# Data Gaps Assessment

R.G. Haley International Site
Bellingham, Washington

*for*
**City of Bellingham**

April 26, 2011

GeoEngineers
Earth Science + Technology

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## Bellingham, Washington

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# Table of Contents

**LIST OF TABLES**



**LIST OF FIGURES**

## 1.0 INTRODUCTION

This data gaps assessment has been completed on behalf of the City of Bellingham (City) for the R.G. Haley International Site (Haley Site). The Site is generally located at 500 Cornwall Avenue in Bellingham, Washington (Figure 1). Wood treatment operations were conducted on this waterfront property from about 1948 until 1985. The Site has been inactive since 1985.

Remedial actions at the Site are being conducted by the City under the Washington State Model Toxics Control Act (MTCA) Cleanup Regulation (Washington Administrative Code [WAC] Chapter 173-340) in accordance with the First Amendment to Agreed Order No. DE 2186 (Order). The First Amendment to the Order removed the previous property owner (Douglas Management Company) as a signatory party to the Order, and added the City as a signatory to the Order.

The previous property owner completed a Remedial Investigation/Feasibility Study (RI/FS) for the Haley Site under the original Order. A draft Final RI/FS Report (GeoEngineers 2007) was submitted to the Washington State Department of Ecology (Ecology) on September 5, 2007. Ecology provided comments to the City on the 2007 Haley RI/FS report on June 10, 2010. The City provided a written response to these comments September 20, 2010. This report identifies additional data and other information needed to further address Ecology's comments on the RI/FS.

## 2.0 BACKGROUND AND PURPOSE

The Haley Site is comprised of upland property where wood treatment operations were conducted, and adjacent aquatic lands in Bellingham Bay. Two other MTCA cleanup sites are located adjacent to the Haley Site. One of these is the Cornwall Avenue Landfill (Cornwall) site, which is the subject of an upland and sediment cleanup, similar to the Haley Site. The other is the Whatcom Waterway site, which is also the subject of a sediment cleanup.

Considerable data has been obtained in upland and aquatic portions of the Haley Site during the 2007 RI/FS and earlier studies. Data from the Haley studies, combined with data from the Cornwall and Whatcom Waterway studies, indicates that the Haley Site overlaps with the adjacent Cornwall and Whatcom Waterway sites. The full extent of contamination associated with the Haley Site has not been identified on the adjacent sites, and therefore, the boundaries of the "Site" as defined in MTCA have not yet been fully defined. One of the main objectives of this assessment is to evaluate general data needs to further define the boundaries of the Haley Site as defined in MTCA.

Many of Ecology's June 2010 comments requested an expanded investigation of sediment quality in the aquatic portion of the Haley Site, with particular emphasis on dioxins. These comments triggered the need to incorporate information from various Bellingham Bay studies that were not previously relevant to the Haley RI, or were not performed prior to completion of the Haley RI. Key information from these studies is summarized in this report because the data helps characterize the Site and define additional data needs. This information will ultimately be incorporated in the revised Haley RI.

The majority of this data gaps assessment focuses on Haley sediment issues due to the nature of Ecology's comments and data needs for the aquatic versus upland portions of the Site. Data needs in the upland portion of the Site are readily apparent and described in a more streamlined manner. The data gaps identified in this report will be filled by future investigation, the details of which will be presented in a work plan. It is anticipated that the additional data will be obtained in a phased approach.

## 3.0 PREVIOUS STUDIES

This section provides a summary of the principal studies reviewed as part of this data gap assessment and describes why the studies are pertinent to the Haley Site RI/FS. Since development of the 2007 Haley RI/FS, numerous additional studies have become pertinent to the Haley site as a result of Ecology's comments. Most of the additional studies focus on sediment quality in Bellingham Bay. Information from several of these studies is presented in later sections of this report.

### 3.1. Whatcom Waterway Site

The Whatcom Waterway site overlaps with the aquatic portion of the Haley Site. Sediment quality and physical conditions in Whatcom Waterway have been evaluated during several previous studies associated with that site. Much of the information in these studies pertaining to surface water circulation and sediment transport and deposition are directly applicable to the Haley Site. Additionally, multiple sediment sample locations associated with the Whatcom Waterway studies are located northwest of the Haley Site and provide data pertinent to Haley. The Haley and Whatcom Waterway cleanups must be compatible with each other and each remedy must address all contaminants in the area of overlap. Information from the following Whatcom Waterway studies was reviewed for data pertinent to the Haley Site.

- Anchor Environmental and Hart Crowser, 2000. Remedial Investigation and Feasibility Study for the Whatcom Waterway Site, prepared for the Georgia-Pacific Corporation.
- Anchor Environmental, L.L.C. and Landau Associates, Inc., March 2003. Whatcom Waterway Pre-Remedial Design Investigation Data Report, prepared for the Georgia-Pacific Corporation, Washington Department of Natural Resources, Port of Bellingham and City of Bellingham.
- The RETEC Group, Inc., October 2006. Supplemental Remedial Investigation & Feasibility Study Whatcom Waterway Site, prepared for the Port of Bellingham.
- Anchor QEA, LLC, August 2010. Pre-Remedial Design Investigation Data Report, Whatcom Waterway Cleanup Sites, prepared for the Port of Bellingham.

### 3.2. Bellingham Bay

A study was conducted by Ecology to evaluate sediment quality adjacent to creosote pilings and structures at the Haley Site, further evaluate sediment conditions at the Cornwall Site, and evaluate dioxin and furan background concentrations in Bellingham Bay. The Study includes data obtained from sampling in the aquatic portion of the Haley Site which, as part of this data gaps assessment, have been incorporated into the Haley Site data set. The results presented in the study provide additional data characterizing dioxins and furans at the Haley Site and background dioxin and furan concentrations in Bellingham Bay. The results from the investigation of Bellingham Bay are included in the following report:

- Hart Crowser, June 2009. Sediment Site Characterization Evaluation of Bellingham Bay Creosote Piling and Structure Removal, Cornwall Avenue Landfill Mapping, Boulevard Park Overwater Walkway Feasibility, and Dioxin Background Sampling and Analysis, prepared for the Washington State Department of Ecology.

### 3.3. Cornwall Avenue Landfill

Contaminants associated with the Haley and Cornwall Sites are comingled in both upland and aquatic portions of the Sites. The Haley and Cornwall cleanups must be compatible with each other, and each remedy must address all contaminants in the area of overlap. Information from the following reports was reviewed for data pertinent to the Haley RI.

- Landau Associates, Inc., August 1997. Expanded Site Investigation Cornwall Avenue Landfill prepared for the Port of Bellingham, City of Bellingham and Department of Natural Resources.
- Landau Associates, Inc., August 1999. Draft Final Report Focused RI/FS Cornwall Avenue Landfill, prepared for the Port of Bellingham, City of Bellingham and Department of Natural Resources.
- Landau Associates, Inc., January 2003. Ecology Review Draft, Remedial Investigation/Feasibility Study, Cornwall Avenue Landfill, prepared for the Port of Bellingham.
- Landau Associates, Inc., 2007. Ecology Review Draft, Cornwall Avenue Landfill Remedial Investigation/Feasibility Study, prepared for the Port of Bellingham.
- Landau Associates, Inc., July 24, 2009. Ecology Review Draft, Cornwall Avenue Landfill Remedial Investigation/Feasibility Study, prepared for the Port of Bellingham.
- Washington State Department of Ecology, June 10, 2010. Ecology Comments on 2009 Cornwall Avenue Landfill Remedial Investigation/ Feasibility Study.

### 3.4. Haley Site

There are many previous studies of the Haley Site, all of which are referenced in the 2007 RI/FS report (GeoEngineers 2007). Since that time, Ecology provided comments on the 2007 RI/FS on June 10, 2010. There have not been additional studies completed specific to the Haley Site since the issuance of the 2007 RI/FS.

## 4.0 WATERFRONT INDUSTRIAL HISTORY

The Haley Site and surrounding properties were originally developed as lumber mills (BBIC and Bloedel Donovan Sawmills) with associated waterfront docks in about 1888. From the mid-1880s to the mid-1900s these properties hosted a variety of activities including sawmill, coal and wharf operations. Wood treatment operations were conducted at the Haley Site from about 1948 until 1985. Landfill operations were conducted at the Cornwall Site from about 1953 until 1965. Details of historical sawmill, wood treatment and landfill activities on the respective properties are presented in Section 3.5 of the Haley 2007 RI/FS.

Numerous findings of the prior historical research (GeoEngineers 2007) are pertinent to this data gaps assessment. These general findings are as follows:

### 4.1. Sawmill Operations

The historical lumber mills included several oil houses at locations that later comprised the southwestern portion of the Haley property and northeastern portion of the Cornwall property. A machine shop, electrical shop and "auto rep'g" structure also were located on what is currently the northern portion of the Cornwall Site.

Historical mill operations included log rafting and burning wood waste ("hog fuel") from the late 1800s until the late 1940s. The burning of salt-encrusted wood waste at lumber mills is a historical source of dioxins in the Puget Sound region (Ecology, 1998).

Over water activities were conducted on a large wharf in front of the mills. Remnants of timber pilings that supported former wharfs and piers are present in the aquatic portion of the Haley Site. It appears that some of the pilings are treated and some are untreated. Ecology recently conducted a sediment investigation adjacent to creosote-treated pilings in front of the Haley Site (Hart Crowser 2009) as discussed later in this report.

### 4.2. Wood treatment Operations

Wood treatment facilities were located on the southwestern portion of the Haley Site. Wood storage areas were located throughout a large portion of the site, including the area adjacent to the shoreline. Figures 2a and 2b show former wood treatment facilities associated with R.G. Haley International Corporation operations.

An oil sheen was observed by the U.S. Coast Guard (USCG) offshore of the Haley wood treatment facility on two different occasions. The exact date of the first event is not known, but was likely in 1985, and the second event was observed on February 10, 2000.

Drainage from an outfall associated with the Haley facility stormwater and process water management system was a potential source of contamination to the aquatic zone.

### 4.3. Landfill Operations

Pulp waste, a potential source of dioxins/furans, was disposed in the landfill.

Documentation exists that indicates the Frank Brooks Manufacturing Company (Brooks) dumped oil at the Cornwall site after the closure of the landfill. This is a potential source of wood treating compounds in the landfill because Brooks treated wood in the Bellingham area. Brooks historically used both pentachlorophenol (PCP) and creosote, which contains carcinogenic polycyclic aromatic hydrocarbons (cPAHs), to treat wood. PCP and cPAHs are also associated with wood treatment operations on the Haley Site.

In addition to the potential historical contamination sources summarized above, both upland and aquatic portions of the Haley Site are underlain by fill, likely placed when shoreline margins were filled to develop uplands. The fill appears to include former sawmill and construction debris wastes, and landfill wastes associated with the adjacent Cornwall Site.

### 4.4. Data Gaps Concerning Waterfront Industrial History

The following additional historical information is needed to provide context for the expanded Haley sediment investigation that will be completed to address Ecology comments. Data gaps identified in this report are summarized in Table 1.

- Georgia Pacific (GP) discharged untreated industrial wastes to Bellingham Bay from about 1965 to 1979, which overlaps the period (1948 to 1985) of wood treatment operations at the Haley Site. This information is pertinent to understanding the comingled nature of GP contaminants with contaminants from other sites including the Haley Site. Specific information of interest regarding GP operations includes the location, period of operation and nature of mill-related discharges, historical sediment quality data associated with these discharges, and details concerning past dredging and in-water disposal activities associated with the Whatcom Waterway. Some of this information has been obtained and is summarized in this report, however, additional information is needed.
- Additional historical information is also needed concerning industrial activities on over-water structures in this portion of Bellingham Bay.

## 5.0 PHYSICAL SETTING

This section describes key elements of the physical setting of the Haley Site that are relevant to this data gaps assessment.

### 5.1. Upland Portion of Site

The elevation of the upland portion of the Site is approximately 15 feet above mean lower low water (MLLW) relative to the City of Bellingham's datum. The upland area is generally flat except for a steep bedrock slope southeast of, and adjacent to, the BNSF railroad tracks. A shoreline bank approximately 4 to 7 feet high is present at the boundary between the upland and aquatic portions of the Site. The bank face has been modified by shoreline erosion. There has been several feet of erosion along portions of the shoreline relative to Site conditions documented in the 2007 RI/FS.

There have been some changes to site features since the 2007 Haley RI/FS report was prepared. A fire in 2007 destroyed the former planning and boring building and, after removing the debris, this area was paved. The remaining above-ground structures except for the smaller (southwestern) drying shed were removed in 2009.

There are three stormwater drains located on the Site (Figures 2a and 3), one of which managed stormwater and process (cooling) water from the former Haley wood treatment facility. This system drain discharged into Bellingham Bay via an outfall on the shoreline bank in front of the southwestern drying shed (Figure 2a). The outlet for this pipe is visible on the shoreline bank. However, no water discharge has been observed from this pipe during periodic inspections. The outfall invert elevation is 9.9 feet MLLW, which is about 1.4 feet higher than mean higher high water (MHHW; 8.5 feet elevation).

A City stormwater drain is located beneath the Site and discharges into Bellingham Bay through a concrete 36-inch-diameter outlet that daylights on the shoreline bank in front of the northeastern drying shed (Figure 2a). This is part of the Western Washington University North Campus stormwater conveyance system that serves neighborhoods located southeast of the Site on Cedar Street. This stormwater utility was constructed on the Site in 1961. The stormwater drain does not have a catchbasin on the Site but there is a manhole access. The outfall invert elevation is 8.5 feet MLLW which is about the same elevation as MHHW. This suggests that surface water from Bellingham Bay could occasionally inundate the end of the drain. Stormwater has been observed discharging from the City stormwater outfall during dry periods. A December 2010 inspection video showed no blockages and flowing water between the on-site manhole and the outfall.

An 8-inch-diameter concrete pipe daylights on the shoreline bank southwest of the City stormwater outfall. The invert elevation of the outlet is 9.6 feet, which is about 1.1 foot higher than MHHW. The alignment and original purpose of this underground pipe are unknown, nor is it known if this pipe currently discharges anything to Bellingham Bay.

#### *5.1.1 Data Gaps Concerning Upland Portion of Site*

Ecology has requested that stormwater discharges on the Site be evaluated as potential sources of contamination to sediment. The underground conveyance piping also should be evaluated as potential preferential groundwater migration pathways. Details concerning this upland source control topic will be outlined in a future work plan.

### 5.2. Aquatic Portion of Site

The aquatic portion of the Site extends from the Haley shoreline into adjacent intertidal and subtidal portions of Bellingham Bay. The elevation of mean higher high water (MHHW) is approximately 8.51 feet above mean low low water (MLLW). The boundary between the intertidal and subtidal zones is approximately -4 feet MLLW. The shoreline bank is steep and generally covered with shoreline armoring including rip and rap. The bathymetry of the intertidal zone below the shoreline bank generally slopes at 10 feet horizontal to 1 foot vertical (i.e., 10H:1V) on the southwestern portion of the Site. This slope is steeper (5H:1V) on the northeastern portion of the Site. The bathymetry of the shallow subtidal zone (approximately -4 feet MLLW to -10 feet MLLW) generally slopes from about 5H:1V to 6H:1V.

Surface sediment in the intertidal portion of the Haley Site predominantly consists of gravel and sand with varying amounts of cobbles and silt. This sediment frequently contains debris that includes wood, brick fragments, and glass fragments. An area predominantly comprised of wood debris is exposed at the surface in the upper intertidal zone on the southwest portion of the Site. Horizons comprised predominantly of wood debris also were identified at depths ranging from approximately 1 to 4 feet below the surface in intertidal zone cores. The wood debris present in the intertidal zone is predominantly comprised of sawdust, wood chips and wood fragments.

