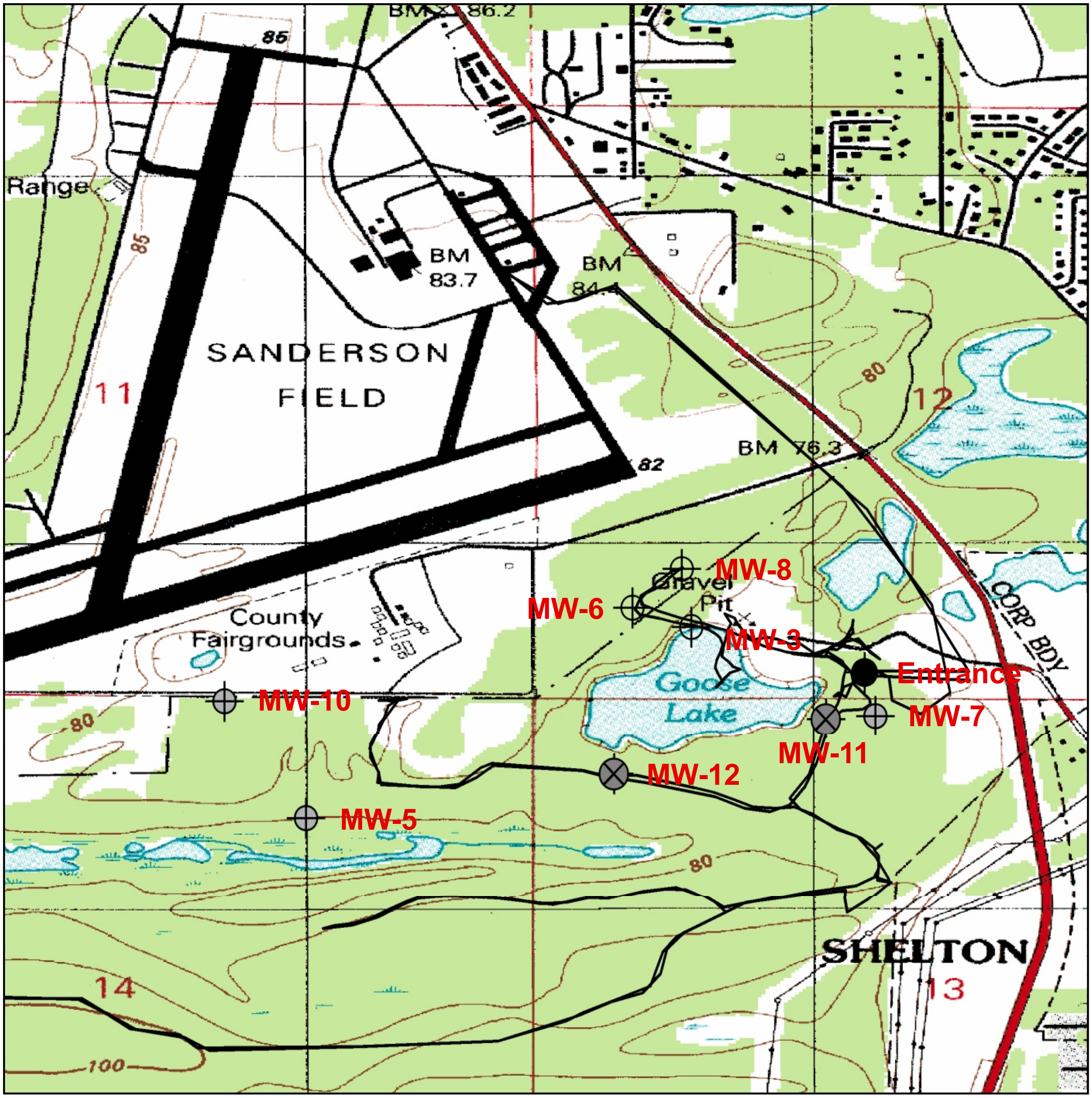
PROJECT NO. 64399 January 2006

Site Vicinity

Proposed 672 - Acres Mixed-Use Development
Southwest of Highway 101 & West Wallace-Kneeland Blvd.
Shelton, Washington

Figure

1



Legend

⊕ *Sampled Wells*

⊕ *Existing Groundwater Wells*

⊗ *Kleinfelder Groundwater Wells (MW-11, MW-12)*

N

Not to Scale

KLEINFELDER

PROJECT NO. 64399 January 2006

Groundwater Monitoring Well Locations

Proposed 672 - Acres Mixed-Use Development
Southwest of Highway 101 & West Wallace-Kneeland Blvd.
Shelton, Washington

Figure

2

ATTACHMENT C

LABORATORY ANALYTICAL REPORT

AAL Job Number:	A51230-2
Client:	Kleinfelder, Inc.
Project Manager:	Dennis O'Neill
Client Project Name:	Shelton
Client Project Number:	64339
Date received:	12/30/05

Analytical Results

8082(PCBs), µg/l		MTH BLK	LCS	SH-5	SH-7	SH-10	SH-11	SH-12
Matrix	Water	Water	Water	Water	Water	Water	Water	Water
Date extracted	Reporting	01/03/06	01/03/06	01/03/06	01/03/06	01/03/06	01/03/06	01/03/06
Date analyzed	Limits	01/03/06	01/03/06	01/03/06	01/03/06	01/03/06	01/03/06	01/03/06
A1221	0.1*	nd		nd	nd	nd	nd	nd
A1232	0.1*	nd		nd	nd	nd	nd	nd
A1242 (A1016)	0.1*	nd		nd	nd	nd	nd	nd
A1248	0.1*	nd		nd	nd	nd	nd	nd
A1254	0.1*	nd		nd	nd	nd	nd	nd
A1260	0.1*	nd	101%	nd	nd	nd	nd	nd
Surrogate recoveries:								
Tetrachloro-m-xylene		95%	72%	102%	88%	98%	79%	101%
Decachlorobiphenyl		88%	78%	108%	74%	78%	91%	95%

*- instrument detection limits

Data Qualifiers and Analytical Comments

nd - not detected at listed reporting limits
na - not analyzed
C - coelution with sample peaks
M - matrix interference
J - estimated value
Acceptable Recovery limits: 70% TO 130%
Acceptable RPD limit: 30%

AAL Job Number:	A51230-2
Client:	Kleinfelder, Inc.
Project Manager:	Dennis O'Neill
Client Project Name:	Shelton
Client Project Number:	64339
Date received:	12/30/05

Analytical Results

8260B, µg/L		MTH BLK	LCS	SH-5	SH-7	SH-10	SH-11
Matrix	Water	Water	Water	Water	Water	Water	Water
Date analyzed	Reporting Limits	12/30/05	12/30/05	12/30/05	12/30/05	12/30/05	12/30/05
Dichlorodifluoromethane	1.0	nd		nd	nd	nd	nd
Chloromethane	1.0	nd		nd	nd	nd	nd
Vinyl chloride(*)	0.2	nd		nd	nd	nd	nd
Bromomethane	1.0	nd		nd	nd	nd	nd
Chloroethane	1.0	nd		nd	nd	nd	nd
Trichlorofluoromethane	1.0	nd		nd	nd	nd	nd
1,1-Dichloroethene	1.0	nd		nd	nd	nd	nd
Methylene chloride	1.0	nd		nd	nd	nd	nd
trans-1,2-Dichloroethene	1.0	nd		nd	nd	nd	nd
1,1-Dichloroethane	1.0	nd		nd	nd	nd	nd
2,2-Dichloropropane	1.0	nd		nd	nd	nd	nd
cis-1,2-Dichloroethene	1.0	nd		nd	nd	nd	nd
Chloroform	1.0	nd		nd	nd	nd	nd
1,1,1-Trichloroethane	1.0	nd		nd	nd	nd	nd
Carbontetrachloride	1.0	nd		nd	nd	nd	nd
1,1-Dichloropropene	1.0	nd		nd	nd	nd	nd
Benzene	1.0	nd	80%	nd	nd	nd	nd
1,2-Dichloroethane(EDC)	1.0	nd		nd	nd	nd	nd
Trichloroethene	1.0	nd	104%	nd	nd	nd	nd
1,2-Dichloropropane	1.0	nd		nd	nd	nd	nd
Dibromomethane	1.0	nd		nd	nd	nd	nd
Bromodichloromethane	1.0	nd		nd	nd	nd	nd
cis-1,3-Dichloropropene	1.0	nd		nd	nd	nd	nd
Toluene	1.0	nd	101%	nd	nd	nd	nd
trans-1,3-Dichloropropene	1.0	nd		nd	nd	nd	nd
1,1,2-Trichloroethane	1.0	nd		nd	nd	nd	nd
Tetrachloroethene	1.0	nd		nd	nd	nd	nd
1,3-Dichloropropane	1.0	nd		nd	nd	nd	nd
Dibromochloromethane	1.0	nd		nd	nd	nd	nd
1,2-Dibromoethane (EDB)*	0.01	nd		nd	nd	nd	nd
Chlorobenzene	1.0	nd	109%	nd	nd	nd	nd
1,1,1,2-Tetrachloroethane	1.0	nd		nd	nd	nd	nd
Ethylbenzene	1.0	nd		nd	nd	nd	nd
Xylenes	1.0	nd		nd	nd	nd	nd
Styrene	1.0	nd		nd	nd	nd	nd
Bromoform	1.0	nd		nd	nd	nd	nd
Isopropylbenzene	1.0	nd		nd	nd	nd	nd
1,2,3-Trichloropropane	1.0	nd		nd	nd	nd	nd
Bromobenzene	1.0	nd		nd	nd	nd	nd

AAL Job Number:	A51230-2
Client:	Kleinfelder, Inc.
Project Manager:	Dennis O'Neill
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Client Project Number:	64339
Date received:	12/30/05

Analytical Results

8260B, µg/L		MTH BLK	LCS	SH-5	SH-7	SH-10	SH-11
Matrix	Water	Water	Water	Water	Water	Water	Water
Date analyzed	Reporting Limits	12/30/05	12/30/05	12/30/05	12/30/05	12/30/05	12/30/05
1,1,2,2-Tetrachloroethane	1.0	nd		nd	nd	nd	nd
n-Propylbenzene	1.0	nd		nd	nd	nd	nd
2-Chlorotoluene	1.0	nd		nd	nd	nd	nd
4-Chlorotoluene	1.0	nd		nd	nd	nd	nd
1,3,5-Trimethylbenzene	1.0	nd		nd	nd	nd	nd
tert-Butylbenzene	1.0	nd		nd	nd	nd	nd
1,2,4-Trimethylbenzene	1.0	nd		nd	nd	nd	nd
sec-Butylbenzene	1.0	nd		nd	nd	nd	nd
1,3-Dichlorobenzene	1.0	nd		nd	nd	nd	nd
Isopropyltoluene	1.0	nd		nd	nd	nd	nd
1,4-Dichlorobenzene	1.0	nd		nd	nd	nd	nd
1,2-Dichlorobenzene	1.0	nd		nd	nd	nd	nd
n-Butylbenzene	1.0	nd		nd	nd	nd	nd
1,2-Dibromo-3-Chloropropan	1.0	nd		nd	nd	nd	nd
1,2,4-Trichlorobenzene	1.0	nd		nd	nd	nd	nd
Hexachloro-1,3-butadiene	1.0	nd		nd	nd	nd	nd
Naphthalene	1.0	nd		nd	nd	nd	nd
1,2,3-Trichlorobenzene	1.0	nd		nd	nd	nd	nd
*-instrument detection limits							
Surrogate recoveries							
Dibromofluoromethane		90%	82%	87%	80%	83%	83%
Toluene-d8		105%	121%	104%	104%	101%	102%
1,2-Dichloroethane-d4		98%	79%	92%	77%	94%	94%
4-Bromofluorobenzene		94%	93%	93%	89%	91%	94%

Data Qualifiers and Analytical Comments

nd - not detected at listed reporting limits

Acceptable Recovery limits: 70% TO 130%

Acceptable RPD limit: 30%

AAL Job Number: A51230-2
Client: Kleinfelder, Inc.
Project Manager: Dennis O'Neill
Client Project Name: Shelton
Client Project Number: 64339
Date received: 12/30/05

Analytical Results				MS	MSD	RPD
8260B, µg/L		**MTH BLK**	**SH-12**	**SH-12**	**SH-12**	**SH-12**
Matrix	Water	Water	Water	Water	Water	Water
Date analyzed	Reporting Limits	12/30/05	12/30/05	12/30/05	12/30/05	12/30/05
Dichlorodifluoromethane	1.0	nd	nd			
Chloromethane	1.0	nd	nd			
Vinyl chloride(*)	0.2	nd	nd			
Bromomethane	1.0	nd	nd			
Chloroethane	1.0	nd	nd			
Trichlorofluoromethane	1.0	nd	nd			
1,1-Dichloroethene	1.0	nd	nd			
Methylene chloride	1.0	nd	nd			
trans-1,2-Dichloroethene	1.0	nd	nd			
1,1-Dichloroethane	1.0	nd	nd			
2,2-Dichloropropane	1.0	nd	nd			
cis-1,2-Dichloroethene	1.0	nd	nd			
Chloroform	1.0	nd	nd			
1,1,1-Trichloroethane	1.0	nd	nd			
Carbontetrachloride	1.0	nd	nd			
1,1-Dichloropropene	1.0	nd	nd			
Benzene	1.0	nd	nd	91%	73%	23%
1,2-Dichloroethane(EDC)	1.0	nd	nd			
Trichloroethene	1.0	nd	nd	92%	98%	7%
1,2-Dichloropropane	1.0	nd	nd			
Dibromomethane	1.0	nd	nd			
Bromodichloromethane	1.0	nd	nd			
cis-1,3-Dichloropropene	1.0	nd	nd			
Toluene	1.0	nd	nd	92%	97%	6%
trans-1,3-Dichloropropene	1.0	nd	nd			
1,1,2-Trichloroethane	1.0	nd	nd			
Tetrachloroethene	1.0	nd	nd			
1,3-Dichloropropane	1.0	nd	nd			
Dibromochloromethane	1.0	nd	nd			
1,2-Dibromoethane (EDB)*	0.01	nd	nd			
Chlorobenzene	1.0	nd	nd	90%	103%	14%
1,1,1,2-Tetrachloroethane	1.0	nd	nd			
Ethylbenzene	1.0	nd	nd			
Xylenes	1.0	nd	nd			
Styrene	1.0	nd	nd			
Bromoform	1.0	nd	nd			
Isopropylbenzene	1.0	nd	nd			
1,2,3-Trichloropropane	1.0	nd	nd			
Bromobenzene	1.0	nd	nd			

AAL Job Number:	A51230-2
Client:	Kleinfelder, Inc.
Project Manager:	Dennis O'Neill
Client Project Name:	Shelton
Client Project Number:	64339
Date received:	12/30/05

Analytical Results				MS	MSD	RPD
8260B, µg/L		**MTH BLK**	**SH-12**	**SH-12**	**SH-12**	**SH-12**
Matrix	Water	Water	Water	Water	Water	Water
Date analyzed	Reporting Limits	12/30/05	12/30/05	12/30/05	12/30/05	12/30/05
1,1,2,2-Tetrachloroethane	1.0	nd	nd			
n-Propylbenzene	1.0	nd	nd			
2-Chlorotoluene	1.0	nd	nd			
4-Chlorotoluene	1.0	nd	nd			
1,3,5-Trimethylbenzene	1.0	nd	nd			
tert-Butylbenzene	1.0	nd	nd			
1,2,4-Trimethylbenzene	1.0	nd	nd			
sec-Butylbenzene	1.0	nd	nd			
1,3-Dichlorobenzene	1.0	nd	nd			
Isopropyltoluene	1.0	nd	nd			
1,4-Dichlorobenzene	1.0	nd	nd			
1,2-Dichlorobenzene	1.0	nd	nd			
n-Butylbenzene	1.0	nd	nd			
1,2-Dibromo-3-Chloropropan	1.0	nd	nd			
1,2,4-Trichlorobenzene	1.0	nd	nd			
Hexachloro-1,3-butadiene	1.0	nd	nd			
Naphthalene	1.0	nd	nd			
1,2,3-Trichlorobenzene	1.0	nd	nd			
*-instrument detection limits						
Surrogate recoveries						
Dibromofluoromethane		90%	79%	92%	83%	
Toluene-d8		105%	102%	105%	104%	
1,2-Dichloroethane-d4		98%	94%	82%	87%	
4-Bromofluorobenzene		94%	92%	98%	94%	

Data Qualifiers and Analytical Comments

nd - not detected at listed reporting limits

Acceptable Recovery limits: 70% TO 130%

Acceptable RPD limit: 30%

Advanced Analytical Laboratory
(425) 497-0110, fax (425) 497-8089

AAL Job Number:	A51230-2
Client:	Kleinfelder, Inc.
Project Manager:	Dennis O'Neill
Client Project Name:	Shelton
Client Project Number:	64339
Date received:	12/30/05

Analytical Results						MS	MSD
8270, mg/kg		MTH BLK	LCS	MW-11	MW-12	MW-12	MW-12
Matrix	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Date extracted	Reporting	01/03/06	01/03/06	01/03/06	01/03/06	01/03/06	01/03/06
Date analyzed	Limits	01/03/06	01/03/06	01/03/06	01/03/06	01/03/06	01/03/06
Phenol	0.50	nd		nd	nd		
2-Chlorophenol	0.50	nd		nd	nd		
1,3-Dichlorobenzene	0.10	nd	88%	nd	nd	78%	82%
1,4-Dichlorobenzene	0.10	nd	103%	nd	nd	94%	93%
1,2-Dichlorobenzene	0.10	nd		nd	nd		
2-Methylphenol (o-cresol)	0.10	nd		nd	nd		
3,4-Methylphenol (m,p-cresol)	0.10	nd		nd	nd		
Hexachloroethane	0.10	nd		nd	nd		
2-Nitrophenol	0.50	nd		nd	nd		
2,4-Dimethylphenol	0.50	nd		nd	nd		
Bis (2-chloroethoxy) methane	0.10	nd		nd	nd		
2,4-Dichlorophenol	0.50	nd		nd	nd		
1,2,4-Trichlorobenzene	0.10	nd		nd	nd		
Naphthalene	0.10	nd		nd	nd		
2,6-Dichlorophenol	0.50	nd		nd	nd		
Hexachlorobutadiene	0.50	nd	104%	nd	nd	103%	100%
4-Chloro-3-methylphenol	0.50	nd		nd	nd		
Hexachlorocyclopentadiene	0.10	nd		nd	nd		
2,4,6-Trichlorophenol	0.50	nd		nd	nd		
2,4,5-Trichlorophenol	0.50	nd		nd	nd		
2-Chloronaphthalene	0.10	nd		nd	nd		
Dimethylphthalate	0.10	nd		nd	nd		
Acenaphthylene	0.10	nd		nd	nd		
Acenaphthene	0.10	nd	100%	nd	nd	100%	94%
2,4-Dinitrophenol	0.50	nd		nd	nd		
4-Nitrophenol	0.50	nd		nd	nd		
2,3,4,6-Tetrachlorophenol	0.10	nd		nd	nd		
Diethylphthalate	0.10	nd		nd	nd		
4-Chlorophenylphenylether	0.50	nd		nd	nd		
Fluorene	0.10	nd		nd	nd		
N-Nitrosodiphenylamine	0.10	nd	75%	nd	nd	70%	70%
2,4,6-Tribromophenol	0.50	nd		nd	nd		
4-Bromophenylphenylether	0.10	nd		nd	nd		
Hexachlorobenzene	0.10	nd		nd	nd		
Pentachlorophenol	0.50	nd		nd	nd		
Phenanthrene	0.10	nd		nd	nd		
Anthracene	0.10	nd		nd	nd		
Di-n-butylphthalate	0.10	nd		nd	nd		

AAL Job Number:	A51230-2
Client:	Kleinfelder, Inc.
Project Manager:	Dennis O'Neill
Client Project Name:	Shelton
Client Project Number:	64339
Date received:	12/30/05

Analytical Results						MS	MSD
8270, mg/kg		**MTH BLK**	**LCS**	**MW-11**	**MW-12**	**MW-12**	**MW-12**
Matrix	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Date extracted	Reporting	01/03/06	01/03/06	01/03/06	01/03/06	01/03/06	01/03/06
Date analyzed	Limits	01/03/06	01/03/06	01/03/06	01/03/06	01/03/06	01/03/06
Fluoranthene	0.10	nd	100%	nd	nd	90%	86%
Pyrene	0.10	nd		nd	nd		
Butylbenzylphthalate	0.50	nd		nd	nd		
Benzo(a)anthracene	0.10	nd		nd	nd		
Chrysene	0.10	nd		nd	nd		
Bis (2-ethylhexyl) ether	0.10	nd		nd	nd		
Di-n-octylphthalate	0.50	nd	104%	nd	nd	130%	104%
Benzo(b)fluoranthene	0.10	nd		nd	nd		
Benzo(k)fluoranthene	0.10	nd		nd	nd		
Benzo(a)pyrene	0.10	nd	109%	nd	nd	120%	130%
Indeno(1,2,3-cd)pyrene	0.10	nd		nd	nd		
Dibenzo(a,h)anthracene	0.10	nd		nd	nd		
Benzo(ghi)perylene	0.10	nd		nd	nd		

Surrogate recoveries						
2-Fluorophenol	95%	103%	114%	104%	83%	96%
Phenol-d6	97%	107%	111%	99%	87%	93%
Nitrobenzene-d5	76%	83%	88%	82%	90%	86%
2-Fluorobiphenyl	105%	126%	116%	118%	130%	126%
4-Terphenyl-d14	83%	118%	78%	86%	84%	90%

Data Qualifiers and Analytical Comments

nd - not detected at listed reporting limits

Acceptable Recovery limits: 70% TO 130%

Acceptable RPD limit: 30%

AAL Job Number:	A51230-2
Client:	Kleinfelder, Inc.
Project Manager:	Dennis O'Neill
Client Project Name:	Shelton
Client Project Number:	64339
Date received:	12/30/05

Analytical Results			RPD
8270, mg/kg		MTH BLK	MW-12
Matrix	Soil	Soil	Soil
Date extracted	Reporting	01/03/06	01/03/06
Date analyzed	Limits	01/03/06	01/03/06
Phenol	0.50	nd	
2-Chlorophenol	0.50	nd	
1,3-Dichlorobenzene	0.10	nd	4%
1,4-Dichlorobenzene	0.10	nd	1%
1,2-Dichlorobenzene	0.10	nd	
2-Methylphenol (o-cresol)	0.10	nd	
3,4-Methylphenol (m,p-cresol)	0.10	nd	
Hexachloroethane	0.10	nd	
2-Nitrophenol	0.50	nd	
2,4-Dimethylphenol	0.50	nd	
Bis (2-chloroethoxy) methane	0.10	nd	
2,4-Dichlorophenol	0.50	nd	
1,2,4-Trichlorobenzene	0.10	nd	
Naphthalene	0.10	nd	
2,6-Dichlorophenol	0.50	nd	
Hexachlorobutadiene	0.50	nd	3%
4-Chloro-3-methylphenol	0.50	nd	
Hexachlorocyclopentadiene	0.10	nd	
2,4,6-Trichlorophenol	0.50	nd	
2,4,5-Trichlorophenol	0.50	nd	
2-Chloronaphthalene	0.10	nd	
Dimethylphthalate	0.10	nd	
Acenaphthylene	0.10	nd	
Acenaphthene	0.10	nd	6%
2,4-Dinitrophenol	0.50	nd	
4-Nitrophenol	0.50	nd	
2,3,4,6-Tetrachlorophenol	0.10	nd	
Diethylphthalate	0.10	nd	
4-Chlorophenylphenylether	0.50	nd	
Fluorene	0.10	nd	
N-Nitrosodiphenylamine	0.10	nd	0%
2,4,6-Tribromophenol	0.50	nd	
4-Bromophenylphenylether	0.10	nd	
Hexachlorobenzene	0.10	nd	
Pentachlorophenol	0.50	nd	
Phenanthrene	0.10	nd	
Anthracene	0.10	nd	
Di-n-butylphthalate	0.10	nd	

AAL Job Number:	A51230-2
Client:	Kleinfelder, Inc.
Project Manager:	Dennis O'Neill
Client Project Name:	Shelton
Client Project Number:	64339
Date received:	12/30/05

Analytical Results			RPD
8270, mg/kg		MTH BLK	MW-12
Matrix	Soil	Soil	Soil
Date extracted	Reporting	01/03/06	01/03/06
Date analyzed	Limits	01/03/06	01/03/06
Fluoranthene	0.10	nd	5%
Pyrene	0.10	nd	
Butylbenzylphthalate	0.50	nd	
Benzo(a)anthracene	0.10	nd	
Chrysene	0.10	nd	
Bis (2-ethylhexyl) ether	0.10	nd	
Di-n-octylphthalate	0.50	nd	22%
Benzo(b)fluoranthene	0.10	nd	
Benzo(k)fluoranthene	0.10	nd	
Benzo(a)pyrene	0.10	nd	8%
Indeno(1,2,3-cd)pyrene	0.10	nd	
Dibenzo(a,h)anthracene	0.10	nd	
Benzo(ghi)perylene	0.10	nd	

Surrogate recoveries		
2-Fluorophenol	95%	
Phenol-d6	97%	
Nitrobenzene-d5	76%	
2-Fluorobiphenyl	105%	
4-Terphenyl-d14	83%	

Data Qualifiers and Analytical Comments

nd - not detected at listed reporting limits

Acceptable Recovery limits: 70% TO 130%

Acceptable RPD limit: 30%

AAL Job Number:	A51230-2
Client:	Kleinfelder, Inc.
Project Manager:	Dennis O'Neill
Client Project Name:	Shelton
Client Project Number:	64339
Date received:	12/30/05

Analytical Results

8270, µg/L		MTH BLK	LCS	SH-5	SH-7	SH-10	SH-11
Matrix	Water	Water	Water	Water	Water	Water	Water
Date extracted	Reporting	01/03/06	01/03/06	01/03/06	01/03/06	01/03/06	01/03/06
Date analyzed	Limits	01/03/06	01/03/06	01/03/06	01/03/06	01/03/06	01/03/06
Penatchloroethane	2.0	nd		nd	nd	nd	nd
Phenol	2.0	nd		nd	nd	nd	nd
2-Chlorophenol	2.0	nd		nd	nd	nd	nd
Bis (2-chloroethyl) ether	2.0	nd		nd	nd	nd	nd
1,3-Dichlorobenzene	2.0	nd	79%	nd	nd	nd	nd
1,4-Dichlorobenzene	2.0	nd	100%	nd	nd	nd	nd
1,2-Dichlorobenzene	2.0	nd		nd	nd	nd	nd
2-Methylphenol (o-cresol)	2.0	nd		nd	nd	nd	nd
Bis (2-chloroisopropyl) ether	2.0	nd		nd	nd	nd	nd
3,4-Methylphenol (m,p-cresol)	2.0	nd		nd	nd	nd	nd
2-Nitrophenol	10	nd		nd	nd	nd	nd
2,4-Dimethylphenol	10	nd		nd	nd	nd	nd
Bis (2-chloroethoxy) methane	2.0	nd		nd	nd	nd	nd
2,4-Dichlorophenol	10	nd		nd	nd	nd	nd
1,2,4-Trichlorobenzene	2.0	nd		nd	nd	nd	nd
Naphthalene	0.1	nd		nd	nd	nd	nd
2,6-Dichlorophenol	10	nd		nd	nd	nd	nd
Hexachloropropylene	10	nd		nd	nd	nd	nd
Hexachlorobutadiene	10	nd	108%	nd	nd	nd	nd
4-Chloro-3-methylphenol	10	nd		nd	nd	nd	nd
1,2,4,5-Tetrachlorobenzene	2.0	nd		nd	nd	nd	nd
Hexachlorocyclopentadiene	2.0	nd		nd	nd	nd	nd
2,4,6-Trichlorophenol	10	nd		nd	nd	nd	nd
2,4,5-Trichlorophenol	10	nd		nd	nd	nd	nd
2-Chloronaphthalene	2.0	nd		nd	nd	nd	nd
Dimethylphthalate	2.0	nd		nd	nd	nd	nd
Acenaphthylene	0.1	nd		nd	nd	nd	nd
Acenaphthene	0.1	nd	99%	nd	nd	nd	nd
2,4-Dinitrophenol	10	nd		nd	nd	nd	nd
4-Nitrophenol	10	nd		nd	nd	nd	nd
Pentachlorobenzene	2.0	nd		nd	nd	nd	nd
2,3,4,6-Tetrachlorophenol	2.0	nd		nd	nd	nd	nd
Fluorene	0.1	nd		nd	nd	nd	nd
Diethylphthalate	10	nd		nd	nd	nd	nd
4-Chlorophenylphenylether	2.0	nd		nd	nd	nd	nd
N-Nitrosodiphenylamine	2.0	nd	74%	nd	nd	nd	nd
4-Bromophenylphenylether	2.0	nd		nd	nd	nd	nd
Hexachlorobenzene	2.0	nd		nd	nd	nd	nd

AAL Job Number:	A51230-2
Client:	Kleinfelder, Inc.
Project Manager:	Dennis O'Neill
Client Project Name:	Shelton
Client Project Number:	64339
Date received:	12/30/05

Analytical Results

8270, µg/L		**MTH BLK**	**LCS**	**SH-5**	**SH-7**	**SH-10**	**SH-11**
Matrix	Water	Water	Water	Water	Water	Water	Water
Date extracted	Reporting	01/03/06	01/03/06	01/03/06	01/03/06	01/03/06	01/03/06
Date analyzed	Limits	01/03/06	01/03/06	01/03/06	01/03/06	01/03/06	01/03/06
Pentachlorophenol	10	nd		nd	nd	nd	nd
Phenanthrene	0.1	nd		nd	nd	nd	nd
Anthracene	0.1	nd		nd	nd	nd	nd
2-sec-Butyl-4,6-dinitrophenol	10	nd		nd	nd	nd	nd
Di-n-butylphthalate	2.0	nd		nd	nd	nd	nd
Fluoranthene	0.1	nd	88%	nd	nd	nd	nd
Pyrene	0.1	nd		nd	nd	nd	nd
Butylbenzylphthalate	10	nd		nd	nd	nd	nd
Benzo(a)anthracene	2.0	nd		nd	nd	nd	nd
Chrysene	0.1	nd		nd	nd	nd	nd
Bis (2-ethylhexyl) ether	2.0	nd		nd	nd	nd	nd
Di-n-octylphthalate	10	nd	120%	nd	nd	nd	nd
Benzo(b)fluoranthene	0.1	nd		nd	nd	nd	nd
Benzo(k)fluoranthene	0.1	nd		nd	nd	nd	nd
Benzo(a)pyrene	0.1	nd	130%	nd	nd	nd	nd
Dibenzo(a,h)anthracene	0.1	nd		nd	nd	nd	nd
Benzo(ghi)perylene	0.1	nd		nd	nd	nd	nd
Indeno(1,2,3-cd)pyrene	0.1	nd		nd	nd	nd	nd

Surrogate recoveries						
2-Fluorophenol	105%	89%	88%	107%	99%	109%
Phenol-d6	71%	96%	88%	78%	92%	92%
Nitrobenzene-d5	82%	77%	72%	80%	81%	92%
2-Fluorobiphenyl	111%	124%	130%	115%	128%	118%
4-Terphenyl-d14	118%	96%	79%	81%	80%	83%