Numerous remnant untreated timber pilings are also generally located in the upper intertidal portion of the Site (i.e., at or above +3 feet MLLW) (Figure 3). The remnant timber pilings located in this area are the remains of a former wharf structure that supported historic lumber mill operations. Figure 3 shows the former wharf, as it appeared in a 1951 historical aerial photograph, overlain on a 2008 aerial photograph of the waterfront.

Creosote-treated pilings associated with several remnant structures were previously located in the northeastern portion of the Haley Site. Sediment near some of the creosote-treated piling was the focus of an investigation by Ecology in 2008 (Hart Crowser 2008). The results of this study are discussed in Section 8.3. Following the Ecology study, the Washington Department of Natural Resources (DNR) removed some or all of the creosote-treated pilings in Bellingham Bay, including the permanent structures located on the northeast portion of the Haley Site.

The grain size of surface sediment in the shallow subtidal zone (i.e., from about -4 feet MLLW to -13 feet MLLW) is finer than in the intertidal zone. Surface sediment in the shallow subtidal area predominantly ranges from silty sand to sandy silt. Debris observed in this area primarily consists of wood fragments (wood pieces and chips, sticks and sawdust). The quantity of wood debris generally increases with depth below the sediment surface, to the extent explored. The vertical sediment profile in the subtidal zone includes some horizons comprised predominantly of wood debris, however, sand and silt is the predominant sediment matrix at most locations and depths. Additionally, it should be noted that landfill debris was identified at depth in cores advanced on the southwestern portion of the Haley Site during the investigation of the Cornwall Site. Items of landfill origin also have been noted in sediment cores completed outside (northeast) of the proposed remedial action (capping) boundary of the Cornwall Site. These items included black plastic and a plastic syringe. Based on existing core logs, it is does not appear that any sediment cores previously advanced in the aquatic portion of the Haley site have contacted undisturbed native sediment.

The physical characteristics of sediment in the intertidal versus shallow subtidal zones generally indicate the amount of energy and resulting sediment transport mechanisms in each zone. The coarser grain size of surface sediment in the intertidal zone suggests this area is generally being eroded. The finer grain size of surface sediment in the shallow subtidal zone suggests that this is an area of sediment deposition.

Information concerning aquatic habitat was not collected as part of the Haley RI. Aquatic habitat surveys performed as part of the Cornwall and Whatcom Waterway RIs have identified the presence of eel grass on both the west side and east side of the Haley Site. Figure 4-12 and Figure 13 from the Cornwall Avenue Landfill RI/FS Report (Landau 2009) and Whatcom Waterway Pre-Remedial Design Investigation Data Report (Anchor QEA 2010), respectively, document the presence of eel grass at an elevation between approximately -5 and -15 feet MLLW on either side of the aquatic portion of the Haley Site. Eel grass was observed in the western portion of the Haley Site during sediment sampling, consistent with the Cornwall Avenue Landfill RI/FS.

#### 5.2.1. *Data Gaps Concerning Aquatic Portion of Site*

Topographic survey information was obtained for the upland and intertidal portions of the Haley Site to support development of the 2007 RI/FS. As a result of the expansion of the Haley sediment investigation, additional topographic/bathymetric data will be needed. Much of this information was collected to support the Cornwall and Whatcom Waterway investigations. The City will attempt to acquire this information and merge it for use in the expanded Haley investigation. The need for additional data, if any, will be evaluated after collecting and merging the existing data.

Additional information is needed regarding DNR's piling removal action in the vicinity of the Haley Site. It will be important to understand where pilings were removed, whether the pilings were entirely removed or cut at the mudline, and other information DNR may have about observations during piling removal, and where treated pilings remain. This information will be needed prior to developing work plans for additional sediment investigation, or evaluating and designing sediment remedial alternatives.

Aquatic habitat surveys have been performed within the boundaries of the Cornwall and Whatcom Waterway Sites. Similar habitat information is needed for portions of the Haley Site where information does not currently exist.

## 6.0 CONCEPTUAL SITE MODEL

A conceptual site model (CSM) was developed for the Haley Site during the 2007 RI/FS. The CSM is a model of the potential contaminant sources, release mechanisms, and transport mechanisms at the Site. Ecology requested that the CSM for the Haley Site be further refined to account for additional exposure pathways and receptors. In response to this comment, a Conceptual Site Exposure Model (CSEM) was developed for the Haley Site as part of this data gaps assessment (Figure 4). The CSEM, in conjunction with the CSM, identify potential receptors that could be affected by Site contaminants and associated exposure pathways. New screening levels were developed to evaluate these exposure pathways and receptors, and are described in Section 7.

### 6.1. Potential Receptors and Exposure Pathways

CSEMs provide a framework for the RI/FS by identifying and organizing potential exposure pathways (sources of contamination, release mechanisms, transport media, exposure points, exposure routes, and receptors) and identifying those pathways that are complete or potentially complete. Current and reasonably likely future land use conditions were considered in development of the Haley CSEM (Figure 4).

The Haley CSEM shows complete potential exposure pathways based on existing site information and analytical data. To be considered complete, an exposure pathway must have: (1) an identified source of the contaminant, (2) a release/transport mechanisms from the source, and (3) an exposure route where contact to the receptor can occur. An exposure pathway is considered complete if the route of contact from a pathway can occur for a person or ecological receptor.

#### 6.1.1. *Soil*

Potential receptors and exposure pathways for identified soil contamination at the Haley Site include:

- Direct contact (incidental ingestion, dermal, and/or inhalation) with contaminated soil by humans.
- Direct contact (incidental ingestion, dermal, and/or inhalation) with contaminated soil and/or food-web exposures by terrestrial wildlife.
- Direct contact with contaminated soil by terrestrial plants and soil biota.

- Contact (via the soil-to-groundwater-to-surface water pathway) with contaminated marine surface water by aquatic organisms, and potential contact by humans through consumption of aquatic organisms.
- Contact (via the soil-to-groundwater-to-sediment pathway) with contaminated marine sediment by aquatic organisms, and potential contact by humans through direct contact (incidental ingestion and dermal) and consumption of aquatic organisms.
- Inhalation of contaminated indoor air (via the soil-to-groundwater-to-indoor air pathway) by site visitors.
- Inhalation of contaminated indoor air (via volatilization from soil) by site visitors. While this exposure pathway is considered potentially complete, soil screening levels are not included because Ecology's review draft Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action (Ecology Publication #09-09-047; dated October 2009) recommends the use of soil gas data to evaluate vapor intrusion at sites with contaminated shallow groundwater and vadose zone soil (see Section 3.1 of the draft guidance). To further evaluate this exposure pathway, GeoEngineers will use the Johnson and Ettinger model, as recommended in the draft vapor intrusion guidance, to estimate maximum indoor air concentrations.

#### 6.1.2. *Groundwater*

In accordance with WAC 173-340-720(2)(d), groundwater beneath the property is not suitable as a domestic water supply due to the proximity of the Site to marine surface water. Additionally, groundwater beneath the property or potentially affected by the property is not a current or reasonable future source of drinking water. Consequently, human ingestion of contaminants in groundwater is not a complete exposure pathway.

Potential receptors and exposure pathways for identified groundwater contamination include:

- Direct contact with contaminated groundwater and LNAPL through shoreline and intertidal discharges.
- Contact (via the groundwater-to-surface water pathway) with contaminated marine surface water by aquatic organisms, and potential contact by humans through consumption of aquatic organisms.
- Contact (via the groundwater-to-sediment pathway) with contaminated marine sediment by aquatic organisms, and potential contact by humans through direct contact (incidental ingestion and dermal) and consumption of these aquatic organisms.
- Contact (via the groundwater-to-indoor air pathway) with contaminated indoor air by humans. To further evaluate this exposure pathway, GeoEngineers will use the Johnson and Ettinger model, as recommended in the draft vapor intrusion guidance, to predict maximum indoor air concentrations.

#### 6.1.3. *Sediment*

Potential receptors and exposure pathways for identified sediment contamination include:

- Contact with contaminated marine sediment by aquatic organisms and humans through direct contact (incidental ingestion and dermal).
- Indirect contact to sediment contaminants through the consumption of aquatic organisms that have come in contact with contaminated marine sediment (i.e., through bioaccumulation of contaminants). These aquatic organisms may be consumed by other aquatic organism and by humans.

## 7.0 REVISED SCREENING LEVELS

Ecology's June 2010 comments required the development and use of additional screening levels to account for a variety of contaminant transport pathways and exposure routes. These screening levels were developed as part of this data gaps assessment. The regulatory criteria used to derive the updated screening levels for soil, groundwater, and sediment are presented in Tables 1 through 3.

In general, screening levels were developed for constituents that were previously detected in soil, groundwater, and sediment at the Site, and that have numeric 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, 2010b). Tables 1 through 3 also include analytes of potential concern associated with the Whatcom Waterway and Cornwall Sites, as requested by Ecology.

The revised screening levels are very conservative (low) primarily because of the method used to calculate values protective of the groundwater to sediment pathway. The method used was recommended by Ecology, and is the same method currently being used to evaluate upland sources of contamination to the Lower Duwamish Waterway. This method incorporates a number of conservative assumptions and is viewed by Ecology as a tool to conservatively eliminate upland properties from impacting adjacent water bodies. Sites with upland soil and groundwater concentrations below Ecology's screening levels are unlikely to lead to an exceedance of marine sediment criteria. However, sites with upland concentrations greater than these screening levels "may or may not pose a threat to marine sediments" (SAIC 2006). Conservative assumptions incorporated into the screening level calculations include the absence of dilution and the assumption of ample time for contaminant concentrations in soil, groundwater, and sediment to reach equilibrium. The screening levels also do not address contaminant mass flux from the upland to sediments.

These conservative screening levels are presented in this report in response to Ecology's comments. They are considered very preliminary values to be used only for screening purposes, and will not be incorporated in the RI without further scrutiny. The validity of these values will be carefully evaluated prior to developing plans to fill data gaps. For instance, we anticipate that existing groundwater data will confirm that many of the conservative soil screening levels are not meaningful. This empirical approach will be used to avoid unnecessary additional investigation. More appropriate screening levels will be developed using site-specific information if needed.

### 7.1. Revised Soil Screening Levels

Screening levels for soil are presented in Table 1 and were selected from 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.
- A site-specific terrestrial ecological evaluation (TEE) is required because the Site does not qualify for exclusion under WAC 173-340-7491. Consistent with WAC 173-340-7493(3), the MTCA Ecological Indicator Soil Concentrations for protection of terrestrial plants and animals (WAC 173-340-900, Table 749-3) were used develop screening levels. The lowest of the indicator soil concentrations for protection of plants, soil biota, and wildlife were selected as the TEE criteria for use in deriving soil screening levels.
- Soil criteria protective of (1) the groundwater to sediment pathway, (2) the groundwater to marine surface water pathway, and (3) the groundwater vapor to indoor air pathway. These soil to groundwater pathways were calculated using the MTCA fixed parameter three-phase partitioning model (WAC 173-340-747[3][a]). For each constituent, the protective groundwater concentrations used in the calculations were selected to be protective of the lowest of the following endpoints/media (values for each source are presented in Table 2):
    - The lowest of the respective marine surface water regulatory criteria presented in Table 2.
    - The Ecology Sediment Management Standards (Chapter 173-204 WAC) Marine Sediment Quality Standards (SQS). Constituent values were obtained from Ecology's Microsoft Excel spreadsheet Draft LDW ARARS CULs v12r5.xls, "Surface Water" tab.
    - Indoor Air values obtained from Ecology's review draft "Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action" dated October 2009 (Table B-1).
- Default assumptions provided in WAC 173-340-747(4) for vadose and saturated zone soils were used in the calculations, and model input parameter values were taken directly from Ecology's CLARC database. Where input parameter values were not available in CLARC, they were obtained from Oak Ridge National Laboratory's Risk Assessment Information System (Oak Ridge National Laboratory, 2010).
- Ecology commented that criteria should be developed for total petroleum hydrocarbons (TPH) in saturated soil with entrapped free product along the shoreline and that these criteria should be protective of sediments and marine water. In response to this comment, GeoEngineers used the MTCA 3- and 4-phase partitioning equations to calculate a TPH concentration for saturated soil that is protective of individual constituents in surface water, but this modeling generated TPH screening levels that appear unrealistic. For example, the EPH data from soil sample HS-DP-4-8-11 yields a TPH screening level of 0.75 mg/kg based on protection of sediment (groundwater to sediment pathway) for 2-methylnaphthalene. Screening levels for individual constituents, rather than TPH, are proposed for use to assess the groundwater to sediment pathway.

- The MTCA Cleanup Regulation (WAC 173-340-705[6]) specifies that the cleanup level (or screening level) for a given constituent shall not be set at a level lower than the natural background concentration or analytical PQL, whichever is higher. The preliminary soil screening levels presented in Table 2 were selected as the lowest of the applicable numeric regulatory criteria. The preliminary screening levels were then adjusted as necessary based on natural background concentrations for metals (Ecology 2010 and for arsenic the natural background value used by Ecology for the MTCA Method A cleanup level) and dioxins/furans (Ecology 2010) in soil. Additional adjustments were incorporated, as needed, to account for PQLs. The final soil screening levels are presented in the right column of Table 2.
- The analytical PQLs listed in Table 2 were obtained from Analytical Resources Incorporated of Tukwila, Washington (ARI), and Frontier Analytical Laboratory of El Dorado Hills, California, both of which are Washington-certified laboratories. Discussions with these laboratories regarding the analytical requirements for this project indicate that the listed soil PQLs in Table 2 are the lowest practicably attainable values. For those analytes listed in Table 2 with PQLs that are greater than the lowest applicable numeric regulatory criteria, the laboratories have determined that PQLs below the regulatory criteria cannot be practicably achieved.

### 7.2. Revised Groundwater Screening Levels

As discussed in Section 6.1.2, groundwater beneath the Site is not a current or reasonable future source of drinking water. Screening levels for groundwater are presented in Table 2 and are based on protection of the following media/exposure scenarios:

- MTCA Method B marine surface water cleanup levels protective of aquatic organisms and human health (WAC 173-340-730[3]), including:
  - Water quality criteria published in the Water Quality Standards for Surface Waters of the State of Washington (WAC 173-201A) protective of aquatic organisms.
  - Water quality criteria based on the protection of aquatic organisms (acute and chronic criteria) and human health published under Section 304 of the Federal Clean Water Act.
  - Concentrations established under the National Toxics Rule (Code of Federal Regulations [CFR] Title 40, Part 131) protective of aquatic organisms and human health.
  - MTCA standard formula values (for carcinogens and non-carcinogens) protective of human health (consumption of aquatic organisms), obtained from Ecology's CLARC.
  - Groundwater screening levels protective of sediment based on Ecology Sediment Management Standards (Chapter 173-204 WAC) Marine Sediment Quality Standards (SQS). Constituent values were obtained from Ecology's Microsoft Excel spreadsheet Draft LDW ARARS CULs v12r5.xls, "Surface Water" tab.
  - Groundwater screening levels protective of indoor air obtained from Ecology's review draft "Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action" dated October 2009 (Table B-1).

MTCA (WAC 173-340-705[6]) specifies that the cleanup level (or screening level) for a given constituent determined using Method B shall not be set at a level below the natural background concentration or analytical PQL, whichever is higher. The preliminary groundwater screening levels presented in Table 3 were selected as the lowest of the applicable numeric regulatory criteria. The preliminary screening levels were then adjusted as necessary based on PQLs and natural background concentrations (for arsenic) to derive the final groundwater screening levels presented in the far right column of Table 3.

The analytical PQLs listed in Table 3 were obtained from ARI and Frontier Analytical Laboratory, both of which are Washington-certified laboratories. Discussions with these laboratories regarding the analytical requirements for this project indicate that the listed groundwater PQLs in Table 3 are the lowest practicably attainable values using conventional/accepted analytical methods. For those analytes listed in Table 3 with PQLs that exceed the lowest applicable numeric regulatory criteria, the laboratories have determined that PQLs below the regulatory criteria cannot be practicably achieved.

## 7.3. Sediment Screening Levels

Sediment screening levels were reviewed for constituents present or potentially present in sediment at the Haley Site as well as the adjacent Cornwall Avenue Landfill and Whatcom Waterway sites. The screening levels identified for sediment are discussed in the following sections and presented in Table 4.

### 7.3.1. *Sediment Management Standards Chemical and Biological Criteria*

Sediment screening levels for chemical and biological testing are provided under the Sediment Management Standards (SMS) (Chapter 173-204 WAC). SMS standards include the Sediment Quality Standards (SQS) and Cleanup Screening Levels (CSL). The SQS criteria correspond to sediment quality that will result in no adverse effects to biological resources, including no acute or chronic effects on biological resources and no significant health risks to humans. The CSL criteria correspond to minor adverse effects and are the minimum cleanup levels to be used in evaluation of cleanup alternatives.

SMS provides numerical criteria for a broad range of chemicals. The criteria for specific chemicals are based on either dry weight or organic carbon normalized concentrations. The analytical results for non-ionizable semi-volatile organic compounds (SVOCs) and polychlorinated biphenyls (PCBs) are organic carbon normalized when the total organic carbon (TOC) concentration in a sediment sample ranges from 0.5 to 3.5 percent. The carbon normalized analytical results are then compared to the published SMS criteria (SQS and CSL). Analytical results for samples with TOC concentrations outside of the 0.5 to 3.5 percent range are screened against the Apparent Effects Threshold (AET) values including the Lowest Apparent Effect Threshold (LAET) and Second Lowest Apparent Effect Threshold (2LAET) on a dry weight basis (EPA 1988).

SMS defines bioassay testing procedures and interpretive criteria that are used to test sediment for adverse affects. Bioassay testing is used to directly screen sediment for adverse biological effects from chemicals as well as other potential stressors in sediment. Bioassay testing can be used to further evaluate potential biological effects of elevated chemical concentrations, and can supersede chemical results if adverse biological effects are not observed in bioassay tests.

The SQS and CSL criteria will be used to screen the results of chemical analyses and biological tests for previous and future sediment samples collected from the Haley Site.

SQS and CSL chemical criteria do not exist for petroleum hydrocarbons or dioxins and furans.

#### 7.3.2. *Petroleum Hydrocarbons*

Numerical criteria for sediment do not currently exist for petroleum hydrocarbons under SMS. Sediment criteria for petroleum hydrocarbons are generally developed on a case by case basis. Bioassay testing can be used to develop site-specific numerical criteria or to directly evaluate potential adverse effects from petroleum hydrocarbons.

A screening level for petroleum hydrocarbons of 200 mg/kg was used by Ecology to screen petroleum hydrocarbon results collected as part of a study in Bellingham Bay that evaluated potential impacts from creosote treated pilings (Hart Crowser 2009). The petroleum hydrocarbon screening level used by Ecology (i.e., 200 mg/kg) is being used in this data gaps assessment as a preliminary screening level for evaluating total petroleum hydrocarbon concentrations in sediment at the Haley Site. Additional evaluation of cleanup criteria for petroleum hydrocarbons at Haley will be developed as part of the RI/FS for the Site.

#### 7.3.3. *Dioxins and Furans*

MTCA and SMS do not currently provide screening levels for dioxins and furans in sediment. To date, site specific cleanup for these compounds has been evaluated on a case-by-case basis. Ecology requested that sediment screening levels be developed for dioxins based on the protection of human health, and that additional information be provided concerning dioxin background concentrations in sediment. Information related to these topics is summarized in this section.

Dioxins and furans are ubiquitous background contaminants in Puget Sound sediment, originating from multiple natural and anthropogenic sources. The Dredged Material Management Program (DMMP) evaluated dioxin and furan concentrations in Puget Sound sediment in 2008. The DMMP is comprised of the Washington State Department of Ecology (Ecology), U.S. Environmental Protection Agency (EPA), Washington State Department Natural Resources and U.S. Army Corps of Engineers. Sediment samples were collected at 70 sampling locations in Puget Sound located within identified reference areas. Reference areas are located outside of urban settings, and therefore, are outside of the influence of local sources of dioxins and furans. Toxic Equivalency (TEQ) values were calculated for dioxin and furan congeners for each sample using the 2005 World Health Organization's (WHO) Toxic Equivalency Factors (TEFs) for mammals. Undetected congeners were assigned a concentration equal to ½ the detection limit. TEQ concentrations for the samples ranged from 0.24 to 11.63 nanograms per kilogram (ng/kg, or parts per trillion) (DMMP Website).

Closer to the Haley Site, dioxin and furan concentrations in Bellingham Bay sediment were investigated by Ecology (Hart Crowser 2009). Surface sediment (i.e., 0-12 cm in depth) samples were collected from six background locations identified within Bellingham Bay. TEQ values were calculated for each sample using the methodology described above. Dioxin and furan background concentrations detected in these samples ranged from 1.5 to 14.3 ng/kg (TEQs). These concentrations are greater than the concentrations reported for non-urban Puget Sound areas described above, as one would expect because of the urban setting of Bellingham Bay.

Human health and ecological (i.e., fish and wildlife) risk associated with dioxins and furans is attributable to bioaccumulation. Available guidance and risk assessment information indicates that sediment screening levels for bioaccumulation are substantially lower than Puget Sound background concentrations. For example, bioaccumulation screening levels for humans (i.e., 1.1x10-3 to 9.1x10-3 ng/kg) and ecological receptors (i.e., 0.052 to 1.4 ng/kg) published by State of Oregon Department of Environmental Quality (Oregon DEQ) are several orders of magnitude lower than non-urban sediment background values for Puget Sound. The level of risk associated with the screening level values developed by Oregon DEQ is 1x10-6. In Washington State, the DMMP implemented new guidelines for in-water disposal of sediment containing dioxins and furans. The guidelines apply to surface sediment at disposal sites and are to be achieved over time as the guidelines are implemented. The guidelines were derived from the non-urban background sediment study summarized above. The new guideline for open water disposal (4 ng/kg) is based on background concentrations because it would not be possible to reach the much lower risk-based screening level.

MTCA and the SMS allow for use of background chemical concentrations as screening levels where risk-based screening levels are lower than background. As a result of the ubiquitous occurrence of dioxins in sediment at concentrations greater than screening levels, sediment projects in Puget Sound have recently been considering this approach. The Lower Duwamish Waterway (LDW) is a prominent example. Risk estimates for dioxins and furans were not prepared for human exposure via seafood consumption in the LDW because EPA, Ecology, and the LDW Group agreed that background dioxin and furan concentrations in sediment from the LDW would result in human health risks greater than 1x10-6. Therefore, EPA, Ecology, and LDWG agreed that remediation of dioxins and furans would be based on concentrations reflective of background rather than the much lower screening level that would be protective of seafood consumption (Windward 2007).

Based on the information summarized above, it is apparent that background concentrations of dioxins and furans in Puget Sound sediment make it unrealistic for cleanup projects to achieve compliance with risk-based screening levels. In light of this situation, Ecology has stated that its long-term goal is to reduce environmental concentrations of dioxins and furans to background levels where possible. The DMMP's approach to management of dioxins and furans at disposal sites reflects this goal but acknowledges that the goal is to be achieved over-time, as guidelines are refined and cleanups implemented. Ecology is still developing its approach to the management of dioxins and furans in sediment, and is expected to implement the approach through proposed revisions to the MTCA and SMS rules.

Ecology has acknowledged that contaminants in sediment in urban bays are the result of multiple natural and anthropogenic sources (Ecology 2010), which is the case for dioxins and furans in sediment in Bellingham Bay. Sources of dioxins and furans in Bellingham Bay include the following:

- Pulp manufacturing and associated waste discharges (e.g. multiple Georgia Pacific outfalls) and disposal (e.g. landfilling of pulp wastes);

- Wood treatment operations (e.g. former Haley, Oeser Company, and other wood treatment facilities);
- Industrial (e.g. historic burning of hog fuel and wood wastes) and residential wood combustion;
- Dredging and dredge material disposal (e.g. Whatcom Waterway dredging and disposal at Star Rock and DMMP open water disposal sites).
- Fossil fuel (e.g. petroleum) combustion; and
- Municipal solid waste disposal and incineration.

The sources identified above, as well as others, have contributed to the bay-wide dioxin and furan concentrations found in Bellingham Bay sediment.

Based on considerations of bay-wide sources of contaminants to sediment, Ecology is developing a coordinated source control and remediation approach in order to reduce ongoing contaminant inputs, and cleanup and monitor areas of contaminated sediment (Ecology 2010). The City proposes the following general approach to address dioxins and furans at the Haley Site, which is consistent with Ecology's proposed approach:

- Further characterize dioxin and furan concentrations related to the Haley Site to evaluate concentration gradients between the 2007 RI samples and the recent nearby surface sediment samples collected as part of Ecology's Bellingham Bay dioxin and furan background and Whatcom Waterway studies (Hart Crowser 2009 and Anchor QEA 2010).
- Use the dioxin/furan characterization results to evaluate the boundary between the elevated dioxin concentrations associated with Haley versus broader bay-wide dioxin background concentrations that reflect historic contributions from multiple sources. This approach will focus efforts on defining the limits of the Haley Site from a source control perspective, and provide additional information pertinent to development of a dioxin screening level.

#### 7.3.4. *Mercury*

A bioaccumulative screening level (BSL) was developed for mercury as part of the Whatcom Waterway investigation. The BSL was developed for protection of human health based on consumption of aquatic organisms. The BSL was derived by correlating (i.e., performing regression analysis) sediment mercury concentrations in Bellingham Bay, as well as other Puget Sound embayment's with documented mercury contamination sources, to tissue concentrations in aquatic species to provide an estimate of mercury bioaccumulation. Additionally, a screening level risk assessment was performed to develop a tissue mercury level for protection of human health. Using the information from the regression analysis and screening level risk evaluation, a BSL of 1.2 mg/kg was identified for mercury. The BSL for mercury was used to evaluate remedial actions for the Whatcom Waterway and will be used to evaluate performance of the Site cleanup. The mercury BSL developed for the Whatcom Waterway will be used to screen investigation results from the Haley Site.

# 8.0 NATURE AND EXTENT OF CONTAMINATION

## 8.1. Soil

Soil analytical results were compared to prior screening levels as described in Section 7.4.2 of the 2007 Haley RI Report. Soil samples collected during the RI were analyzed for one or more of the following constituents:

- Volatile organic compounds (VOCs) by SW-846 8260B
- SVOCs by SW-846 8270C
- Halogenated volatile organic compounds (HVOC) by EPA Method 8260B
- Total organic carbon by SW-846 9060
- CPAHs by GC/MS-SIM and SW-846 8270C
- Metals by SW-846 6020 and SW-846 7196A
- Dioxins/furans by SW-846 8290
- Petroleum hydrocarbons by NWTPH-Dx, NWTPH-HCID, and Extractable Petroleum Hydrocarbons (EPH)

As part of this data gaps assessment, the soil analytical data from the 2007 Haley RI was compared to the revised screening levels presented in Table 2. As discussed in Section 7.1 these screening levels are very conservative (low) primarily because of the assumptions used to evaluate the leaching pathway from soil to groundwater to sediment. Ecology's own view on these low soil screening levels is that exceedances of the screening levels "may or may not pose a threat to marine sediments." Accordingly, a substantially greater number of constituents in soil exceed the revised screening levels versus the prior screening levels. Twenty-seven constituents in upland soil exceed the revised screening levels; 12 constituents exceeded the prior soil screening levels.

The 2007 RI soil analytical results exceed the revised screening levels in most of areas explored. The explorations in which one or more constituents exceed the revised soil screening levels are shown in Figure 5. As a result of the broad footprint of soil screening level exceedances, detailed constituent-specific maps are not needed for the purposes of this data gaps assessment.

Additional data is needed to evaluate the lateral and vertical extent of soil exceedances, as discussed below.

### 8.1.1. *Data Gaps Concerning Nature and Extent of Soil Contamination*

As shown on Figure 5, additional investigation is needed to evaluate the lateral extent of Haley constituents in soil on the Cornwall site. It is anticipated that this investigation would be conducted in the general area bounded by the following features: the landfill waste body to the northwest, the railroad tracks to the southeast, the Haley property boundary to the northeast and one of the "AF" designated monitoring wells (yet to be determined) to the southwest.

Constituents in soil exceed the revised screening levels adjacent to the southeast boundary of the Haley property. However, additional investigation is not needed southeast of the Haley property because the soil/fill prism beneath Haley terminates against the underlying bedrock surface. Bedrock is exposed at the ground surface at many locations southeast of the property boundary.

The lateral extent of soil screening level exceedances in the northeastern portion of the Haley property has been partially identified, although additional data is needed.

The vertical extent of soil contamination beneath the Haley Site was relatively well identified using the screening levels presented in the 2007 RI report. Dioxins were the only constituent for which the depth limits of screening level exceedances were not identified. However, several additional constituents exceed the revised screening levels in the deepest samples obtained from the RI explorations. Additional data may be needed to evaluate constituent concentrations in soil at depth, pending further scrutiny of the revised screening levels as described below.

This preliminary evaluation of soil data needs will be further scrutinized during development of a future work plan. As described in Section 7.0, existing empirical data may refute the validity of some of the revised soil screening levels. This will be evaluated during work plan development, and may modify the preliminary assessment of general data needs summarized above.

### 8.2. Groundwater

Groundwater analytical results were compared to prior screening levels as described in Section 7.4.3 of the 2007 Haley RI Report. Groundwater conditions were evaluated during the 2007 RI using 32 monitoring wells. Two of the monitoring wells were located in the intertidal zone and have since been damaged by erosion. Four of the monitoring wells (CL-MW-1S, -1D, -6, and -7) were located on Cornwall. It is not known if these wells are still accessible. Groundwater samples collected during the RI were analyzed for one or more of the following constituents:

- VOCs by SW-846 8260B
- Total organic carbon by EPA 415. 1 and SW-846 9060
- Petroleum hydrocarbons by NWTPH-Dx and EPH
- Metals by SW-846 6020 and SW-846 7196A
- CPAHs by SW-846 8270C
- SVOCs by SW-846 8270C
- Dioxins/furans by SW-846 8290

As part of this data gaps assessment, the groundwater analytical data from the 2007 Haley RI was compared to the revised screening levels presented in Table 3. As discussed in previous sections, the revised screening levels are very conservative (low) and an exceedance of these values "may or may not pose a threat to marine sediments." Accordingly, an additional 10 constituents exceed the revised screening levels that did not exceed the previous (2007) screening levels. In total, 26 constituents in groundwater exceed the revised screening levels; 16 constituents exceeded the prior groundwater screening levels (Table 14, 2007 Haley RI).