Data Qualifiers and Analytical Comments

nd - not detected at listed reporting limits

Acceptable Recovery limits: 70% TO 130%

Acceptable RPD limit: 30%

AAL Job Number:	A51230-2
Client:	Kleinfelder, Inc.
Project Manager:	Dennis O'Neill
Client Project Name:	Shelton
Client Project Number:	64339
Date received:	12/30/05

Analytical Results

8270, µg/L		MTH BLK	SH-12
Matrix	Water	Water	Water
Date extracted	Reporting	01/03/06	01/03/06
Date analyzed	Limits	01/03/06	01/03/06
Penatchloroethane	2.0	nd	nd
Phenol	2.0	nd	nd
2-Chlorophenol	2.0	nd	nd
Bis (2-chloroethyl) ether	2.0	nd	nd
1,3-Dichlorobenzene	2.0	nd	nd
1,4-Dichlorobenzene	2.0	nd	nd
1,2-Dichlorobenzene	2.0	nd	nd
2-Methylphenol (o-cresol)	2.0	nd	nd
Bis (2-chloroisopropyl) ether	2.0	nd	nd
3,4-Methylphenol (m,p-cresol)	2.0	nd	nd
2-Nitrophenol	10	nd	nd
2,4-Dimethylphenol	10	nd	nd
Bis (2-chloroethoxy) methane	2.0	nd	nd
2,4-Dichlorophenol	10	nd	nd
1,2,4-Trichlorobenzene	2.0	nd	nd
Naphthalene	0.1	nd	nd
2,6-Dichlorophenol	10	nd	nd
Hexachloropropylene	10	nd	nd
Hexachlorobutadiene	10	nd	nd
4-Chloro-3-methylphenol	10	nd	nd
1,2,4,5-Tetrachlorobenzene	2.0	nd	nd
Hexachlorocyclopentadiene	2.0	nd	nd
2,4,6-Trichlorophenol	10	nd	nd
2,4,5-Trichlorophenol	10	nd	nd
2-Chloronaphthalene	2.0	nd	nd
Dimethylphthalate	2.0	nd	nd
Acenaphthylene	0.1	nd	nd
Acenaphthene	0.1	nd	nd
2,4-Dinitrophenol	10	nd	nd
4-Nitrophenol	10	nd	nd
Pentachlorobenzene	2.0	nd	nd
2,3,4,6-Tetrachlorophenol	2.0	nd	nd
Fluorene	0.1	nd	nd
Diethylphthalate	10	nd	nd
4-Chlorophenylphenylether	2.0	nd	nd
N-Nitrosodiphenylamine	2.0	nd	nd
4-Bromophenylphenylether	2.0	nd	nd
Hexachlorobenzene	2.0	nd	nd

AAL Job Number:	A51230-2
Client:	Kleinfelder, Inc.
Project Manager:	Dennis O'Neill
Client Project Name:	Shelton
Client Project Number:	64339
Date received:	12/30/05

Analytical Results

8270, µg/L		MTH BLK	SH-12
Matrix	Water	Water	Water
Date extracted	Reporting	01/03/06	01/03/06
Date analyzed	Limits	01/03/06	01/03/06
Pentachlorophenol	10	nd	nd
Phenanthrene	0.1	nd	nd
Anthracene	0.1	nd	nd
2-sec-Butyl-4,6-dinitrophenol	10	nd	nd
Di-n-butylphthalate	2.0	nd	nd
Fluoranthene	0.1	nd	nd
Pyrene	0.1	nd	nd
Butylbenzylphthalate	10	nd	nd
Benzo(a)anthracene	2.0	nd	nd
Chrysene	0.1	nd	nd
Bis (2-ethylhexyl) ether	2.0	nd	nd
Di-n-octylphthalate	10	nd	nd
Benzo(b)fluoranthene	0.1	nd	nd
Benzo(k)fluoranthene	0.1	nd	nd
Benzo(a)pyrene	0.1	nd	nd
Dibenzo(a,h)anthracene	0.1	nd	nd
Benzo(ghi)perylene	0.1	nd	nd
Indeno(1,2,3-cd)pyrene	0.1	nd	nd

Surrogate recoveries			
2-Fluorophenol		105%	108%
Phenol-d6		71%	81%
Nitrobenzene-d5		82%	89%
2-Fluorobiphenyl		111%	126%
4-Terphenyl-d14		118%	81%

Data Qualifiers and Analytical Comments

nd - not detected at listed reporting limits

Acceptable Recovery limits: 70% TO 130%

Acceptable RPD limit: 30%

ANALYTICAL

A51230-2

REDMOND, WA 98052
Phone: (425) 497-0110 Fax: (425) 497-8089
e-mail: aachemlab@yahoo.com

Client: Kleinfelder

Project Manager: Denis O'Nail

Address: 2405 140th Ave NE Ste A101 Bellevue WA 98005

Phone: 425 562 4200

Fax: 425 562 4201

Project Name: Shelton

Project Number:

Collector: S. Darst

Date of collection: 12-30-05

	Sample ID	Time	Matrix	Container type	8260 Volatiles	8021B Volatiles	BTEX	BTEX-NWTPH-Gx	NWTPH-Gx	NWTPH-Dx	NWTPH-HCID	8270	8270 PAH	PCB 8082	Pesticides 8081	~~RCRA 8 Metals~~ MTCA5	Lead				Notes, comments	# of containers
1	SH-10	1030	w		✓					✓		✓		✓		✓						5
2	SH-5	1130	w		✓					✓		✓		✓		✓						5
3	SH-12	1230	w		✓					✓		✓		✓		✓						5
4	SH-11	1315	w		✓					✓		✓		✓		✓						5
5	SH-7	1430	w		✓					✓		✓		✓		✓						5
6																						
7																						
8																						
9																						
10																						
11																						
12																						
13																						
14																						
15																						

Relinquished by:	Date/Time	Received by:	Date/Time
Scott Darst	1-3-05/1000		1-3-06
Relinquished by:	Date/Time	Received by:	Date/Time

Sample receipt info:

Total # of containers:

Condition (temp, °C)

Seals (intact?, Y/N)

Comments:

Turnaround time:

Same day ○

24 hr ○

48 hr ○

Standard ☒

AAL Job Number:	A51230-2
Client:	Kleinfelder, Inc.
Project Manager:	Dennis O'Neill
Client Project Name:	Shelton
Client Project Number:	64339
Date received:	12/30/05

Analytical Results					Dupl
NWTPH-Dx, mg/kg		MTH BLK	MW-11	MW-12	MW-12
Matrix	Soil	Soil	Soil	Soil	Soil
Date extracted	Reporting	01/03/06	01/03/06	01/03/06	01/03/06
Date analyzed	Limits	01/03/06	01/03/06	01/03/06	01/03/06
Kerosene/Jet fuel	20	nd	nd	nd	nd
Diesel/Fuel oil	20	nd	nd	nd	nd
Heavy oil	50	nd	nd	nd	nd
Surrogate recoveries:					
Fluorobiphenyl		101%	87%	87%	82%
o-Terphenyl		100%	77%	78%	73%

Data Qualifiers and Analytical Comments

nd - not detected at listed reporting limits
na - not analyzed
C - coelution with sample peaks
M - matrix interference
J - estimated value
Results reported on dry-weight basis
Acceptable Recovery limits: 70% TO 130%
Acceptable RPD limit: 30%

AAL Job Number:	A51230-2
Client:	Kleinfelder, Inc.
Project Manager:	Dennis O'Neill
Client Project Name:	Shelton
Client Project Number:	64339
Date received:	12/30/05

Analytical Results

NWTPH-Dx, mg/l		MTH BLK	SH-5	SH-7	SH-10	SH-11	SH-12	Dupl SH-12
Matrix	Water	Water	Water	Water	Water	Water	Water	Water
Date extracted	Reporting	01/03/06	01/03/06	01/03/06	01/03/06	01/03/06	01/03/06	01/03/06
Date analyzed	Limits	01/03/06	01/03/06	01/03/06	01/03/06	01/03/06	01/03/06	01/03/06
Kerosene/Jet fuel	0.20	nd	nd	nd	nd	nd	nd	nd
Diesel/Fuel oil	0.20	nd	nd	nd	nd	nd	nd	nd
Heavy oil	0.50	nd	nd	nd	nd	nd	nd	nd
Surrogate recoveries:								
Fluorobiphenyl		94%	108%	110%	94%	99%	86%	84%
o-Terphenyl		94%	93%	98%	83%	89%	81%	76%

Data Qualifiers and Analytical Comments

nd - not detected at listed reporting limits
na - not analyzed
C - coelution with sample peaks
M - matrix interference
J - estimated value
Acceptable Recovery limits: 70% TO 130%
Acceptable RPD limit: 30%

AAL Job Number:	A51230-2
Client:	Kleinfelder, Inc.
Project Manager:	Dennis O'Neill
Client Project Name:	Shelton
Client Project Number:	64339
Date received:	12/30/05

Analytical Results

Metals Dissolved (7010), mg/l		**MTH BLK**	**LCS**	**SH-5**	**SH-7**	**SH-10**	**SH-11**
Matrix	Water	Water	Water	Water	Water	Water	Water
Date extracted	Reporting	01/03/06	01/03/06	01/03/06	01/03/06	01/03/06	01/03/06
Date analyzed	Limits	01/03/06	01/03/06	01/03/06	01/03/06	01/03/06	01/03/06
Lead (Pb)	0.002	nd	99%	nd	nd	nd	nd
Chromium (Cr)	0.01	nd	103%	nd	nd	nd	0.02
Cadmium (Cd)	0.005	nd	116%	nd	nd	nd	nd
Arsenic (As)	0.005	nd	95%	nd	nd	nd	nd
Mercury (Hg) (7470A)	0.0005	nd	116%	nd	nd	nd	nd

<u>Data Qualifiers and Analytical Comments</u>

nd - not detected at listed reporting limits
na - not analyzed
J - estimated value
Acceptable Recovery limits: 70% TO 130%
Acceptable RPD limit: 30%

AAL Job Number:	A51230-2
Client:	Kleinfelder, Inc.
Project Manager:	Dennis O'Neill
Client Project Name:	Shelton
Client Project Number:	64339
Date received:	12/30/05

Analytical Results

				Dupl
Metals Dissolved (7010), mg/l		**MTH BLK**	**SH-12**	**SH-12**
Matrix	Water	Water	Water	Water
Date extracted	Reporting	01/03/06	01/03/06	01/03/06
Date analyzed	Limits	01/03/06	01/03/06	01/03/06
Lead (Pb)	0.002	nd	nd	nd
Chromium (Cr)	0.01	nd	0.01	0.01
Cadmium (Cd)	0.005	nd	nd	nd
Arsenic (As)	0.005	nd	nd	nd
Mercury (Hg) (7470A)	0.0005	nd	nd	nd

Data Qualifiers and Analytical Comments

nd - not detected at listed reporting limits
na - not analyzed
J - estimated value
Acceptable Recovery limits: 70% TO 130%
Acceptable RPD limit: 30%

AAL Job Number: A51230-2
Client: Kleinfelder, Inc.
Project Manager: Dennis O'Neill
Client Project Name: Shelton
Client Project Number: 64339
Date received: 12/30/05

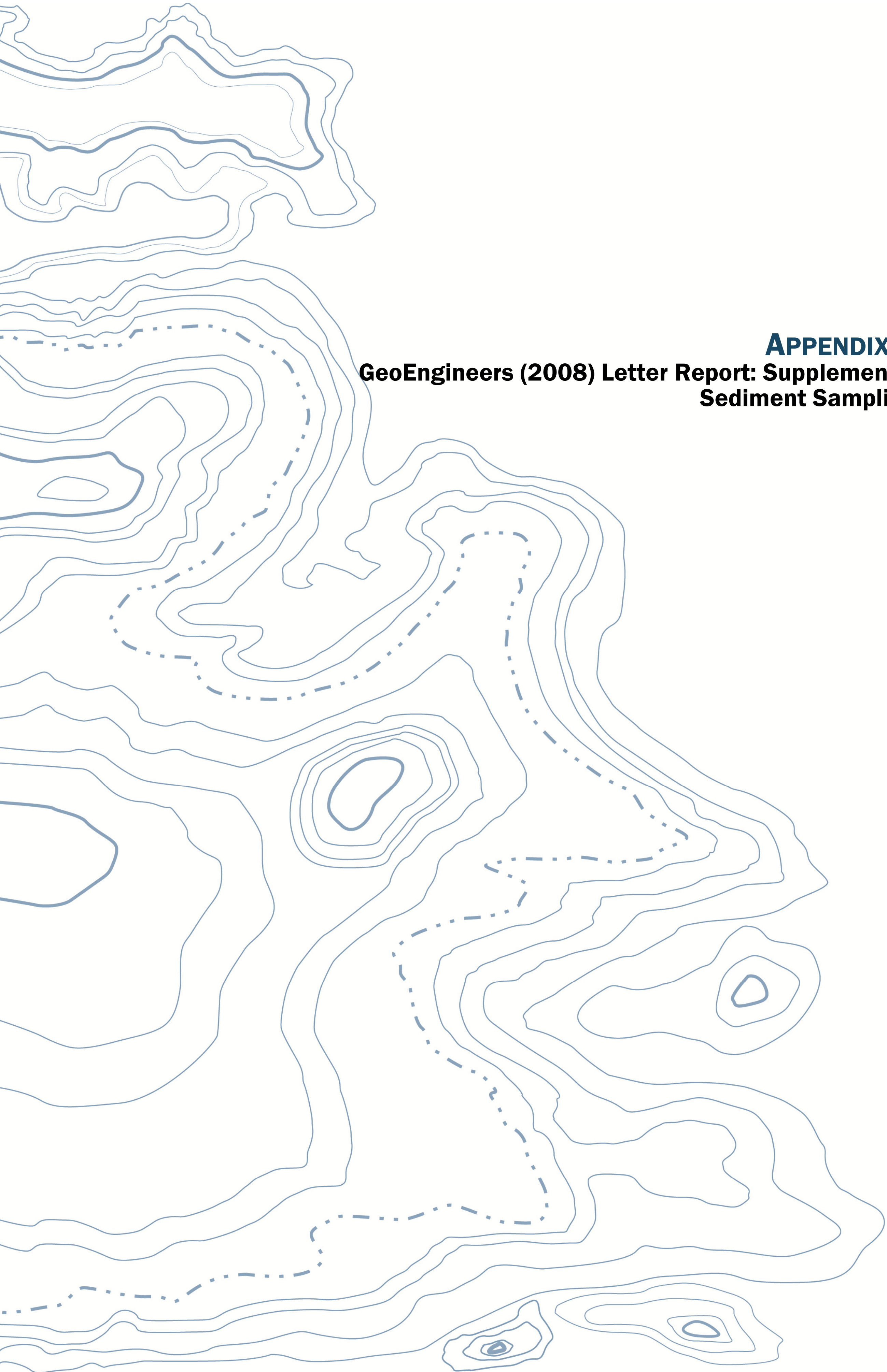
Analytical Results

						Dupl
8082(PCBs), mg/kg		MTH BLK	LCS	MW-11	MW-12	MW-12
Matrix	Soil	Soil	Soil	Soil	Soil	Soil
Date extracted	Reporting	01/03/06	01/03/06	01/03/06	01/03/06	01/03/06
Date analyzed	Limits	01/03/06	01/03/06	01/03/06	01/03/06	01/03/06
A1221	0.20	nd		nd	nd	nd
A1232	0.20	nd		nd	nd	nd
A1242 (A1016)	0.20	nd		nd	nd	nd
A1248	0.20	nd		nd	nd	nd
A1254	0.20	nd		nd	nd	nd
A1260	0.20	nd	98%	nd	nd	nd

Surrogate recoveries:

Tetrachloro-m-xylene		100%	123%	97%	73%	101%
Decachlorobiphenyl		99%	122%	85%	76%	96%

Data Qualifiers and Analytical Comments
nd - not detected at listed reporting limits
na - not analyzed
C - coelution with sample peaks
M - matrix interference
J - estimated value
Results reported on dry-weight basis
Acceptable Recovery limits: 70% TO 130%
Acceptable RPD limit: 30%



APPENDIX D

GeoEngineers (2008) Letter Report: Supplemental Sediment Sampling

GEOENGINEERS

January 14, 2008

Rayonier Inc. Properties, LLC
4470 Savannah Highway
P.O. Box 2070
Jesup, Georgia 31598-2070

Attention: Jack Anderson

Subject: Supplemental Sediment Sampling
Goose Lake Site
Shelton, Washington
File No. 0137-010-06

1.0 INTRODUCTION

GeoEngineers collected sediment samples from Rayonier's Goose Lake site and submitted the samples to Econotech Services Ltd. (Econotech) for microscopic fiber analysis. The sediment samples were collected in general accordance with GeoEngineers' task order dated October 24, 2007. The site is located at 200 West Wallace Kneeland Boulevard, about 0.3 mile west of Shelton, Washington. The site and surrounding features are shown in Figure 1.

Previous studies identified the presence of two visually distinct sediment horizons in Goose Lake. The shallowest horizon is approximately 3 to 6 centimeters thick and consists of black organic silt. Sediment beneath the surficial horizon is generally brown and contains fibrous organic matter. The brown fibrous sediment horizon was the target of sampling activities described in this letter.

2.0 SCOPE OF SERVICES

GeoEngineers' collected representative samples of the brown fibrous sediment horizon at five locations in Goose Lake. These samples were submitted to Econotech for microscopic fiber analysis. The purpose of Econotech's analysis was to assess whether the brown fibrous sediment in Goose Lake originated from the deposition of native organic debris, or the discharge of pulp fiber materials from Rayonier's former pulp mill. Our specific scope of services included the following tasks:

1. Complete site reconnaissance to observe the water level in Goose Lake relative to viable sampling techniques.
2. Research equipment and procedures to obtain samples of the brown fibrous sediment horizon in the lake.
3. Complete a health and safety plan for use by GeoEngineers employees during sampling activities.
4. Mobilize a boat and sampling equipment to the site and collect sediment samples from five locations. Place each sample in an 8-ounce laboratory-prepared jar.
5. Document sampling locations using global positioning system (GPS) technology accurate to approximately 15 feet.
6. Arrange for transport of the samples to Econotech for microscopic fiber analysis.

3.0 SAMPLING PROCEDURES

Five (5) sediment samples (SED-13 through SED-17) were obtained from Goose Lake on November 20, 2007. Sampling locations were selected along a westerly transect beginning near the south end of the landfill. The spacing between these coring stations was approximately 200 feet. Sample locations were documented using a Garmin 60CSX GSP receiver. The depth of water at the coring stations ranged from about 5 to 8 feet. Sediment sampling locations are shown in Figure 2.

Sediment samples were collected from a 12-foot aluminum boat. The samples were collected at each station using a Wildco 2424-series sampler. This sampling device is a stainless steel cylinder approximately 1 inch in diameter. The sampler was driven approximately 18 inches into the sediment at each sampling location. A plastic catcher was used to prevent the sediment sample from falling out of the sampler when it was retrieved.

The sampling device successfully retrieved a core of the brown fibrous sediment at each sampling location. The length of core recovered at each location was less than the total depth of sampler penetration, likely as a result of the compression of the fibrous sediment. Details of the sampling results at each location are summarized in the table below.

Sample Name	Water Depth (feet)	Depth of Sampler Penetration (inches)	Length of Core Recovered (inches)
SED-13	5	24	8
SED-14	5	20	8
SED-15	8	20	10
SED-16	6	16	8
SED-17	6	18	8

The surficial black organic silt, which was not the target of this investigation, was not recovered at any sampling location. The black silt was apparently extruded from the coring device along with lake water. This situation was likely a result of the semi-solid nature of the surficial organic silt, which is known to have a low solids content based on previous studies.

The cores of brown fibrous sediment collected at each location were placed in laboratory-prepared glass jars. Each core was placed in two jars; one of the jars contained the shallower part of the core and the other jar contained the deeper part of the core. Care was taken to minimize physical disturbance of the individual pieces of core. One jar from each sampling location was submitted to Econotech and the other jar was submitted to the Washington State Department of Ecology (Ecology). Alternating samples (shallower versus deeper) from the different coring locations were submitted to Econotech and Ecology.

Sediment samples designated for submittal to Econotech were delivered to Air Truck in Ferndale, Washington, for subsequent transport to Econotech in Delta, British Columbia, Canada. The samples were kept cool and chain-of-custody procedures were followed during transport. Sediment samples were delivered to Lisa Pearson at Ecology via UPS on November 29, 2007.

4.0 MICROSCOPIC FIBER ANALYSIS

Econotech performed a microscopic fiber analysis of the sediment samples submitted by GeoEngineers. A summary of Econotech's findings is presented in a report they prepared dated December 12, 2007. A copy of their report is attached. Their report also includes a summary of their qualifications as an independent laboratory specializing in detailed fiber analysis for the pulp and paper industry.

Please contact us if you have questions regarding the sampling activities described in this letter.

Yours very truly,

GeoEngineers, Inc.

For

Stephen C. Woodward, LG
Principal

Kurt SA

Kurt S. Anderson, LG, LHG
Senior Principal

TNO:SCW:KSA:ja
REDM:/P:\0\0137010\06\Finals\013701006 SED Rpt.doc

Attachments: Econotech Report
Figures 1 and 2

Email

econotech
INTERNATIONAL PULPING TECHNOLOGY

852 Derwent Way
Delta, BC, Canada
V3M 5R1

to	Jack Anderson	*from*	Jodi R. Murphy
company	Rayonier – Jesup GA	*position*	Group Leader
email	Jack.Anderson@rayonier.com	*dept*	Microscopy, Environmental and AOX
date	December 12, 2007	*email*	jodi@econotech.com
subject	Econotech WO #V70322	*tel*	604-526-4221/800-463-5700
pages		*Fax*	www.econotech.com

On November 27,2007, five sediment samples from Goose Lake were received at Econotech for microscopic fiber analysis. The request was to examine the materials for any evidence or identification of wood fibers that might have come from a pulp mill. Each sample consisted of material from core samples taken from the bottom of Goose Lake, collected by GeoEngineers of Redmond Washington on November 20, 2007.

Sample Identification:

- **SED-13**
- **SED-14**
- **SED-15**
- **SED-16**
- **SED-17**

Each sample was examined using a stereomicroscope at 10x and 30x magnifications. The major components of the sample were categorized and %-by-volume was estimated for each category. As needed, representative portions of the material were removed and examined using Polarized Light Microscopy (PLM) at magnifications ranging from 40x to 400x.

The results were as follows, with category descriptions and discussion below:

Sample	wood-related material	non-wood plant material	sediment, dirt
SED-13	10-20%	30-40%	45-55%
SED-14	1-10%	45-55%	40-50%
SED-15	--	40-50%	50-60%
SED-16	1-10%	45-55%	40-50%
SED-17	1-10%	50-60%	35-45%

Category Descriptions:

"wood-related material": any fibers, particles, chunks or other pieces of material identified as being from wood/trees. This included bark and small twig/branch pieces fully intact with bark. This category could include wood chips, individual pulp fibers, wood shives, and any wood rejects commonly found in pulp processing wastewaters.

"non-wood plant material": leaves, roots; also any fibers, particles, chunks or other pieces of material identified as "plant, but not wood." This category consisted mostly of wavy branched strands, like plant roots or moss, and a considerable amount of flat, white, strip-like tubes, approximately 0.5cm wide by 4-8cm long.

"sediment, dirt": moist, fine-textured soil material, mostly very dark-colored.

Discussion: Econotech Services Ltd. has provided independent lab analysis services to the pulp and paper industry for 35 years. Aspects of paper production ranging from pulping and bleaching to paper testing and contaminant identification are areas of Econotech's expertise, including process liquor analysis and environmental testing of effluents. Econotech's Microscopy department offers detailed fiber analysis and species identification of wood, pulps and paper products.

Identifying paper-making fibers, primarily wood but including other cellulose like cotton, etc, is the specialty of the Microscopy department. We routinely analyze wood, pulps and papers and are able to distinguish not only hardwood from softwood but also dozens of species common to North American pulping and also distinguish between various pulp processes. All of this information can come from a single fiber, though most often we work with representative portions of larger samples.

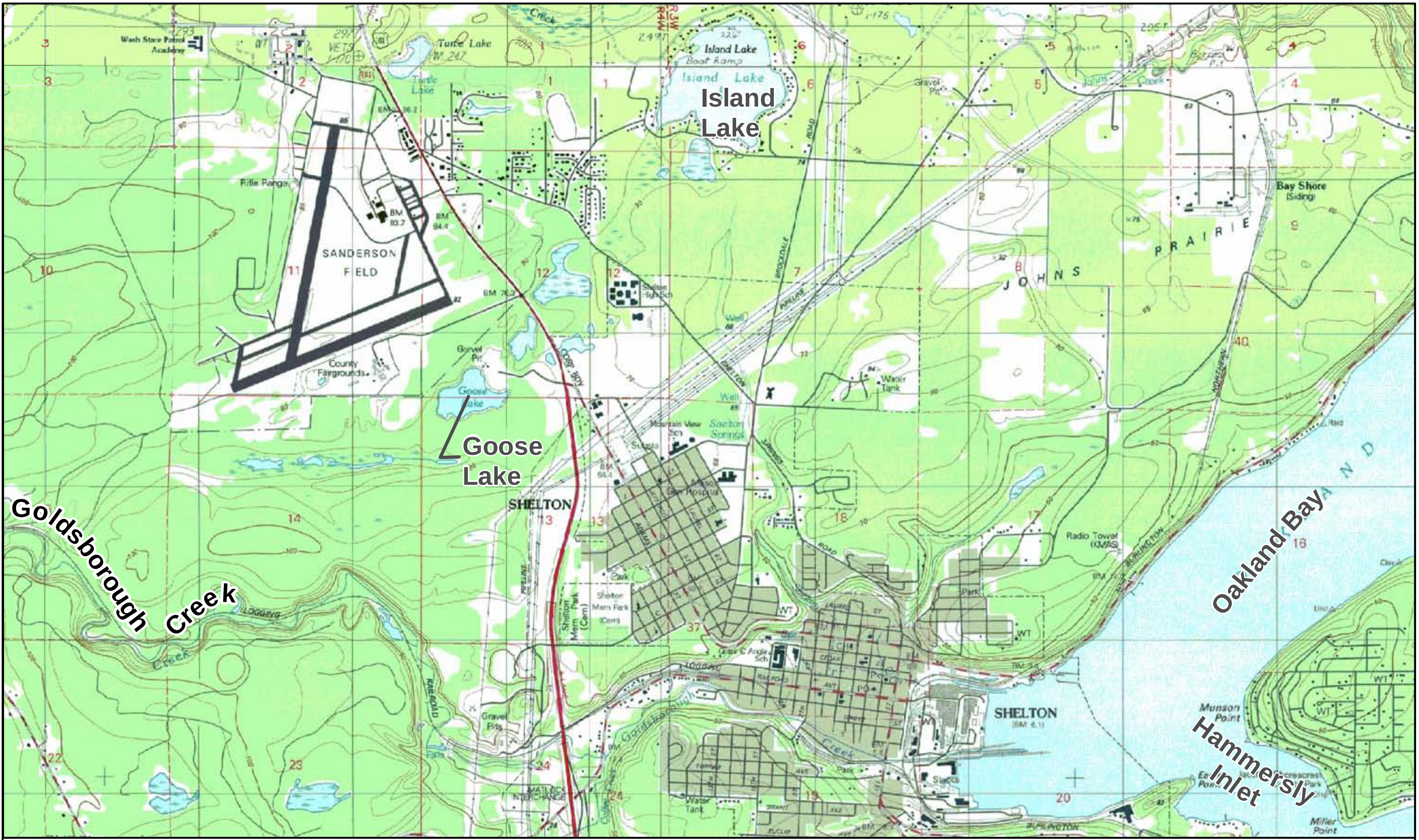
In examining these samples of lake bottom sediment, I observed no evidence of material that I would associate with pulping, paper-making or mill rejects. There was relatively little material in the samples that was identifiable as wood-related. The wood-related material that was observed was composed mostly of branch and twig pieces, short in length but with intact cross-sections including full bark, and pieces of bark. These materials would be removed from trees prior to chipping and pulping, thus would not likely be present in any significant amount in a pulp mill's waste or effluent. In addition, I would expect these materials to be quite common on the bottom of any water body surrounded by trees. Again, I would emphasize the relatively small amount of this material in each sample.

The authority of my opinion extends only to the description and identification of wood and/or pulp materials. I understand it has been charged that a considerable amount of wood material related to operation of a pulp mill was deposited on the lake bottom, but I did not observe this type of material in the samples.

I hope that these results are helpful to you. A final copy will follow by mail. Thank you for having Econotech carry out this work.

Yours truly,

Jodi R. Murphy
Group Leader – Microscopy, Environmental and AOX



Map Revised: February 11, 2004

Path: P:\0\0137010\02\GIS\0137010002vicinitymap.mxd

This map is for information purposes. Data were compiled from multiple sources as listed on this map. The data sources do not guarantee these data are accurate or complete. There may have been updates to the data since the publication of this figure. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication. The locations of all features shown are approximate.

Data Source: Topography from Sure!Maps at scale of 1:24K. Note: contours are shown in 10 meter intervals.

3,000

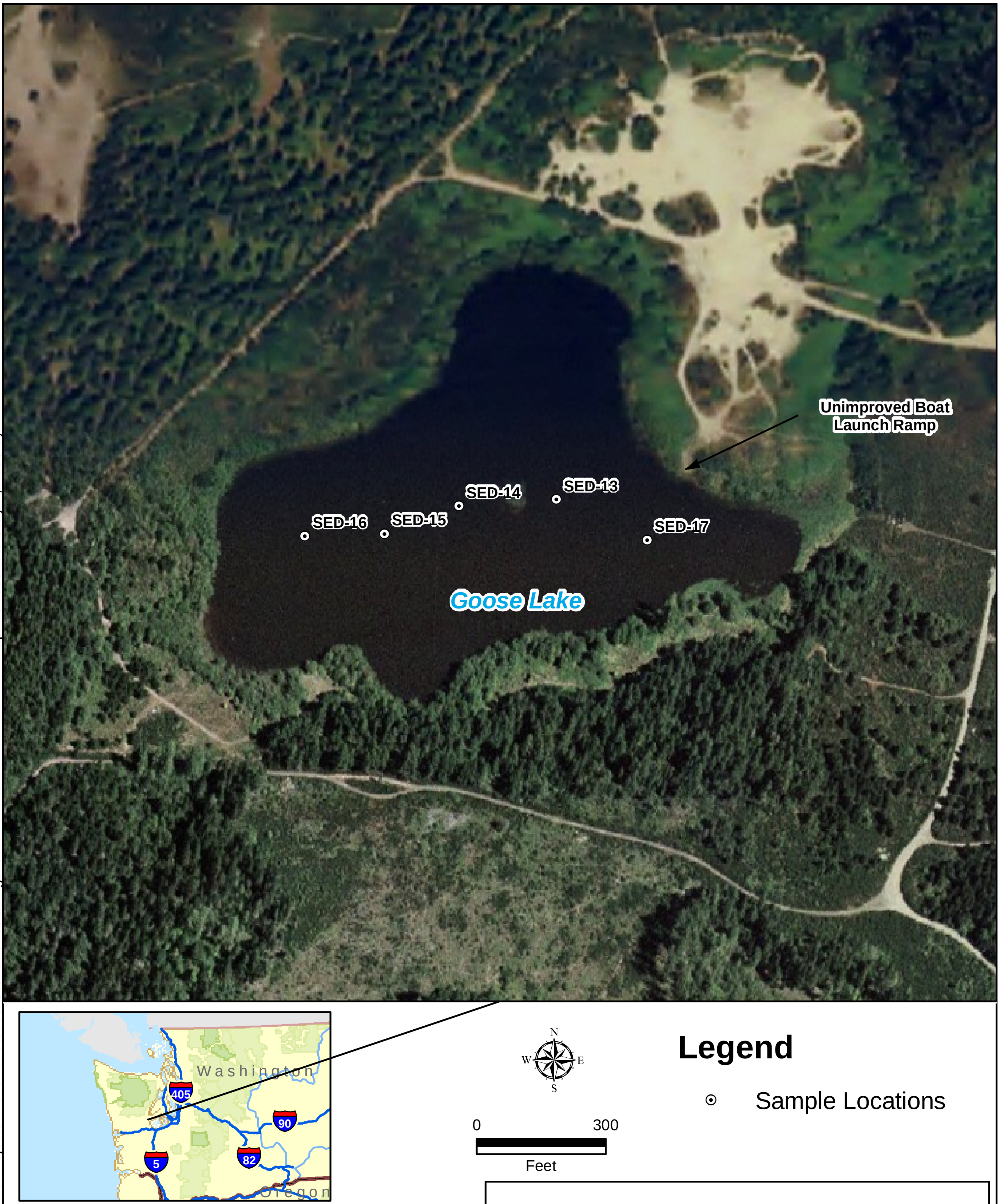
Feet

Lambert Conformal Conic
Washington State Plane South
North American Datum 1983

GEOENGINEERS

SITE VICINITY

FIGURE 1



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.
3. It is unlawful to copy or reproduce all or any part thereof, whether for personal use or resale, without permission.