The 2007 RI data exceeds the revised groundwater screening levels in most of the monitoring wells sampled. The monitoring wells in which one or more constituents exceed the revised groundwater screening levels are shown in Figure 6. As a result of the broad footprint of groundwater screening level exceedances, detailed constituent-specific maps are not needed for the purposes of this data gaps assessment. Additional groundwater quality data is needed on the Cornwall site. Unlike the Cornwall soil sampling approach described above, groundwater samples will be collected from the landfill waste horizon. Several monitoring wells installed during the Cornwall RI could help fill this data gap, if the wells are still present and accessible. The extent of groundwater screening level exceedances in the northeastern portion of the Haley Property have been defined for most, but not all constituents.

#### 8.2.1. *Data Gaps Concerning Nature and Extent of Groundwater Contamination*

Efforts to fill groundwater quality data gaps will be phased, beginning with the sampling of selected existing monitoring wells on both the Cornwall and Haley sites. This would provide updated groundwater quality data since completion of the RI. The groundwater data presented in the RI was collected primarily between 2000 and 2005. The need for additional monitoring wells will be assessed after conducting an additional round of groundwater sampling. During the groundwater monitoring efforts, site-wide observations of free product also would be made. These observations, along with the free product measurements obtained as part of the ongoing quarterly free product removal program, will inform other sampling and remedial alternative evaluations described in this report.

This preliminary evaluation of groundwater data needs will be further scrutinized during development of a future work plan. As described in Section 7 existing empirical data may refute the validity of some of the revised groundwater screening levels. This will be evaluated during work plan development, and may result in the identification of different data needs than summarized above.

### 8.3. Sediment

Several phases of investigation were performed to evaluate the nature and extent of contaminants in sediment at the Haley Site to support development of the draft RI. Several additional investigations of sediment have been performed since the development of the draft RI for the Haley Site to support characterization and remedial design for the adjacent Cornwall and Whatcom Waterway sites as well as additional characterization of sediment in Bellingham Bay. The investigations have included sediment sampling and analysis that provides additional information concerning characterization of the nature and extent of contamination within and adjacent to the Haley Site and Ecology has requested that the additional data be incorporated into the data for the Haley Site. The data from investigation of sediment at the Haley and adjacent sites has been combined and is presented in this section.

Additionally, Ecology is requiring that each of the Haley, Whatcom Waterway and Cornwall sites account for all constituents of concern located in the area where these sites overlap. The constituents of concern identified for sediment at the Cornwall site as part of the Cornwall RI (Landau 2009) include:

- Metals including copper, lead, mercury, silver and zinc;
- Polychlorinated biphenyls (PCBs); and

- Bis(2-ethylhexyl)phthalate (DEHP).

The sediment data for these chemicals presented in the Cornwall RI, is not located near the area investigated during the Haley RI. The closest Cornwall RI sediment sample location with chemical analytical data (HC-SS-28) is located approximately 275 feet southwest of Haley (Figure 7).

At the Cornwall Site, landfill refuse and wood debris were identified in the RI as a potential threat to benthic organisms. The proposed Cornwall sediment remedial action area boundary (Figure 7) has been delineated based on the presence of landfill refuse and/or wood debris. As a result, chemical analytical data for sediment has not been collected as part of the Cornwall RI in close proximity to the current Haley sediment investigation area.

The constituents of concern identified for sediment at the Whatcom Waterway Site include (RETEC 2006):

- Mercury; and
- Phenolic compounds including 4-methylphenol, 2,4-dimethylphenol and phenol.

Discharges from pulp and paper manufacturing processes are a substantial historical source of dioxins and furans to Bellingham Bay, as documented by previous investigations. However dioxins and furans have not been identified as constituents of concern for the Whatcom Waterway Site.

The 2007 Haley RI identified the following constituents of concern in sediment (GeoEngineers 2007):

- Pentachlorophenol (PCP);
- Diesel and oil-range petroleum hydrocarbons;
- Polycyclic aromatic hydrocarbons (PAHs);
- Dibenzofuran;
- 2-methylnaphthalene; and
- Dioxins and furans.

The investigations of the Cornwall, Whatcom Waterway and Haley sites, have identified that constituents of concern or potential concern and landfill refuse associated with these sites are comingled. In addition, the proposed remedial action areas for the Cornwall and Whatcom Waterway sites extend onto the Haley Site. The sediment sampling locations and portions of the Cornwall and Whatcom Waterway remediation areas within and adjacent to the Haley Site are presented in Figure 7. Table 5 summarizes the available conventional and chemical analytical data for samples collected from the locations identified in Figure 7. Figures 8 through 12 present the results from sediment characterization for selected constituents including PCP, petroleum hydrocarbons, PAHs, dioxins and furans, and mercury resulting from investigation of the Haley Site and adjacent sites. Additionally, Figure 13 presents the results for bioassay testing performed as part of investigation of Haley and the Whatcom Waterway.

The following sections summarize the chemical analytical results for the sediment samples within and adjacent to the Haley Site and provides a comparison of the results to the revised screening levels.

#### 8.3.1. *Pentachlorophenol (PCP)*

Analysis for PCP has been performed on 21 samples collected from the sediment surface (mudline) to approximately 10 to 15 cm in depth (Figure 8). The samples were collected from 18 locations adjacent to Haley and three locations north of Haley. Detected PCP concentrations were greater than the SMS numerical criteria in three surface samples. Two of the three surface samples with PCP concentrations greater than SMS numerical criteria were collected from the upper intertidal zone in the central portion of the Site (PS-4, and PS-20). The PCP concentrations in these two surface sediment samples were 3,200 and 4,700 ug/kg, and were greater than the CSL (690 ug/kg). The remaining location where PCP was detected in surface sediment at a concentration greater than SMS numerical criteria (SRI-3) was located in the shallow subtidal area adjacent to where PCP was greater than SMS criteria in upper intertidal sediment. The detected PCP concentration at this location (560 ug/kg) was greater than the SQS (360 ug/kg) but less than the CSL (690 ug/kg). The PCP detection limit was greater than SMS numerical criteria in surface sediment at three locations in the upper intertidal zone in the central portion of the Haley Site.

Analysis of PCP has been performed on 36 near-surface (from the surface to 2 feet below the mudline) and subsurface samples collected from 18 locations. The samples were collected from depths up to 6.8 feet below the mudline. PCP was detected in 11 of the 36 samples at concentrations greater than SMS numerical criteria. The PCP concentrations in the 11 samples ranged from 380 to 4,100 ug/kg, and were greater than the CSL. Subsurface samples with PCP concentrations greater than SMS numerical criteria were generally located in the upper intertidal zone. Where near surface and subsurface sediment samples were collected from the same location, the subsurface sediment samples with PCP concentrations greater than SMS criteria were generally collected from a depth of 2 feet or greater and the PCP concentrations in the top 2-foot interval were less than the SMS criteria.

The data for PCP indicates that an area of surface sediment in the upper intertidal zone contains PCP concentrations greater than the CSL (PS-4 and PS-20). This area of surface sediment is bounded by multiple surface sediment samples with PCP concentrations less than the SQS criteria. The one location (SRI-3) where the PCP concentration in surface sediment is greater than the SQS in the shallow subtidal zone is not bounded as there is no surface sediment sample located bayward with a PCP concentration less than the SQS.

PCP is present in subsurface sediment at concentrations greater than the SMS numerical criteria at several locations on the northeastern portion of the Site (RGH-SC-01, RGH-SC-03, and RGH-SC-09). At these locations, PCP concentrations where less than SMS criteria in near surface and/or surface sediment samples. Multiple additional sample locations are situated further to the northeast (RGH-SC-04, RGH-SC-05, and RGH-SC-06) that have PCP concentrations less than SMS criteria in samples collected from the surface to a depth of six feet below the mudline. Additionally, PCP was not detected in samples collected from the surface to a depth of 6.8 feet below the mudline at the southwestern-most sample location (RGH-SC-07).

Although the aerial (horizontal) extent of subsurface sediment with concentrations of PCP greater than SMS criteria is bounded on the northeast and southwest, it is not bounded on the northwest. At two locations (RGH-SC-08 and RGH-SC-09) subsurface sediment samples had detected concentrations greater than SMS numerical criteria and there are no subsurface sample locations located further to the northwest.

Where PCP was detected at concentrations greater than SMS numerical criteria in subsurface sediment, the vertical extent of sediment with PCP concentrations greater than SMS criteria has not been identified as the PCP concentrations are greater than SMS criteria in the deepest subsurface sediment sample collected.

#### 8.3.2. *Petroleum Hydrocarbons*

Diesel- and oil-range petroleum hydrocarbons were analyzed in nine surface sediment samples at the Haley Site (Figure 9). Total petroleum hydrocarbon concentrations were detected at concentrations greater than the screening level of 200 mg/kg in five of the nine samples. All five of these samples were collected from the upper intertidal zone in the central portion of the Site (PS-2, PS-4, PS-13, PS-16 and PS-20). The concentration of total petroleum hydrocarbons ranged from 372 mg/kg to 50,000 mg/kg in the five samples.

Analysis of petroleum hydrocarbons has been performed on 32 near-surface and subsurface samples collected from 14 locations. The samples were collected from depths up to 6.8 feet below the mudline. Total petroleum hydrocarbon concentrations were detected in 18 of the 32 samples at concentrations greater than the screening level. The total petroleum hydrocarbon concentrations in the 18 samples ranged from 233 to 5,480 ug/kg. Petroleum hydrocarbon concentrations were generally greatest in subsurface samples in the upper intertidal zone. Several near surface sediment samples contained total petroleum hydrocarbon concentrations that were greater than the screening level in the lower intertidal / shallow subtidal area in the northwestern portion of the Site. No surface sediment samples have been collected in this portion of the Site to evaluate total petroleum hydrocarbon concentrations within the compliance interval.

The data for total petroleum hydrocarbons in sediment indicates that an area of surface sediment in the upper intertidal zone contains petroleum hydrocarbon concentrations greater than the screening level. The horizontal and vertical extent of the area of sediment with petroleum hydrocarbon concentrations greater than the screening level in the northwest portion of the Site has not been delineated.

#### 8.3.3. *Polycyclic Aromatic Hydrocarbons (PAHs)*

Analysis for PAHs has been performed on 22 surface samples (Figure 10). The samples were collected from 19 locations on the Haley Site and two locations north of the Site. PAH concentrations were greater than the SMS numerical criteria in three of the 21 surface samples (Figure 10). These three surface samples were collected from the upper intertidal zone in the central portion of the Site (PS-4, PS-13 and PS-20). The PAH concentrations in the three surface sediment samples were greater than SQS/LAET and/or CSL/2LAET criteria. Multiple surface sediment samples with PAH concentrations less than the SQS/LAET bound the surface sediment samples with PAH concentrations greater than the SMS numerical criteria.

Analysis of PAHs has been performed on 36 near-surface and subsurface samples collected from 18 locations. The samples were collected from depths up to 6.8 feet below the mudline. PAHs were detected in 13 of the 36 samples at concentrations greater than SMS numerical criteria. These 13 samples were predominantly located in the upper intertidal zone but some were also in the lower intertidal / shallow subtidal area. Where near surface and subsurface sediment samples were collected from the same location in the lower intertidal / shallow subtidal area, the SMS exceedances generally occurred at a depth of 2 feet or greater, and not in the upper 2 feet.

The PAH data indicates that surface sediment exceeds SMS criteria in a portion of the upper intertidal zone. This area is bounded by surface sediment samples with PAH concentrations less than the SQS. The vertical (depth) extent of SMS exceedances in this area and at several shallow subtidal locations has not been delineated. PAH exceedances of SMS criteria in subsurface sediment in the lower intertidal / shallow subtidal area are overlain by sediment with PAH concentrations less than SMS criteria.

#### 8.3.4. *Dioxins/Furans*

Six surface sediment samples collected adjacent to the Haley Site have been analyzed for dioxins/furans (Figure 11). The TEQ concentrations in these samples ranged from 52 ng/kg to 201 ng/kg. Nine near surface and subsurface sediment samples have also been collected from seven locations. The dioxin/furan TEQ concentrations in these nine samples ranged from 24 ng/kg to 557 ng/kg.

Investigations of the Whatcom Waterway and Bellingham Bay sites have included surface sediment sampling and analysis for dioxins and furans (Anchor 2009 and 2010; Hart Crowser 2009). Dioxin/furan TEQ concentrations from these studies ranged from 13.4 ng/kg to 14.8 ng/kg in the surface sediment locations west (BBDx-SS-03 and 1B-01-SS) and northwest (1C-01-SS) of the Haley Site (Figure 11). One surface sediment sample located west of the Haley Site (BBDx-SS-03) was collected as part of the Bellingham Bay study performed by Ecology to identify background dioxin and furan concentrations. The dioxin and furan TEQ concentration in this Bellingham Bay background sample was 14.3 ng/kg.

Limited data has been collected to characterize dioxin and furan concentrations in sediment at the Haley Site, and between the Haley site and recent surface sediment samples collected as part of Ecology's Bellingham Bay dioxin and furan background study and Whatcom Waterway Studies. Additional data is needed to characterize dioxin and furan concentrations in surface and subsurface sediment related to the Haley Site in this area.

#### 8.3.5. *Mercury*

Analysis for mercury has been performed on surface samples collected from six locations at the Haley Site, three locations north of the Site and one location southwest of the Site (Figure 12). The mercury concentration was greater than the SMS numerical criteria in one surface sample collected from the Site (RI-1). The detected mercury concentration (0.45 mg/kg) was greater than the SQS criteria (0.41 mg/kg) but less than the CSL (0.59 mg/kg). The mercury concentrations at one location north of the Site (0.5 mg/kg at AN-SS-29) and one location southwest of the Site (0.47 mg/kg at HC-SS-28) also were greater than the SQS criteria but less than the CSL. The data for the samples collected north and southwest of the Site are from 2002 and older and therefore, may not represent current conditions.

Analysis for mercury has been performed on 27 near-surface and subsurface samples collected from nine locations at the Haley Site and two samples from one location north of the site. The samples were collected from depths up to 6.8 feet below the mudline. The mercury concentrations were greater than SMS numerical criteria in 11 of the 27 samples collected from the Site and the two samples collected north of the Site. The mercury concentrations ranged from 0.48 mg/kg to 11.3 mg/kg at the Site and were 0.45 mg/kg and 0.52 mg/kg north of the Site. The mercury concentrations increased with depth at all locations where near surface and subsurface samples were collected.

The extent of mercury concentrations greater than SMS numerical criteria in surface and subsurface sediment is not being delineated as part of the investigation of the Haley Site. The investigation of the Whatcom Waterway site has identified that mercury concentrations are greater than SMS criteria in sediment at the Haley Site and surrounding areas.

#### 8.3.6. *Other Chemicals*

Several additional COCs were detected in one or more sediment samples collected from the Haley Site. Phthalates including dimethyl phthalate and butylbenzyl phthalate were detected at concentrations greater than LAET and 2LAET criteria in surface (RI-1 and SRI-1) and subsurface sediment (RGH-SC-02, RGH-SC-07, and RGH-SC-08). Dibenzofuran was detected at two locations (PS-4 and PS-20) in surface sediment and N-nitrosodiphenylamine was detected at two locations (IZ-MW-3 and IZ-DP-1) in subsurface sediment at concentrations greater than the CSL/2LAET criteria. Additionally, 2,4-dimethylphenol and phenol were detected at one location in surface (PS-16) and subsurface (RGH-SC-07) sediment at concentrations greater than the SQS/CSL.

The detection limits for multiple contaminants were greater than the SMS numerical criteria in sediment samples. Generally, samples collected from locations with elevated contaminant concentrations had the most detection limits that were greater than SMS numerical criteria.

#### 8.3.7. *Bioassays*

Bioassay testing was performed on surface sediment from seven locations (RI-1 through RI-5, RGH-SS-01 and RGH-SS-03) adjacent to the Haley Site and three locations (AN-SS-29, 6B-03-SS, and 6B-04-SS) northwest to northeast of the Site (Figure 13). The bioassays failed SQS criteria for three samples and failed CSL criteria for four samples collected adjacent to the Site. The bioassays performed on samples collected from the three locations northwest, north, and northeast of the Site passed SMS criteria.

Relatively few chemicals were detected in samples on which the bioassays were performed. Chemicals that were detected included butyl benzyl phthalate and dimethyl phthalate. The extent of exceedances of SMS biological criteria are not bounded by the existing bioassay data.

#### 8.3.8. *Data Gaps Concerning Nature and Extent of Sediment Contamination*

Additional investigation of sediment at the Haley Site is needed to accomplish the following:

- Evaluate the lateral and vertical limits of Haley constituents that exceed SMS numerical, biological and human health criteria.
- Further characterize dioxins and furans in sediment to evaluate the boundary between elevated dioxin concentrations associated with the Haley Site versus broader bay-wide dioxin background concentrations that reflect historic contributions from multiple sources.
- Evaluate the vertical profile of constituent concentrations and sediment stratigraphy to further refine the CSM and support evaluation and design of remedial alternatives.
- Further evaluate the extent of overlap between the Haley Site and adjacent sediment cleanup sites, and evaluate the compatibility of remedies.

### 8.4. Evaluation of Natural Recovery

The natural recovery of contaminated sediment in Bellingham Bay has been documented in multiple studies. The studies have evaluated natural recovery processes including sediment transport and deposition in Bellingham Bay. Multiple studies have empirically shown decreases in contaminant concentrations through periodic sampling at the same location or periodic sampling in known source areas. As a result, monitored natural recovery is the selected remedy for a significant portion of the Whatcom Waterway Site to address surface and subsurface contaminated sediment. Natural recovery is also identified to have occurred at the Cornwall Site as a result of the deposition of over a foot of sediment on top of landfill refuse and wood debris.

The remedial investigation of the Whatcom Waterway included evaluation of natural recovery processes using sediment trap and core sampling. The study identified that the average net sedimentation rate at three locations surrounding the Whatcom Waterway ranged between 1.52 and 1.77 centimeters per year (cm/yr). A natural recovery sampling location (HC-NR-100) used in the Whatcom Waterway study was located west of Haley, between Haley and the Whatcom Waterway. The average net sedimentation rate at this location was 1.52 cm/yr (RETEC 2006).

Studies performed in 1996 (Anchor and Hart Crowser 2000) and 2002 (Anchor and Landau 2003) also provided empirical evidence that natural recovery has decreased contaminant concentrations in surface sediment along the shoreline northeast of Haley. A sample collected in 1996 (SS-29) had a mercury concentration of 0.70 mg/kg. A subsequent sample collected in 2002 (AN-SS-29; see Figure 12) had a mercury concentration of 0.50 mg/kg. Phenol concentrations in the same samples also decreased from 1,000 ug/kg in 1996 to 130 ug/kg in 2002 (GeoEngineers 2005).

Sediment data from monitoring of a previous dioxin and furan source discharge area within Bellingham Bay indicates that the dioxin and furan concentrations have decreased by an order of magnitude since the source discharge was stopped. Dioxin and furan concentrations in surface sediment samples collected at the GP outfall in 2000 were as high as 167.3 ng/kg (note: not all dioxin and furan congeners were tested in the samples collected at the GP outfall in 2000). Surface sediment samples collected again in 2008 near the GP outfall found dioxin and furan concentrations ranging between 12.7 and 21.97 ng/kg (Hart Crowser 2009 and SAIC 2008). This decrease is attributed to natural recovery resulting from deposition from the Nooksack River (Hart Crowser 2009).

These study results collectively indicate that natural recovery processes are occurring in this portion of Bellingham Bay, at or adjacent to the Haley Site. Additional sediment data will be collected to support revision of the Haley RI/FS, as discussed in other sections of this report. This data will be evaluated for indications of natural recovery. Additional data needs to evaluate natural recovery processes, if any, will be considered during a subsequent phase of work.

## 9.0 DATA NEEDS TO SUPPORT REMEDIAL TECHNOLOGY EVALUATION

Several of Ecology's comments require additional data to support the evaluation of more remedial technologies, or further evaluate technologies that were presented in the 2007 Haley FS. In particular, the FS must be revised to include options for upland groundwater treatment to the extent practicable. Ecology also requested the completion of a pilot or bench scale study to further evaluate stabilization remedial technologies, and an expanded evaluation of remedial technologies to address the presence of light nonaqueous phase liquid (LNAPL). The potential applicability of revised lower screening levels also may trigger the need for additional data if the lower screening levels expand the geographic scope of the remedy, or require a more robust remedy to address certain pathways.

In order to evaluate data needs to support the requested FS revisions, a preliminary review of potentially applicable remedial technologies was performed for Site soil, groundwater, and sediment. Based on a list of potentially applicable technologies, as well as the specific process options already evaluated in the 2007 Haley FS, specific data needs were identified that will facilitate the technology screening process as well as development and evaluation of revised cleanup alternatives.

In addition to remedial technologies that were evaluated in the 2007 FS, additional soil, groundwater, and sediment remedial technologies were reviewed for Site applicability and further evaluation in the Feasibility Study. General technology categories that are expected to be applicable for the Site include:

- In-situ soil, groundwater, and LNAPL treatment technologies;
- Soil, groundwater, and LNAPL removal technologies;
- Ex-situ soil and groundwater treatment technologies;
- Soil, groundwater, and LNAPL disposal options;
- Groundwater and LNAPL containment technologies;
- In-situ sediment treatment technologies;
- Sediment capping technologies;
- Sediment removal and disposal technologies.

A more complete technology screening process will be performed for the revised FS that evaluates specific process options for the above technology categories with respect to site-specific conditions. Some of the technologies expected to be assembled into cleanup action alternatives in the revised FS require further data to evaluate effectiveness, implementability, and cost. Data needed to evaluate cleanup action alternatives include performing bench-scale treatability testing, updating soil and groundwater chemistry data, and hydrogeologic data necessary for basic sediment cap modeling and evaluation of groundwater removal and treatment alternatives. These are discussed further below.

Bench-Scale Treatability Testing – For the 2007 Haley FS, the potential application of in-situ stabilization was evaluated for the LNAPL plume area and discussions with stabilization vendors indicated that subsurface areas with significant wood debris and areas with significant free product can be technically difficult to successfully stabilize in-situ. The evaluation of in-situ stabilization will be expanded to its potential use in areas of the Site without significant wood debris or LNAPL. To determine the potential cost and feasibility of in-situ soil stabilization technology on different areas of the Site, bench-scale treatability testing of in situ stabilization is recommended on three types of soil/media; 1) soil with wood debris and LNAPL, 2) soil with no wood debris or LNAPL, and 3) soil with wood debris but no LNAPL. The primary purpose of the stabilization bench-scale testing will be to determine the technical constraints and aspects of stabilizing contaminants using a mixture of Portland cement or similar binding agent. This will include evaluation of mixing ratios for wood debris and soil matrixes, post-stabilization leachability of contaminants, strength of the mixture, overall technical feasibility and cost of full-scale implementation. The bench-scale testing will involve obtaining bulk representative samples from the Site and performing several mixture tests. Each mixture test will determine physical parameters of the stabilized soil mixture such as density, leachability, unconfined compressive strength, percent bulking, durability, compressibility, and hydraulic conductivity. Based on the results of the treatability testing, if stabilization is determined to be effective and implementable, a cost estimate will be obtained from the stabilization contractor.

Soil and Groundwater Chemistry – To complete the evaluation of in-situ and ex-situ remediation technologies during the feasibility study, additional chemistry data for both soil and groundwater is needed. Evaluation of potential in situ technologies will benefit from additional chemistry data to assist the initial screening process and better estimate cleanup action costs. Evaluation of ex situ treatment and disposal options for both soil and groundwater will also benefit from additional chemistry data to allow more accurate determination of feasibility and costs of various treatment and disposal options.

Additional upland soil and groundwater samples collected to fill data gaps should be analyzed for general chemistry parameters in addition to Site contaminants. Soil samples representative of conditions within the LNAPL plume and outside the LNAPL plume in areas with and without significant wood debris should be obtained and analyzed for total organic carbon (TOC). Similarly, groundwater samples representative of different areas of the Site should be analyzed for TOC, total dissolved solids, hardness, and monitored natural attenuation parameters including nitrate-nitrogen, sulfate, dissolved oxygen (DO), oxidation-reduction potential, pH, and conductivity.

LNAPL Characteristics – In order to evaluate LNAPL removal technologies additional data regarding LNAPL conductivity and transmissivity is needed. This information can be obtained by completing free product bail-down tests using existing wells located within the LNAPL plume and obtaining specific gravity values for LNAPL collected during these tests.

*Hydrogeologic Conditions* – Sediment cap alternatives will require preliminary evaluation of groundwater flow conditions at the shoreline and via submarine discharge to develop a conceptual level cap design. Conceptual design of sediment capping alternatives will require an estimate of the groundwater flux through contaminated sediments that may be capped in place. The groundwater flux is used to calculate the rate of migration of sediment contaminants to clean cap material to determine required cap thicknesses and/or any required amendments. For the feasibility study, flux values associated with different remedial alternatives will need to be estimated. In order to develop these flux values and evaluate submarine groundwater discharge and upland groundwater extraction scenarios a groundwater flow model will be needed. A previous groundwater model was developed in 2000 to assist in the design of the sheet pile wall; however, this model does not satisfy current needs because it is only calibrated to groundwater conditions at the sheet pile wall. A future groundwater modeling approach will be evaluated and outlined in a future work plan.

The data described above will allow more complete and accurate evaluation of cleanup action alternatives during revision of the FS. Following selection of a preferred cleanup action alternative, additional data may be needed to perform full scale remedial design. Additional data that may need to be collected at a later date include: pump test performance data for design of a groundwater extraction system; ex-situ groundwater treatment bench testing to design treatment components; and ex-situ soil treatment bench testing to facilitate design of a potential on site ex-situ treatment system.

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# Table 1

## Summary of Data Gaps

**R.G. Haley International Site**

**Bellingham Washington**

| Data Gap Topic | Report Reference | Summary of Identified Data Gap |
|---|---|---|
| Waterfront Industrial History | Section 4.0 and 4.4 | 1.1 Information about Georgia Pacific industrial discharges to Bellingham Bay |
| | | 1.2 Details of past Whatcom Waterway dredging and disposal activities |
| | | 1.3 Industrial activities on over-water structures |
| Physical Setting (Upland Portion of Site) | Sections 5.1 and 5.1.1 | 2.1 Evaluation of stormwater discharges for upland source control |
| | | 2.2 Evaluation of underground stormwater piping as preferential groundwater migration pathway to aquatic portion of site |
| Physical Setting (Aquatic Portion of Site) | Sections 5.2 and 5.2.1 | 3.1 Topographic/bathymetric data over broader area |
| | | 3.2 Details about DNR piling removal in Haley sediment area |
| | | 3.3 Aquatic habitat survey on Haley site |
| Nature and Extent of Soil Contamination | Sections 8.1 and 8.1.1 | 4.1 The lateral extent of constituents exceeding screening levels in soil on the Cornwall property, and to a lesser extent, in the northeastern portion of the Haley property |
| | | 4.2 The vertical extent of constituents exceeding screening levels on the Haley and Cornwall properties |
| Nature and Extent of Groundwater Contamination | Sections 8.2 and 8.2.1 | 5.1 Updated groundwater quality data from selected existing monitoring wells on the Haley and Cornwall properties |
| | | 5.2 Potential additional monitoring wells and associated sampling depending on the results of 5.1 |
| | | 5.3 Updated data concerning free product occurrence |
| Nature and Extent of Sediment Contamination | Sections 8.3.1 through 8.3.9 | 6.1 Lateral and vertical extent of constituents that exceed SMS criteria and human health criteria |
| | | 6.2 Lateral and vertical extent of dioxins/furans; evalute the boundary between elevated dioxins at Haley site versus bay-wide background concentrations |
| | | 6.3 Sediment stratigraphy |
| Remedial Technology Evaluation | Section 9.0 | 7.1 Bench-scale treatability testing for in-situ stabilization |
| | | 7.2 Selected general chemistry parameters for soil and groundwater |
| | | 7.3 Conductivity and transmissivity data for free product (LNAPL) |
| | | 7.4 Hydrogeologic data to support groundwater modeling |