Data Sources: 2005 NAIP imagery from US Department of Agriculture

Transverse Mercator, Zone 10 N North, North American Datum 1983
North arrow oriented to grid north

Sediment Sampling Location Map

Rayonier Goose Lake Site
Shelton, Washington

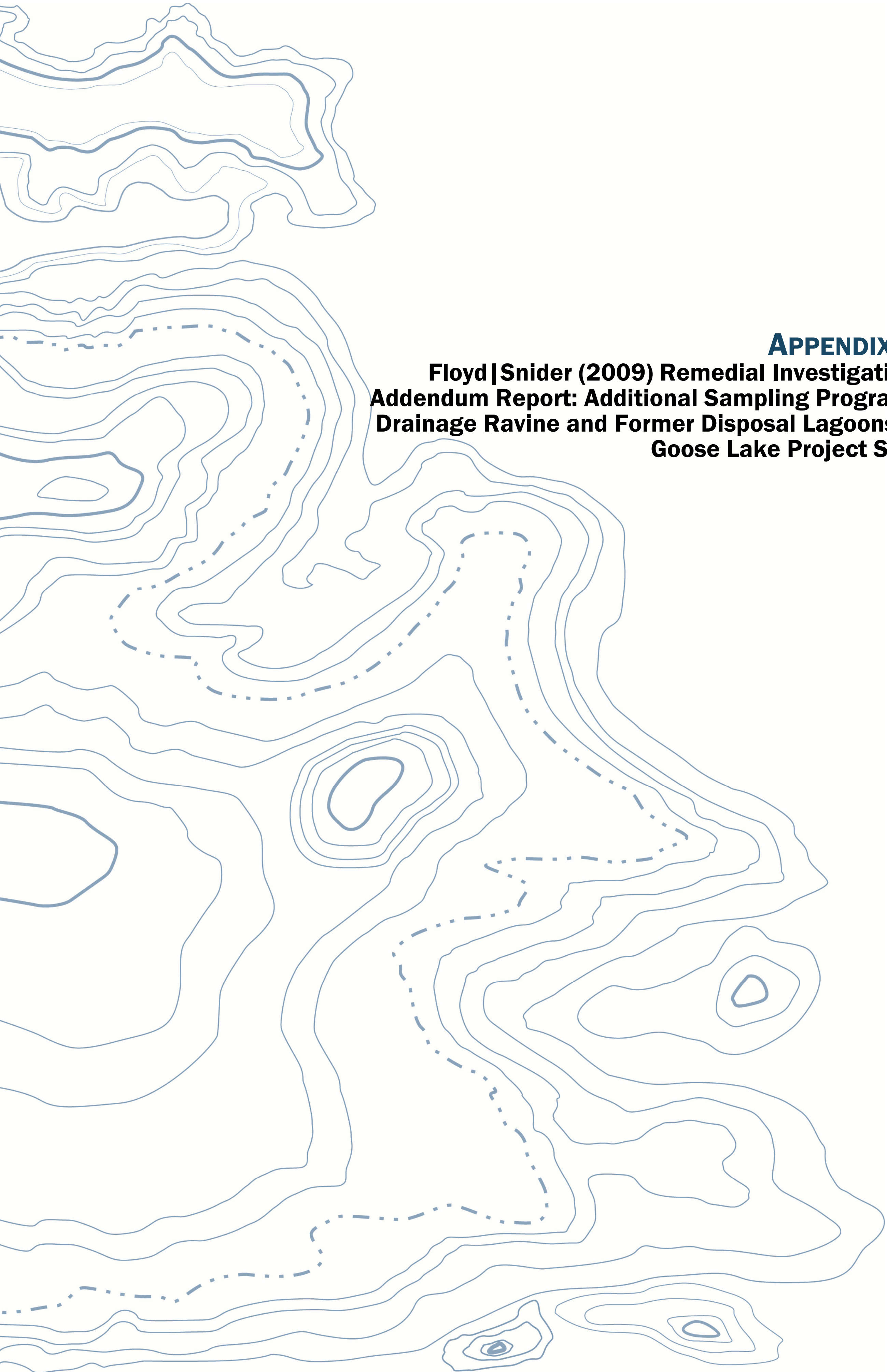
GeoEngineers

Figure 2

Office: SEA Path: W:\Seattle\Projects\0\0137010\06\GIS\013701006 Figure2.mxd Map Revised: January 4, 2008 by EL

APPENDIX E

Floyd|Snider (2009) Remedial Investigation Addendum Report: Additional Sampling Program, Drainage Ravine and Former Disposal Lagoons – Goose Lake Project Site



Goose Lake Project Site

Remedial Investigation Addendum Report

Additional Sampling Program Drainage Ravine and Former Disposal Lagoons

Prepared for

Hall Equities Group
101 Capitol Way
Suite 203
Olympia, Washington 98501

Prepared by

FLOYD | SNIDER
1019 Pacific Avenue
Suite 1020
Tacoma, Washington 98402

January 29, 2009

FINAL

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1.0 INTRODUCTION

This Remedial Investigation (RI) Addendum Report presents the findings of additional site characterization sampling conducted on June 18, 2008 as part of the Goose Lake RI Program. The additional RI sampling focused on collecting soil samples in a portion of the Drainage Ravine, behind check Dam 1, and within the former Disposal Lagoons Area at the Goose Lake Project Site in Shelton, Washington. The additional characterization was conducted per the *Work Plan Addendum Remedial Investigation Sampling and Interim Action, Drainage Ravine and Former Disposal Lagoon Areas at the Goose Lake Project Site* (Kleinfelder 2008). The scope of the additional site characterization presented in this report was developed from conversations between Ms. Lisa Pearson of the Washington State Department of Ecology (Ecology), the Shelton Hills Mixed-use Development Team, Rayonier Properties LLC (Rayonier), the City of Shelton, and information presented in the RI Report titled *Remedial Investigation Report Goose Lake Site, Shelton, Washington* (GeoEngineers and Entrix 2004). The additional site characterization was also designed to meet the scope of work outlined in the Draft Amendment No. 1 to Agreed Order No. DE 99TC-S260 between Rayonier Properties LLC and Shelton Hills Investors, LLC, dated February 2008 (Ecology 2008).

2.0 BACKGROUND

The Goose Lake Project Site is located at 200 West Wallace Kneeland Boulevard, approximately 0.3 miles west of downtown Shelton, Washington (Figure 1). The site encompasses approximately 170 acres. Goose Lake is located in the eastern portion of the site.

The Goose Lake Project Site was used as a receiving area for spent calcium sulfite liquor generated at Rayonier's former pulp mill in Shelton, Washington (Rayonier Shelton Pulp Mill) from 1931 through 1943. The calcium sulfite liquor was discharged to Goose Lake from May 1931 to September 1934. The spent liquor was discharged into disposal lagoons located on the western portion of the site after September 1934.

From 2002 through 2003, a remedial investigation was performed to assess the presence of historical waste material released from the former Rayonier Shelton Pulp Mill operations into the Goose Lake area. The Goose Lake Study Area includes: Goose Lake, an Inactive Landfill, Drainage Ravine, and former Disposal Lagoons area. The approximate locations of these areas are shown on Figure 2. The RI work was conducted as part of an Agreed Order established in 2001 between Ecology, Rayonier, and Peninsula Holdings Company LLC.

As part of the 2002–2003 RI sampling program, shallow soil samples were collected from behind a series of man-made check dams within the Drainage Ravine to assess the potential presence of historical contaminants. The man-made dams appeared to be constructed along the Drainage Ravine to manage overflow from Goose Lake. One soil sample collected from sample location SED-09 within the Drainage Ravine behind Dam 1 contained detected concentrations of polychlorinated biphenyls (PCBs) and polychlorinated dibenzo-p-dioxin and polychlorinated dibenzofuran congeners (dioxins/furans; Figure 3). Based on these results, Ecology requested that additional sampling be performed to characterize the nature and extent of PCBs and dioxins/furans detected in the area encompassing sample location SED-09 within the Drainage Ravine.

Ecology has stated that an interim action is applicable to address the PCBs and dioxins/furans previously detected in the Drainage Ravine. As defined by the Model Toxics Control Act (MTCA) Cleanup Regulations Chapter 173-340 of the Washington Administrative Code (WAC 173-340), an interim action consists of a remedial action that partially addresses the cleanup of a site, is technically necessary to reduce the threat to human health or the environment, and corrects a problem that may have become substantially worse or will cost substantially more if remedial action is delayed (WAC 173-340-430). An interim action may also be a key component of the final cleanup action.

More recent conversations with Ecology representatives indicated the need for additional soil sampling in the former Disposal Lagoons area. Although previous soil and groundwater testing in the former Disposal Lagoons area has not indicated the presence of contaminated soil or groundwater, Ecology requested that a limited number of soil samples be collected and analyzed for PCBs, dioxins/furans, and total sulfides to further assess the potential presence of contaminated soil.

Based upon available information and previous discussions with Ecology, a draft Work Plan was prepared summarizing the additional sampling and analytical program to be conducted in the Drainage Ravine and former Disposal Lagoons area. A draft copy of the Work Plan was provided to Ecology for review and was subsequently approved (Kleinfelder 2008).

3.0 SAMPLING OBJECTIVES AND PROCEDURES

The objective of the additional sampling was to further characterize the presence of PCBs and dioxins/furans detected in the Drainage Ravine, as well as to further assess soils in the former Disposal Lagoons area. The results of the sampling program were also to provide additional data to evaluate and develop an interim action to remove a limited volume of impacted soil from the Drainage Ravine and to assess the potential need for an interim action in the former Disposal Lagoons area. The overall objective is for this information to provide the basis for Ecology to remove the Drainage Ravine and former Disposal Lagoons area from the Goose Lake Project Site and Agreed Order.

To accomplish the project objectives, soil samples were collected in the Drainage Ravine behind Dam 1 and in the eastern portion of the former Disposal Lagoons area. The sampling program consisted of collecting and analyzing six shallow soil samples from the area encompassing sample location SED-09 within the Drainage Ravine to further assess the extent of impacted soils. Additional soil sampling in the former Disposal Lagoons area consisted of excavating six test pits to collect subsurface soil samples for laboratory analysis. The test pits were performed to assess the subsurface soil conditions for evidence of historic liquid waste disposal. Sampling was performed by Dennis O’Neill and Michelle Bethune with Floyd|Snider and Kim Adams and Richard Tine with Hall Equities Group. Lisa Pearson with Ecology also visited the site during the sampling event.

The following sections describe field sample collection activities and sample analyses.

3.1 Drainage Ravine Sampling and Analysis

Additional soil sampling activities were performed on June 18, 2008 in the Drainage Ravine behind Dam 1 to provide data to further assess the presence, extent, and nature of PCBs and dioxins/furans previously detected at sample location SED-09, which had PCBs detected at 0.047 mg/kg and dioxin/furan congeners detected at concentrations ranging from 2.92 pg/g to 767.04 pg/g. Additionally, the results are also used to assess the area that would undergo an interim action.

Six shallow soil samples (SH-DR-01 through SH-DR-06) were collected from the area encompassing sample location SED-09 (Figure 3). Drainage Ravine sample locations were established in relation to the position of SED-09 using a Trimble GPS unit. Three sample locations were established approximately 30 feet north, south, and east of SED-09. The remaining two sample locations were established approximately 100 and 200 feet northeast of SED-09. The sample location coordinates are presented in Table 1.

Soil Sample SH-DR-01 was collected at approximately 1 foot below ground surface (bgs) beneath the previous sample location SED-09 to assess the vertical extent of PCBs and dioxins/furans and to assess the depth of soil removal activities. The sample collected at SED-09 was collected from the surface to approximately 0.4 foot deep. Soil samples north (SH-DR-02), south (SH-DR-03), and east (SH-SD-04) of the previous sample location SED-09 were collected from the surface to approximately 0.5 foot bgs. The two soil samples in the drainage ravine northeast of SED-09 and toward Goose Lake (SH-DR-05 and SH-DR-06) were also collected from the surface to approximately 0.5 foot bgs.

The Drainage Ravine is heavily vegetated and samples were collected only after vegetation, logs, and large boulders were removed. Surface vegetation and other material were removed using a shovel. Then a pre-cleaned stainless steel spoon was used to remove soil from the desired sample depth at each location. The soil was placed in a stainless steel bowl and thoroughly mixed. Sample material was then placed in pre-cleaned glass jars provided by the laboratory. Organic debris and particles larger than 1 inch in diameter were excluded from the material submitted for analysis. Approximately 60 to 70 percent of the soil collected from the sample locations was composed of cobbles ranging from 1 to 5 inches in diameter. No evidence of soil staining or discoloration was observed by field personnel. After the samples were collected they were labeled and placed in a cooler containing ice.

All six soil samples collected from the Drainage Ravine were submitted for PCB analyses. Two samples, SH-DR-01 collected from a depth of approximately 1 foot at the original location of SED-09, and SH-DR-06 collected from approximately 200 feet northeast of SED-09, were analyzed for dioxin/furan congener analyses. Previous analytical results suggested a correlation between the presence of PCBs and dioxins/furans in the Drainage Ravine. Soil Sample SED-09 collected behind Dam 1 from the surface to 0.4 foot bgs contained PCBs at 0.047 mg/kg and dioxin/furan congeners ranging from 2.92 pg/kg to 767.04 pg/kg. Based on this relationship, the sampling approach consisted of testing for PCBs at all sample locations as an indicator of historical contamination and the presence of dioxin/furan concentrations to define the area that would be remediated as part of an interim action.

3.2 Disposal Lagoon Sampling and Analysis

Additional soil sampling activities were performed on June 18, 2008 in the former Disposal Lagoons area to provide data to further assess the presence of PCBs and dioxins/furans, to evaluate sulfide concentrations, and to assess the need for an interim action.

Six test pits (SH-TP-01 through SH-TP-06) were excavated in the former Disposal Lagoons area. The test pit locations were selected based on the former locations of the Disposal Lagoons determined by review of aerial photography. The location of each test pit is shown on Figure 4. The test pit location coordinates are presented in Table 1.

The disposal lagoons were located in an area of vegetated rolling hills. Test pit excavation was initiated by removing surface vegetation using an excavator. Then the excavator dug to a depth of approximately 5 feet bgs. The soil within each test pit was evaluated for the presence of contamination indicative of historical waste disposal activities. No evidence of soil discoloration or staining was observed within the test pits. Therefore, one representative subsurface soil sample was collected from each test pit (SH-TP-01 through SH-TP-06). A pre-cleaned stainless steel spoon was used to remove soil from the desired sample depth at each location. The soil was placed in a stainless steel bowl and thoroughly mixed. Sample material was then placed in pre-cleaned glass jars provided by the laboratory. The samples were labeled and placed in a cooler containing ice.

The soil samples were collected at a depth ranging from approximately 2.5 to 3.0 feet bgs. Samples collected from the former Disposal Lagoons area consisted of sand, gravel, and some areas of silt. Cobble sizes varied from 0.5 to over 7 inches in diameter. Organic debris and particles larger than 1 inch in diameter were excluded from the material submitted for analysis. A field duplicate sample (SH-TP-07) was collected from SH-TP-06 to assess field quality control procedures. After the samples were collected, the test pits were excavated to depths of approximately 14 feet bgs and further observations of soil in each test pit were made. Field observations and descriptions of the soil type were noted on test pit logs. The test pit logs are provided in Appendix A.

It should be noted that a dark layer previously identified during the RI was observed at the surface at test pit locations SH-TP-01 and SH-TP-02. The layer was up to 0.5 inch thick and was composed of burnt wood and charred soil. The dark layer appeared to be associated with previous forestry or land management activities and was thought to be the result of the burning of forest residue associated with ground clearing after harvesting activities.

All soil samples collected from the former Disposal Lagoons area were submitted for PCB, dioxin/furan congener, and sulfide analyses.

3.3 Sample Tracking and Analytical Laboratories

All samples collected as part of the additional sampling in the Drainage Ravine and former Disposal Lagoons area were labeled and tracked in accordance with the procedures specified in the Work Plan (Kleinfelder 2008). As stated above, all samples were labeled in the field and then placed in a cooler with ice to maintain the proper temperature. A Chain-of-Custody Form was completed in the field prior to leaving the site. Chain-of-custody procedures were followed through sample handling and transport.

Sample analyses were performed by laboratories that are accredited by Ecology. PCB and sulfide analyses were performed using U.S. Environmental Protection Agency (USEPA) Method 8082 and USEPA Method 9034, respectively, by Test America Laboratories in Fife, Washington and Nashville, Tennesse. Frontier Analytical Laboratory in California performed the dioxin/furan congener analyses using USEPA Method 8290. The laboratory analytical data reports are presented in Appendix B.

4.0 RESULTS OF SAMPLING AND ANALYSIS

The following sections present the results from the additional sampling performed at the Goose Lake Project Site. Tables 2 and 3 present the analytical results, screening criteria, and reference concentrations for PCB Aroclors, Total PCBS and dioxin/furan congeners for the Drainage Ravine and the former Disposal Lagoons samples, respectively. Table 3 also presents the results of sulfide analyses performed on samples collected from the former Disposal Lagoons area.

Total PCBs are calculated by summing the detected PCB Aroclor concentrations for each sample. Tables 2 and 3 compare Total PCBs to the MTCA Method B criteria provided in Ecology's Cleanup Levels and Risk Calculation (CLARC) database. This represents a concentration that is acceptable for unrestricted land use.

Dioxins/furans are generally present in the environment as a complex mixture of chemical congeners that differ in terms of the number and location of chlorine atoms. The most toxic and best-studied of the dioxin/furan congeners is 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). Because of the need to evaluate the risks associated with a mixture of congeners, the toxicity equivalency factor (TEF) methodology was developed, which assigns a TEF value to each congener that is some fraction of the toxicity of TCDD. The total toxic equivalency (TEQ) of a mixture is the sum of the products of the concentration of each congener in a sample and the TEF value for that congener. Dioxins are unintentionally produced by natural and industrial activities. Natural activities include forest fires or volcanic activity. Industrial processes include incomplete combustion of materials in the presence of chloride, such as burning of fuels, municipal and domestic waste incineration, as well as chlorine bleaching of pulp and paper.

TEQ values are presented in Tables 2 and 3 and were calculated with TEF values for humans and mammals from the 2005 World Health Organization (WHO) TEFs (Van den Berg et al. 2006), and for wildlife the 1998 WHO TEFs (Van den Berg et al. 1998) cited in the Draft Framework for Application of the Toxicity Equivalence Methodology for Polychlorinated Dioxins, Furans and Biphenyls in Ecological Risk Assessment (EPA 2003). For comparison to criteria, Total TEQs were calculated using two methods, first using only the detected dioxin/furan congener results and secondly, using the detected congeners plus one-half the detection limit for non-detected congeners. For wildlife, the same method was used, but Total TEQs were calculated separately for dioxins and furans.

The TEQ results for dioxin/furan analyses are compared to the MTCA Method B criteria, for humans, provided in Ecology's CLARC database, and the Wildlife criteria from MTCA Ecological

Indicator Soil Concentrations for Protection of Terrestrial Plants and Animals, Table 749-3. As stated above, the Method B criteria represent a concentration that is acceptable for unrestricted land use.

Additionally, the TEQ results for dioxin/furan analyses are compared to typical dioxin/furan concentrations identified for forested, open, and urban areas in Western Washington from a screening survey for metals and dioxins in Washington State performed by Ecology (Ecology 1999). The objective of the Ecology screening survey was to provide an initial assessment of typical dioxin concentrations in soils in Washington State. As stated in the report presenting the study results, low levels of dioxin are pervasive in the environment as there are naturally occurring sources as well as industrial sources and long-range transport and deposition of aerial particles from various combustion activities. Ecology sampled soils in forested, open, and urban areas in Western and Eastern Washington to determine if dioxins occur in these areas and at what concentrations. Ranges of TEQS for Western Washington areas are presented in Tables 2 and 3; for this report the TEQs have been recalculated from the original data using the updated 2005 WHO TEFs for detected congeners only.

4.1 Drainage Ravine Results

PCBs were not detected in any of the six soil samples collected from the Drainage Ravine. Samples SH-DR-01 and SH-DR-06 were also analyzed for dioxin/furans. The dioxin/furan calculated TEQ values for protection of human health for samples SH-DR-01 and SH-DR-06, 1.27 pg/g and 5.54 pg/g, respectively, were less than the MTCA Method B standard of 11 pg/g. Additionally the dioxin and furan TEQs calculated for mammalian and avian wildlife protection were less than the MTCA wildlife soil screening levels for sample SH-DR-01 (Table 2). For sample SH-DR-06, the dioxin TEQs calculated for mammalian and avian wildlife protection marginally exceeded the MTCA wildlife soil screening levels by less than a factor of two. The mammalian and avian calculated TEQs were 3.72 pg/g and 3.12 pg/g, respectively, and the MTCA wildlife soil screening levels are 2 pg/g. The furan TEQ calculated for avian protection for sample SH-DR-06 (7.33 pg/g), also exceeded the avian furan MTCA wildlife soil screening level of 2 pg/g.

Sample SH-DR-01, collected from a depth of approximately 1 foot at the location of SED-09, had no detectable PCBs. PCBs were previously detected at 0.047 mg/kg in surface soil (i.e., from the surface to 0.4 feet deep) at SED-09. Previously, the dioxin/furan TEQ for the sample collected from SED-09, calculated using the updated WHO 2005 TEFs was 27.91 pg/g (Table 2). The results for SH-DR-01 identify that the PCBs and higher dioxin/furan concentrations detected in SED-09 are only present in a limited area of surface soil.

As stated above, PCBs were also not detected in the samples collected from SH-DR-02, SH-DR-03, and SH-DR-04, indicating that detectable PCBs and the higher dioxin/furan concentrations detected in SED-09 are only present in a limited area at that location. Additionally, PCBs were not detected in samples collected from SH-DR-05 and SH-DR-06. For sample SH-DR-04 the wildlife/avian summed dioxin and furan TEQs ranged from 1.82 to 7.33 pg/g. The results for samples from SH-DR-05 and SH-DR-06 identify that detectable PCBs and higher dioxin/furan concentrations are not present in the remaining portion of the Drainage Ravine.

As stated above, PCBs were not detected in any of the additional samples collected from the Drainage Ravine. The PCB analytical detection limits were all less than the MTCA Method B criteria (Table 2). The human dioxin/furan TEQ concentrations were also less than the MTCA Method B criteria. Only the concentrations at SH-DR-06 exceeded the MTCA wildlife screening value of 2 pg/g. The dioxin/furan TEQ concentrations found in the Drainage Ravine as part of this supplemental sampling (1.27 and 5.54 pg/g) are within typical background concentrations found in forest and open areas (0.3 to 5.6 pg/g), or urban areas (0.1 to 20 pg/g) (Ecology 1999) of Washington State. The detected concentrations of dioxin/furans in samples SH-DR-01 and SH-DR-06 appear to be associated with naturally occurring sources as the concentrations are within the Washington State reference area ranges and the historical source relationship of PCB and dioxin/furan co-located detections was not observed.

These results suggest that a limited, localized area at SED-09 contains detectable concentrations of PCBs and dioxin TEQ concentrations greater than the MTCA Method B cleanup criteria for unrestricted land use. Therefore, an interim action is proposed to remove the soil surrounding SED-09 so that the soil in the Drainage Ravine meets the MTCA Method B cleanup criteria. The proposed interim action would consist of excavating the soil in an area 25 feet wide by 25 long centered on the original location of SED-09 to a depth of approximately 6 inches. The soil that is excavated would be removed for off-site disposal. The excavated area would be backfilled and planted to restore the interim action area. The interim action would be performed following procedures identified in the Work Plan (Kleinfelder 2008). The Work Plan describing interim action procedures is provided in Appendix C.

4.2 Former Disposal Lagoons Area Results

PCBs were also not detected in any of the samples collected from SH-TP-01 through SH-TP-06 within the former Disposal Lagoons area. All seven samples (including the field duplicate) were also analyzed for dioxin/furans. The dioxin/furan calculated TEQ values for protection of human health ranged from less than 0.01 to 5.13 pg/g, less than the MTCA Method B standard of 11 pg/g. The calculated dioxin TEQs for the protection of mammalian wildlife were greater than the MTCA wildlife soil screening level (2 pg/g) in samples SH-TP-01, SH-TP-05, and SH-TP-07, by less than a factor of two. The calculated dioxin TEQs and furan TEQs for the protection of avian wildlife were also greater than the MTCA wildlife soil screening level (2 pg/g) in samples SH-TP-01, SH-TP-04, SH-TP-05, and SH-TP-07. The avian calculated dioxin TEQs ranged in concentration from less than 0.01 to 3.12 pg/g. While the avian calculated furan TEQs ranged in concentration from 0.13 to 6.33 pg/g.

The PCB analytical detection limits were all less than the MTCA Method B criteria for unrestricted land use. The dioxin TEQ concentrations were also less than the MTCA Method B criteria and MTCA wildlife soil screening levels. Additionally, the dioxin TEQ concentrations in the former Disposal Lagoons are within typical concentrations found in forest, open, and urban areas in Western Washington (Table 3). The detected concentrations of dioxin/furans in appear to be associated with naturally occurring sources as the concentrations are within the Washington State reference area ranges and the historical source relationship of PCB and dioxin/furan co-located detections was not observed.

Total sulfide was detected in two of the six samples submitted for analysis from the Disposal Lagoons. A screening level is not available for comparison to this data.

The detected concentrations of dioxins are within typical concentrations found in forest, open, and urban areas in Western Washington and were not associated with or co-located with PCB detections. Therefore, no remedial actions are warranted based on the results of additional sampling and analysis in the former Disposal Lagoons area.

5.0 QUALITY ASSURANCE AND QUALITY CONTROL

The following sections describe the Quality Assurance/Quality Control (QA/QC) procedures followed during the additional sampling and analyses performed at the Goose Lake Project Site.

5.1 Data Quality Review

A Level IV/Tier III data quality review was performed on the data resulting from laboratory analysis. The analytical data was validated in accordance with the following guidelines:

- USEPA National Functional Guidelines for Chlorinated Dioxin/Furan Data Review (USEPA 2005)
- USEPA C LP National Functional Guidelines for Organic Data Review (USEPA 1999)

The Level IV data quality review included evaluation of all QC elements such as sample preservation, analytical holding times, blank contamination, precision, accuracy, and detection limits, as well as instrument performance and calibration, and evaluation of compound identification and quantitation. Qualifiers were only added to the analytical results of the sulfide data, analyzed using method SW 9030B. The sulfide detections are flagged as estimated with a "J" qualifier because of holding time concern. The analytical method SW 9030B does not specify a holding time for sulfide analysis in soils/sediments. However, in general, the Puget Sound Estuary Program (PSEP)-specified holding time of 7 days is applied to sulfide samples. The sulfide soil samples were analyzed 11 days past the PSEP 7-day holding time. Therefore, the sulfide detections received a "J" qualifier indicating estimated values. No other qualifiers were added to the analytical results based on the data quality review. The data are determined to be of acceptable quality for use, as qualified. A memorandum presenting the results of the data quality review is included in Appendix D and the data provided in Environmental Information Management format are included in Appendix E.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Drainage Ravine

Based on the results of additional sampling and analysis in the Drainage Ravine, a limited, localized area at SED-09 contains detectable concentrations of PCBs and dioxin/furan TEQ concentrations greater than the MTCA Method B cleanup criteria for unrestricted land use. Therefore, an interim action is proposed to remove the soil surrounding SED-09 so that the soil in the Drainage Ravine meets the MTCA Method B cleanup criteria. The interim action would be performed following procedures identified in the Work Plan (Kleinfelder 2008).

6.2 Former Disposal Lagoons Area

Based on the results of additional sampling and analysis in the former Disposal Lagoons area, no remedial actions are warranted because the concentrations of PCBs and dioxin/furans are less than the MTCA Method B cleanup criteria for unrestricted land use and the dioxin/furan TEQ concentrations are within the range of typical concentrations found in forest, open, and urban areas in Western Washington.

With acknowledgement of an interim action to be performed in the drainage ravine area, the information collected provides a solid basis for Ecology to remove the Drainage Ravine and former Disposal Lagoons area from the Goose Lake Site and Agreed Order.

7.0 REFERENCES

GeoEngineers and Entrix. 2004. *Remedial Investigation Report Goose Lake Site, Shelton, Washington*. 19 March.

Kleinfelder. 2008. *Work Plan Addendum Remedial Investigation Sampling and Interim Action, Drainage Ravine and Former Disposal Lagoon and Former Disposal Lagoon Areas at the Goose Lake Project Site.* 11 June.

U.S. Environmental Protection Agency (USEPA). 1999. *USEPA Contract Laboratory Program, National Functional Guidelines for Organic Data Review*. EPA-540/R-99/008. October.

_____. 2003. *External Draft Framework for Application of the Toxicity Equivalence Methodology for Polychlorinated Dioxins, Furans and Biphenyls in Ecological Risk Assessment.* EPA 630/P-03/002A. June.

_____. 2005. *USEPA Analytical Services Branch National Functional Guidelines for Chlorinated Dibenzo-p-Dioxins and Chlorinated Dibenzofurans Data Review*. OSWER 9240.1-51. EPA-540-R-05-001. September.

Van den Berg, M; Birnbaum, L; Denison, M; De Vito, M; Farland, W; Feeley, M; Fiedler, H; Hakansson, H; Hanberg, A; Haws, L; Rose, M; Safe, S; Schrenk, D;Tohyama, C; Tritscher, A; Tuomisto, J; Tysklind, M; Walker, N; and Peterson, RE. 2006. *The 2005 World Health Organization Re-evaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds*. Toxicological Sciences, 93(2):223-41.

Van den Berg, M; Birnbaum, L; Bosveld, ATC; Brunstrom, B; Cook, P; Feeley, M; Giesy, JP; Hanberg, A; Hasegawa, R; Kennedy, SW; Kubiak, T; Larsen, JC; van Leeuwen, FX; Liem, AK; Nolt, C; Peterson, RE; Poellinger, L; Safe, S; Schrenk, D; Tillitt, D; Tysklind, M; Younes, M; Waern, F; Zacharewski, T. (1998) *Toxic Equivalency Factors (TEFs) for PCBs, PCDDs, PCDFs for Humans and Wildlife*. Environ Health Perspect 106(12):775-792.

Washington State Department of Ecology (Ecology). 1999. *Screening Survey for Metals and Dioxins in Fertilizer Products in Soils in Washington State and Appendices*. Publications 99-309 and 99-310. April.

Washington State Department of Ecology (Ecology). 2008. Revised Amendment No. 1 to Agreed Order No. DE 99TC-S260 between Rayonier Properties, LLC and Shelton Hills Investors, LLC. February.

Goose Lake Project Site

Remedial Investigation Addendum Report

Additional Sampling Program
Drainage Ravine and
Former Disposal Lagoons

Tables

FINAL

Table 1
Sample Locations and Coordinates

Additional Sampling Area	Sample Location	Easting (Feet)	Northing (Feet)
Drainage Ravine	SH-DR-01	984069.90	701505.95
	SH-DR-02	984065.16	701555.76
	SH-DR-03	984067.72	701455.97
	SH-DR-04	984119.26	701467.87
	SH-DR-05	984194.18	701590.66
	SH-DR-06	984261.6	701664.60
Former Disposal Lagoons Area	SH-TP-01	983262.55	702266.78
	SH-TP-02	983056.68	702286.83
	SH-TP-03	982792.51	702303.22
	SH-TP-04	983174.79	702644.23
	SH-TP-05	983043.50	702576.85
	SH-TP-06	982857.67	702651.14

Note:

1 Coordinates based on NAD83 Washington State Planes Units of Survey in feet.

2 A field duplicate sample (SH-TP-07) was also collected from sample location SH-TP-06.

Table 2
Drainage Ravine Sample Results

		RI Sample	June 2008 Sample Locations						Screening Criteria		Reference Area Values		
Analyte Group	Analyte	SED-09	SH-DR-01	SH-DR-02	SH-DR-03	SH-DR-04	SH-DR-05	SH-DR-06	MTCA Method B Standard[1]	MTCA Wildlife Soil Screening Levels[2]	Western Washington Forest Areas[3]	Western Washington Open Areas[4]	Western Washington Urban Areas[5]
Polychlorinated Biphenyls (PCBs) mg/kg	PCB-1016	0.042 U	0.011 U	0.012 U	0.012 U	0.012 U	0.012 U	0.014 U					
	PCB-1221	0.084 U	0.011 U	0.012 U	0.012 U	0.012 U	0.012 U	0.014 U					
	PCB-1232	0.042 U	0.011 U	0.012 U	0.012 U	0.012 U	0.012 U	0.014 U					
	PCB-1242	0.042 U	0.011 U	0.012 U	0.012 U	0.012 U	0.012 U	0.014 U					
	PCB-1248	0.042 U	0.011 U	0.012 U	0.012 U	0.012 U	0.012 U	0.014 U					
	PCB-1254	0.42 U	0.011 U	0.012 U	0.012 U	0.012 U	0.012 U	0.014 U					
	PCB-1260	0.047	0.011 U	0.012 U	0.012 U	0.012 U	0.012 U	0.014 U					
	Total PCBs	0.047	0.011 U	0.012 U	0.012 U	0.012 U	0.012 U	0.014 U	0.5	NA	NA	NA	NA
Dioxins pg/g	2,3,7,8-TCDD	2.92	0.232 J	NA	NA	NA	NA	0.918					
	1,2,3,7,8-PeCDD	9.04	0.361 J	NA	NA	NA	NA	1.75 J					
	1,2,3,4,7,8-HxCDD	16.54	0.61 J	NA	NA	NA	NA	1.94 J					
	1,2,3,6,7,8-HxCDD	15.34	1.13 J	NA	NA	NA	NA	3.45					
	1,2,3,7,8,9-HxCDD	43.15	0.938 J	NA	NA	NA	NA	2.87					
	1,2,3,4,6,7,8-HpCDD	161.09	8.43	NA	NA	NA	NA	19.7					
	OCDD	767.04	52.1	NA	NA	NA	NA	111	NA	NA	NA	NA	NA
Furans pg/g	2,3,7,8-TCDF	13.25	0.552	NA	NA	NA	NA	4.32					
	1,2,3,7,8-PeCDF	6.801	0.463 J	NA	NA	NA	NA	2.61					
	2,3,4,7,8-PeCDF	9.66	0.32 J	NA	NA	NA	NA	2.06 J					
	1,2,3,4,7,8-HxCDF	7.77	0.419 J	NA	NA	NA	NA	1.67 J					
	1,2,3,6,7,8-HxCDF	3.6	0.359 J	NA	NA	NA	NA	1.8 J					
	2,3,4,6,7,8-HxCDF	5.19	0.412 J	NA	NA	NA	NA	2.09 J					
	1,2,3,7,8,9-HxCDF	2.5	0.106 U	NA	NA	NA	NA	0.657 J					
	1,2,3,4,6,7,8-HpCDF	22.56	1.88 J	NA	NA	NA	NA	5.96					
	1,2,3,4,7,8,9-HpCDF	2.5	0.25 J	NA	NA	NA	NA	0.595 J					
	OCDF	81.81	4.96 J	NA	NA	NA	NA	14.1	NA	NA	NA	NA	NA
Human Health Dioxin/Furan TEQs pg/g	Summed Dioxin/Furan TEQ[6]	27.9	1.27 J	NA	NA	NA	NA	5.54 J	11	NA	2.05 - 5.61	0.32 - 4.15	0.13 - 19.99
	Summed Dioxin/Furan TEQ with One-Half of the Detection Limits[6]	NA	1.27 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wildlife - Mammalian Dioxin and Furan TEQs pg/g	Summed Mammalian Dioxin TEQ[6]	21.3	0.96 J	NA	NA	NA	NA	**3.72** J	NA	2	NA	NA	NA
	Summed Mammalian Dioxin TEQ with One-Half of the Dectection Limits[6]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Summed Mammalian Furan TEQ[6]	6.61	0.31 J	NA	NA	NA	NA	1.82 J	NA	2	NA	NA	NA
	Summed Mammalian Furan TEQ with One-Half of the Dectection Limits[6]	NA	0.31 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wildlife - Avian Dioxin and Furan TEQs pg/g	Summed Avian Dioxin TEQ[7]	17.5	0.74 J	NA	NA	NA	NA	**3.12** J	NA	2	NA	NA	NA
	Summed Avian Dioxin TEQ with One-Half of the Dectection Limits[7]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Summed Avian Furan TEQ[7]	25.8	1.06 J	NA	NA	NA	NA	**7.33** J	NA	2	NA	NA	NA
	Summed Avian Furan TEQ with One-Half of the Dectection Limits[7]	NA	1.06 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

Bold concentrations indicate values greater than the MTCA Wildlife Soil Screening Levels.

1 MTCA Method B Soil Carcinogen Standard for unrestricted land use (Chapter 173-340 WAC)

2 MTCA Ecological Indicator Soil Concentrations for Protection of Terrestrial Plants and Animals, Table 749-3

3 Typical range of concentrations in soil in Western Washington forest areas (Ecology 1999)

4 Typical range of concentrations in soil in Western Washington open areas (Ecology 1999)

5 Typical range of concentrations in soil in Western Washington urban areas (Ecology 1999)

6 WHO 2005 TEFs (Van den Berg et al. 2005)

Table 3
Disposal Lagoons Sample Results

		June 2008 Sample Locations							Screening Criteria		Reference Area Values		
Analyte Group	**Analyte**	**SH-TP-01**	**SH-TP-02**	**SH-TP-03**	**SH-TP-04**	**SH-TP-05**	**SH-TP-06**	**SH-TP-07[1]**	**MTCA Method B Standard[2]**	**MTCA Wildlife Soil Screening Levels[3]**	**Western Washington Forest Areas[4]**	**Western Washington Open Areas[5]**	**Western Washington Urban Areas[6]**
Sulfides	Total Sulfides	20 UJ	20 UJ	20 UJ	28.0	20 UJ	20 UJ	23.0					
Polychlorinated Biphenyls (PCBs) mg/kg	PCB-1016	0.01 U	0.01 U	0.0099 U	0.0097 U	0.0096 U	0.0098 U	0.01 U					
	PCB-1221	0.01 U	0.01 U	0.0099 U	0.0097 U	0.0096 U	0.0098 U	0.01 U					
	PCB-1232	0.01 U	0.01 U	0.0099 U	0.0097 U	0.0096 U	0.0098 U	0.01 U					
	PCB-1242	0.01 U	0.01 U	0.0099 U	0.0097 U	0.0096 U	0.0098 U	0.01 U					
	PCB-1248	0.01 U	0.01 U	0.0099 U	0.0097 U	0.0096 U	0.0098 U	0.01 U					
	PCB-1254	0.01 U	0.01 U	0.0099 U	0.0097 U	0.0096 U	0.0098 U	0.01 U					
	PCB-1260	0.01 U	0.01 U	0.0099 U	0.0097 U	0.0096 U	0.0098 U	0.01 U					
	Total PCBs	0.01 U	0.01 U	0.0099 U	0.0097 U	0.0096 U	0.0098 U	0.01 U	0.5	NA	NA	NA	NA
Dioxins pg/g	2,3,7,8-TCDD	0.779	0.118 U	0.114 U	0.407 J	1.02	0.0958 U	0.647					
	1,2,3,7,8-PeCDD	1.37 J	0.161 U	0.0879 U	0.582 J	1.74 J	0.773 J	1.16 J					
	1,2,3,4,7,8-HxCDD	1.58 J	0.199 U	0.171 U	0.703 J	1.83 J	0.941 J	1.28 J					
	1,2,3,6,7,8-HxCDD	2.88	0.219 U	0.193 U	1.53 J	2.62	1.55 J	2.39 J					
	1,2,3,7,8,9-HxCDD	2.05 J	0.212 U	0.187 U	0.926 J	2.31 J	1.22 J	1.72 J					
	1,2,3,4,6,7,8-HpCDD	22.5	0.267 U	0.215 U	16.9	7.45	8.25	20.4					
	OCDD	183	1.84	1.25	127	10	71.2	166	NA	NA	NA	NA	NA
Furans pg/g	2,3,7,8-TCDF	3.07	0.0867 U	0.0598 U	1.2	3.69	0.863	2.34					
	1,2,3,7,8-PeCDF	2.57	0.204 U	0.171 U	1.04 J	2.91	1.43 J	2.09 J					
	2,3,4,7,8-PeCDF	1.49 J	0.206 U	0.173 U	0.687 J	1.7 J	1.49 J	1.78 J					
	1,2,3,4,7,8-HxCDF	1.61 J	0.0664 U	0.0393 U	0.75 J	1.68 J	0.816 J	1.31 J					
	1,2,3,6,7,8-HxCDF	1.78 J	0.0706 U	0.0407 U	0.745 J	2 J	1.02 J	1.5 J					
	2,3,4,6,7,8-HxCDF	1.77 J	0.0751 U	0.0458 U	0.837 J	1.94 J	1.02 J	1.46 J					
	1,2,3,7,8,9-HxCDF	0.569 J	0.0949 U	0.0519 U	0.26 J	0.588 J	0.378 J	0.408 J					
	1,2,3,4,6,7,8-HpCDF	10.5	0.0761 U	0.0989 U	10.1	2.5	2.27 J	9.2					
	1,2,3,4,7,8,9-HpCDF	0.876 J	0.0883 U	0.115 U	0.73 J	0.141 J	0.423 J	0.691 J					
	OCDF	38.1	0.318 U	0.289 U	32.3	1.32 J	2.82 J	34.20	NA	NA	NA	NA	NA
Human Health Dioxin/Furans pg/g	Summed Dioxin/Furan TEQ[7]	4.61 J	0.00	0.00	2.25 J	5.13 J	2.18 J	4.01 J	11	NA	2.05 - 5.61	0.32 - 4.15	0.13 - 19.99
	Summed Dioxin/Furan TEQ with One-Half of the Detection Limits[7]	NA	0.23	0.17	NA	NA	2.22 J	NA					
Mammalian Dioxin and Furan TEQs pg/g	Summed Mammalian Dioxin TEQ[7]	**3.08** J	0.00	0.00	1.51 J	**3.51** J	1.25 J	**2.60** J	NA	2	NA	NA	NA
	Summed Mammalian Dioxin TEQ with One-Half of the Dectection Limits[7]	NA	0.17	0.13	NA	NA	1.30 J	NA	NA	NA	NA	NA	NA
	Summed Mammalian Furan TEQ[7]	1.53 J	NA	NA	0.73 J	1.61 J	0.93 J	1.41 J	NA	2	NA	NA	NA
	Summed Mammalian Furan TEQ with One-Half of the Dectection Limits[7]	NA	0.05	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA
Avian Dioxin and Furan TEQs pg/g	Summed Avian Dioxin TEQ[8]	**2.50** J	0.00	0.00	1.16 J	**3.12** J	0.97 J	**2.10** J	NA	2	NA	NA	NA
	Summed Avian Dioxin TEQ with One-Half of the Dectection Limits[8]	NA	0.16	0.12	NA	NA	1.02 J	NA	NA	NA	NA	NA	NA
	Summed Avian Furan TEQ[8]	**5.51** J	NA	NA	2.36 J	**6.33** J	2.85 J	**4.90** J	NA	2	NA	NA	NA
	Summed Avian Furan TEQ with One-Half of the Dectection Limits[8]	NA	0.17	0.13	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

Bold concentrations indicate values greater than the MTCA Wildlife Soil Screening Levels.

1 Sample SH-TP-07 is a field duplicate of sample SH-TP-06.

2 MTCA Method B Soil Carcinogen Standard for unrestricted land use (Chapter 173-340 WAC)

3 MTCA Ecological Indicator Soil Concentrations for Protection of Terrestrial Plants and Animals, Table 749-3

4 Typical range of concentrations in soil in Western Washington forest areas (Ecology 1999)

5 Typical range of concentrations in soil in Western Washington open areas (Ecology 1999)

6 Typical range of concentrations in soil in Western Washington urban areas (Ecology 1999)

7 WHO 2005 TEFs (Van den Berg et al. 2005)

8 EPA 2003 TEFs (EPA/630/P-03/002A)

NA Not applicable

Goose Lake Project Site

Remedial Investigation Addendum Report

Additional Sampling Program
Drainage Ravine and
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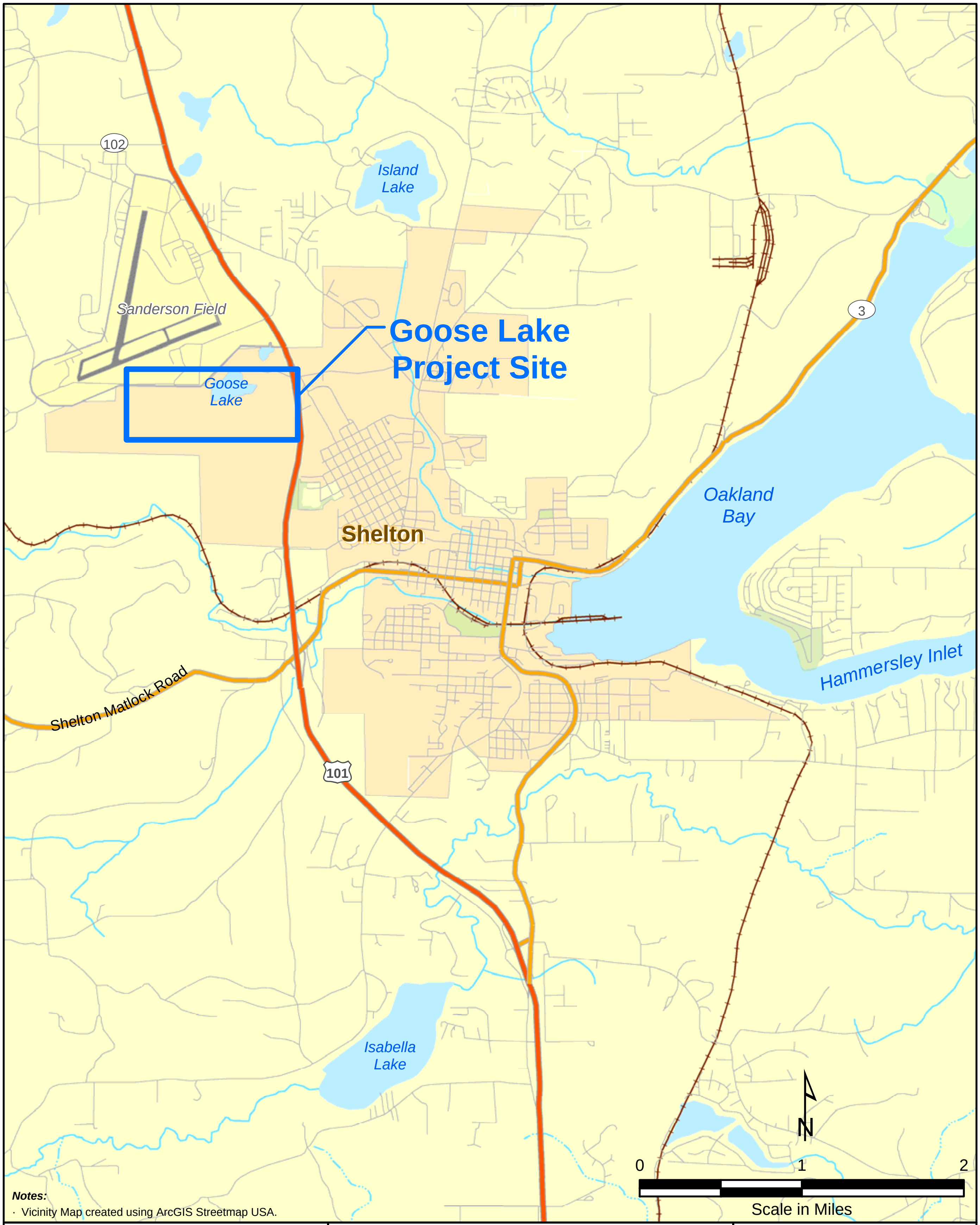
Figures

FINAL



Notes:

- Vicinity Map created using ArcGIS Streetmap USA.

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Remedial Investigation Addendum
Goose Lake Project Site
Shelton, Washington

Figure 1
Vicinity Map

File: F:\projects\Hall-Shelton\GIS\MXD\Figure 1 (Vicinity Map).mxd
7/18/2008 10:35 AM

Notes:

- Orthoimage provided by National Agriculture Imagery Program (NAIP) and dated 2006.
- Approximate study area locations based on those appearing in Exhibit A, Site Boundary of Goose Lake RI/FS Study Areas, Kleinfelder West, Inc., 2007.

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Remedial Investigation Addendum
Goose Lake Project Site
Shelton, Washington

Figure 2
Site Study Areas

File: F:\projects\Hall-Shelton\GIS\MXD\Figure 2 (Shelton Hills Mixed-Use Deveolpment and Goose Lake Project Study Areas).mxd
7/17/2008 2:41 PM

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Remedial Investigation Addendum
Goose Lake Project Site
Shelton, Washington

Figure 3
Additional Drainage Ravine Soil Sample Locations

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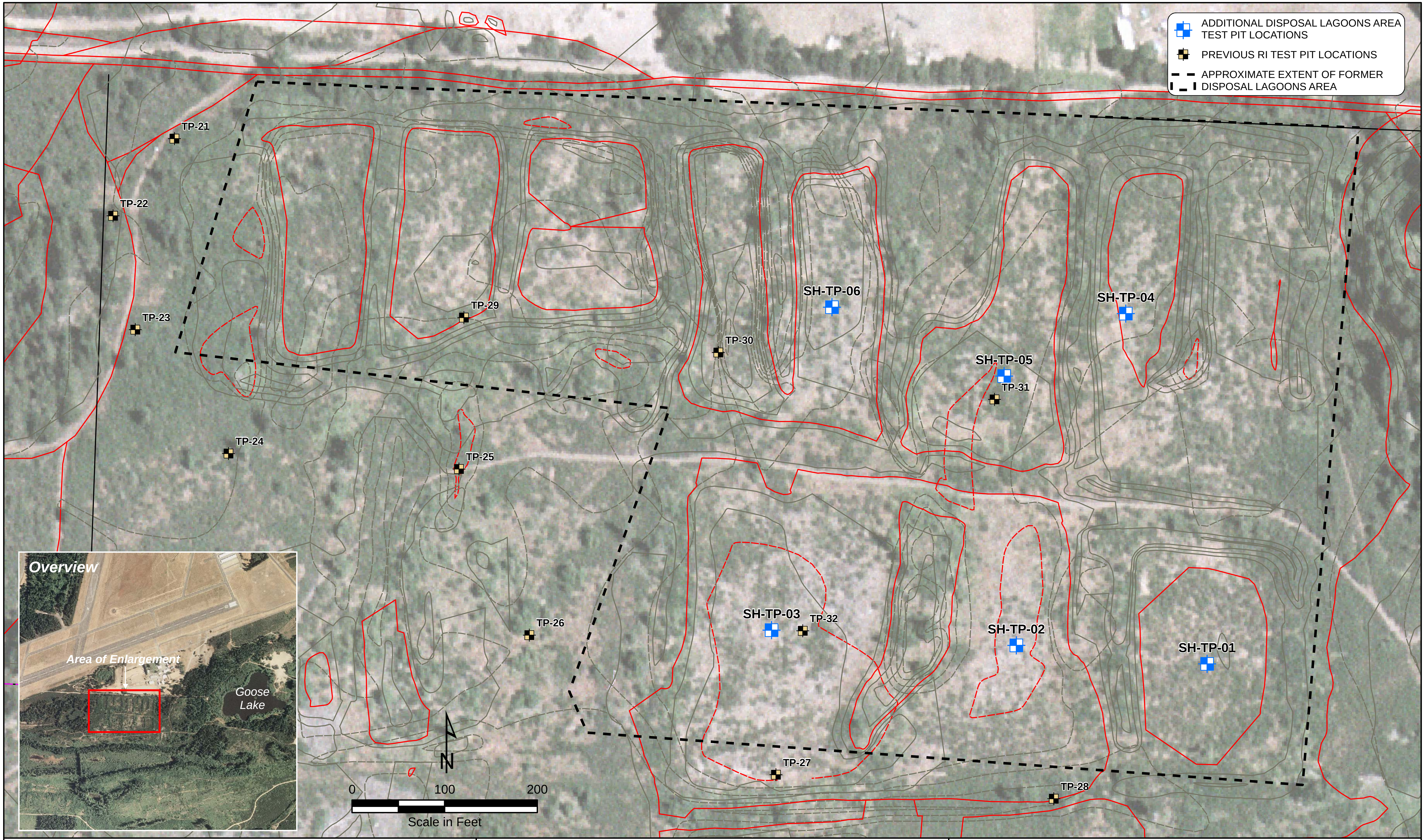

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Remedial Investigation Addendum
Goose Lake Project Site
Shelton, Washington

Figure 4
Additional Test Pit Locations
Disposal Lagoons Area

File: F:\projects\Hall-Shelton\GIS\MXD\Figure 4 (Additional Test Pit Locations in Former Disposal Lagoon Area).mxd
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Goose Lake Project Site

Remedial Investigation Addendum Report

Additional Sampling Program
Drainage Ravine and
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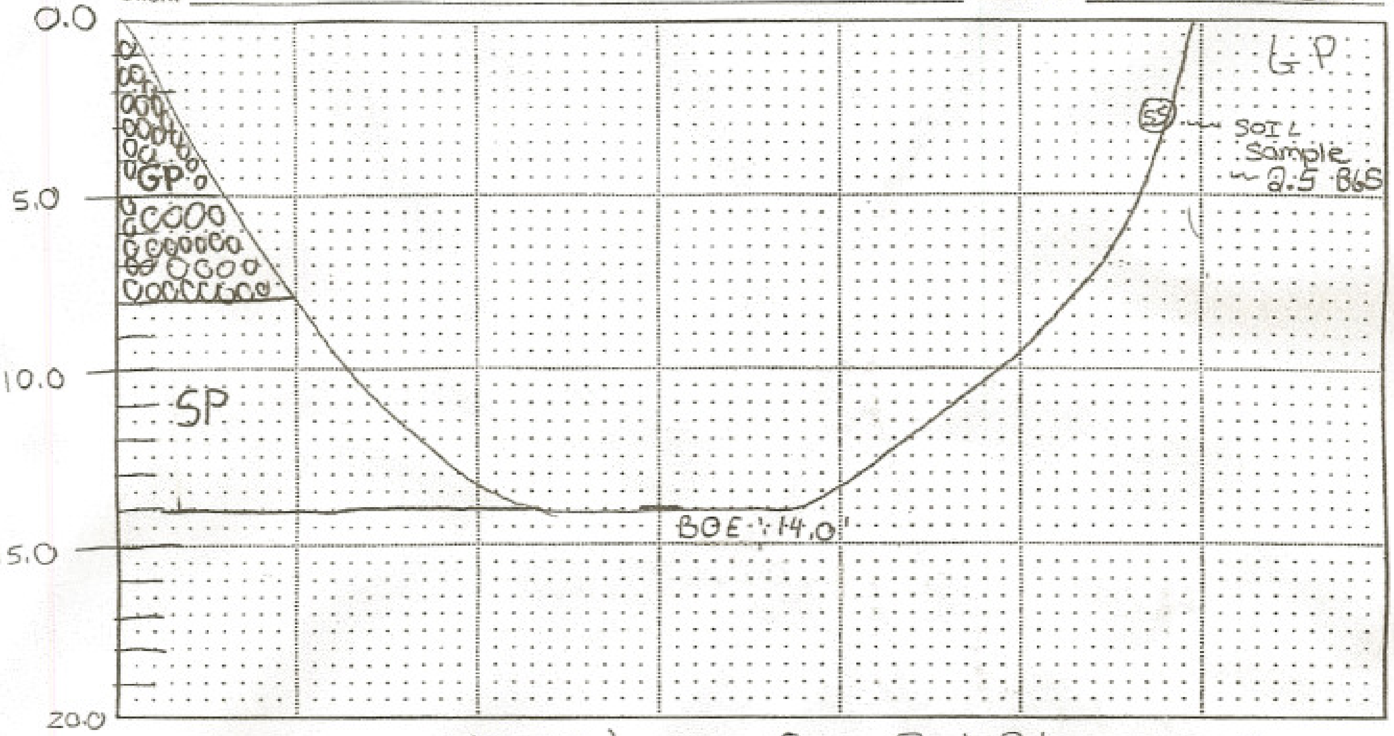
Appendix A
Test Pit Logs

FINAL

Log of Test Pit

TEST PIT NO. SH- TP-01
(Approx. Elev. NA ft.)

Project Shelton Hills mixed-use development
Project No. Hall-shelton
Client
Observer Michelle Bethune



Comments/Field Notes: NO Evidence of Soil Staining OR Groundwater

Depth (ft.)	USCS Symbol	Description color, modifier, predominant size class, with modifiers (density/consistencey, moisture) (Geologic Unit)	Sample No./ Depth	Moisture Content,%	Other Tests
0-8"	GP	Light Grey, coursegrained. Rounded Gravel, Cobble Size 0-5", no odor			
8-14"	SP	Lgt Grey, course grained, damp sand with "5.0"-8.0' cobbles			

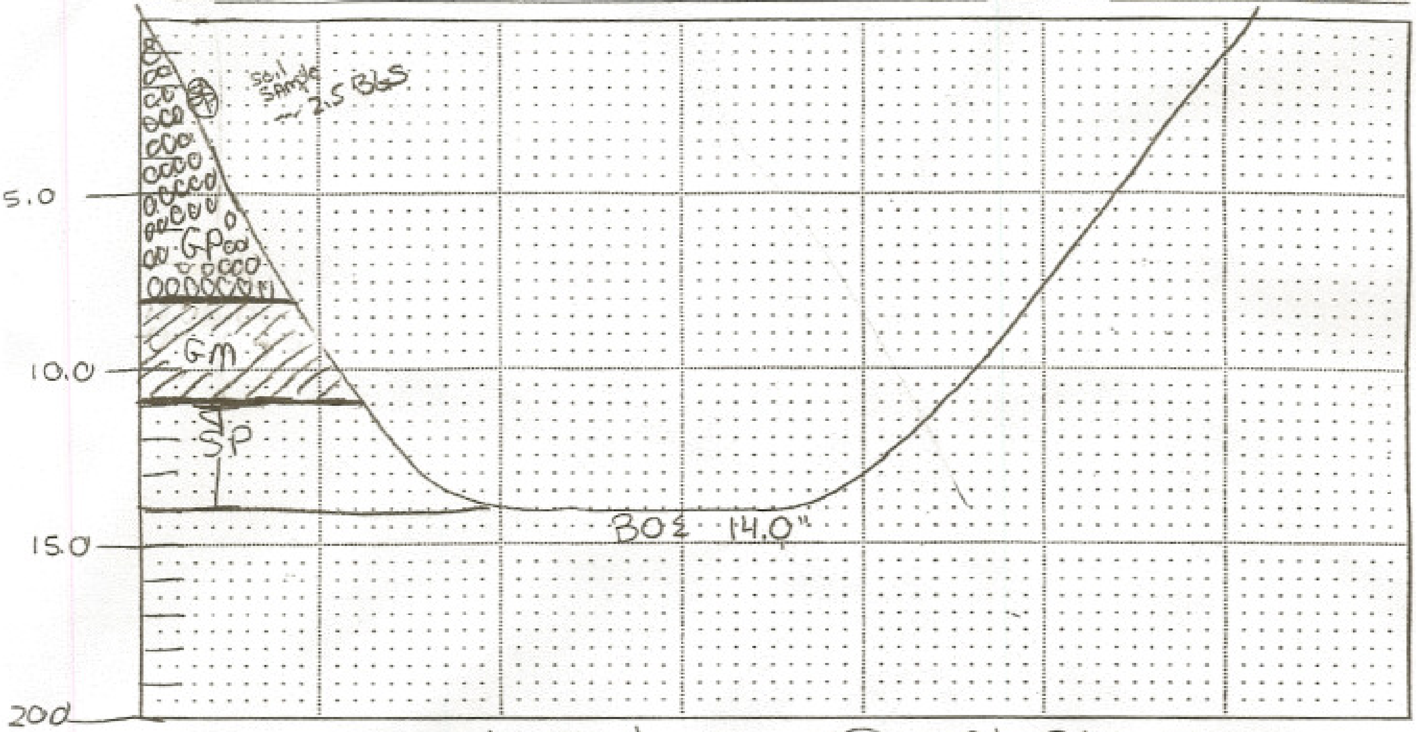
- Test Pit completed to 14.0 ft. on (date) 6-18-08
- No ground water seepage encountered

or • (Describe/Quantity) ______ ground water seepage encountered at ______ ft.

Log of Test Pit

TEST PIT NO. SH-TP-02
(Approx. Elev. NA ft.)

Project Shelton Hills Mixed use development
Project No. Hall- Shelton
Client
Observer Michelle Bethune



Comments/Field Notes: NO EVidence of soil Staining or Ground H2O

Depth (ft.)	USCS Symbol	Description color, modifier, predominant size class, with modifiers (density/consistencey, moisture) (Geologic Unit)	Sample No./ Depth	Moisture Content,%	Other Tests
0 8"	GP	Lgt brown GRAVEL with med-coursegrained Sand. 0"-5" cobbles observed			
8-11"	GM	Light Brown silty GRAVEL with med-course Grained Sand			
11-14'	SP	" " " @ 11" 1/2 foot Gravelly wet SAND			

- Test Pit completed to 14 ft. on (date) 6-18-08
- No ground water seepage encountered

or • (Describe/Quantity) ______ ground water seepage encountered at ______ ft.