# Table 2

## Revised Soil Screening Levels

R.G. Haley International Site
Bellingham, Washington

| Analyte Group | CASRN | Constituent | Background Concentration (d) (mg/kg) | MTCA Method B Screening Levels for Direct Contact - Unrestricted Land Use (WAC 173-340) | | Ecological Indicator Soil Concentration for Protection of Terrestrial Plants and Animals (MTCA Table 749-3) (mg/kg) | MTCA Method B Screening Levels (b) Protection of Groundwater (Surface Water) | | MTCA Method B Screening Levels (b) Protection of Groundwater (Sediment) | | MTCA Method B Screening Levels (b) Protection of Groundwater (Indoor Air) | | Preliminary Revised Screening Level (before adjustment for PQL) (mg/Kg) | | PQL (c) (mg/kg) | Preliminary Revised Screening Level (after adjustment for PQL) (mg/Kg) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Carcinogen (mg/kg) | Noncarcinogen (mg/kg) | | Vadose (mg/kg) | Saturated (mg/kg) | Vadose (mg/kg) | Saturated (mg/kg) | Vadose (mg/kg) | Saturated (mg/kg) | Vadose (mg/kg) | Saturated (mg/kg) | | Vadose (mg/kg) | Saturated (mg/kg) |
| Total Petroleum Hydrocarbons | -- | Gasoline-range (e) | -- | 1.0E+02 | | - | -- | -- | -- | -- | -- | -- | 1.0E+02 | 1.0E+02 | **5.0E+00** | 1.0E+02 | 1.0E+02 |
| | 68334-30-5 | Diesel-Range | -- | 1.275E+03 to 3.39E+03 (d) | | 2.0E+02 | -- | -- | -- | -- | -- | -- | 2.0E+02 | 2.0E+02 | 5.0E+00 | 2.0E+02 | 2.0E+02 |
| | -- | Lube Oil-Range | -- | | | 2.0E+02 | -- | -- | -- | -- | -- | -- | 2.0E+02 | 2.0E+02 | 1.0E+01 | 2.0E+02 | 2.0E+02 |
| BETX | 71-43-2 | Benzene | -- | 1.8E+01 | 2.4E+02 | -- | 1.3E-01 | 7.9E-03 | -- | -- | 1.4E-02 | 8.4E-04 | 1.4E-02 | 8.4E-04 | 1.4E-03 | 1.4E-02 | 1.4E-03 |
| | 100-41-4 | Ethylbenzene | -- | -- | 8.0E+03 | -- | 1.8E+01 | 1.0E+00 | -- | -- | 2.4E+01 | 1.4E+00 | 1.8E+01 | 1.0E+00 | 2.5E-02 | 1.8E+01 | 1.0E+00 |
| | 108-88-3 | Toluene | -- | -- | 1.6E+04 | 2.0E+02 | 1.1E+02 | 6.4E+00 | -- | -- | 1.1E+02 | 6.4E+00 | 1.1E+02 | 6.4E+00 | 2.5E-02 | 1.1E+02 | 6.4E+00 |
| | 1330-20-7 | Xylenes (total) | -- | -- | 1.6E+05 | -- | -- | -- | -- | -- | 2.7E+00 | 1.6E-01 | 2.7E+00 | 1.6E-01 | 7.5E-02 | 2.7E+00 | 1.6E-01 |
| SVOCs | 58-90-2 | 2,3,4,6-Tetrachlorophenol | -- | -- | 2.4E+03 | -- | -- | -- | -- | -- | -- | -- | 2.4E+03 | 2.4E+03 | 6.3E-03 | 2.4E+03 | 2.4E+03 |
| | 120-83-2 | 2,4-Dichlorophenol | -- | -- | 2.4E+02 | -- | 1.3E+00 | 8.3E-02 | -- | -- | -- | -- | 1.3E+00 | 8.3E-02 | 5.0E+00 | 5.0E+00 | 5.0E+00 |
| | 105-67-9 | 2,4-Dimethylphenol | -- | -- | 1.6E+03 | -- | 4.5E+00 | 2.7E-01 | 1.7E-02 | 1.0E-03 | -- | -- | 1.7E-02 | 1.0E-03 | 1.0E+00 | 1.0E+00 | 1.0E+00 |
| | 95-95-4 | 2,4,5-Trichlorophenol | -- | -- | 8.0E+03 | 4.0E+00 | -- | -- | -- | -- | -- | -- | 4.0E+00 | 4.0E+00 | 1.0E-01 | 4.0E+00 | 4.0E+00 |
| | 88-06-2 | 2,4,6-Trichlorophenol | -- | 9.1E+01 | 8.0E+00 | 1.0E+01 | 2.8E-02 | 1.6E-03 | -- | -- | -- | -- | 2.8E-02 | 1.6E-03 | 6.3E-03 | 2.8E-02 | 6.3E-03 |
| | 95-48-7 | 2-Methylphenol | -- | -- | 4.3E+03 | -- | -- | -- | 4.1E-02 | 2.7E-03 | -- | -- | 4.1E-02 | 2.7E-03 | 1.0E+00 | 1.0E+00 | 1.0E+00 |
| | 91-57-6 | 2-Methylnaphthalene | -- | -- | 3.2E+02 | -- | -- | -- | 9.8E-01 | 5.0E-02 | -- | -- | 9.8E-01 | 5.0E-02 | 5.0E-03 | 9.8E-01 | 5.0E-02 |
| | 83-32-9 | Acenaphthene | -- | -- | 4.8E+03 | 2.0E+01 | 6.6E+01 | 3.3E+00 | 2.7E-01 | 1.4E-02 | -- | -- | 2.7E-01 | 1.4E-02 | 5.0E-03 | 2.7E-01 | 1.4E-02 |
| | 208-96-8 | Acenaphthylene | -- | -- | -- | -- | -- | -- | 1.1E+00 | 5.7E-02 | -- | -- | 1.1E+00 | 5.7E-02 | 5.0E-03 | 1.1E+00 | 5.7E-02 |
| | 120-12-7 | Anthracene | -- | -- | 2.4E+04 | -- | 1.2E+04 | 6.0E+02 | 5.0E+00 | 2.5E-01 | -- | -- | 5.0E+00 | 2.5E-01 | 5.0E-03 | 5.0E+00 | 2.5E-01 |
| | 85-68-7 | Butylbenzylphthalate | -- | -- | 1.6E+04 | -- | 3.7E+02 | 1.9E+01 | 1.5E-01 | 7.5E-03 | -- | -- | 1.5E-01 | 7.5E-03 | 1.0E+00 | 1.0E+00 | 1.0E+00 |
| | 132-64-9 | Dibenzofuran | -- | -- | 1.6E+02 | -- | -- | -- | 2.5E-01 | 1.3E-02 | -- | -- | 2.5E-01 | 1.3E-02 | 5.0E-03 | 2.5E-01 | 1.3E-02 |
| | 206-44-0 | Fluoranthene | -- | -- | 3.2E+03 | -- | 8.9E+01 | 4.4E+00 | 2.2E+00 | 1.1E-01 | -- | -- | 2.2E+00 | 1.1E-01 | 5.0E-03 | 2.2E+00 | 1.1E-01 |
| | 86-73-7 | Fluorene | -- | -- | 3.2E+03 | 3.0E+01 | 5.5E+02 | 2.8E+01 | 3.2E-01 | 1.6E-02 | -- | -- | 3.2E-01 | 1.6E-02 | 5.0E-03 | 3.2E-01 | 1.6E-02 |
| | 91-20-3 | Naphthalene | -- | -- | 1.6E+03 | -- | 1.4E+02 | 7.3E+00 | 1.5E+00 | 8.0E-02 | 4.8E+00 | 2.5E-01 | 1.5E+00 | 8.0E-02 | 5.0E-03 | 1.5E+00 | 8.0E-02 |
| | 86-30-6 | N-Nitrosodiphenylamine | -- | 2.0E+02 | -- | 2.0E+01 | 1.8E-01 | 9.5E-03 | 5.9E-02 | 3.1E-03 | -- | -- | 5.9E-02 | 3.1E-03 | 2.0E-02 | 5.9E-02 | 2.0E-02 |
| | 87-86-5 | Pentachlorophenol | -- | 8.3E+00 | 2.4E+03 | 3.0E+00 | 4.7E-02 | 2.6E-03 | 8.4E-02 | 4.7E-03 | -- | -- | 4.7E-02 | 2.6E-03 | 6.3E-03 | 4.7E-02 | 6.3E-03 |
| | 85-01-8 | Phenanthrene | -- | -- | -- | -- | -- | -- | 1.6E+00 | 8.2E-02 | -- | -- | 1.6E+00 | 8.2E-02 | 5.0E-03 | 1.6E+00 | 8.2E-02 |
| | 129-00-0 | Pyrene | -- | -- | 2.4E+03 | -- | 3.5E+03 | 1.8E+02 | 2.0E+01 | 9.8E-01 | -- | -- | 2.0E+01 | 9.8E-01 | 5.0E-03 | 2.0E+01 | 9.8E-01 |
| | 191-24-2 | Benzo(g,h,i)perylene | -- | -- | -- | -- | -- | -- | 4.5E-01 | 2.3E-02 | -- | -- | 4.5E-01 | 2.3E-02 | 5.0E-03 | 4.5E-01 | 2.3E-02 |
| | 56-55-3 | cPAHs: Benzo(a)anthracene | -- | 1.4E-01 | -- | -- | 1.3E-01 | 6.5E-03 | 1.9E+00 | 9.3E-02 | -- | -- | 1.3E-01 | 6.5E-03 | 5.0E-03 | 1.3E-01 | 6.5E-03 |
| | 50-32-8 | Benzo(a)pyrene | -- | 1.4E-01 | -- | 1.2E+01 | 3.5E-01 | 1.7E-02 | 2.4E+00 | 1.2E-01 | -- | -- | 1.4E-01 | 1.7E-02 | 5.0E-03 | 1.4E-01 | 1.7E-02 |
| | 205-99-2 | Benzo(b)fluoranthene | -- | 1.4E-01 | -- | -- | 4.3E-01 | 2.2E-02 | 6.9E-01 | 3.4E-02 | -- | -- | 1.4E-01 | 2.2E-02 | 5.0E-03 | 1.4E-01 | 2.2E-02 |
| | 207-08-9 | Benzo(k)fluoranthene | -- | 1.4E-01 | -- | -- | 4.3E-01 | 2.2E-02 | 7.0E-01 | 3.5E-02 | -- | -- | 1.4E-01 | 2.2E-02 | 5.0E-03 | 1.4E-01 | 2.2E-02 |
| | 218-01-9 | Chrysene | -- | 1.4E-01 | -- | -- | 1.4E-01 | 7.2E-03 | 3.7E+00 | 1.9E-01 | -- | -- | 1.4E-01 | 7.2E-03 | 5.0E-03 | 1.4E-01 | 7.2E-03 |
| | 193-39-5 | Indeno(1,2,3-cd)pyrene | -- | 1.4E-01 | -- | -- | 1.3E+00 | 6.3E-02 | 8.9E-01 | 4.4E-02 | -- | -- | 1.4E-01 | 4.4E-02 | 5.0E-03 | 1.4E-01 | 4.4E-02 |
| | 53-70-3 | Dibenz(a,h)anthracene | -- | 1.4E-01 | -- | -- | 6.5E-01 | 3.2E-02 | 1.6E-01 | 8.2E-03 | -- | -- | 1.4E-01 | 8.2E-03 | 5.0E-03 | 1.4E-01 | 8.2E-03 |
| Total Dioxins and Furans | 1746-01-6 | Total Dioxins and Furans TEC (f) | 5.2E-06 | 1.1E-05 | -- | 2.0E-06 | 2.5E-08 | 1.3E-09 | -- | -- | -- | -- | 5.2E-06 | 5.2E-06 | 5.7E-07 | 5.2E-06 | 5.2E-06 |

| Analyte Group | CASRN | Constituent | Background Concentration (d) (mg/kg) | MTCA Method B Screening Levels for Direct Contact - Unrestricted Land Use (WAC 173-340) Carcinogen (mg/kg) | MTCA Method B Screening Levels for Direct Contact - Unrestricted Land Use (WAC 173-340) Noncarcinogen (mg/kg) | Ecological Indicator Soil Concentration for Protection of Terrestrial Plants and Animals (MTCA Table 749-3) (mg/kg) | MTCA Method B Screening Levels (b) Protection of Groundwater (Surface Water) Vadose (mg/kg) | MTCA Method B Screening Levels (b) Protection of Groundwater (Surface Water) Saturated (mg/kg) | MTCA Method B Screening Levels (b) Protection of Groundwater (Sediment) Vadose (mg/kg) | MTCA Method B Screening Levels (b) Protection of Groundwater (Sediment) Saturated (mg/kg) | MTCA Method B Screening Levels (b) Protection of Groundwater (Indoor Air) Vadose (mg/kg) | MTCA Method B Screening Levels (b) Protection of Groundwater (Indoor Air) Saturated (mg/kg) | Preliminary Revised Screening Level (before adjustment for PQL) (mg/Kg) Vadose (mg/kg) | Preliminary Revised Screening Level (before adjustment for PQL) (mg/Kg) Saturated (mg/kg) | PQL (c) (mg/kg) | Preliminary Revised Screening Level (after adjustment for PQL) (mg/Kg) Vadose (mg/kg) | Preliminary Revised Screening Level (after adjustment for PQL) (mg/Kg) Saturated (mg/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Metals | 7440-38-2 | Arsenic | 2.0E+01 | 6.7E-01 | 2.4E+01 | 7.0E+00 | 5.7E-02 | 2.9E-03 | -- | -- | -- | -- | 2.0E+01 | 2.0E+01 | 2.0E-01 | 2.0E+01 | 2.0E+01 |
| | 18540-29-9 | Chromium VI | -- | -- | 2.4E+02 | -- | 1.9E+01 | 9.6E-01 | -- | -- | -- | -- | 1.9E+01 | 9.6E-01 | 5.0E+00 | 1.9E+01 | 5.0E+00 |
| | 16065-83-1 | Chromium III | 4.8E+01 | -- | 1.2E+05 | -- | 4.9E+06 | 2.4E+05 | 6.1E+03 | 3.1E+02 | -- | -- | 6.1E+03 | 3.1E+02 | 2.0E+00 | 6.1E+03 | 3.1E+02 |
| | 7440-47-3 | Chromium (total) | 4.8E+01 | -- | 1.2E+05 | 4.2E+01 | 4.9E+06 | 2.4E+05 | 6.1E+03 | 3.1E+02 | -- | -- | 4.8E+01 | 4.8E+01 | 2.0E+00 | 4.8E+01 | 4.8E+01 |
| | 7440-50-8 | Copper (e) | 3.6E+01 | -- | 3.0E+03 | -- | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 3.6E+01 | 3.6E+01 | 2.0E-01 | 3.6E+01 | 3.6E+01 |
| | 7440-02-0 | Nickel (e) | 4.8E+01 | 1.6E+03 | -- | 3.0E+01 | N/A | N/A | N/A | N/A | N/A | N/A | 4.8E+01 | 4.8E+01 | 5.0E-01 | 4.8E+01 | 4.8E+01 |
| | 7440-66-6 | Zinc (e) | 8.5E+01 | -- | 2.4E+04 | 8.6E+01 | N/A | N/A | N/A | N/A | N/A | N/A | 8.6E+01 | 8.6E+01 | 1.0E+00 | 8.6E+01 | 8.6E+01 |

**Notes:**

TEC = Toxicity equivalent concentration

BETX = Benzene, ethylbenzene, toluene, and total xylenes

SVOC = Semivolatile organic compound

cPAHs = Carcinogenic polycyclic aromatic hydrocarbons

NA = Not applicable. This analyte was not identified as a constituent of potential concern in groundwater for the Cornwall Avenue Landfill site (Landau Associates Inc, 2009 Cornwall Avenue Landfill RI/FS) so these pathways are not applicable.

(a) Metal background values, except for arsenic, based on Puget Sound Region 90th percentile values, from *Natural Background Soil Metals Concentrations in Washington State* (Ecology Publication #94-115, 1994). Natural background value for arsenic, based on the value used by Ecology to develop the MTCA Method A soil cleanup level. Total dioxins/furans TEC background value based on Department of Ecology Technical Memorandum #8, Natural Background for Dioxins/Furans in WA Soils, August 9,2010.

(b) Soil values protective of groundwater calculated using Equation 747-1 from WAC 173-340-747. Values for Kd, Koc, and Henry's Law Constant are from CLARC if available; if not, values from EPIWIN or ORNL RAIS were used.

(c) PQL is lowest available value from Analytical Resources, Inc. (Tukwilla, WA) or Frontier Analytical Laboratory (El Dorado Hills, CA)

(d) Site specific screening levels were calculated using Equation 740-3 from WAC 173-340-740 based on EPH analytical results from soil samples that contained detectable concentrations of cPAHs. The range (lowest and highest) of calculated screening levels is 1,275 to 3,390 mg/kg.

(e) These analytes are constituents of potential concern related to the Cornwall Avenue Landfill site (Landau Associates Inc, 2009 Cornwall Avenue Landfill RI/FS) but not the Haley Site, and

are included in this table because cleanup actions in the area where the Cornwall Site and the Haley Site overlap must address constituents of concern related to both sites.

(f) Dioxin/furan mixtures are evaluated using the TEQ methodology.

Shading indicated basis for preliminary revised screening level.