Log of Test Pit

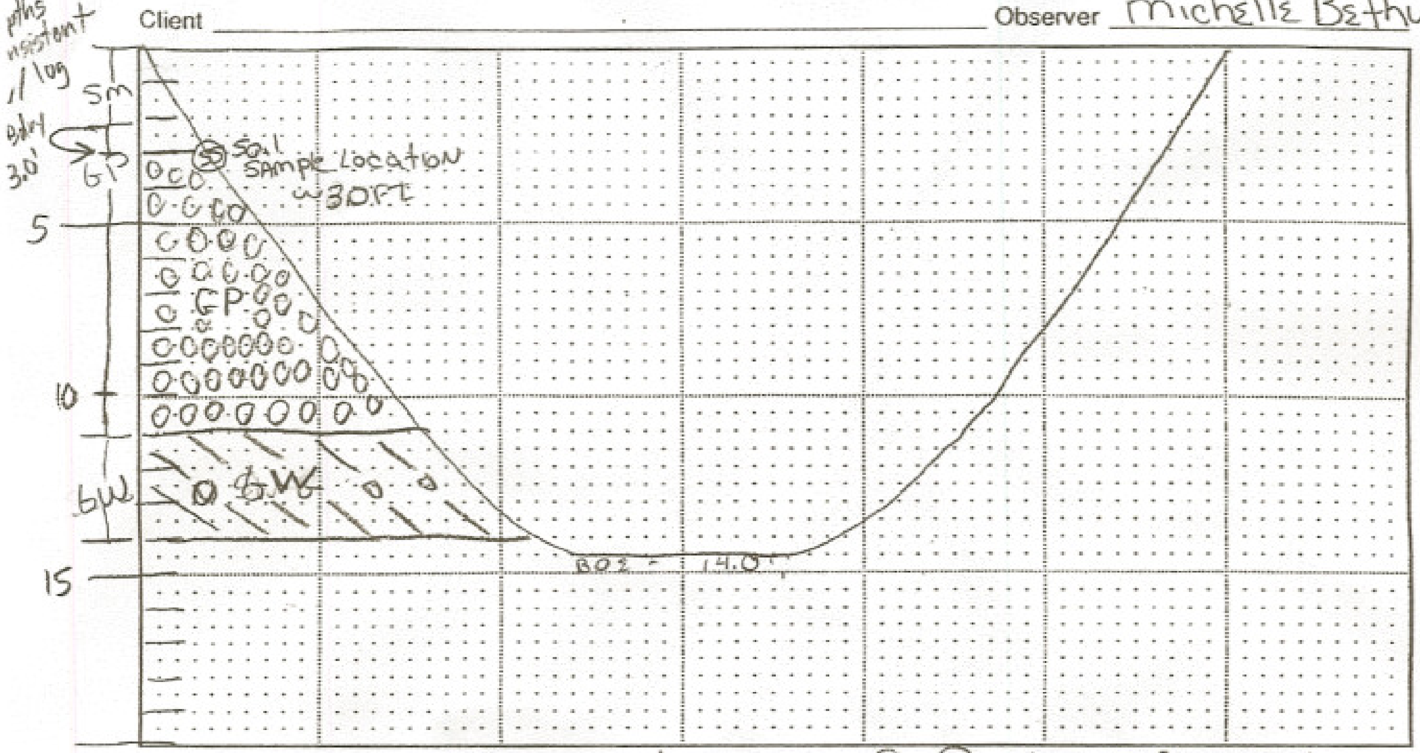
TEST PIT NO. SH-TP-03

(Approx. Elev. N/A ft.)

Project Shelton Hills Mixed USE Development Project No. HALL-SHELTON

Client ______

Observer Michelle Bethune



Comments/Field Notes: NO evidence of SOIL STAINING of G. H_2O

Depth (ft.)	USCS Symbol	Description color, modifier, predominant size class, with modifiers (density/consistencey, moisture) (Geologic Unit)	Sample No./ Depth	Moisture Content,%	Other Tests
0-3	Sm	Lgh Brown, SILTYSAND, Poorly graded 0"-4" Cobble Size			
3-11	GP	Lgh Brown, Poorly graded, course Grained GRAVEL: Slight mottling throughout (Yellow, orange) 0-5" G.Size			
11-14	GW	Lgh Grey, GRAVELYSAND, 0-7" Gravel Size. No odor.			

- Test Pit completed to 14 ft. on (date) 6-18-08
- No ground water seepage encountered

or • (Describe/Quantity) ______ ground water seepage encountered at ______ ft.

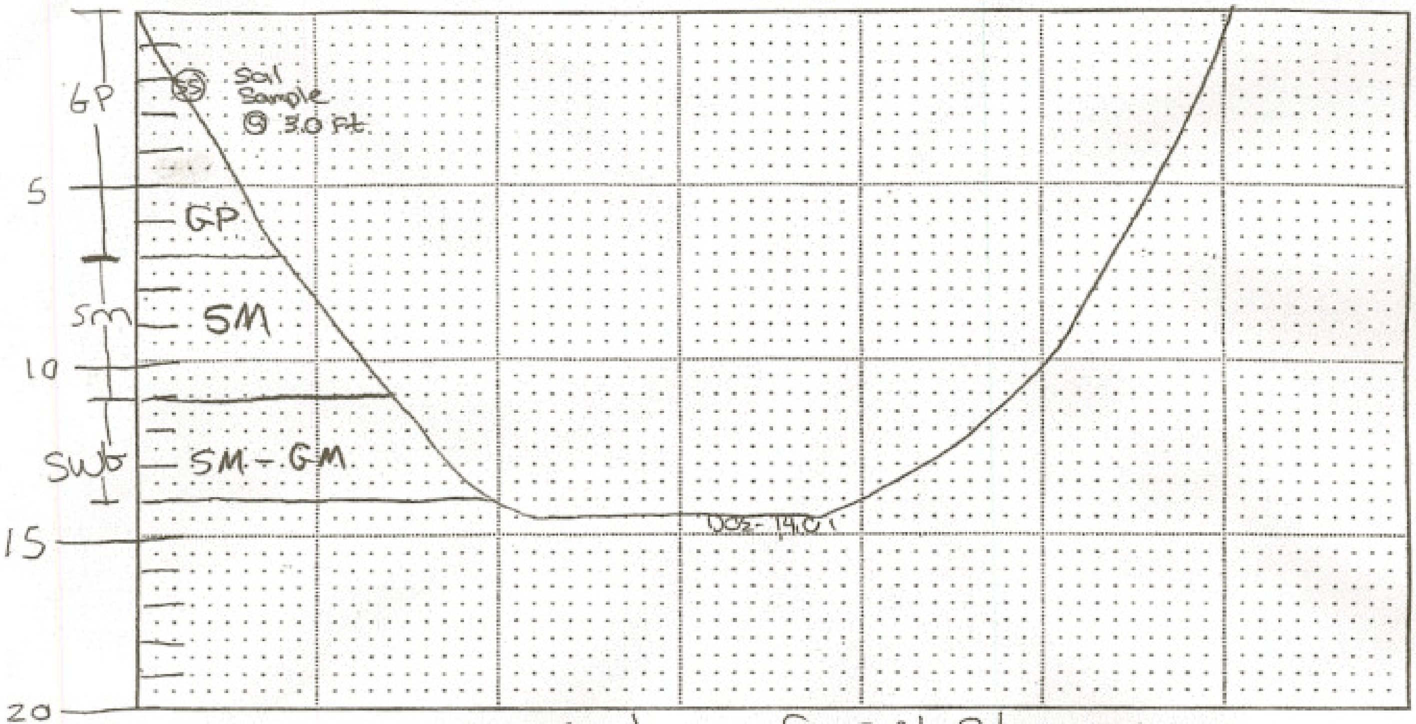
Log of Test Pit

TEST PIT NO. SH-TP-04
(Approx. Elev. N/A ft.)

Project Shelton Hills Mixed USE Development Project No. Hall-Shelton

Client

Observer Michelle Bethune



Comments/Field Notes: NO Evidence of Soil Staining OR G.Water

Depth (ft.)	USCS Symbol	Description color, modifier, predominant size class, with modifiers (density/consistencey, moisture) (Geologic Unit)	Sample No./ Depth	Moisture Content,%	Other Tests
0-7"	GP	LGT GREY, poorly graded GRAVELL/SAND, SUB rounded, 0-5" Gravel Size, NO odor (heavily RootED)			
7-11"	SM	LT Grey- SILTY-SAND 0-5" Gravel Size. SUB rounded NO roots. or odoR			
11-14"	SM-GM	Same as above - but GRAVELL/SAND			

- Test Pit completed to 14 ft. on (date) 6-18-08
- No ground water seepage encountered

or • (Describe/Quantity) ____________ ground water seepage encountered at ______ ft.

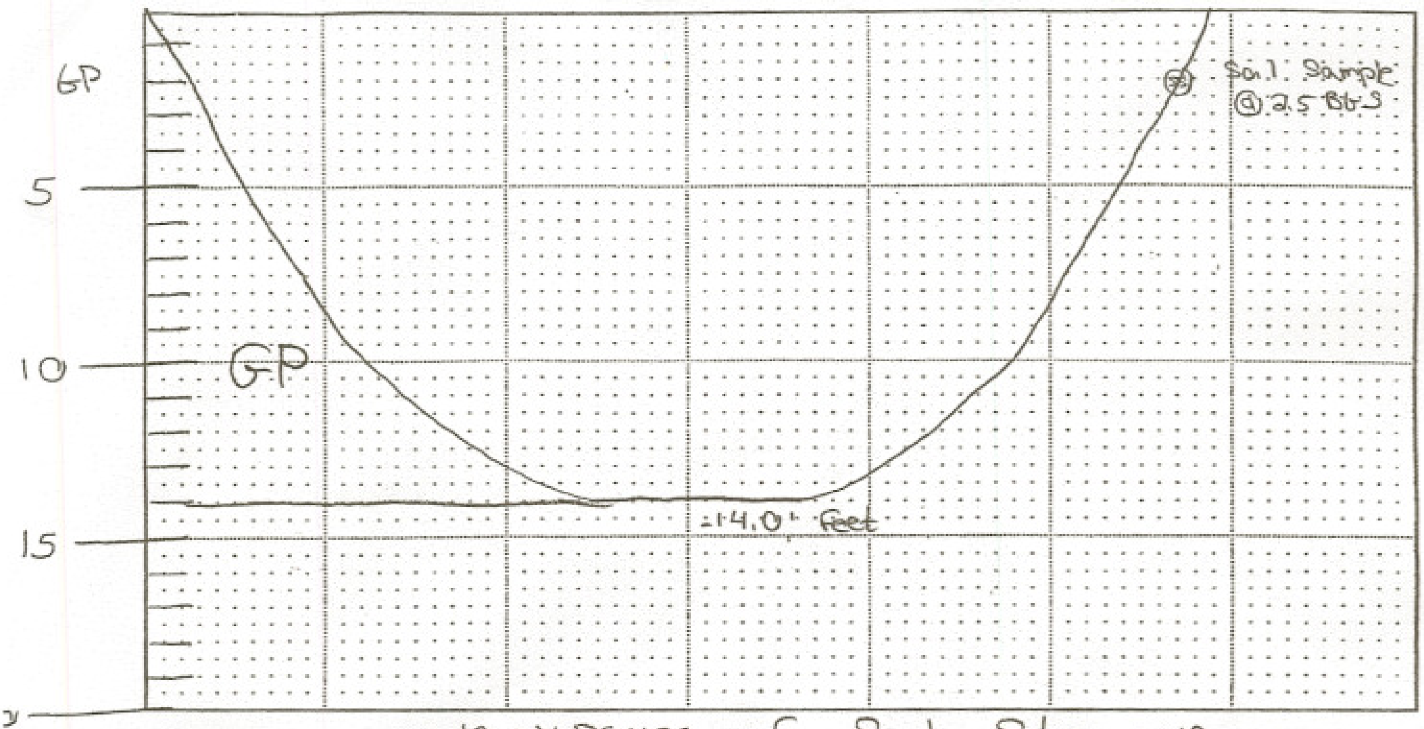
Log of Test Pit

TEST PIT NO. SH-TP-05
(Approx. Elev. N/A ft.)

Project SheltonHills Mixed USE Development Project No. Hall-Shelton

Client

Observer



Comments/Field Notes: NO EVIDENCE of Soil Staining OR G. H_2O

Depth (ft.)	USCS Symbol	Description color, modifier, predominant size class, with modifiers (density/consistencey, moisture) (Geologic Unit)	Sample No./ Depth	Moisture Content,%	Other Tests
0-14'	GP	Light Grey, Poorly Graded GRAVEL-0-6" Gravel Size Rounded Gravel, NO ODOR			

- Test Pit completed to ______ ft. on (date) ______
- No ground water seepage encountered

or • (Describe/Quantity) ______ ground water seepage encountered at ______ ft.

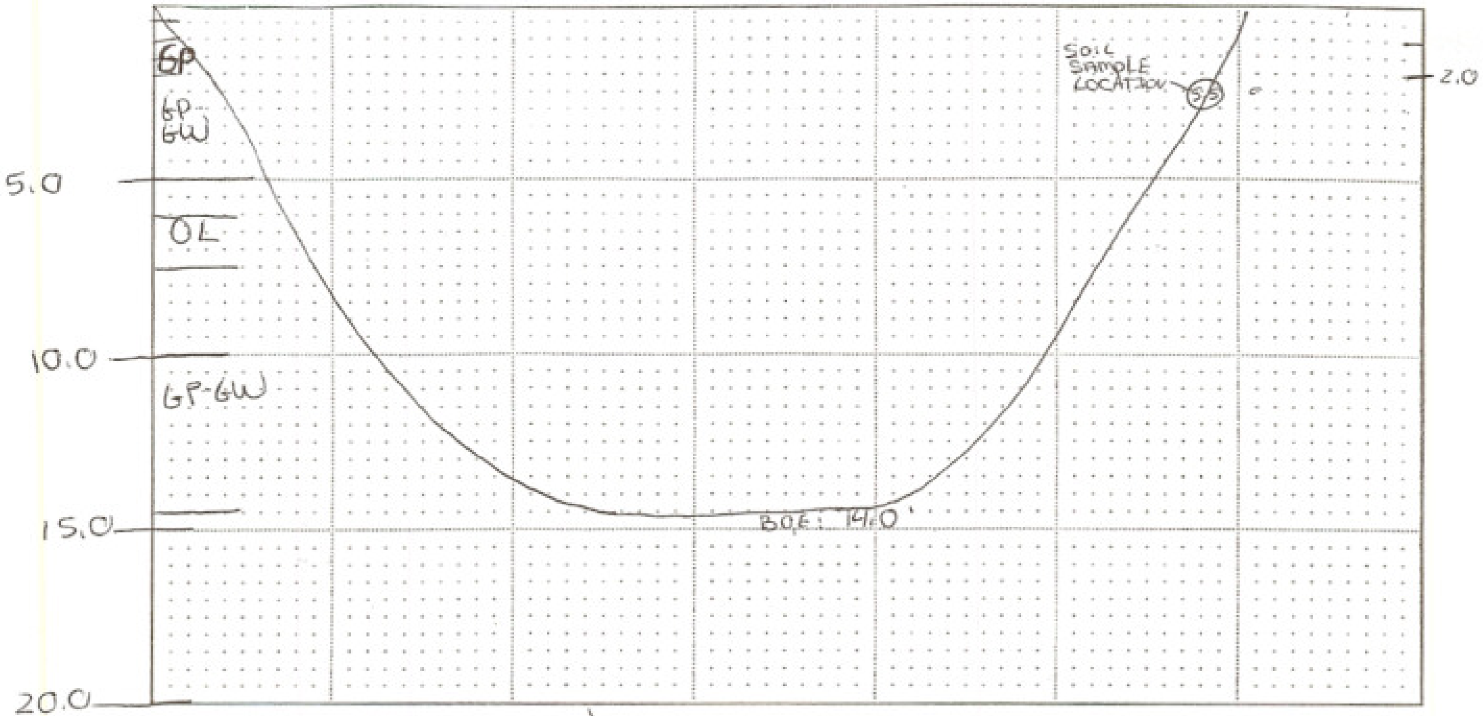
Log of Test Pit

TEST PIT NO. SH-TP-06

(Approx. Elev. NA ft.)

Project SHELTON Hills Mixed-USE DEVEL Project No. HALL-SHELTON

Client ______ Observer Michelle Bethune



Comments/Field Notes: NO Evidence of Soil Staining or groundwater.

Depth (ft.)	USCS Symbol	Description color, modifier, predominant size class, with modifiers (density/consistencey, moisture) (Geologic Unit)	Sample No./ Depth	Moisture Content,%	Other Tests
0-2.0	GP	LT Grey, course, well-rounded Gravel (NO odor)			
2.0-5.0	GP/GW	course, sandy Gravel w/ organic mottling observed throughout interval			
5.0-7'	OL	" " w/ Layer of organic Silty/Sand			
7.0-14.0	GP/GW	LT Grey, course, rounded gravel, c-7" Gravel size, poorly graded			

- Test Pit completed to ______ ft. on (date) ______
- No ground water seepage encountered

or • (Describe/Quantity) ______ ground water seepage encountered at ______ ft.

Goose Lake Project Site

Remedial Investigation Addendum Report

Additional Sampling Program
Drainage Ravine and
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Appendix B
Laboratory Analytical Results

FINAL

Goose Lake Project Site

Remedial Investigation Addendum Report

Additional Sampling Program
Drainage Ravine and
Former Disposal Lagoons

Appendix C
Addendum Remedial Investigation Work Plan

FINAL

WORK PLAN
ADDENDUM REMEDIAL INVESTIGATION SAMPLING AND INTERIM ACTION DRAINAGE RAVINE AND FORMER DISPOSAL LAGOON AREAS
GOOSE LAKE PROJECT SITE
SHELTON, WASHINGTON

TABLE OF CONTENTS

1.0 INTRODUCTION

This Work Plan presents the scope of work associated with conducting additional site characterization sampling as part of the overall Goose Lake Remedial Investigation (RI) Program. The additional RI sampling program will focus on collecting additional soil samples in the former Disposal Lagoon Area and in a portion of the Drainage Ravine Area behind Dam 1 (Figure 1). Based on the additional RI results, an Interim Action will be conducted within a limited area of the Drainage Ravine Area and potentially in the former Disposal Lagoons.

The scope of work presented herein was developed from conversations between Lisa Pearson of the Department of Ecology, the Shelton Hills Development Team and information presented in the RI/FS report entitled: Remedial Investigation Report Goose Lake Site Shelton, Washington, prepared by GeoEngineers and Entrix, dated March 19, 2004. The scope of work presented herein is also designed to meet the Work to be Performed outlined in the State of Washington Department of Ecology Amendment No. 1 to Agreed Order No. DE 99TC-S260 between Rayonier Properties, LLC and Shelton Hills Investors, LLC, dated February 2008.

1.1 Background

From 2002 through 2003, a remedial investigation/feasibility study (RI/FS) was performed to assess the presence of historic waste material released from the former Rayonier Shelton Pulp Mill operations into the Goose Lake area from 1936 through 1974. The Goose Lake Study area includes: Goose Lake, an Inactive Landfill, Drainage Ravine and former Disposal Lagoons. The approximate locations of these areas are shown on Figure 2. The RI/FS work was conducted as part of an Agreed Order established in 2001 between the Washington State Department of Ecology (Ecology), Rayonier Inc., and Peninsula Holdings Company LLC.

As part of the RI/FS sampling program, a series of shallow soil samples were collected from behind a series of man-made dams within the Drainage Ravine to assess the potential presence of historic contaminants. The man-made dams appeared to be constructed along the Drainage Ravine to manage over-spillage from Goose Lake. One soil sample (Sed-09) collected in the Drainage Ravine behind Dam 1 revealed the presence of low levels of PCBs and dioxins (Figure 3). Based on these findings, Ecology has requested that additional sampling be performed to fully characterize the nature and extent of PCBs and dioxins detected in this area of the Drainage Ravine.

As defined by the Model Toxics Control Action (MTCA) Cleanup Regulations Chapter 173-340 of the Washington Administrative Code (WAC 173-340), an interim action consists of a remedial action that partially addresses the cleanup of a Site, is technically necessary to reduce the threat to human health or the environment, and correct a problem that may have become substantially worse or cost substantially more if remedial action is delayed (WAC 173-340-430). An interim action also may be a key component of the final cleanup action. Ecology has stated that an Interim Action is applicable to address the low levels of PCBs and dioxins/furan previously detected in the Drain Ravine.

More recent conversations with Ecology representatives have indicated the need for additional soil sampling in the former Disposal Lagoon Area. Although previous soil and groundwater testing in the former Disposal Lagoon Area have not indicated the presence of contaminated soil or groundwater, Ecology has requested that a limited number of soil samples be collected and tested for dioxins, PCBs, and total sulfides to further assess the potential presence of contaminated soil in the former Disposal Lagoon Area.

Based upon available information and our previous discussions with Ecology, our field program will consist of three main phases (Phases 1, 2, and 3). Phase 1 will focus on collecting additional shallow soil samples to further assess the extent of the low levels of PCBs and dioxins/furans in the Drainage Ravine and former Disposal Lagoon areas. Phase 2 will focus on implementation of an Interim Action within the Drain Ravine area behind Dam 1. This work will likely include removal and disposal of a limited volume of PCBs and dioxin-impacted soil within the Drainage Ravine behind Dam 1. Please note that the Interim Action will be conducted as part of the overall Goose Lake Cleanup Action and based upon the additional soil sampling results collected during this project. If the presence of contaminated soil is identified in the former Disposal Lagoon Area, an Interim Action may be conducted within that area as well. Phase 3 will focus on restoration of the Interim Action impacted areas.

This work plan addresses sampling activities proposed only for the Drainage Ravine and former Disposal Lagoon areas. This document also defines applicable procedures and protocols to be followed during field investigations and describes the quality assurance (QA) and quality control (QC) procedures to be followed for field collection and laboratory analysis of samples collected during the both the additional site characterization and interim action. Information regarding proper waste handling and disposal is also discussed in this plan.

2.0 PURPOSE AND SCOPE OF SERVICES

The purpose of this Work Plan is to define applicable field procedures, analytical testing procedures, waste handling and disposal protocol to be followed during the additional sampling and interim action program. This Work Plan also describes the QA/QC procedures to be followed for field collection and laboratory analysis of samples collected during the field program.

The objective of additional sampling program is to further characterize the presence and extent of low levels of PCBs and dioxins detected in the Drainage Ravine as well as additional testing in the former Disposal Lagoon area. The results of the additional sampling will enable the project team to implement an Interim Action to remove the impacted soil in the Drainage Ravine and to assess the potential need for an Interim Action in the former Disposal Lagoon Area. Ultimately, this information will provide a basis for Ecology to remove the Drainage Ravine and Former Disposal Lagoon areas from the Goose Lake study area and Agreed Order.

To accomplish the project objectives, we propose to collect and test additional shallow soil samples in the Drainage Ravine behind Dam 1 and soil samples in the eastern portion of the former Disposal Lagoons. Our overall sampling program will consist of collecting and testing five shallow soil samples within the Drainage Ravine to further assess the extent of impacted soils. A second phase of post-excavation soil samples will be collected as part of the interim action to confirm that the project established cleanup levels have been met. Additional soil sampling in the former Disposal Lagoon area will consist of completing six test pits (TP-1 through TP-6) to collect subsurface soil samples for analytical testing. The test pits will also be used to assess the subsurface soil conditions for evidence of historic liquid waste disposal.

3.0 FIELD APPROACH AND PROCEDURES

This section presents the rationale and approach for our proposed field program to be conducted in a portion of the Drainage Ravine and former Disposal Lagoon areas. As stated above, our field program will consist of three main phases. Phase 1 will focus on additional shallow soil sampling to further assess the extent of the low levels of PCBs ad dioxins/furans in the Drainage Ravine and the potential presence in the former Disposal Lagoon Area. Phase 2 will focus on implementation of the Interim Action, which will include removal and disposal of impacted soils within the Drainage Ravine. Phase 3 will focus on restoration activities of within the Drainage Ravine. A brief discussion of the specific tasks to be conducted in each phase is presented below.

3.1 PHASE 1 (ADDITIONAL SOIL SAMPLING IN DRAINAGE RAVINE AND FORMER DISPOSAL LAGOONS)

The additional soil sampling activities will be performed to provide data of sufficient quality and quantity to further assess the presence, extent and nature of low levels of PCBs and dioxins/furans previously detected in Drainage Ravine area behind Dam 1. This information will be used to assess the area that will require remediation during the interim action.

Previous testing results suggest a good correlation between the presence of PCBs and dioxins/furans in the Drainage Ravine. For example, soil sample Sed-09 collected behind Dam 1 at depths ranging from 0 to 0.4 feet below ground surface (bgs) contained PCBs of 47 ug/kg and dioxins congeners ranging from 2.92 ng/kg to 767.04 ng/kg. Our overall sampling approach will consist of testing for PCBs as an indicator for the historic contaminants and thus defining the area that will require remediation.

Additional soil samples will also be collected in the former Disposal Lagoon area. The previous sampling program conducted within the perimeter of the former Disposal Lagoon area did not include sufficient information to assess the presence of dioxins, PCBs and total sulfides. Consequently, Ecology has requested that additional soil samples be collected within the perimeter of the former Disposal Lagoon area. These samples will be tested for dioxins, PCBs and total sulfides.

Information regarding the field procedures for collecting the additional soil samples in both the Drainage Ravine and former Disposal Lagoon areas is presented below.

Sample Locations in Drainage Ravine

Previous soil analytical testing conducted in the Drainage Ravine detected the presence of low levels of PCBs, and dioxins/furans. Based on these results, Ecology has recommended that additional shallow soil sampling should be conducted for chemical analysis in the area of Dam 1 of the Drainage Ravine and within the corridor between Goose Lake and the Drainage Ravine.

Based on these results, we will collect and analyze a total of five shallow soil samples (SS-1 through SS-5) behind Dam 1 and within the corridor between Goose Lake and the Drainage Ravine. The approximate sample locations are shown on Figure 4. Three soil samples will be collected at a depth ranging from 0 to ½ foot bgs to the north. east and south of the previous sample location Sed-09. An additional sample will be collected at approximately 1 foot depth beneath the sample Sed-09 to asses the vertical extent of proposed soil removal activities. Two shallow soil sample samples will also be collected at depth ranging from 0 to 1/2 –foot bgs in the corridor between Sed-09 and Goose Lake.

The soil will be visually inspected for staining or discoloration. Soil samples will be screened for the presence of volatile organic compounds using a photoionization detector (PID). All field observations including soil type and vapor reading will be noted on our field notes.

Sample Locations in Former Disposal Lagoons

Additional soil sampling and testing information is required within the perimeter of the former Disposal Lagoons. Ecology has recommended that additional subsurface soil sampling should be conducted in the eastern portion of the former Disposal Lagoons for chemical analysis of dioxins, PCBs, and total sulfides.

Based on these results, we will collect completed six test pits to depth s of approximately 4 feet bgs. The soils within each test pit will be evaluate by en experienced geologist/hydrogeologist to assess the potential presence of contaminated soil, If evidence of suspected impacted soil is identified, soil samples will be collected from the suspected area for analytical testing. A total of four subsurface soil samples

(TP-1 through TP-4) will be collected from 4 of the 6 test pits. The approximate sample locations are shown on Figure 4. The soil samples will be collected at a depth ranging from 2 to 4 feet bgs, or within an area that exhibits evidence of contamination. Again, the soil will be visually inspected for staining or discoloration. Soil samples will be screened for the presence of volatile organic compounds using a photoionization detector (PID). All field observations including soil type and vapor reading will be noted on our field notes.

Sampling Method

The following procedures will be used to collect and ship the shallow soil samples to an approved analytical laboratory. The sampler will use the following procedures to collect samples:

- Wear a clean pair of disposable nitrile gloves and other appropriate PPE during the entire sampling procedure.
- Shallow soil samples will be collected at depths ranging from 0 to 6 inches bgs in the Drainage Ravine and 2 to 4 feet bgs in the former Disposal Lagoons. A clean stainless steel spoon will be used to remove soil from the desired depth. The soil be removed and placed in a stainless steel bowl. The volume must be sufficient to fill the required sample containers (24 oz).
- Soil samples will exclude organic debris and particles larger than 1 inch in diameter.
- Place the soil in a laboratory provided pre-cleaned glass jar.
- Samples will be labeled and handled as described in Section 5.
- Place sample containers in a cooler maintained at approximately 4 degree Celsius by ice or ice substitute.

Drainage Ravine Soil Sample Analysis

Representative soil samples will be delivered to an Ecology-approved analytical laboratory (Test America in Tacoma, WA) for appropriate analytical testing under chain-of-custody protocol. Each sample will be analyzed for PCBs by EPA Method 8082. One selected sample will be analyzed for dioxins/furans by EPA Method 8290. Additional testing of these samples will include pH, total organic carbon and moisture.

Former Disposal Lagoon Soil Sample Analysis

Representative soil samples will be delivered to an Ecology-approved analytical laboratory (Test America in Tacoma, WA) for appropriate analytical testing under chain-of-custody protocol. Each sample will be analyzed for PCBs by EPA Method 8082, dioxins/furans by EPA Method 8290 and total sulfides.

3.2.1 Analytical Test Methods

The Ecology accredited laboratory will perform the environmental testing. The following is a list of parameters and the test method:

- PCBs by EPA Method 8082
- Dioxins by EPA Method 8290 or 1613-B

3.2 PHASE 2 (INTERIM ACTION)

Phase 2 will focus on soil removal and disposal of impacted soil and post-excavation soil sampling to confirm that the project established cleanup levels have been met. During this phase of the project, post-excavation soil samples will be tested for both PCBs and dioxins/furans. If evidence of PCBs or dioxins/furans are detected in the post-excavation sample, additional soil will be removed followed by additional post-excavation sampling.

Dewatering and Soil Removal Activities

Prior to removal of the impacted soil removal, the proposed excavation area will be dewatered. A series of earthen berms will be constructed to divert surface water from the proposed excavated area. If deemed necessary, surface water will also be pumped from the proposed excavation area to the downstream portion of Dam 1. During the dewatering process, precautions will be taken by the field crew to not disturb the surface soil and potentially spread impacted soils down stream. If suspended soil becomes a issue, the pumped water will be placed into a temporary aboveground storage tank and allowed to settle prior to discharge.

Removal, Transportation and Disposal of Impacted Soil

A limited volume of impacted soil will be removed from the Drainage Ravine behind Dam 1 (Figure 4.) At this point, we anticipate that the excavation dimensions will be approximately 25 feet wide by 25 feet long and 1 feet deep (approximately 35 tons). If analytical results from Phase 1 reveal additional areas of impacted soil, the initial excavated areas around sample Sed-09 will be adjusted accordingly.

During the soil removal activities, an experienced geologist will monitor for visual evidence of soil staining, unusual odors, and elevated PID readings. Based on previous sampling results, the PCBs and dioxins/furans impacted soil appears to be concentrated in the shallow soils less than 1 foot bgs.

The impacted soil will be removed with a track-hoe operated by an experienced contractor. Based on the existing laboratory results, the impacted soils are currently characterized as non-hazardous waste. Excavated soil will be loaded directly into WSDOT approved trucks for transportation to the Waste Management transfer station located in Bremerton, Washington. Two composite soil samples (Comp-1-1 and Comp-1-2) from the excavation will be collected to document the level of PCBs and dioxins. Subsequently, the impacted soil will be disposed of via rail to the Columbia Ridge Landfill, an Ecology approved disposal facility, in Klickitat County, Washington.

Soil transportation and disposal will be conducted in accordance with applicable local, state and federal regulations. As part of the soil disposal process, Bill of Ladings will be generated at the transfer station to document the volume and proper disposal of the impacted soil. Copies of the Bill of Ladings will be included in the final report.

Post-excavation Soil Samples

Initially, five post-excavation soil samples (EX-1-1 through EX-1-5) will be collected from the sidewalls and base of each excavation. The sidewall soil samples will be collected at approximately ½-foot bgs. One soil sample (EX-1-5) will be collected from the base of the excavation at a depth of approximately 1 feet bgs. The soil samples will be retrieved using a stainless spoon. The soil will be placed in laboratory supplied glass sample jars and securely fitted with Teflon-lined plastic lids. Sample labels will be fixed to all sample jars and contain the following information: sample number, owner name, date and time of collection, and sampler's initials. Sealed samples will be stored in an ice chest containing blue ice and will be maintained in a cooled condition until delivery to the analytical laboratory operated by Test America in Federal Way, Washington.

Complete chain-of-custody records will be transferred with the samples to the analytical laboratory. All sampling equipment will be washed with a detergent wash and tap water rinse prior to the collection of the samples. An example copy of chain-of-custody forms is presented in Appendix A.

Composite Stockpiled Soil Samples

Composite soil samples will be collected from the stockpiled soils generated during the soil removal program. The composite soil samples will be placed in a laboratory provided glass jar following the same sampling protocol discussed above.

3.3 PHASE 3 (SITE RESTORATION)

Following receipt of the post-excavation soil sample results that indicate the project establish cleanup levels have been met, the excavation will be backfilled and compacted with clean imported top soil conducive to the surrounding soils. Specific precautions will be taken to minimize disruption to the surrounding wetland areas. As part of the mitigation program, native plants and wood debris will be placed in the excavation area to enhance the overall native environment.

4.0 QUALITY ASSURANCE AND QUALITY CONTROL

Information pertinent to the environmental samples, including decontamination procedures, specific collection data, names of sampling personnel,

4.1 DECONTAMINATION

All non-disposable sampling equipment used in the collection of samples will be decontaminated in the mobile decontamination stations. Decontamination shall be executed directly prior to equipment use when practical. Whenever this is not practical, measures will be taken so that contamination of clean equipment will not occur. Clean, disposable gloves that do not degrade when exposed to the selected decontamination solvent will be worn while decontaminating sampling equipment and tools. Clean sampling equipment will not be placed on the ground or other potentially contaminated surfaces prior to use. The waste decontaminated fluids will be collected and transferred to D.O.T. approved container at the end of each day.

The decontamination procedure is as follows:

- Pre-rinse to dislodge soil or waste sample remains.
- Non-phosphate detergent wash
- Rinse with distilled water.
- Air dry.

4.2 FIELD QUALITY ASSURANCE

Internal quality control checks and sampling procedures will be performed by submitting and evaluating field QA/QC samples which include a blind field duplicate sample and a field blank sample.

5.3 Field Log

The field log will provide a daily record of notable events, observations, and measurements taken during field investigations. At a minimum, information recorded will include the following:

- Weather conditions.
- Sampling locations.
- Instrument calibrations.
- Field measurements.
- Deviations from the Work Plan.
-

4.3 SAMPLE NUMBERING SYSTEM

A unique identification will be assigned to each sample. This name will be an alphanumeric sequence that serves as an acronym to identify the sample. Specific sample identification procedures will follow a strategy as illustrated below:

Soil Sample Numbering

Example – "SS-8"

SS-8 – Soil sample location number 8

Post-Excavation Soil Sample Numbering

Example – "EX-1-5"

EX-1– Excavation 1

5 – Sample location Identification number.

Composite Soil Sample Numbering

Example – "Comp-1-2"

Comp-1– Composite soil sample collected from Excavation 1
2- Sample location identification number

Test Pit Soil Sample Numbering

Example – "TP-1-2"
SH - TP--1– Test Pit 1
2 – Sample location Identification number.

This number will be entered on to the sample container, in the field notes, and in the sample chain-of-custody form.

4.5 SAMPLE DOCUMENTATION

4.5.1 Sample Labels

Labels bearing job designation, time sample depth interval, sample ID, date sampled preservative (if necessary), and the initials of the sampler will be affixed to the bags, canisters, brass liners, jars, and bottles of the collected samples. The soil and water samples will then be enclosed in a plastic bag and stored in a cooler maintained at approximately 4 degrees Celsius.

4.5.2 Chain-of-Custody Records

A chain-of-custody form will be completed in advance for each sample cooler shipped. The chain-of-custody forms will include the laboratory identification number, sample location, parameter list, sample type, and site name. Each chain-of-custody form will be signed by the persons relinquishing and receiving the samples.

5.0 DATA EVALUATION AND REPORTING

5.1 DATA EVALUATION

As the soil data is received from the laboratory, it will be reviewed and validated. The reviewed laboratory data will be entered directly into a database or spreadsheet for use in the final reports.

5.2 REPORTING

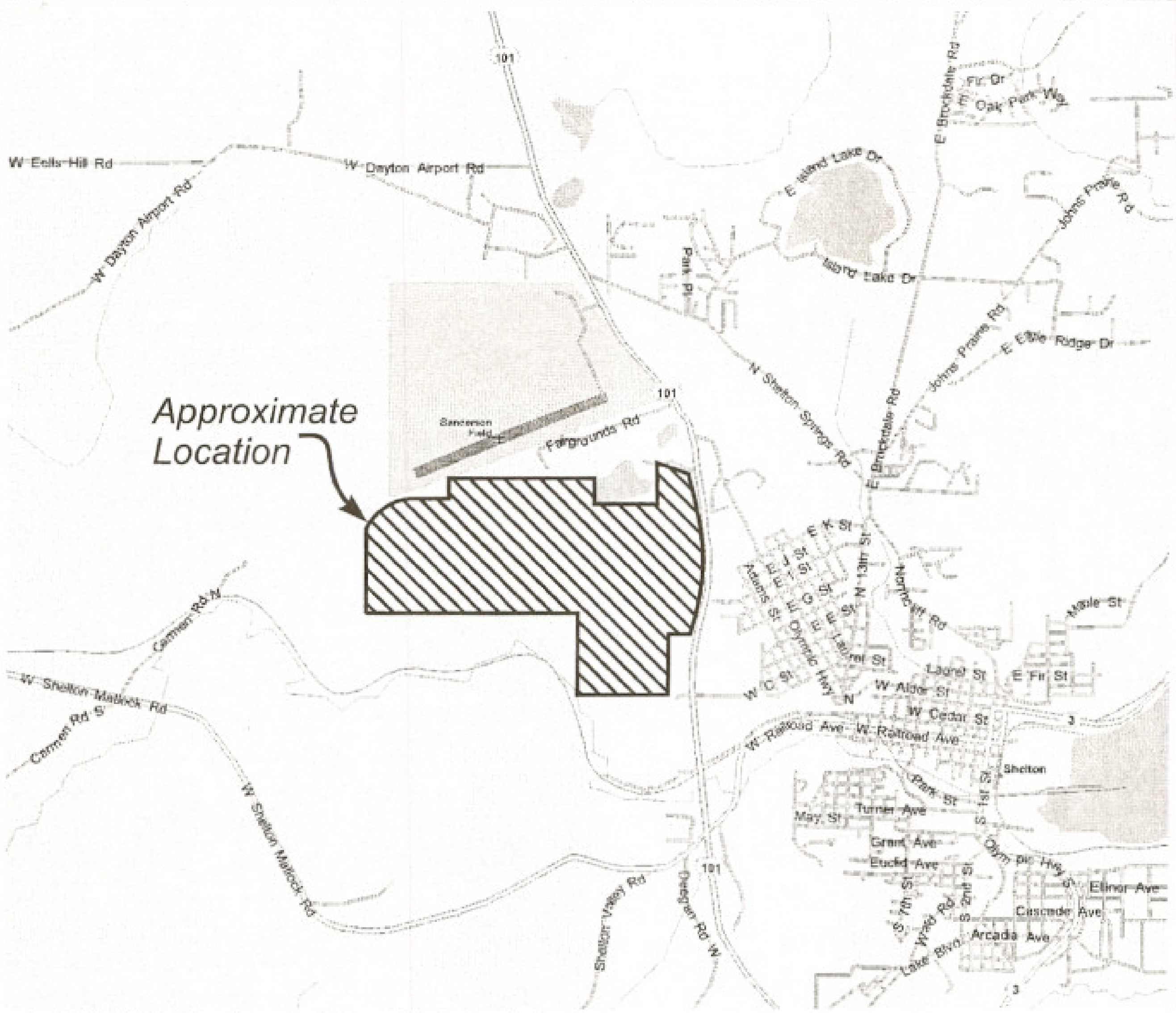
After field activities are complete and all analytical data have been reviewed, a summary report will be prepared. This report will summarize the field procedures, subsurface findings, and analytical results associated with the Drainage Ravine and former Disposal Lagoon. The analytical results will be submitted to Ecology's EIM system. In addition, analytical results will be presented in summary data tables and compared to applicable regulatory cleanup levels under MTCA. The report will include the following:

- Document the investigation activities, including any field modifications to this Work Plan.
- Provide an updated discussion of site hydrogeology, including updated geologic cross-sections as necessary.
- Provide data summary tables and a brief discussion of the nature and extent of potential contamination within each area
- Provide documentation of proper waste removal, transportation and disposal.
- Document the site restoration activities.
- Provide recommendations for additional work, if deemed necessary.

6.0 LIMITATIONS

The services described in this report were performed consistent with generally accepted professional consulting principles and practices. No other warranty, express or implied, is made. These services were performed consistent with our agreement with our client. This report is solely for the use and information of our client unless otherwise noted. Any reliance on this report by a third party is at such party's sole risk.

Opinions and recommendations contained in this report apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, nor the use of segregated portions of this report.



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© Copyright 2000 by Compusearch Micromarketing Data and Systems Ltd.

KLEINFELDER

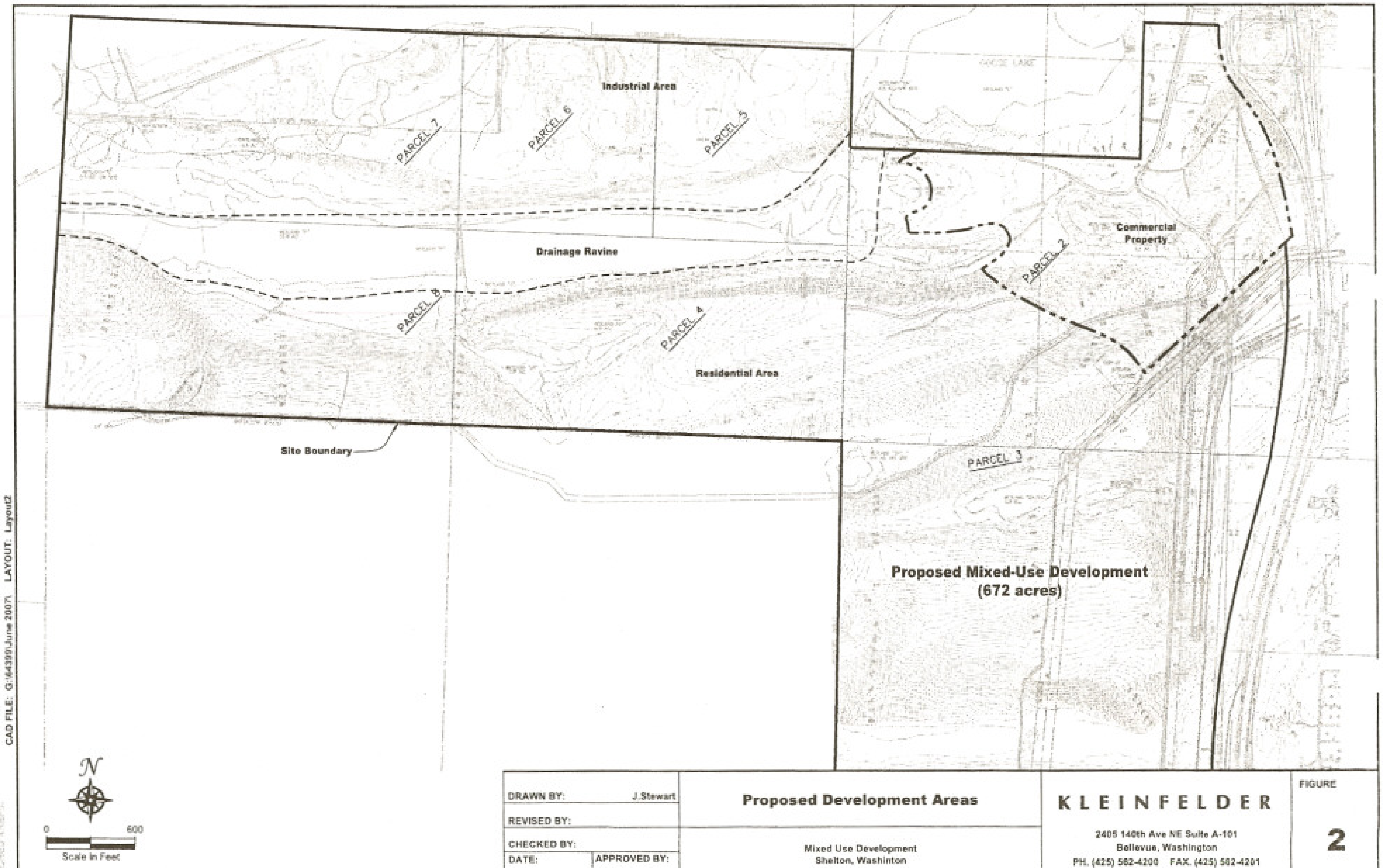
PROJECT NO. 64399 June 2007

Site Vicinity

Proposed 672 - Acres Mixed-Use Development
Southwest of Highway 101 & West Wallace-Kneeland Blvd.
Shelton, Washington

Figure

1



CAD FILE: G:\64399\June 2007\ LAYOUT: Layout2

ATTACHED XREFS:

DRAWN BY:	J.Stewart
REVISED BY:	
CHECKED BY:	
DATE: June 2007	APPROVED BY:

Proposed Development Areas

Mixed Use Development
Shelton, Washinton

PROJECT NO. 64399 FILE NAME:

KLEINFELDER

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Bellevue, Washington
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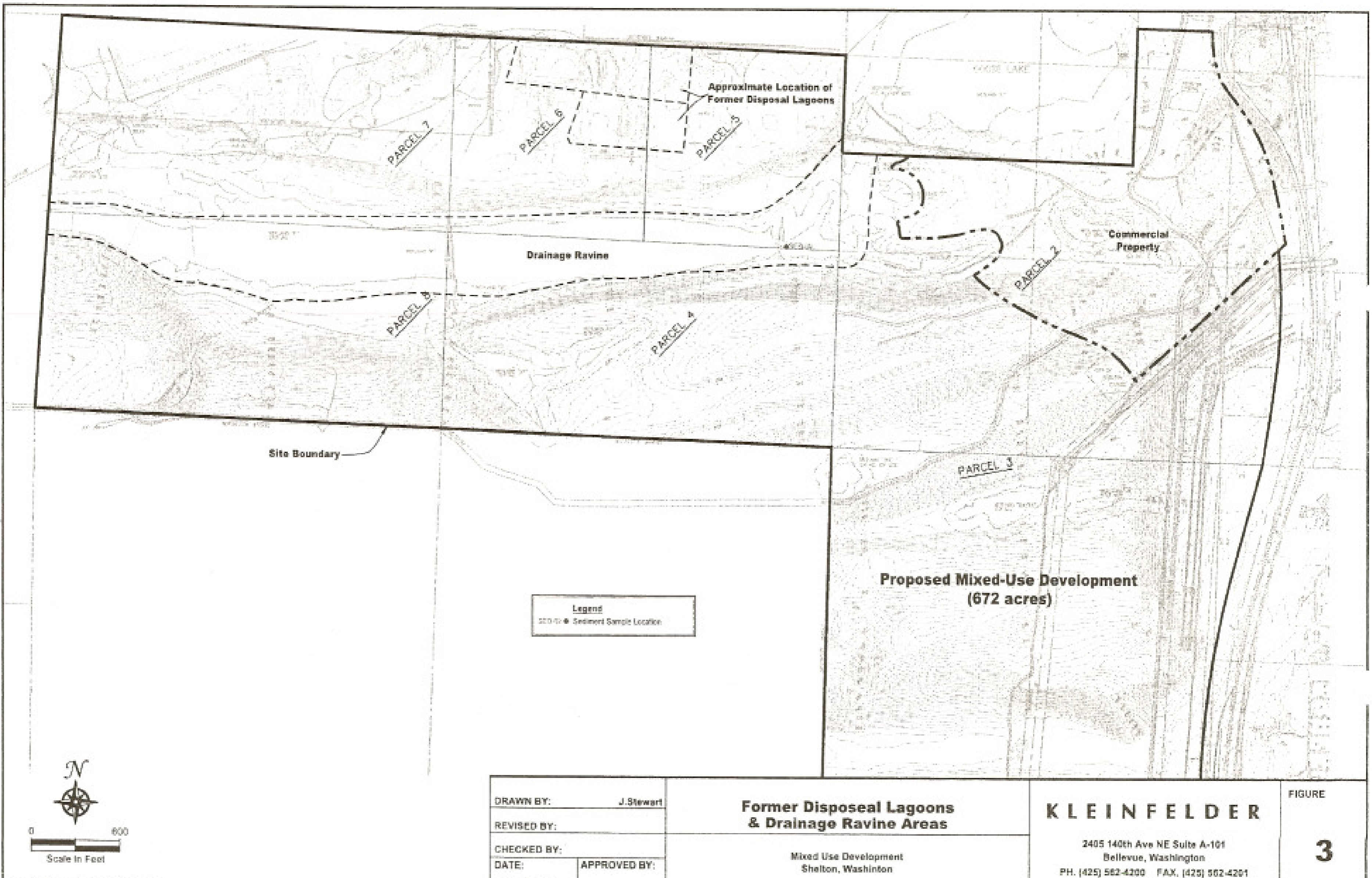
FIGURE
2

ATTACHED IMAGES:
ATTACHED XREFS:
CAD FILE: G:\64399\June 2007\ LAYOUT: Layout2



ⓒ by Kleinfelder West Inc., 2007

DRAWN BY: J.Stewart
REVISED BY:
CHECKED BY:
DATE: June 2007
APPROVED BY:

Former Disposeal Lagoons & Drainage Ravine Areas

Mixed Use Development
Shelton, Washinton

PROJECT NO. 64399
FILE NAME:

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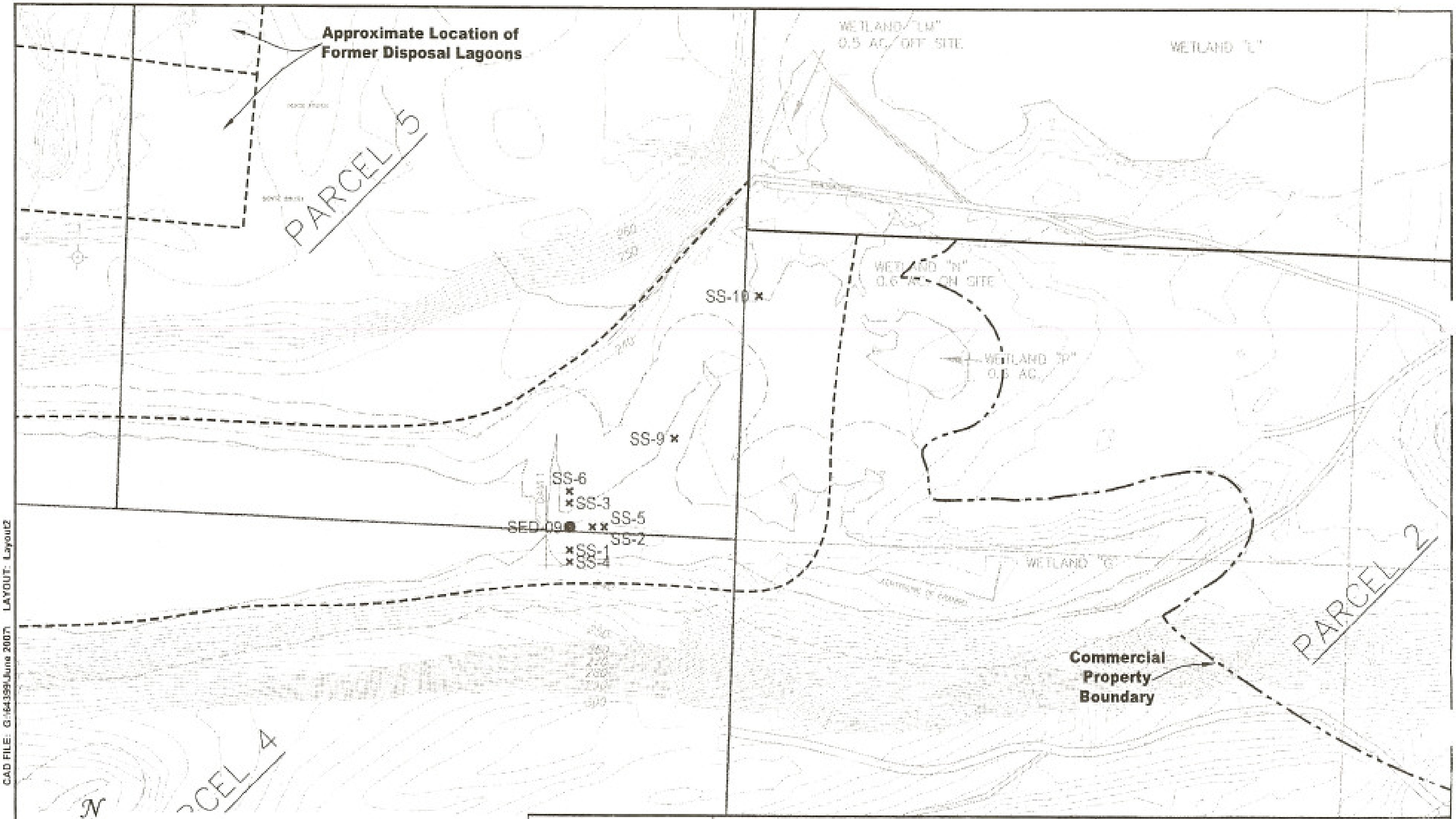
FIGURE
3



Legend

SED-09 ● Pervious Soil / Sediment Sample Location

SS-1 × Soil / Sediment Sample Location

CAD FILE: G:\64399\June 2007\ LAYOUT: Layout2

DRAWN BY:	J.Stewart
REVISED BY:	
CHECKED BY:	
DATE: June 2007	APPROVED BY:

Proposed Sample Locations

Mixed Use Development
Shelton, Washinton

PROJECT NO. 64399

FILE NAME:

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www.kleinfelder.com

FIGURE
4

Goose Lake Project Site

Remedial Investigation Addendum Report

Additional Sampling Program
Drainage Ravine and
Former Disposal Lagoons

Appendix D
Data Validation Report

FINAL

EcoChem, INC.
Environmental Data Quality

QUALITY ASSURANCE REPORT

HALL – SHELTON

Prepared for:

Floyd|Snider
601 Union Street, Suite 600
Seattle, Washington 98101-2341

Prepared by:

EcoChem, Inc.
710 Second Avenue, Suite 660
Seattle, Washington 98104

EcoChem Project: C15205-1

July 21, 2008

Approved by:

Eric Strout
Technical Director
EcoChem, Inc.

Basis for Data Validation

This report summarizes results from data validation performed on soil sample data and the associated laboratory quality control data. All data were subjected to a full validation effort.

Samples were analyzed for the following parameters and were reviewed by the chemists listed below.

Test	Method	Primary Chemist	Secondary Chemist
Dioxin/Furan Compounds	SW846 8290	Mark Brindle	John Mitchell
PCB Aroclors	SW846 8082	Mark Brindle	John Mitchell
Total Sulfide	SW846 9030B/9034	Mark Brindle	John Mitchell

Data validation was based on the quality control (QC) criteria recommended in the methods listed above and in *National Functional Guidelines for Organic and/or Inorganic Data Review* (USEPA 1994, 1999 & 2002). The dioxin/furan data were also evaluated using *USEPA Region 10 SOP for Validation of Dioxins & Furans* (USEPA 1996).

EcoChem's goal in assigning data assessment qualifiers is to assist in proper data interpretation. If values are estimated (J or UJ), data may be used for site evaluation and risk assessment purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. If values are assigned an R, the data are to be rejected and should not be used for any site evaluation purposes. If values have no data qualifier assigned, then the data meet the data quality objectives as stated in the documents and methods referenced above.

USEPA data qualifier definitions and EcoChem reason codes are included as **Appendix A**. Validation acceptance criteria are also provided in **Appendix A.** Data Validation Worksheets are kept on file at EcoChem, Inc.

A qualified electronic data deliverable (EDD) was also submitted with this report.

DATA VALIDATION REPORT
Hall-Shelton
PCB Aroclors by Method SW846 8082

This report documents the review of analytical data from the analyses of soil samples and the associated laboratory quality control (QC) samples. Samples were analyzed by TestAmerica, Tacoma, Washington.

SDG	Number of Samples	Validation Level
580-10373-1	13 Soil	Screening Level

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables, with the exception of the case narrative.

II. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed in the following table.

- Holding Times and Sample Receipt
- Initial Calibration (ICAL)
- Continuing Calibration (CCAL)
- Laboratory Blanks
- Surrogate Compounds
- Matrix Spikes/Matrix Spike Duplicates (MS/MSD)
- Laboratory Control Samples (LCS)
- Reporting Limits
- Compound Identification
- 1 Calculation Verification (Full validation only)

---

[1] ***Quality control results are discussed below, but no data were qualified.***

Calculation Verification

SDG 580-10373-1: Calculation verifications were performed on this SDG. No calculation errors were found.

III. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable, as demonstrated by the surrogate, LCS, and MS/MSD %R values. Precision was also acceptable as demonstrated by the RPD values from the MS/MSD.

All data, as reported, are acceptable for use.

DATA VALIDATION REPORT
Hall-Shelton
Dioxin/Furan Compounds by EPA 8290

This report documents the review of analytical data from the analyses of soil samples and the associated laboratory and field quality control (QC) samples. Frontier Analytical Laboratory, El Dorado Hills, California, analyzed the samples.

SDG	Number of Samples	Validation Level
4988	9 Soil	Full

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed in the following table.

1 Holding Times and Sample Receipt
Instrument Performance
Initial Calibration (ICAL)
Continuing Calibration (CCAL)
Laboratory Blanks
Labeled Compounds
1 Matrix Spikes/Matrix Spike Duplicates (MS/MSD)
Ongoing Precision and Recovery (OPR)
1 Laboratory Duplicates
Compound Identification
Reporting Limits
1 Calculation Verification (full validation only)

---

[1] ***Quality control results are discussed below, but no data were qualified.***
[2] ***Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.***

Holding Times and Sample Receipt

The validation guidance documents state that the cooler temperatures should be within an advisory temperature range of 2° to 6°C. The temperature of the sample cooler was less than the lower control upon receipt at the laboratory. This temperature outlier did not impact data quality and no qualifiers were required.

Matrix Spike/Matrix Spike Duplicate (MS/MSD)

SDG 4988: No matrix spike/matrix spike duplicate (MS/MSD) sets were performed. Accuracy was assessed using labeled compound recoveries and ongoing precision and recovery (OPR) samples.

Laboratory Duplicates

SDG 4988: No laboratory duplicate analyses were performed. Precision could not be assessed.

Calculation Verification

SDG 4988: Calculation verifications were performed on this SDG. No calculation errors were found.

III. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable, as demonstrated by the labeled compound, and OPR %R values. Precision was not assessed.

All data, as reported, are acceptable for use.

DATA VALIDATION REPORT
Hall-Shelton
Total Sulfide by SW846 9030B/9034

This report documents the review of analytical data from the analyses of soil samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by TestAmerica, Nashville, Tennessee.

SDG	Number of Samples	Validation Level
NRF2403	7 Soil	Full

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed in the following table.

2 Holding Times and Sample Preservation
Calibration Verification
Laboratory Blanks
Laboratory Control Samples
Matrix Spike (MS)
Laboratory Replicate
Reporting Limits
1 Calculation Verification (Full validation only)

---

[1] ***Quality control results are discussed below, but no data were qualified***
[2] ***Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.***

Holding Times and Sample Preservation

The validation guidance documents state that the cooler temperatures should be within an advisory temperature range of 2° to 6°C. The temperature of the sample cooler was less than the lower control upon receipt at the laboratory. This temperature outlier did not impact data quality and no qualifiers were required.

SDG NRF2403: A seven day holding time is specified in the analytical method for water samples. No holding time is specified for soil samples; however, the seven day hold time is typically used. All samples were analyzed for sulfide beyond seven days. These results were estimated (J/UJ-1) in all samples.

Calculation Verification

SDG NRF2403: Several results were verified by recalculation from the raw data. No calculation errors were found.

III. OVERALL ASSESSMENT

As determined by this evaluation, the laboratory followed the specified analytical method. The laboratory replicate RPD and %RSD values indicated acceptable precision. Accuracy was also acceptable, as demonstrated by the matrix spike and laboratory control sample recoveries.

Data were qualified based on holding time outliers.

All data, as qualified, are acceptable for use.

EcoChem, INC.
Environmental Data Quality

APPENDIX A

DATA QUALIFIER DEFINITIONS, REASON CODES, AND CRITERIA TABLES

DATA VALIDATION QUALIFIER CODES
National Functional Guidelines

The following definitions provide brief explanations of the qualifiers assigned to results in the data review process.

U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
J	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
N	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification".
NJ	The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents the approximate concentration.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
R	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

The following is an EcoChem qualifier that may also be assigned during the data review process:

DNR	Do not report; a more appropriate result is reported from another analysis or dilution.