-- = no value available

# Table 3

## Revised Groundwater Screening Levels

R.G. Haley International Site

Bellingham, Washington

| Analyte Group | CASRN | Constituent | Surface Water Criteria: 40 CFR Part 131.36 (a) — Protection of Aquatic Organisms, Marine Water: Acute (ug/L) | 40 CFR Part 131.36 (a) — Protection of Aquatic Organisms, Marine Water: Chronic (ug/L) | 40 CFR Part 131.36 (a) — Protection of Human Health For Consumption of: Organism Only (ug/L) | Section 304 of the Clean Water Act (b) — Protection of Aquatic Organisms, Marine Water: Acute (ug/L) | Section 304 of the Clean Water Act (b) — Protection of Aquatic Organisms, Marine Water: Chronic (ug/L) | Section 304 of the Clean Water Act (b) — Protection of Human Health For Consumption of: Organism Only (ug/L) | WAC 173-201A (c) — Protection of Aquatic Organisms, Marine water: Acute (ug/L) | WAC 173-201A (c) — Protection of Aquatic Organisms, Marine water: Chronic (ug/L) | WAC 173-340-730 (d) — Protection of Human Health (fish consumption), MTCA Method B: Carcino-gen (ug/L) | WAC 173-340-730 (d) — Protection of Human Health (fish consumption), MTCA Method B: Non-Carcinogen (ug/L) | Protection of Sediment (SQS values in 173-204 WAC) Note (e) (ug/L) | Method B Groundwater Criteria for Vapor Intrusion (f): Carcino-gen (ug/L) | Method B Groundwater Criteria for Vapor Intrusion (f): Non-Carcinogen (ug/L) | Preliminary Revised Screening Level (before adjustment for PQL) (ug/L) | PQL (g) (µg/L) | Selected Preliminary Revised Screening Level (after adjustment for PQL and background) (µg/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TPH | 68334-30-5 | Diesel-Range | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 2.5E+02 | (i) |
| | 64742-65-0 | Lube Oil-Range | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 4.0E+02 | (i) |
| BETX | 71-43-2 | Benzene | -- | -- | 7.1E+01 | -- | -- | 5.1E+01 | -- | -- | 2.3E+01 | 2.0E+03 | -- | 2.4E+00 | 1.0E+02 | 2.4E+00 | 4.5E-01 | 2.4E+00 |
| | 100-41-4 | Ethylbenzene | -- | -- | 2.9E+04 | -- | -- | 2.1E+03 | -- | -- | -- | 6.9E+03 | -- | -- | 2.8E+03 | 2.1E+03 | 4.2E-01 | 2.1E+03 |
| | 108-88-3 | Toluene | -- | -- | 2.0E+05 | -- | -- | 1.5E+04 | -- | -- | -- | 1.9E+04 | -- | | 1.5E+04 | 1.5E+04 | 4.8E-01 | 1.5E+04 |
| | 1330-20-7 | Xylenes (total) | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | | 3.1E+02 | 3.1E+02 | 7.8E-01 | 3.1E+02 |
| SVOCs | 120-83-2 | 2,4-Dichlorophenol | -- | -- | 7.9E+02 | -- | -- | 2.9E+02 | -- | -- | -- | 1.9E+02 | -- | -- | -- | 1.9E+02 | 5.0E+00 | 1.9E+02 |
| | 105-67-9 | 2,4-Dimethylphenol | -- | -- | -- | -- | -- | 8.5E+02 | -- | -- | -- | 5.5E+02 | 2.0E+00 | -- | -- | 2.0E+00 | 1.0E+00 | 2.0E+00 |
| | 95-95-4 | 2,4,5-Trichlorophenol | -- | -- | -- | -- | -- | 3.6E+03 | -- | -- | -- | -- | -- | -- | -- | 3.6E+03 | 5.0E+00 | 3.6E+03 |
| | 88-06-2 | 2,4,6-Trichlorophenol | -- | -- | 6.5E+00 | -- | -- | 2.4E+00 | -- | -- | 3.9E+00 | -- | -- | -- | -- | 2.4E+00 | 2.5E-01 | 2.4E+00 |
| | 95-48-7 | 2-Methylphenol | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 7.1E+00 | -- | -- | 7.1E+00 | 1.0E+00 | 7.1E+00 |
| | 91-57-6 | 2-Methylnaphthalene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1.8E+01 | -- | -- | 1.8E+01 | 1.0E+00 | 1.8E+01 |
| | 83-32-9 | Acenaphthene | -- | -- | -- | -- | -- | 9.9E+02 | -- | -- | -- | 6.4E+02 | 2.6E+00 | -- | -- | 2.6E+00 | 1.0E+00 | 2.6E+00 |
| | 208-96-8 | Acenaphthylene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1.1E+01 | -- | -- | 1.1E+01 | 1.0E+00 | 1.1E+01 |
| | 120-12-7 | Anthracene | -- | -- | 1.1E+05 | -- | -- | 4.0E+04 | -- | -- | -- | 2.6E+04 | 1.1E+01 | -- | -- | 1.1E+01 | 1.0E+00 | 1.1E+01 |
| | 85-68-7 | Butylbenzylphthalate | -- | -- | -- | -- | -- | 1.9E+03 | -- | -- | | 1.3E+03 | 5.2E-01 | -- | -- | 5.2E-01 | 1.0E+00 | 1.0E+00 |
| | 132-64-9 | Dibenzofuran (see comment) | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1.3E+00 | -- | -- | 1.3E+00 | 1.0E+00 | 1.3E+00 |
| | 206-44-0 | Fluoranthene | -- | -- | 3.7E+02 | -- | -- | 1.4E+02 | -- | -- | -- | 9.0E+01 | 2.3E+00 | -- | -- | 2.3E+00 | 1.0E+00 | 2.3E+00 |
| | 86-73-7 | Fluorene | -- | -- | 1.4E+04 | -- | -- | 5.3E+03 | -- | -- | -- | 3.5E+03 | 2.0E+00 | -- | -- | 2.0E+00 | 1.0E+00 | 2.0E+00 |
| | 91-20-3 | Naphthalene | -- | -- | -- | -- | -- | -- | -- | -- | -- | 4.9E+03 | 5.4E+01 | -- | 1.7E+02 | 5.4E+01 | 1.0E+00 | 5.4E+01 |
| | 86-30-6 | N-Nitrosodiphenylamine | -- | -- | 1.6E+01 | -- | -- | 6.0E+00 | -- | -- | 9.7E+00 | -- | 2.0E+00 | -- | -- | 2.0E+00 | 1.0E+00 | 2.0E+00 |
| | 87-86-5 | Pentachlorophenol | 1.3E+01 | 7.9E+00 | 8.2E+00 | 1.3E+01 | 7.9E+00 | 3.0E+00 | 1.3E+01 | 7.9E+00 | 4.9E+00 | 7.1E+03 | 5.3E+00 | -- | -- | 3.0E+00 | 2.5E-01 | 3.0E+00 |
| | 85-01-8 | Phenanthrene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 4.8E+00 | -- | -- | 4.8E+00 | 1.0E+00 | 4.8E+00 |
| | 129-00-0 | Pyrene | -- | -- | 1.1E+04 | -- | -- | 4.0E+03 | -- | -- | -- | 2.6E+03 | 1.4E+01 | -- | -- | 1.4E+01 | 1.0E+00 | 1.4E+01 |
| | 191-24-2 | Benzo(g,h,i)perylene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1.2E-02 | -- | -- | 1.2E-02 | 1.0E+00 | 1.0E+00 |

| | | | | Surface Water Criteria | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 40 CFR Part 131.36 (a) | | | Section 304 of the Clean Water Act (b) | | | WAC 173-201A (c) | | WAC 173-340-730 (d) | | | | | | | |
| | | | | Protection of Aquatic Organisms | | Protection of Human Health For Consumption of: | Protection of Aquatic Organisms | | Protection of Human Health For Consumption of: | Protection of Aquatic Organisms | | Protection of Human Health (fish consumption) | | Protection of Sediment (SQS values in 173-204 WAC) Note (e) | Method B Groundwater Criteria for Vapor Intrusion (f) | | Preliminary Revised Screening Level (before adjustment for PQL) | PQL (g) | Selected Preliminary Revised Screening Level (after adjustment for PQL and background) |
| | | | | Marine Water | | | Marine Water | | | Marine water | | MTCA Method B | | | | | | | |
| Analyte Group | CASRN | | Constituent | Acute (ug/L) | Chronic (ug/L) | Organism Only (ug/L) | Acute (ug/L) | Chronic (ug/L) | Organism Only (ug/L) | Acute (ug/L) | Chronic (ug/L) | Carcino-gen (ug/L) | Non-Carcinogen (ug/L) | (ug/L) | Carcino-gen (ug/L) | Non-Carcinogen (ug/L) | (ug/L) | (µg/L) | (µg/L) |
| SVOCs (continued) | 56-55-3 | cPAHs | Benzo(a)anthracene | -- | -- | 3.1E-02 | -- | -- | 1.8E-02 | -- | -- | 3.0E-02 | -- | 2.6E-01 | -- | -- | 1.8E-02 | 1.0E-02 | 1.8E-02 |
| | 50-32-8 | | Benzo(a)pyrene | -- | -- | 3.1E-02 | -- | -- | 1.8E-02 | -- | -- | 3.0E-02 | -- | 1.3E-01 | -- | -- | 1.8E-02 | 1.0E-02 | 1.8E-02 |
| | 205-99-2 | | Benzo(b)fluoranthene | -- | -- | 3.1E-02 | -- | -- | 1.8E-02 | -- | -- | 3.0E-02 | -- | 2.9E-01 | -- | -- | 1.8E-02 | 1.0E-02 | 1.8E-02 |
| | 207-08-9 | | Benzo(k)fluoranthene | -- | -- | 3.1E-02 | -- | -- | 1.8E-02 | -- | -- | 3.0E-02 | -- | 2.9E-01 | -- | -- | 1.8E-02 | 1.0E-02 | 1.8E-02 |
| | 218-01-9 | | Chrysene | -- | -- | 3.1E-02 | -- | -- | 1.8E-02 | -- | -- | 3.0E-02 | -- | 4.7E-01 | -- | -- | 1.8E-02 | 1.0E-02 | 1.8E-02 |
| | 193-39-5 | | Indeno(1,2,3-cd)pyrene | -- | -- | 3.1E-02 | -- | -- | 1.8E-02 | -- | -- | 3.0E-02 | -- | 1.3E-02 | -- | -- | 1.3E-02 | 1.0E-02 | 1.3E-02 |
| | 53-70-3 | | Dibenz(a,h)anthracene | -- | -- | 3.1E-02 | -- | -- | 1.8E-02 | -- | -- | 3.0E-02 | -- | 4.6E-03 | -- | -- | 4.6E-03 | 1.0E-02 | 1.0E-02 |
| Total Dioxins and Furans | 1746-01-6 | 2378-TCDD | TEQ Calculation | -- | -- | 1.4E-08 | -- | -- | 5.1E-09 | -- | -- | 8.6E-09 | -- | -- | -- | -- | 5.1E-09 | 5.7E-06 | 5.7E-06 |
| Dissolved Metals | 7440382 | | Arsenic | 6.9E+01 | 3.6E+01 | 1.4E-01 | 6.9E+01 | 3.6E+01 | 1.4E-01 | 6.9E+01 | 3.6E+01 | 9.8E-02 | 1.8E+01 | -- | -- | -- | 9.8E-02 | 2.0E-01 | 5.0E+01 (h) |
| | 18540-29-9 | | Chromium (VI) | 1.1E+03 | 5.0E+01 | -- | 1.1E+03 | 5.0E+01 | -- | 1.1E+03 | 5.0E+01 | -- | 4.9E+02 | -- | -- | -- | 5.0E+01 | 2.0E+01 | 5.0E+01 |
| | 16065-83-1 | | Chromium III | -- | -- | -- | -- | -- | -- | -- | -- | -- | 2.4E+05 | 3.1E+02 | -- | -- | 3.1E+02 | 5.0E-01 | 3.1E+02 |
| | 7440-47-3 | | Chromium (total) | -- | -- | -- | -- | -- | -- | -- | -- | -- | 2.4E+05 | 3.1E+02 | | | 3.1E+02 | 5.0E-01 | 3.1E+02 |
| | 7440508 | | Copper | 2.4E+00 | 2.4E+00 | -- | 4.8E+00 | 3.1E+00 | -- | 4.8E+00 | 3.1E+00 | -- | 2.7E+03 | 1.2E+02 | -- | -- | 2.4E+00 | 5.0E-01 | 2.4E+00 |
| | 57-12-5 | | Cyanide (total) (j) | 1.0E+00 | 1.0E+00 | 2.2E+05 | 1.0E+00 | 1.0E+00 | 1.6E+04 | 1.0E+00 | 1.0E+00 | -- | 5.2E+04 | -- | -- | -- | 1.0E+00 | 4.0E+00 | 4.0E+00 |
| | 7439-92-1 | | Lead (j) | 2.1E+02 | 8.1E+00 | -- | 2.1E+02 | 8.1E+00 | -- | 2.1E+02 | 8.1E+00 | -- | -- | 1.1E+01 | -- | -- | 8.1E+00 | 1.0E+00 | 8.1E+00 |
| Other | 7664-41-7 | | Ammonia (j) | -- | -- | -- | -- | -- | -- | 2.3E+02 | 3.5E+01 | -- | -- | -- | -- | -- | 3.5E+01 | 1.0E+01 | 3.5E+01 |
| | 27323-18-9 | | PCBs (j) | -- | 3.0E-02 | 1.7E-04 | -- | 3.0E-02 | 6.4E-05 | 1.0E+01 | 3.0E-02 | 1.1E-04 | -- | 2.7E-01 | -- | -- | 6.4E-05 | 1.0E-02 | 1.0E-02 |

**Notes:**

(a) Ambient water quality criteria (AQWC) for the protection of aquatic organisms and protection of human health based on consumption of organisms from 40 CFR part 131.36 (National Toxics Rule).

(b) National recommended water quality criteria for the protection of aquatic organisms and protection of human health based on consumption of organisms from Section 304 of the Clean Water Act.

(c) Water Quality Standards for Surface Waters of the State of Washington, Chapter 173-201A WAC, amended July 1, 2003. Based on protection of aquatic organisms.

(d) MTCA Method B surface water screening levels calculated according to WAC 173-340-730(3)(b)(iii)(a) (equation 730-1) and WAC 173-340-730(3)(b)(iii)(b) (equation 730-2).

(e) Groundwater criteria considered protective of sediment (SQS criteria) using calculations developed by Ecology for the Lower Duwamish Waterway (Draft LDW CULs v12r5.xlsx)

(f) Values obtained from Ecology's draft Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action (Ecology Publication #09-09-047), Table B-1.

(g) PQL is lowest available value from Analytical Resources, Inc. (Tukwilla, WA) or Frontier Analytical Laboratory (El Dorado Hills, CA).

(h) This screening level is based on MTCA Method A Cleanup Level for arsenic in groundwater (5 µg/L) which is based on natural background concentration in Washington State (WAC 173-340-900, Table 720-1).

(i) See screening levels for individual components in TPH

(j) These analytes are constituents of potential concern related to the Cornwall Avenue Landfill site (Landau Associates Inc, 2009 Cornwall Avenue Landfill RI/FS) but not the Haley Site, and are included in this table because cleanup actions in the area where the Cornwall site and the Haley Site overlap must address constituents of concern related to both sites.