DATA QUALIFIER REASON CODES

1	Holding Time/Sample Preservation
2	Chromatographic pattern in sample does not match pattern of calibration standard.
3	Compound Confirmation
4	Tentatively Identified Compound (TIC) (associated with NJ only)
5A	Calibration (initial)
5B	Calibration (continuing)
6	Field Blank Contamination
7	Lab Blank Contamination (e.g., method blank, instrument, etc.)
8	Matrix Spike(MS & MSD) Recoveries
9	Precision (all replicates)
10	Laboratory Control Sample Recoveries
11	A more appropriate result is reported (associated with “R” and “DNR” only)
12	Reference Material
13	Surrogate Spike Recoveries (a.k.a., labeled compounds & recovery standards)
14	Other (define in validation report)
15	GFAA Post Digestion Spike Recoveries
16	ICP Serial Dilution % Difference
17	ICP Interference Check Standard Recovery
18	Trip Blank Contamination
19	Internal Standard Performance (e.g., area, retention time, recovery)
20	Linear Range Exceeded
21	Potential False Positives

EcoChem Validation Guidelines for Dioxin/Furan Analysis by HRMS
(Based on EPA Reg. 10 SOP, Rev. 2, 1996 & EPA SW-846, Methods 1613b and 8290)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler/Storage Temperature	Waters/Solids < 4°C Tissues <-10°C	EcoChem PJ, see TM-05	1
Holding Time	Extraction - Water: 30 days from collection *Note:* Under CWA, SDWA, and RCRA the HT for H2O is 7 days* Extraction - Soil: 30 days from collection Analysis: 40 days from extraction	J(+)/UJ(-) if ext > 30 days J(+)/UJ(-) if analysis > 40 Days EcoChem PJ, see TM-05	1
Mass Resolution	>=10,000 resolving power at m/z 304.9824 Exact mass of m/z 380.9760 w/in 5 ppm of theoretical value (380.97410 to 380.97790) . Analyzed prior to ICAL and at the start and end of each 12 hr. shift	R(+/-) if not met	14
Window Defining Mix and Column Performance Mix	Window defining mixture/Isomer specificity std run before ICAL and CCAL Valley < 25% (valley = (x/y)*100%) x = ht. of TCDD y = baseline to bottom of valley For all isomers eluting near 2378-TCDD/TCDF isomers (TCDD only for 8290)	J(+) if valley > 25%	5A (ICAL) 5B (CCAL
Initial Calibration	Minimum of five standards %RSD < 20% for native compounds %RSD <30% for labeled compounds (%RSD <35% for labeled compounds under 1613b)	J(+) natives if %RSD > 20%	5A
	Abs. RT of $^{13}C_{12}$-1234-TCDD >25 min on DB5 >15 min on DB-225	EcoChem PJ, see TM-05	
	Ion Abundance ratios within QC limits (Table 8 of method 8290) (Table 9 of method 1613B)	EcoChem PJ, see TM-05	
	S/N ratio > 10 for all native and labeled compounds in CS1 std.	If <10, elevate Det. Limit or R(-)	

EcoChem Validation Guidelines for Dioxin/Furan Analysis by HRMS
(Based on EPA Reg. 10 SOP, Rev. 2, 1996 & EPA SW-846, Methods 1613b and 8290)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Continuing Calibration	Analyzed at the start and end of each 12 hour shift. %D+/-20% for native compounds %D +/-30% for labeled compounds (Must meet limits in Table 6, Method 1613B) (If %Ds in the closing CCAL are w/in 25%/35% the avg RF from the two CCAL may be used to calculate samples per Method 8290, Section 8.3.2.4)	Do not qualify labeled compounds. Narrate in report for labeled compound %D outliers. For native compound %D outliers: 8290: J(+)/UJ(-) if %D = 20% - 75% J(+)/R(-) if %D > 75% 1613: J(+)/UJ(-) if %D is outside Table 6 limits J(+)/R(-) if %D is +/- 75% of Table 6 limit	5B
	Abs. RT of $^{13}C_{12}$-1234-TCDD and ^{13}C12-123789-HxCDD +/- 15 sec of ICAL.	EcoChem PJ, see ICAL section of TM-05	
	RRT of all other compounds must meet Table 2 of 1613B.	EcoChem PJ, see TM-05	
	Ion Abundance ratios within QC limits (Table 8 of method 8290) (Table 9 of method 1613B)	EcoChem PJ, see TM-05	
	S/N ratio > 10	If <10, elevate Det. Limit or R(-)	
Method Blank	One per matrix per batch No positive results	If sample result <5X action level, qualify U at reported value.	7
Field Blanks (Not Required)	No positive results	If sample result <5X action level, qualify U at reported value.	6
LCS / OPR	Concentrations must meet limits in Table 6, Method 1613B or lab limits.	J(+) if %R > UCL J(+)/UJ(-) if %R < LCL J(+)/R(-) using PJ if %R <<LCL (< 10%)	10
MS/MSD (recovery)	May not analyze MS/MSD %R should meet lab limits.	Qualify parent only unless other QC indicates systematic problems: J(+) if both %R > UCL J(+)/UJ(-) if both %R < LCL J(+)/R(-) if both %R < 10% PJ if only one %R outlier	8
MS/MSD (RPD)	May not analyze MS/MSD RPD < 20%	J(+) in parent sample if RPD > CL	9

EcoChem Validation Guidelines for Dioxin/Furan Analysis by HRMS
(Based on EPA Reg. 10 SOP, Rev. 2, 1996 & EPA SW-846, Methods 1613b and 8290)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Lab Duplicate	RPD <25% if present.	J(+)/UJ(-) if outside limts	9
Labeled Compounds / Internal Standards	*Method 8290:* %R = 40% - 135% in all samples *Method 1613B:* %R must meet limits specified in Table 7, Method 1613	J(+)/UJ(-) if %R = 10% to LCL J(+) if %R > UCL J(+)/R(-) if %R < 10%	13
Quantitation/ Identification	Ions for analyte, IS, and rec. std. must max w/in 2 sec. S/N >2.5 IA ratios meet limits in Table 9 of 1613B or Table 8 of 8290 RRTs w/in limits in Table 2 of 1613B	If RT criteria not met, use PJ (see TM-05) If S/N criteria not met, J(+). if unlabelled ion abundance not met, change to EMPC If labelled ion abundance not met, J(+).	21
EMPC (estimated maximum possible concentration)	If quantitation idenfication criteria are not met, laboratory should report an EMPC value.	If laboratory correctly reported an EMPC value, qualify with U to indicate that the value is a detection limit.	14
Interferences	PCDF interferences from PCDPE	If both detected, change PCDF result to EMPC	14
Second Column Confirmation	All 2378-TCDF hits must be confirmed on a DB-225 (or equiv) column. All QC specs in this table must be met for the confirmation analysis.	Report lower of the two values. If not performed use PJ (see TM-05).	3
Field Duplicates	Use QAPP limits. If no QAPP: Solids: RPD <50% OR absolute diff. < 2X RL (for results < 5X RL) Aqueous: RPD <35% OR absolute diff. < 1X RL (for results < 5X RL)	Narrate and qualify if required by project (EcoChem PJ)	9
Two analyses for one sample	Report only one result per analyte	"DNR" results that should not be used	11

EcoChem Validation Guidelines for Pesticides/PCBs by GC/ECD
(Based on Organic NFG 1999 & EPA SW-846 Method 8081/8082)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature	4°C ±2°	J(+)/UJ(-) if greater than 6 deg. C (EcoChem PJ)	1
Holding Time	Water: 7 days from collection Soil: 14 days from collection Analysis: 40 days from extraction	J(+)/UJ(-) if ext/analyzed > HT J(+)/R(-) if ext/analyzed > 3X HT (EcoChem PJ)	1
Resolution Check	Beginning of ICAL Sequence Within RTW Resolution >90%	Narrate (Use Professional Judgement to qualify)	14
Instrument Performance (Breakdown)	DDT Breakdown: < 20% Endrin Breakdown: <20% Combined Breakdown: <30% Compounds within RTW	J(+) DDT NJ(+) DDD and/or DDE R(-) DDT - If (+) for either DDE or DDD J(+) Endrin NJ(+) EK and/or EA R(-) Endrin - If (+) for either EK or EA	5A
Retention Times	Surrogates: TCX (+/- 0.05); DCB (+/- 0.10) Target compounds: elute before heptachlor epoxide (+/- 0.05) elute after heptachlor epoxide (+/- 0.07)	NJ(+)/R(-) results for analytes with RT shifts For full DV, use PJ based on examination of raw data	5B
Initial Calibration	Pesticides: Low=CRQL, Mid=4X, High=16X Multiresponse - one point Calibration %RSD<20% %RSD<30% for surr; two comp. may exceed if <30% Resolution in Mix A and Mix B >90%	J(+)/UJ(-)	5A
Continuing Calibration	Alternating PEM standard and INDA/INDB standards every 12 hours (each preceeded by an inst. Blank) %D < 25% Resolution >90% in IND mixes; 100% for PEM	J(+)/UJ(-) J(+)R(-) if %D > 90% PJ for resolution	5B
Method Blank	One per matrix per batch No results > CRQL	U(+) if sample result is < CRQL and < 5X rule (raise sample value to CRQL) U(+) if sample result is > or equal to CRQL and < 5X rule (at reported sample value)	7
Instrument Blanks	Analyzed at the beginning of every 12 hour sequence No analyte > 1/2 CRQL	Same as Method Blank	7
Field Blanks	Not addressed by NFG No results > CRQL	Apply 5X rule; U(+) < action level	6

EcoChem Validation Guidelines for Pesticides/PCBs by GC/ECD
(Based on Organic NFG 1999 & EPA SW-846 Method 8081/8082)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
MS/MSD (recovery)	One set per matrix per batch Method Acceptance Criteria	Qualify parent only unless other QC indicates systematic problems: J(+) if both %R > UCL J(+)/UJ(-) if both %R < LCL J(+)/R(-) if both %R < 10% PJ if only one %R outlier	8
MS/MSD (RPD)	One set per matrix per batch Method Acceptance Criteria	J(+) in parent sample if RPD > CL	9
LCS	One per SDG Method Acceptance Criteria	J(+) if %R > UCL J(+)/UJ(-) if %R < LCL J(+)/R(-) using PJ if %R <<LCL (< 10%)	10
LCS/LCSD *(if required)*	One set per matrix and batch of 20 samples RPD < 35%	J(+)/UJ(-) assoc. cmpd. in all samples	9
Surrogates	TCX and DCB added to every sample %R = 30-150%	J(+)/UJ(-) if both %R = 10 - 60% J(+) if both >150% J(+)/R(-) if any %R <10%	13
Quantitation/ Identification	Quantitated using ICAL calibration factor (CF) RPD between columns <40%	J(+) if RPD = 40 - 60% NJ(+) if RPD >60% EcoChem PJ - See TM-08	3
Two analyses for one sample	Report only one result per analyte	"DNR" results that should not be used to avoid reporting two results for one sample	11
Sample Clean-up	GPC required for soil samples Florisil required for all samples Sulfur is optional Clean-up standard check %R within CLP limits	J(+)/UJ(-) if %R < LCL J(+) if %R > UCL	14
Field Duplicates	Use QAPP limits. If no QAPP: Solids: RPD <50% OR absolute diff. < 2X RL (for results < 5X RL) Aqueous: RPD <35% OR absolute diff. < 1X RL (for results < 5X RL)	Narrate (Qualifiy if required by project QAPP)	9

EcoChem Validation Guidelines for Conventional Chemistry Analysis
(Based on EPA Standard Methods)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature and Preservation	Cooler Temperature 4°C ±2°C Preservation: Method Specific	Use Professional Judgment to qualify based to qualify for coole temp outliers J(+)/UJ(-) if preservation requirements not met	1
Holding Time	Method Specific	Professional Judgment J(+)/UJ(-) if holding time exceeded J(+)/R(-) if HT exceeded by > 3X	1
Initial Calibration	Method specific r>0.995	Use professional judgment J(+)/UJ(-) for r < 0.995	5A
Initial Calibration Verification (ICV)	Where applicable to method Independent source analyzed immediately after calibration %R method specific, usually 90% - 110%	R(+/-) if %R significantly < LCL J(+)/UJ(-) if %R < LCL J(+) if %R > UCL R(+) if %R significantly > UCL	5A
Continuing Cal Verification (CCV)	Where applicable to method Every ten samples, immed. following ICV/ICB and end of run %R method specific, usually 90% - 110%	R(+/-) if %R significantly < LCL J(+)/UJ(-) if %R < LCL J(+) if %R > UCL R(+) if %R significantly > UCL	5B

Initial and Continuing Cal Blanks (ICB/CCB)	Where applicable to method
	After each ICV and CCV every ten samples and end of run
	| blank| < MDL
		Action level is 5x absolute value of blank conc.
		For (+) blanks, U(+) results < action level
		For (-) blanks, J(+)/UJ(-) results < action level
		refer to TM-02 for additional details
			7

Method Blank	One per matrix per batch
	(not to exceed 20 samples)
	blank < MDL
		Action level is 5x absolute value of blank conc.
		For (+) blk value, U(+) results < action level
		For (-) blk value, J(+)/UJ(-) results < action level
			7

Laboratory Control Sample	Waters: One per matrix per batch %R (80-120%)	R(+/-) if %R < 50% J(+)/UJ(-) if %R = 50-79% J(+) if %R >120%	10
	Soils: One per matrix per batch Result within manufacturer's certified acceptance range	J(+)/UJ(-) if < LCL, J(+) if > UCL	10
Matrix Spike	One per matrix per batch; 5% frequency 75-125% for samples less than 4 x spike level	J(+) if %R > 125% or < 75% UJ(-) if %R = 30-74% R(+/-) results < IDL if %R < 30%	8
Laboratory Duplicate	One per matrix per batch RPD <20% for samples > 5x RL Diff <RL for samples >RL and <5 x RL (may use RPD < 35%, Diff < 2X RL for solids)	J(+)/UJ(-) if RPD > 20% or diff > RL all samples in batch	9

EcoChem Validation Guidelines for Conventional Chemistry Analysis
(Based on EPA Standard Methods)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Field Blank	blank < MDL	Action level is 5x blank conc. U(+) sample values < action level in associated field samples only	6
Field Duplicate	For results > 5X RL: Water: RPD < 35% Solid: RPD < 50% For results < 5 x RL: Water: Diff<RL Solid: Diff < 2X RL	J(+)/UJ(-) in parent samples only	9

Goose Lake Project Site

Remedial Investigation Addendum Report

Additional Sampling Program
Drainage Ravine and
Former Disposal Lagoons

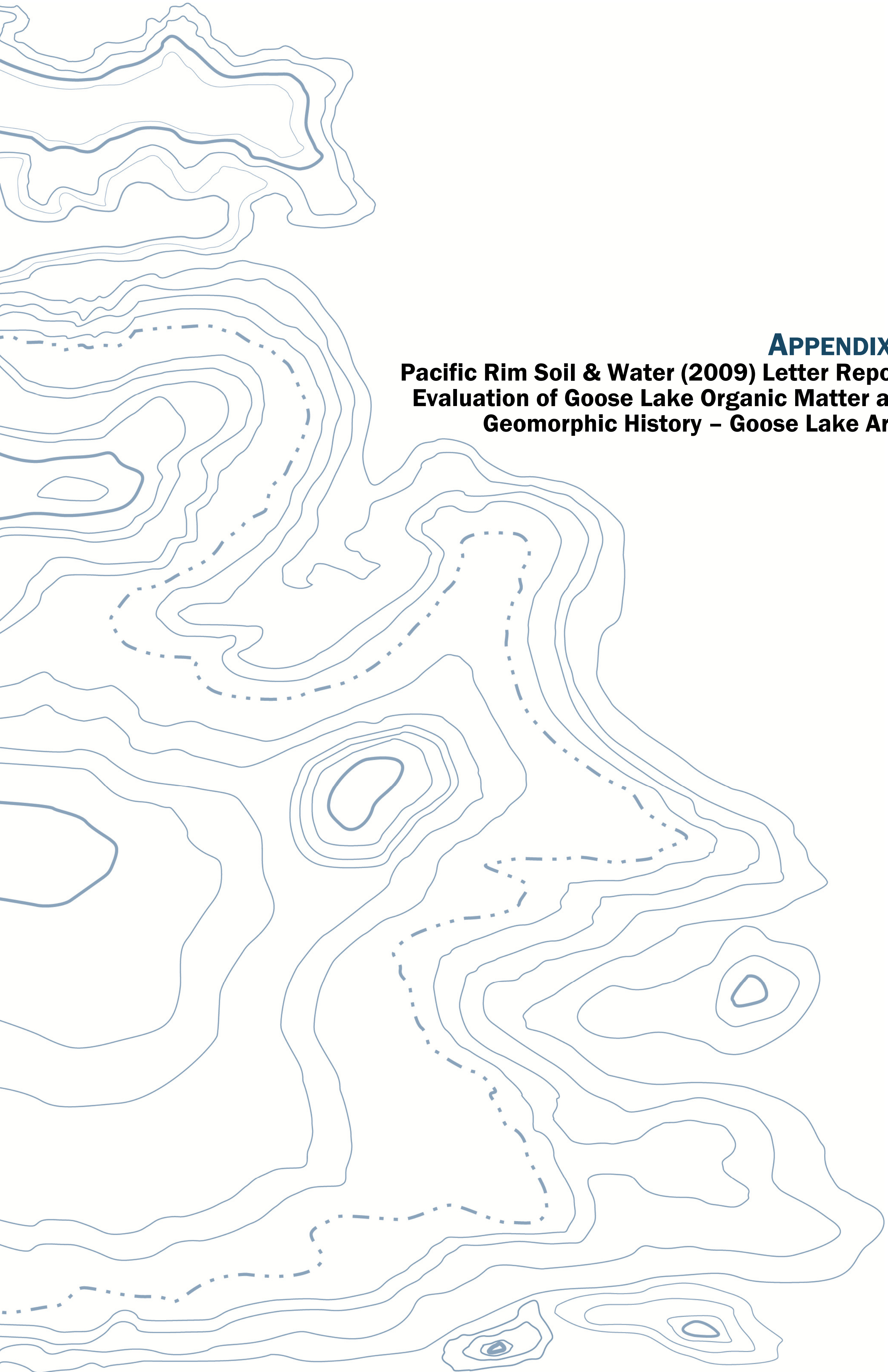
Appendix E
Environmental Information Management Data

FINAL

The electronic Environmental Information Management files included as Appendix E of this report are provided in CSV format on the attached CD-ROM.

APPENDIX F

Pacific Rim Soil & Water (2009) Letter Report: Evaluation of Goose Lake Organic Matter and Geomorphic History – Goose Lake Area



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Floyd|Snider Inc.
Dennis O'Neill, LEG, LHG
601 Union Street, Suite 600
Seattle, WA 98101

February 27, 2009

Subject: **Evaluation of Goose Lake Organic Matter and Geomorphic History**
Goose Lake Area[1]
Location: **Shelton Washington**
File Number: **S08-0074**

EXECUTIVE SUMMARY

Pacific Rim Soil & Water (PRSW) was retained to provide an assessment of Goose Lake sediments and its overall origin. PRSW provides expertise in freshwater lakes, soils and wetlands and has been providing these services in the Pacific Northwest since 1991. PRSW maintains a staff of certified professional soil and wetland scientists. They are recognized as experts in evaluation of both hydric[2] and non-hydric soil morphology.

This work was carried out in response to a request by the Washington State Department of Ecology (Ecology) for additional information regarding the origin and nature of brown fibrous organic material located beneath the lake under the surface black sludge layer previously described by other consultants. PRSW's task was to determine if organic materials underlying the lake are organic soils that developed as a result of natural geomorphic processes, or are instead at least partially the result of human caused disturbance and land-use.

To address these questions, we conducted a 3-Phase approach. Phase 1 consisted of conducting an overall evaluation of the geologic setting associated with Goose Lake to identify potential environments that may have resulted in the accumulation of organic

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[1] T20, S12 and 13, R4W. Tax Parcel Numbers: 420132000000 and 420123300000

[2] Hydric soils develop unique morphologies as a result of long-duration saturation (a persistent, shallow groundwater table) within 12 inches of the soil surface; they may also be called "wetland soils".

materials. This process included an extensive paper search on existing geology, soils and mapping coverage, including LIDAR images (Light Detection and Ranging), to document the origin of the lake and of the surrounding area's geomorphic history and condition. Phase 2 consisted of an onsite assessment by PRSW staff of soil conditions around the eastern and southeastern lake perimeter. This process included hand-augering and evaluating soil and substrate to 5 feet depth at several locations around the eastern portion of Goose Lake. Phase 3 consisted of visual and microscopic evaluation of sediments samples, including the brown fibrous organic material collected by PRSW scientists during Phase 2. In addition, we evaluated split sediments samples collected from the bottom of Goose Lake by GeoEngineers in 2007 and previously evaluated by Econotech. No samples were collected for chemical analyses.

Phase 1: Based on a review of site geologic and soil formation history, Goose Lake appears to be natural, but may have been expanded from what was originally a smaller glacial kettle lake, similar to other natural kettle lakes that occur along a broad peat-based swale that extends from Goldsborough Creek (west-southwest of the lake) up to and including areas around Island Lake (to the northeast of Highway 101). This swale is clearly visible on LIDAR images, and is an old glacial outwash flood channel that appears to flow toward Goldsborough Creek. The northern outwash swale edge escarpment indicated on the LIDAR image is very linear and smooth, as is expected with this sort of a terrace landform. Any scallops or indents in that escarpment around Goose Lake may be taken to be a result of human impacts – most likely from gravel or peat mining. The surface elevation of the peat soils across the majority of the swale may be used to represent the natural, pre-human-impact surface elevation. Any surface in the swale base, at elevations above the peat, is likely to be some form of fill material from human impacts.

Phase 2: On November 6th, 2008, PRSW conducted a site visit to document onsite soil conditions around the lake. During the site visit, the lake surface water elevation was low and thus exposed a good portion of a bench/fill pad along the eastern and southeastern portion of the lake. Given the topography, the exposed bench appears to be remnants of historical fill material associated with the adjacent, inactive landfill. Several representative sediment samples were collected from exposed sediments on the bench and revealed approximately 3 feet of wood chips overlying a brown native organic peat made up of fibrous sedge and grass materials. A thin layer of viscous, black sediment[3] was located at the contact between the wood chips and underlying organic materials. Additional sediment samples collected along the southeastern lake perimeter indicated that the wood chip layer is concentrated next to the inactive landfill and not wide spread throughout the lake. The wood chip layer detected on the eastern portion of the lake correlated well with previous test pit findings completed by GeoEngineers in the adjacent inactive landfill. The wood chip layer appears to reflect debris associated with the inactive landfill that encroached upon the eastern portion of the lake. The underlying natural peat soil corresponds to an extensive area of peat mapped throughout the same broad wetland swale depression described in Phase 1 research

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[3] This layer is inferred to be the same "surficial black sludge" layer observed and described in other areas of the lake.

materials. The swale contains Goose Lake and other surface water bodies, and connects to Goldsborough Creek to the southwest and is currently defined by Highway 101 to the east.

Phase 3: Results from previous sediment sampling and evaluation of Goose Lake by GeoEngineers indicated a thin, low bulk density, organic-rich, surficial black sludge layer ranging in thickness from 3 to 6 centimeters throughout the bottom of the lake. Sediments beneath the surficial black sludge layer were described as a brown fibrous organic material that did not contain wood chip materials characteristic of pulp mill operations. As mentioned above, Ecology requested additional information regarding the origin and nature of the brown fibrous organic material from beneath the lake. In response to that request, in November 2007, GeoEngineers collected additional sediment samples to further assess the nature of the brown organic fibrous material. Several split sediment samples were collected from the lake bottom and provided to Ecology for potential testing.

These samples were also inspected by PRSW scientists, alongside samples collected by PRSW during the November 2008 site visit, described above. Our inspection confirmed that the brown fibrous organic material in the samples is a naturally developed organic soil (peat) derived from centuries of accumulation and very slow breakdown of sedges and grasses, and is not effluent waste from the historical Rayonier paper mill operations.

INTRODUCTION

Pacific Rim Soil & Water (PRSW) was retained to provide an assessment of Goose Lake sediments and its origin. PRSW provides expertise in freshwater lakes, soils and wetlands and has been providing these services in the Pacific Northwest since 1991. PRSW staff consists of certified professional soil wetland scientists. They are recognized as experts in evaluation of both hydric[4] and non-hydric soil morphology.

The Goose Lake study site is approximately 70 acres, but the lake water surface covers about 17-20 acres. The site is located southwest of the intersection of Highway 101 and W. Fairgrounds Road, approximately 2 miles northwest of Shelton Washington. It is owned by Rayonier Properties LLC, and was used as part of historical pulp and paper operations associated with Rayonier facilities located in Shelton Washington. The study site is currently undeveloped, but is part of a much larger tract of land that is currently known as the proposed Shelton Hills Mixed-Use Development.

PURPOSE AND SCOPE OF SERVICES

PRSW work described herein was carried out in response to a request by the Washington State Department of Ecology (Ecology) for additional information regarding the origin and

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[4] Hydric soils develop unique morphologies as a result of long-duration saturation (a persistent, shallow groundwater table) within 12 inches of the soil surface; they may also be called “wetland soils”.

nature of brown fibrous organic material located beneath the lake, under a surficial black sludge layer and previously described by other consultants. PRSW's task was to determine if the brown, fibrous organic materials underlying the lake are organic soils that developed as a result of natural geomorphic processes, or are instead at least partially the result of human caused disturbance and land-use.

To accomplish the project objectives, we conducted an evaluation in three phases:

Phase 1: Evaluation of Geologic History
Phase 2: Site Visit and Collection of Sediment Samples
Phase 3: Evaluation of Sediment Samples

A brief description of the scope of services provided during each phase of the project is presented below.

Phase 1: Review of geology, soils and topography mapping as well as LIDAR and aerial photo images indicates that the area within and surrounding the lake is first, the result of post-glacial flood events that carved a deep swale through the higher glacial till plain about 7,000-10,000 years ago. The swale base and associated uplands were subsequently affected by human disturbance related to peat and gravel mining potentially associated with historic Rayonier pulp and paper operations.

Phase 2: An onsite soils investigation was carried out on November 6th, 2008, by PRSW staff (Lisa Palazzi and Daniel Ufnar, both Certified Professional Soil Scientists) accompanied by Dennis O'Neill, a licensed engineering geologist and hydrogeologist from Floyd|Snider. The intent of this work was to examine onsite soil conditions in and around Goose Lake. At the time of our site visit, the lake levels were unusually low, and therefore exposed a bench area. As a result of that, we completed several hand-augers of that material to evaluate the subsurface conditions. No chemical testing was performed on these samples.

Phase 3: Using a dissecting microscope, PRSW scientists examined and compared soil samples collected during Phase 2 of the work, as well as other samples that were collected from the lake bottom by a previous consultant (GeoEngineers) in November of 2007. PRSW also reviewed a previous consultant letter report describing an assessment of the GeoEngineers samples by pulp and paper material specialists (Econotech, 2007).

The information gathered during the three phases was used by PRSW staff to provide the following summary of the geomorphic history and formation of Goose Lake, and to provide an opinion as to whether the brown, fibrous organic materials underlying the lake are native organic soils versus pulp and paper debris remnants.

RESULTS AND DISCUSSION

The information presented in this section discusses our findings associated with our evaluation of the overall geologic setting of Goose Lake and previous and recent sediment samples collected in Goose Lake.

Phase 1: Evaluation of Geologic History

According to the topography data obtained from digitized USGS Topo Quads (20-foot contours) on the Mason County GIS viewer website (Mason County's critical areas mapping program), the Goose Lake water surface has an elevation of approximately 240 feet (± 10 ft) (Figure 1). Goose Lake lies in the base of a broad depressional swale that extends from Goldsborough Creek (±9,000 feet west-southwest of the lake) through to Island Lake (about 7,000 feet east-northeast of the lake) on the east side of Highway 101. The swale base has a similar elevation as the lake surface, as would be expected, and is either marsh and/or seasonally- to permanently-ponded with water. The swale, interpreted as a glacial outwash flood channel, is oriented more or less from east to west, draining very slowly to the west in the direction of Goldsborough Creek (about 2 miles west of the lake). The outwash flood channel was historically connected across Highway 101 to the east with Island Lake and the Johns Creek system, although some of those historic hydrologic pathways have been greatly altered or eliminated entirely by roads and related development.

***Figure 1*. USGS Topography of Goose Lake area (20-ft contours) indicating a swale base elevation of 240 ft, and terrace surface elevation of 260 ft (± 10 ft).**

The escarpment located along the northern edge of this swale (labeled as "A" and "B" in the LIDAR image in Figure 2 below) -- in proximity to Goose Lake -- has an elevation of about 260 feet (±10 ft). The majority of the escarpment edge along the northern side of the swale, west of Goose Lake, is smooth and linear, as is shown by Point "A" in Figure 2. The escarpment directly adjacent to the lake is scalloped and non-linear, as is shown by the estimated pre-impact terrace edge drawn in orange in Figure 3 and labeled as "B" in Figure 2. This irregular shape is not a natural terrace edge form, and does not match the more natural form of the majority of the escarpment farther west (marked as "A"). This distinction is clear in the LIDAR images below, and appears to be the result of human disturbance, cut and fill activities.

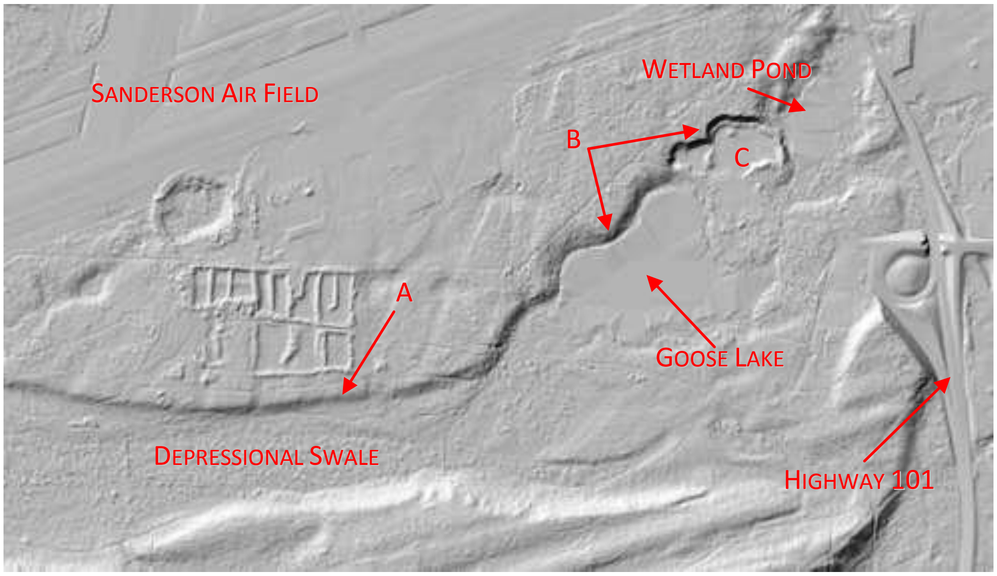

***Figure 2:* LIDAR image from the Puget Sound LIDAR Consortium of the Goose Lake area. Local landmarks have been labeled for reference. A) Shows typical boundary between the Depressional Swale and the upland glacial drift plain. B) Irregular boundary of drift plain relative to the edge of depressional swale, indicating past human disturbance. C) Graveled area with bare soil surface – also evidence of past disturbance.**

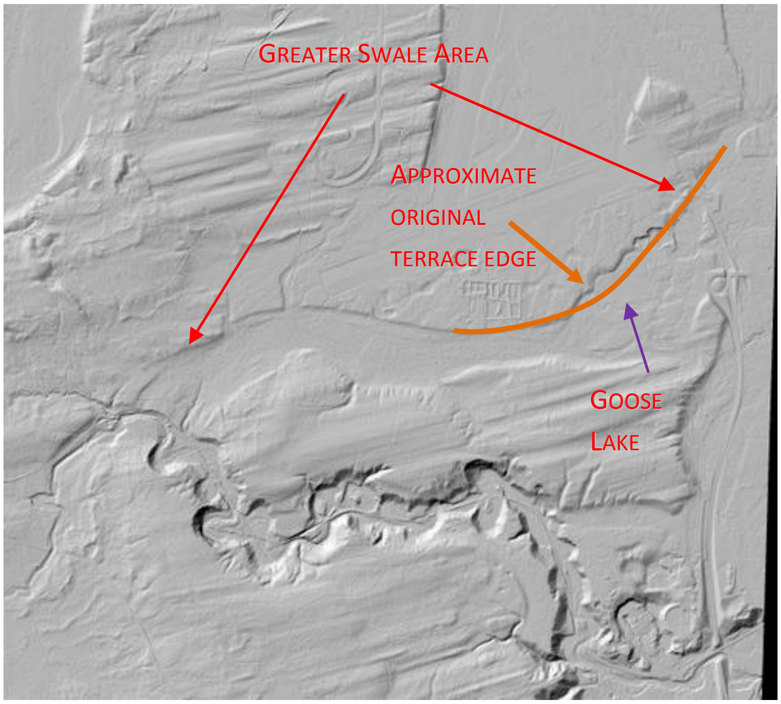

***Figure 3.* LIDAR area expanded to show entire outwash swale leading to Goldsborough Creek west of Highway 101. The orange line shows the approximate, pre-gravel mining, more linear terrace edge.**

Other than Goose Lake, there are several surface water features in the vicinity of the study site. We have provided a map of these water bodies in Figure 4 below; the map was obtained from a Washington DNR website depicting stream and water typing for the state.

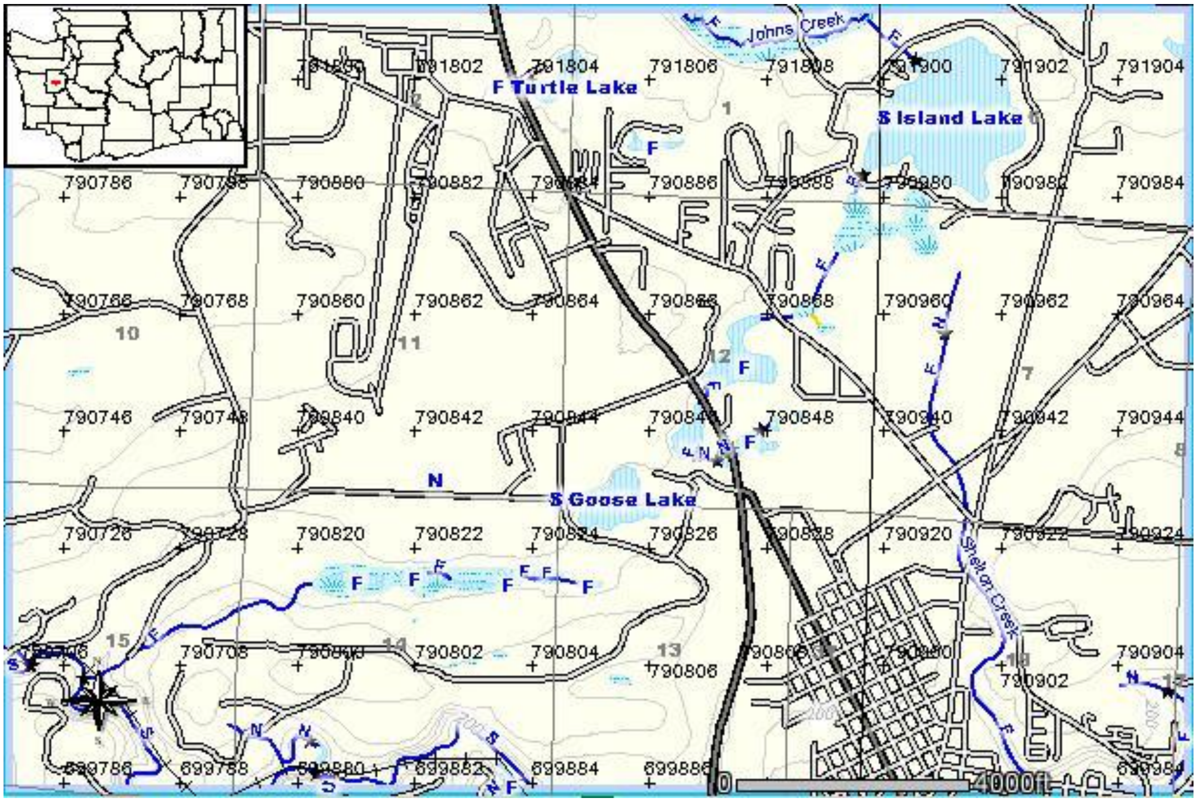

Figure 4: **Stream coverage of the Goose Lake area obtained from the DNR FPARS (Forest Practices Application Review System) GIS website, http://fortress.wa.gov/dnr/app1/fpars/viewer.htm. Goose Lake and Island Lake are labeled. Streams types, which relate to fish or fish habitat presence, are shown for particular stream segments. Type F waters mean fish habitat is present; Type N waters are non-fish bearing streams and can be seasonal.**

As shown in Figures 1, 2 and 3, there is an offsite pond located to the northeast of Goose Lake, on the east side of the bare earth area that covers the inactive landfill (mentioned above). The Northeast pond has surface water at approximately the same elevation as that of Goose Lake. However, that system appears to have a surface connection (through a culvert under Highway 101) only to other systems east of the highway. The surface water system connects through intermittent channels, culverts, and wetlands to Island Lake and possibly to Johns Creek, based on the DNR coverage shown in Figure 4. At this point in time, the landfill area between Goose Lake and the small pond to the northeast seems to force a drainage divide, and overflow water from Goose Lake would now be expected to drain to the west, based on topography, in the direction of Goldsborough Creek (located about 9000 feet to the west-southwest). The surface water elevation of the wetlands and water bodies in the glacial outwash channel on both sides of the freeway are all similar and groundwater hydrology may still be shared to some degree between these systems. Prior to gravel mining and localized associated cutting and filling, the small northeast pond may have been directly connected or may have at least shared surface hydrology with Goose Lake (see discussion below). But there does not appear to be any surface water connection at this time.

Most of this swale feature is mapped as wetland on Mason County GIS coverage, and on Ecology wetland GIS coverage, as well as on National Wetland Inventory mapping. Goose Lake is listed as a “Category 2” water by Ecology under their Water Quality program. Category 2 waters are described as “waters of concern” that:

- may contain pollution either at levels too low to violate current standards,
- may not have acquired enough violations to be listed as impaired, or
- current data is inadequate to accurately define as impaired.

According to the DNR geology map (Walsh et. al., 1987), Goose Lake and the surrounding area between Goldsborough Creek and Island Lake, is mapped as Qa – “recent” or post-glacial Alluvium (shown below in yellow). The map polygon for this unit is the same long, broad swale feature as is apparent on the LIDAR maps above. So this geology mapping confirms that the Qa swale is a post-glacial alluvial channel that was carved into the till/outwash plain (Qgt/ Qgo map units respectively) that is mapped across the upland terraces in the surrounding area. The Qa mapping unit in the swale base is described as containing sand, silt, and gravel deposited in streambeds, and fans. The surfaces of these landforms are relatively undisturbed, i.e. they lack dissection by subsequent drainages, which infers that they are reasonably young features on the landscape.

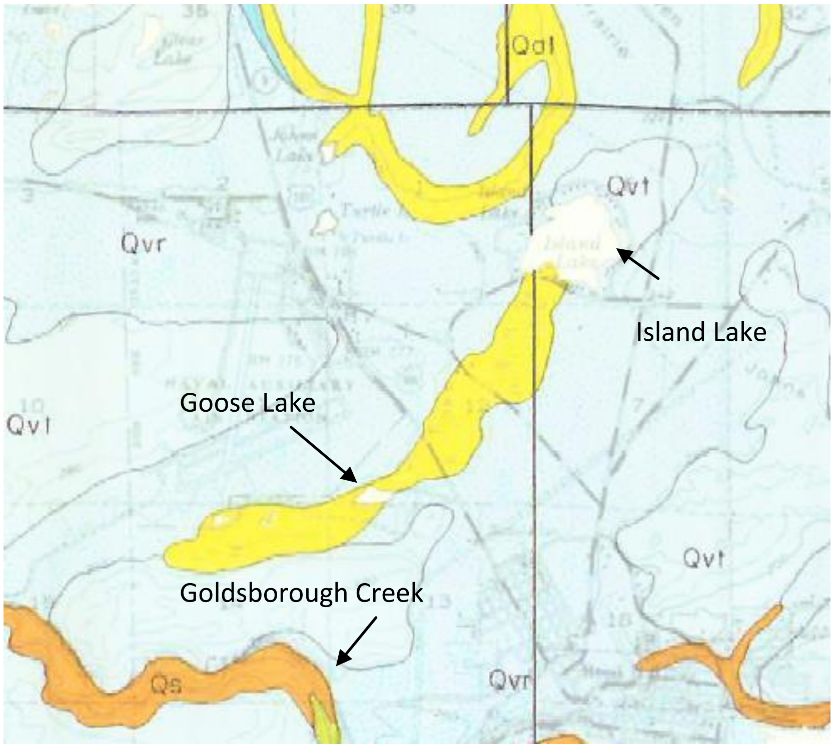

Figure 5: **Geology of Goose Lake area of southeastern Mason County taken from Molenaar & Noble (1970). Goose Lake, Island Lake and Goldsborough Creek have been identified for reference. Mapped units include Qal (Alluvium), Qvt (Till), Qvr (Recessional Outwash), and Qs (Skokomish Gravel).**

Molenaar and Noble’s (1970) description of recent alluvium mapped in Mason County is similar to that described in the later DNR mapping (and was likely used as a data source considering the delineations of polygons are identical between the two sources); however, they also include areas of *peat found in depressions on drift (outwash/till) plains* in their concept of the alluvium map unit (labeled as Qvl on Molennar and Noble’s geology map of southeastern Mason County).

Based on soils mapped throughout this broad swale feature (see below in Figure 6), this area between Goldsborough Creek and Island Lake would likely fall into the category of a “peat filled depression” described in the Molenaar and Noble (1970) geology mapping. Based on the topographic shape of this feature, it is likely that the depression was formed and carved out of the drift plain by a post-glacial flood event.

According to the Mason County Soil Survey[5], the Grove, Mukilteo and Shelton soil series are most common across the study site and the immediate surrounding area. We provided a soil map below for easy reference, but also include a larger copy in the attachments with a map legend:

> 1) Map units Gg, Gh and Gk are all Grove gravelly sandy loam series with slope classes of 0-5% for Gg and Gh and 5-15% for Gk. The Grove series is classified as a sandy-skeletal, mixed, mesic Dystric Xerorthent[6]. It is a very deep, somewhat excessively drained soil found on glacial outwash plains and formed in glacial outwash. Generally, the texture becomes coarser and more gravelly with depth, from a reddish brown very gravelly (35-65% gravel) sandy loam surface to about 15 inches, underlain by a dark brown extremely gravelly loamy sand or sand down to greater than 60 inches. The Grove series is mapped across much of the glacial outwash terrace that forms the lowlands surrounding the City of Shelton. It is mapped across the north and south edge of Goose Lake, as well as in the area that appears to have been gravel mined to the north and filled to the east of the lake. The Gg phase (called the "basin phase") is mapped in the western end of the swale base, near Goldsborough Creek – an old gravel bar. The steeper phase of this series (Gk, slopes of 5-15%) is mapped along the escarpment north and west of the lake.
>
> 2) Map unit Mg is the Mukilteo peat, 0-2% slopes (classified as a dystric, mesic Typic Haplohemist[7]). The Mukilteo peats are very deep, very poorly-drained hydric (wetland) soils formed in upland depressions out of organic materials derived primarily from sedges and rushes. The surface horizons can be mucky, but trends to a brown layer of fibrous peat with depth. In areas where these soils have been drained and used for agriculture, the average water table is approximately 1-2 feet deeper than for undrained areas. But the high water table and mucky textures generally greatly limit trafficability and/or development. The Mason County soil survey describes the Mukilteo peats as often being underlain by compact glacial till at a depth as shallow as 3 feet from the surface. The series is often found on depressions and old channels that were carved into the till/outwash plain found in the Mason County lowlands surrounding Shelton. The till does not allow for vertical flow, causing water to perch in the depression and to slowly

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[5] As viewed through the NRCS web-based Soil Survey website found at http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx.

[6] Sandy-skeletal, mixed, mesic Dystric Xerorthent, generally meaning, the soil is very young with little horizon development (ent), has no unusual features that classify at the subgroup level (orth), has developed under climatic conditions of wet winters and dry summers (Xer), and has a relatively low nutrient, low base-saturation chemical character (Dystric), has a mesic temperature regime (mean annual temperature ranges from 8° to 15° C (47° - 59° F), has no specific mineralogic source (mixed), has 15-50% sand by weight and greater than 35% coarse fragments by volume (sandy-skeletal).

[7] Dysic, mesic Typic Haplohemists, generally meaning the soil is dominated by organic rather than mineral components, is greater than 20-30% organic matter (ist), has moderately- (as compared to slightly- or extremely-) decomposed organic materials (hem), and is otherwise not very unusual for an organic soil (Haplo and Typic), has developed under conditions of a mesic climate (mean annual temperature ranges from 8° to 15° C (47° - 59° F), and has a pH lower than 4.5 (dysic).

fill in over time with a marsh type community of plants, resulting in the buildup of organic soils.

The Mukilteo peats are mapped in the base of the same broad topographic swale extending from Goldsborough Creek through the study site to Highway 101, and east (intermittently) to Island Lake. This same topographic feature is clearly visible on USGS topography maps, LIDAR coverage, and available geology maps.

3) Map unit Sf is the Shelton gravelly sandy loam, 5-15% slopes (classified as a medial-skeletal, mixed, mesic Typic Haploxerands[8]). The Shelton gravelly sandy loams are moderately deep, moderately well-drained soils formed in local glacial drift and colluvium overlying compact, strongly cemented basal till. Generally, the upper soils are gravelly or very gravelly sandy loams; a more weakly cemented hardpan is found at around 30 inches depth, and a strongly cemented duripan is found underlying the hardpan at 20 to 40 inches depth. The Shelton soil series is mapped across the higher terrace areas south of Goose Lake and to north on airport property. The mapping of this series on terraces in close proximity to the Mukilteo peat swale map unit west and south of the lake, indicates clearly that compacted till is common throughout the area, and is expected to underlay both peat and glacial outwash deposits. The till will cause water to perch locally during the winter months.

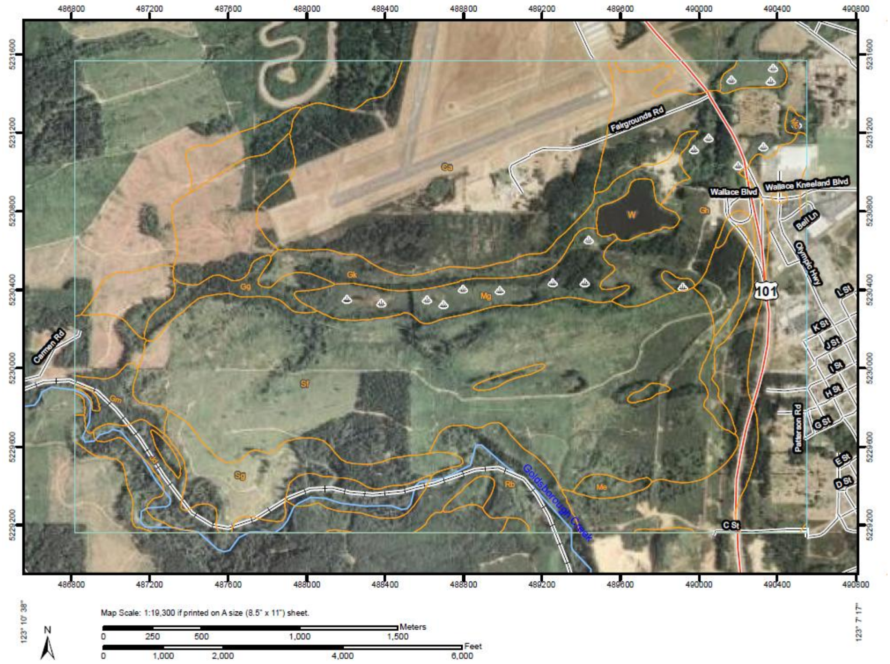

Figure 6. **Goose Lake area soil survey map. (Larger map and legend provided in the attachments.)**

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[8] Medial-skeletal, mixed, mesic Typic Haploxerands, generally meaning the soil is of volcanic origin (ands), has developed under climate conditions of wet winters and droughty summers (xer), are otherwise typical of xerands (Haplo), soil properties are otherwise typical of these soil types (Typic), has a mesic temperature regime (mean annual temperature ranges from 8° to 15° C (47° - 59° F), has no specific mineralogic source (mixed), and has volcanic ash influence on texture with 35 % or more (by volume) rock fragments (Medial-skeletal).

Standard characteristics of the mapped soil series are described in Attachment A. Please note that the Natural Resources Conservation Service (NRCS) (formerly the Soil Conservation Service [SCS]) soil series maps and descriptions represent expected characteristics in only the top 60 inches of soil. Furthermore, the map units can have extensive inclusions of other soil types, and in some rare cases, can be entirely in error. Taxonomic descriptions listed reflect the most recent changes to Soil Taxonomy and represent the current accepted understanding of soil forming processes. Please refer to the individual pit descriptions in the discussion in the text below for specifics on observed site soil conditions.

Phase 2: Site Visit and Collection of Sediment Samples

On November 6th, 2008, PRSW scientists visited the project site to assess the current site conditions. On the day of our site visit, when lake water levels were somewhat lower than average, we observed a small vegetated island (estimated at about 1,000 square feet) near the center of the lake (see Figure 7 below). The island is visible on some aerial photos, and appears to persist even with higher lake levels. The lake lies in the base of a broad glacial outwash flood channel swale that has been described above, and will be described in more detail below. The north and south sides of the swale are old stream terrace escarpments, and about 20-30 feet higher in elevation. Goose Lake is bounded to the east by impacts of past earth moving, cutting and filling (inactive landfill area and past gravel mining pit), and to the west by more natural wetland surfaces. Aerial photos show bare soil areas east of Goose Lake (inactive landfill) along with several gravel roads and trails surrounding the lake; approximately 20% of the 70-acre study site area is bare ground, and the vegetation in more disturbed areas is almost 100% Scot's broom.

Figure 7. **View of Goose Lake facing west. Foreground shows fill pad (landfill encroachment) at east end of the Lake. The small island mentioned above is visible at right side of photo.**

The remainder of the study site swale base is Palustrine Scrub/Shrub and Palustrine Emergent wetland (as can be seen across the lake in Figure 7); upland areas on the north and south sides of the swale are covered by a mix of trees and shrubs – mostly willow and alder (as can be seen to the left in Figure 7). As mentioned before, Scot's broom covers large areas in proximity to the disturbed eastern side of the lake. Planted Douglas-fir was observed in upland areas south of the lake. There are also extensive areas of reed canarygrass (non-native, invasive species) along the banks of the lake.

Figure 8. Rayonier Goose Lake Evaluation of Goose Lake Organic Matter and Geomorphic History Shelton, Washington

PRSW scientists completed six hand-auger boreholes to depths of approximately 5 feet at several locations around the east and southeast perimeter of Goose Lake (Figure 8, and Figure 9). The lake had receded considerably from its Ordinary High-water Mark (OHWM), in some locations measuring over 100-feet lateral from the OHWM to the water edge present at the time of the study. Our field investigation concentrated in the area between the OHWM and the water edge to provide a reconnaissance level evaluation of soils underlying the perimeter of the lake bottom. (Additional pictures of the sampling locations are provided in the Attachment C). The evaluation was concentrated at the east end of the lake due to that area showing the most evidence of surface soil disturbance from past land-use. The swale base west of the lake – in contrast – does have a filled road crossing just below the lake, but is a comparatively undisturbed wetland swale, as described above.

Soils around the eastern lake perimeter had between 2 and 4 feet of weakly decomposed, dark brown or black, coarse wood chips at the surface. Below that, we observed a thin layer of finer decomposed wood chips and reworked native peat (shown in Figure 10) mixed with a black organic suspension that may be a derivative of the pulp making process, called "black liquor". This material is inferred to be the same surficial black sludge layer observed and described by others on the lake bottom outside of the area of apparent land filling (see next section).

***Figure 9*. Hand augering on fill pad.**

***Figure 10*. Fibrous peat below fill**

Beneath these chips and pulp-like materials, there was natural organic soil -- a layer of brown, fibrous peat that is consistent with the Mukilteo peat mapped throughout the broad swale, as described above. These peats are derived from sedge and other grass-like plant species, remnants of which were clearly visible to the naked eye. This organic soil material was examined both in the field and later in the office under a dissecting microscope. Many thread-like root and leaf fibers were present and visually consistent with the remnants of grasses and sedges found in native organic peats that we have studied in other areas. In addition, the large dark brown or black wood chips observed at the surface were entirely absent from the peat subsoils. Aside from the brown fibrous peat substrate, no materials were collected for formal sampling and analysis.

Hand auger boreholes farther to the south along the lake edge were similar to what was described above, but with a thinner surface veneer of wood chips. Soils even farther to the southwest, around the southern edge of the lake and farther from direct road access were somewhat mixed (disturbed, including gravels, peats, and mineral sediments), and layers of gravel were observed within 18 inches of the soil surface. This could be the result of gravel mining or possibly natural sloughing from the outwash gravel and sand hills along the lake edge.

Further work would be necessary to fully characterize onsite soil conditions around the entire lake perimeter. But it appears that the wood chip surface fill is thickest in the pad at the east end of the lake, which is likely part of the inactive landfill (located to the east). This condition is not expected to occur across the entire lake bottom, as is also indicated by the previous sampling across the bottom by GeoEngineers staff in November 2007 (described below).

Phase 3: Evaluation of Sediment Samples

Previous sediment samples collected in June 2002 and evaluated by GeoEngineers indicated a low bulk density, black, organic, surficial black sludge layer ranging in thickness from 3 to 6 centimeters throughout the bottom of the lake. Sediments beneath the surficial black sludge layer were described as a brown fibrous organic material that did not contain wood chip materials characteristic of pulp mill operations.

Ecology requested additional information regarding the origin and nature of the brown fibrous organic material from beneath the lake. In response to that request, in November 2007, GeoEngineers collected additional sediment core samples to further assess the nature of the brown organic fibrous material. Several split sediment samples were collected from the lake bottom and provided to Ecology for potential testing. GeoEngineers also sent the split samples to be evaluated by Econotech, located in Delta, British Columbia, Canada -- a pulp and paper materials specialty firm. The GeoEngineers samples were collected across the lake base below 4-8 feet of water, and sample depth was at most, 24 inches (GeoEngineers, January, 2008). Econotech described the samples of brown fibrous material as having no wood chips such as would indicate a pulp and paper source, and described the material as being natural organic soil.

Soil samples collected during the PRSW field visit (as described in the section above) were evaluated under a dissecting microscope and were compared to several of the samples collected in November 2007 by GeoEngineers. The dissecting scope was used to ensure that the previously collected samples had similar characteristics to the new samples, and to differentiate between native plant materials and sawdust or chipped wood materials in both sample collections.

PRSW brown fibrous organic material samples collected in November of 2008 were very similar to the November 2007 GeoEngineers samples. They were composed of similar fibrous material associated with the breakdown of sedges and grass-like plant species. There was some intact (not chipped) woody plant material – small twigs and branches -- that may be remnants of a scrub-shrub plant community that still persists alongside the sedge and grass emergent plant community in nearby wetland areas to the southwest. These results indicate that the brown fibrous organic material in the samples is a naturally developed organic soil (peat) derived from centuries of accumulation and very slow breakdown of sedges and grasses, and is not effluent waste from the historic Rayonier paper mill operations.

CONCLUSIONS

Based on our evaluation of onsite sediment samples collected in November 2007 (by GeoEngineers) and November 2008 (by PRSW), the brown fibrous organic materials below Goose Lake (beneath the black surficial sludge) appear to be native organic peat. Evidence of wood chips overlying the peat was observed on the eastern portion of the lake and is believed to represent encroachment of wood chips placed in the inactive landfill. We did not observe evidence of the wood chips throughout the entire lake.

Previous sediment core samples collected in June 2002 by GeoEngineers from the middle of the lake did not indicate the presence of wood chips beyond the eastern portion of lake, and also consisted of a similar peat material beneath a relatively thin surficial black sludge layer.

Based on evaluation of soil mapping, topography, LIDAR images, geology mapping, and hydrology data for Goose Lake and the surrounding landscape, we conclude that Goose Lake lies in the base of a natural depressional swale that developed during post-glacial outwash flood events, down cutting through the surrounding glacial till plain. The swale historically extended from Goldsborough Creek to the east-northeast to Island Lake and beyond to the east side of Highway 101. The Highway and associated development has redirected some of the hydrology.

This swale has intermittent kettle lakes (such as Island Lake and the small ponds to the northeast of Goose Lake) connected by expansive areas of peat marsh that cover much of the swale bottom. Some of the kettle lakes may have been expanded by peat and gravel mining activities, including Goose Lake. Based on USGS topography maps (20-foot contours), most of the peat wetlands and the water surface in the lakes are at approximately the same elevation, as would be expected in this setting. USGS maps show the surface elevation as 240 feet, but with a 20-foot contour interval, that is not precise enough for purposes of more detailed assessments. But field-based observations make it clear that the surface elevations are similar.

Areas within the swale base with a surface elevation higher than the associated peat wetlands (approximately 240 feet) are likely to be fill material. This is the case for the inactive landfill area east of Goose Lake (Area C in Figure 2). The LIDAR image (Figures 2 and 3) of the area shows evidence of cut and fill activities along the scalloped terrace edges in that vicinity (north of Area C and Goose Lake) – presumably from gravel mining. The material on the terrace is composed of gravelly sandy loam outwash, and ablative till –a good gravel source. This evidence of excavation indicates that the original Goose Lake may have been expanded due to past land-use actions, but the lake and the underlying peat soils are natural.

We trust the information in this report meets your current requirements for further assessing the source of organic matter in Goose Lake. Please call if you have questions or require additional detail or clarification on issues presented in this report.

Respectfully submitted,
Pacific Rim Soil & Water, Inc.

Lisa Palazzi, CPSS, PWS

Attachments:
A Summary Soil Description
B Field Photographs
C Soil Survey Map with tables

References

Econotech report WO# V70322 (December 12, 2007)
GeoEngineers sampling report (January 14, 2008)
Soil Maps from the web-based Soil Survey database: (http://websoilsurvey.nrcs.usda.gov/app/)
LIDAR source: Puget Sound Lidar Consortium (http://pugetsoundlidar.ess.washington.edu/)
Aerial photos from Mason County GIS system (http://www.co.mason.wa.us/gis/index.php)
Stream Type Maps from WA DNR FPARS system: (www.**dnr**.**wa**.gov/BusinessPermits/Topics/ForestPracticesApplications/Pages/fp_watertyping.aspx*)*

ATTACHMENT A

GROVE SERIES

The Grove series is a very deep, somewhat excessively drained soil found on glacial outwash plains and formed in glacial outwash. Generally, the texture becomes coarser and more gravelly with depth, from a reddish brown very gravelly (35-65% gravel) sandy loams from the surface to about 15 inches, underlain by a dark brown extremely gravelly loamy sand or sand down to greater than 60 inches.

Soil permeability is rapid (6-20 inches per hour).

These soils are generally used as woodland, but are suitable for homesites with a few restrictions. Cutbanks will slough severely and should be avoided to control erosion. Septic absorption field and stormwater facility design is limited by poor filtering capacity -- i.e. these soils often drain too rapidly to provide adequate treatment. Either community sewage systems or specially designed septic systems should be used to avoid contamination of water supplies. Grass-lined swales or sand-lined ponds may be encouraged for pretreatment of stormwater prior to infiltration in areas with water quality concerns.

MUKILTEO SERIES

The Mukilteo peats are very deep, very poorly-drained soils formed in upland depressions out of organic materials derived primarily from sedges and rushes. The surface horizons can be sapric (highly decomposed organic materials), but become increasingly hemic (moderately decomposed organic materials) with depth. The high water table and mucky/peaty textures generally greatly limit trafficability and/or development of any sort.

Percolation rates are expected to be moderate (0.6-2 inches per hour).

Mukilteo soils are generally suitable for wildlife habitat or woodland. They are not suited for homesites or road building due to wetness and ponding, as well as poor load-bearing capacities.

SHELTON SERIES

The Shelton gravelly sandy loams are moderately deep, moderately well-drained soils formed in local drift and colluvium overlying compact, strongly cemented basal till. Generally, the upper soils are gravelly or very gravelly sandy loams. Generally, a more weakly cemented hardpan is found at around 30 inches depth, and a strongly cemented duripan is found underlying the hardpan at 20 to 40 inches depth.

Average soil percolation rates in the upper horizons are expected to be moderately rapid (2-6 inches per hour) above the pan and very slow (less than 0.06 inches per hour) in the pan -- effectively impermeable.

The Shelton soils are generally suitable for woodland and homesites with the main limitation being seasonal wetness (a perched water table) at 18 to 36 inches depth.

The main limitations for onsite septic and stormwater treatment are related to both the minimal depth to the hardpan and seasonal wetness. Soil water percolating through these soils will move laterally in the soil across the till surface rather than down through the till. The seasonal high water table and/or the shallow till layer limit the amount of soil available to effectively treat stormwater or septic effluent.

ATTACHMENT B: FIELD PHOTOGRAPHS

Fill pad edge at east end of Goose Lake, looking west

Fill pad edge at east end of Goose Lake, looking south

End of dirt road leading from landfill to lake edge, looking west

End of dirt road leading from landfill to lake edge, looking south

Fibrous peat below chip fill

Sampling at edge of lake surface

ATTACHMENT C: SOIL MAPS AND TABLES

Soil Map—Mason County, Washington
(Goose Lake Area Soils Map)

Map Scale: 1:19,300 if printed on A size (8.5" x 11") sheet.

MAP LEGEND

Area of Interest (AOI)

- ▭ Area of Interest (AOI)

Soils

- ▭ Soil Map Units

Special Point Features

- Blowout
- ☒ Borrow Pit
- Clay Spot
- ♦ Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- ◎ Miscellaneous Water
- ◉ Perennial Water
- ∨ Rock Outcrop
- \+ Saline Spot
- Sandy Spot
- Severely Eroded Spot
- ◇ Sinkhole
- Slide or Slip
- ø Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- ▲ Other

Special Line Features

- Gully
- Short Steep Slope
- Other

Political Features

- ● Cities

Water Features

- 🟦 Oceans
- ~ Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:19,300 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:31,680.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 10N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Mason County, Washington
Survey Area Data: Version 4, Dec 5, 2006

Date(s) aerial images were photographed: 7/21/2006; 7/24/2006

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Mason County, Washington (WA645)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
Ca	Carstairs gravelly loam, 0 to 5 percent slopes	498.9	22.5%
Gg	Grove gravelly loam, basin phase, 0 to 5 percent slopes	26.1	1.2%
Gh	Grove gravelly sandy loam, 0 to 5 percent slopes	352.9	15.9%
Gk	Grove gravelly sandy loam, 5 to 15 percent slopes	161.3	7.3%
Gm	Grove gravelly sandy loam, 15 to 30 percent slopes	41.8	1.9%
Jd	Juno sandy loam, 0 to 3 percent slopes	26.7	1.2%
Mc	McKenna gravelly loam, 0 to 3 percent slopes	4.7	0.2%
Me	McMurray peat, 0 to 2 percent slopes	8.1	0.4%
Mg	Mukilteo peat, 0 to 2 percent slopes	90.8	4.1%
Rb	Rough broken land	106.0	4.8%
Sf	Shelton gravelly sandy loam, 5 to 15 percent slopes	801.1	36.1%
Sg	Shelton gravelly sandy loam, 15 to 30 percent slopes	77.2	3.5%
W	Water	24.0	1.1%
Totals for Area of Interest		**2,219.4**	**100.0%**

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GEOENGINEERS