Shading indicates basis for preliminary revised screening level

-- = no value available

# Table 4

## Revised Sediment Screening Levels

R.G. Haley International Site

Bellingham, Washington

| Analytes | SMS Criteria[1] | | AET Criteria[2] | |
|---|---|---|---|---|
| | SQS[3] | CSL[4] | LAET[5] | 2LAET[6] |
| **Metals** | **mg/kg** | **mg/kg** | **mg/kg** | **mg/kg** |
| Copper[7] | 390 | 390 | 390 | 390 |
| Lead[7] | 450 | 530 | 450 | 530 |
| Mercury[8] | 0.41 | 0.59 | 0.41 | 0.59 |
| Silver[7] | 6.1 | 6.1 | 6.1 | 6.1 |
| Zinc[7] | 410 | 960 | 410 | 960 |
| **Total LPAHs** | **mg/kg OC** | **mg/kg OC** | **µg/kg** | **µg/kg** |
| Total LPAH | 370 | 780 | 5,200 | 5,200 |
| Naphthalene | 99 | 170 | 2,100 | 2,100 |
| Acenaphthylene | 66 | 66 | 1,300 | 1,300 |
| Acenaphthene | 16 | 57 | 500 | 500 |
| Fluorene | 23 | 79 | 540 | 540 |
| Phenanthrene | 100 | 480 | 1,500 | 1,500 |
| Anthracene | 220 | 1,200 | 960 | 960 |
| 2-Methylnaphthalene | 38 | 64 | 670 | 670 |
| **Total HPAHs** | **mg/kg OC** | **mg/kg OC** | **µg/kg** | **µg/kg** |
| Total HPAH | 960 | 5,300 | 12,000 | 17,000 |
| Fluoranthene | 160 | 1,200 | 1,700 | 2,500 |
| Pyrene | 1,000 | 1,400 | 2,600 | 3,300 |
| Benzo(a)anthracene | 110 | 270 | 1,300 | 1,600 |
| Chrysene | 110 | 460 | 1,400 | 2,800 |
| Total Benzofluoranthenes | 230 | 450 | 3,200 | 3,600 |
| Benzo(a)pyrene | 99 | 210 | 1,600 | 1,600 |
| Indeno(1,2,3-cd)pyrene | 34 | 88 | 600 | 690 |
| Dibenzo(a,h)anthracene | 12 | 33 | 230 | 230 |
| Benzo(ghi)perylene | 31 | 78 | 670 | 720 |
| **Chlorinated Hydrocarbons** | **mg/kg OC** | **mg/kg OC** | **µg/kg** | **µg/kg** |
| 1,2-Dichlorobenzene | 2.3 | 2.3 | 35 | 50 |
| 1,3-Dichlorobenzene | -- | -- | >170 | -- |
| 1,4-Dichlorobenzene | 3.1 | 9 | 110 | 110 |
| 1,2,4-Trichlorobenzene | 0.81 | 1.8 | 31 | 51 |
| Hexachlorobenzene | 0.38 | 2.3 | 22 | 70 |
| **Phthalates** | **mg/kg OC** | **mg/kg OC** | **µg/kg** | **µg/kg** |
| Dimethyl phthalate | 53 | 53 | 71 | 160 |
| Diethyl phthalate | 61 | 110 | 200 | 1,200 |
| Dibutyl phthalate | 220 | 1,700 | 1,400 | 5,100 |

| Analytes | SMS Criteria[1] | | AET Criteria[2] | |
|---|---|---|---|---|
| | SQS[3] | CSL[4] | LAET[5] | 2LAET[6] |
| Butyl benzyl phthalate | 4.9 | 64 | 63 | 900 |
| Bis(2-Ethylhexyl) Phthalate[7] | 47 | 78 | 1,300 | 3,100 |
| Di-N-Octyl Phthalate | 58 | 4,500 | 6,200 | 6,200 |
| **Miscellaneous Extractables** | **mg/kg OC** | **mg/kg OC** | **µg/kg** | **µg/kg** |
| Dibenzofuran | 15 | 58 | 540 | 540 |
| Hexachlorobutadiene | 3.9 | 6.2 | 11 | 120 |
| N-Nitrosodiphenylamine | 11 | 11 | 28 | 40 |
| Benzyl Alcohol | 57 | 73 | 57 | 73 |
| Benzoic Acid | 650 | 650 | 650 | 650 |
| **PCBs** | **mg/kg** | **mg/kg** | **µg/kg** | **µg/kg** |
| Total PCBs[7] | 12 | 65 | 130 | 1,000 |
| **Phenols** | **µg/kg** | **µg/kg** | **µg/kg** | **µg/kg** |
| Phenol[8] | 420 | 1,200 | 420 | 1,200 |
| 2-methylphenol[8] | 63 | 63 | 63 | 63 |
| 4-methylphenol[8] | 670 | 670 | 670 | 670 |
| 2,4-Dimethylphenol | 29 | 29 | 29 | 29 |
| Pentachlorophenol | 360 | 690 | 360 | 690 |
| **Petroleum Hydrocarbons** | **mg/kg** | **mg/kg** | **mg/kg** | **mg/kg** |
| Diesel-range Hydrocarbons | -- | -- | -- | -- |
| Heavy Oil-Range Hydrocarbons | -- | -- | -- | -- |
| Total TPH | 200 [9] | -- | -- | -- |
| **Dioxins and Furans** | **ng/kg** | **ng/kg** | **ng/kg** | **ng/kg** |
| 2,3,7,8-TCDD | -- | -- | -- | -- |
| 1,2,3,7,8-PeCDD | -- | -- | -- | -- |
| 1,2,3,4,7,8-HxCDD | -- | -- | -- | -- |
| 1,2,3,6,7,8-HxCDD | -- | -- | -- | -- |
| 1,2,3,7,8,9-HxCDD | -- | -- | -- | -- |
| 1,2,3,4,6,7,8-HpCDD | -- | -- | -- | -- |
| OCDD | -- | -- | -- | -- |
| 2,3,7,8-TCDF | -- | -- | -- | -- |
| 1,2,3,7,8-PeCDF | -- | -- | -- | -- |
| 2,3,4,7,8-PeCDF | -- | -- | -- | -- |
| 1,2,3,4,7,8-HxCDF | -- | -- | -- | -- |
| 1,2,3,6,7,8-HxCDF | -- | -- | -- | -- |
| 1,2,3,7,8,9-HxCDF | -- | -- | -- | -- |
| 2,3,4,6,7,8-HxCDF | -- | -- | -- | -- |
| 1,2,3,4,6,7,8-HpCDF | -- | -- | -- | -- |
| 1,2,3,4,7,8,9-HpCDF | -- | -- | -- | -- |
| OCDF | -- | -- | -- | -- |
| Dioxin/Furan TEQ ND=0 | -- | -- | -- | -- |
| Dioxin/Furan TEQ ND=1/2 | -- | -- | -- | -- |

**Notes:**

SMS = Sediment Management Standards

SQS = Sediment Quality Standards

CSL = Cleanup Screening Levels

LAET = Lowest Apparent Effects Threshold

2LAET = Second Lowest Apparent Effects Threshold

μg/kg = microgram per kilogram

ng/kg = nanogram per kilogram

mg/kg OC = milligram per kilogram

Total LPAHs are the total of Napthalene, Acenapthylene, Acenapthene, Fluorene, Phenanthrene and Anthracene; 2-Methylnapthalene is not included in the sum of LPAHs.

Total HPAHs are the total of Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzofluoranthenes, Benzo(a)pyrene, Indeno(1,2,3-c-d)pyrene, Dibenzo(a,h)anthracene and Benzo(g,h,i)perylene.

[1] Sediment Management Standards (Chapter 173-204 WAC)

[2] Apparent Effects Threshold Criteria

[3] Sediment Quality Standards (Chapter 173-204-320)

[4] Cleanup Screening Level (Chapter 173-204-520)

[5] Lowest Apparent Effects Threshold Criteria (provided in an email from Peter Adolphson, Washington State Department of Ecology, dated April 18, 2011).

[6] Second Lowest Apparent Effects Threshold Criteria (provided in an email from Peter Adolphson, Washington State Department of Ecology, dated April 18, 2011).

[7] This analyte was identified as a constituent of concern related to the Cornwall Avenue Landfill site (Landau Associates Inc, 2009 Cornwall Avenue Landfill RI/FS) and is included in this table because cleanup actions in the area where the Cornwall site and the Haley Site overlap must address constituents of concern related to both sites.

[8] This analyte was identified as a constituent of concern related to the Whatcom Waterway site (RETEC, 2006, Whatcom Waterway Supplemental RI/FS) and is included in this table because cleanup actions in the area where the Whatcom Waterway site and the Haley Site overlap must address constituents of concern related to both sites.

[9] Preliminary Screening Level from *Sediment Site Characterization Evaluation of Bellingham Bay Creosote Piling and Structure Removal - Cornwell Avenue Landfill Mapping, Boulevard Park Overwater Walkway Feasibility Study and Dioxin Background Sampling and Analysi* s, June 26, 2009.

# Table 5

## Sediment Chemical and Physical Testing Results

R.G. Haley International Site

Bellingham, Washington

| Analyte | Units | SQS/LAET | CSL/2LAET | PS-2 | PS-4 | PS-7 | PS-13 | PS-16 | PS-20 | RI-1 | RI-2 | RI-3 | RI-4 | RI-5 | RI-6 | RI-7 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample ID: | PS-2 | PS-4 | PS-7 | PS-13 | PS-16 | PS-20 | RI-1-0-0.33 | RI-2-0-0.33 | RI-3-0-0.33 | RI-4-0-0.33 | RI-5-0-0.33 | RI-6-3.5-4.5 | RI-7-3-4 |
| | | | Sample Date: | 9/19/2003 | 9/19/2003 | 9/19/2003 | 9/19/2003 | 9/19/2003 | 9/19/2003 | 7/29/2004 | 7/29/2004 | 7/29/2004 | 7/29/2004 | 7/30/2004 | 7/30/2004 | 7/29/2004 |
| | | | Sample Depth (feet): | 0-0.5 | 0-0.5 | 0-0.5 | 0-0.5 | 0.25-0.5 | 0.25-0.5 | 0-0.33 | 0-0.33 | 0-0.33 | 0-0.33 | 0-0.33 | 3.5-4.5 | 3-4 |
| **Conventional Parameters** | | | | | | | | | | | | | | | | |
| Ammonia | mg/kg | – | – | – | – | – | – | – | – | 3.7 | 0.5 J | 1 | 3.4 | 4 | – | – |
| Sulfide | mg/kg | – | – | – | – | – | – | – | – | 466 | 18.7 | 328 | 1610 | 1830 | – | – |
| Total Organic Carbon | Percent | – | – | 0.46 | 1.03 | 0.48 | 4.62 | 35.2 | 30.2 | 3.86 | 35.3 | 2.36 | 4.56 | 2.06 | 1.9 | 12.8 |
| Total Solids | Percent | – | – | 81 | 90 | 87 | 69.2 | 15 | 28 | 63.8 | 28.7 | 76.8 | 68 | 78.8 | – | – |
| **Metals** | | | | | | | | | | | | | | | | |
| Mercury | mg/kg | 0.41 | 0.59 | – | – | – | – | – | – | 0.45 N | – | – | 0.27 N | 0.19 N | – | – |
| **Aromatic Hydrocarbons (OC Normalized)** | | | | | | | | | | | | | | | | |
| Total LPAH | mg/kg OC | 370 | 780 | 11.696 JT | 1147.573 T | 8.083 JT | 673.593 T | 8.486 T | 202.318 T | 21.684 T | 1.518 T | 18.602 T | 27.325 T | 54.369 T | 146.053 T | 18.969 T |
| Naphthalene | mg/kg OC | 99 | 170 | 1.13 J | 155.34 U | 1.062 J | 4.762 | 3.125 | 3.642 | 1.114 | 0.34 | 1.907 | 2.412 | 4.223 | 1.947 D | 2.031 D |
| Acenaphthylene | mg/kg OC | 66 | 66 | 1.174 J | 14.563 U | 1.146 J | 23.81 | 0.852 | 13.576 U | 3.109 | 0.091 | 1.314 | 2.632 | 7.767 | 0.947 D | 0.766 D |
| Acenaphthene | mg/kg OC | 16 | 57 | 0.87 J | 708.738 | 2.5 | 45.455 | 0.219 | 36.424 | 0.648 | 0.082 | 1.229 | 1.228 | 1.505 | 15.789 D | 1.172 D |
| Fluorene | mg/kg OC | 23 | 79 | 0.848 J | 242.718 | 1.583 U | 62.771 | 0.398 | 14.238 | 1.528 | 0.116 | 1.653 | 2.632 | 3.981 | 11.579 D | 1.016 D |
| Phenanthrene | mg/kg OC | 100 | 480 | 6.087 | 145.631 | 2.292 | 389.61 | 3.125 | 139.073 | 12.176 | 0.708 | 9.746 | 14.035 | 30.097 | 89.474 D | 10.938 D |
| Anthracene | mg/kg OC | 220 | 1200 | 1.587 J | 50.485 | 1.083 | 147.186 | 0.767 | 8.94 | 3.109 | 0.181 | 2.754 | 4.386 | 6.796 | 26.316 D | 3.047 D |
| 2-Methylnaphthalene | mg/kg OC | 38 | 64 | – | – | – | – | – | – | 0.829 | 0.116 | 1.483 | 2.171 | 2.573 | 2.053 D | 0.422 D |
| Total HPAH (SMS) | mg/kg OC | 960 | 5300 | 58.435 JT | 1196.117 T | 23.229 JT | 2160.173 T | 13.551 T | 22.781 JT | 119.145 T | 7.564 T | 80.085 T | 109.079 T | 222.184 T | 333.526 T | 76.719 T |
| Fluoranthene | mg/kg OC | 160 | 1200 | 9.783 | 378.641 | 3.542 | 497.835 | 3.125 | 5.298 | 18.394 | 0.907 | 9.322 | 14.912 | 33.981 | 78.947 D | 14.844 D |
| Pyrene | mg/kg OC | 1000 | 1400 | 8.696 | 155.34 | 2.917 | 476.19 | 3.409 | 8.609 | 31.088 | 1.756 | 19.915 | 28.509 | 63.107 | 78.947 D | 16.406 D |
| Benzo(a)anthracene | mg/kg OC | 110 | 270 | 5 | 126.214 | 1.562 J | 216.45 | 1.108 | 1.921 | 9.845 | 0.68 | 7.203 | 9.649 | 16.99 | 33.158 D | 7.422 D |
| Chrysene | mg/kg OC | 110 | 460 | 6.087 | 126.214 | 2.5 | 238.095 | 1.335 | 1.722 | 12.176 | 0.793 | 8.898 | 11.404 | 22.816 | 34.737 D | 8.594 D |
| Benzofluoranthenes (Sum) | mg/kg OC | 230 | 450 | 9.565 T | 157.282 T | 3.75 T | 261.905 T | 1.733 T | 1.821 JT | 17.098 T | 1.246 T | 11.864 T | 16.009 T | 30.583 T | 41.579 T | 11.25 T |
| Benzo(a)pyrene | mg/kg OC | 99 | 210 | 6.304 | 106.796 | 2.5 | 196.97 | 1.136 | 1.325 J | 10.881 | 0.85 | 8.475 | 10.746 | 20.874 | 31.053 D | 7.578 D |
| Indeno(1,2,3-cd)pyrene | mg/kg OC | 34 | 88 | 5 | 66.019 | 2.708 | 114.719 | 0.767 | 0.894 J | 8.808 | 0.623 | 6.356 | 7.675 | 15.049 | 17.895 D | 5 D |
| Dibenzo(a,h)anthracene | mg/kg OC | 12 | 33 | 1.261 J | 16.505 | 1.583 U | 28.139 | 0.597 U | 1.623 U | 1.788 | 0.249 U | 2.161 U | 1.623 | 2.767 | 4.053 D | 1.016 D |
| Benzo(ghi)perylene | mg/kg OC | 31 | 78 | 6.739 | 63.107 | 3.75 | 129.87 | 0.938 | 1.192 J | 9.067 | 0.708 | 8.051 | 8.553 | 16.019 | 13.158 D | 4.609 D |
| **Chlorinated Benzenes (OC Normalized)** | | | | | | | | | | | | | | | | |
| 1,2-Dichlorobenzene | mg/kg OC | 2.3 | 2.3 | 1.674 U | 14.563 U | 1.583 U | 3.463 U | 0.597 U | 1.623 U | 1.295 U | 0.249 U | 2.161 U | 1.118 U | 2.476 U | 1.684 U | 0.391 U |
| 1,4-Dichlorobenzene | mg/kg OC | 3.1 | 9 | 1.674 U | 14.563 U | 1.583 U | 3.463 U | 0.597 U | 1.623 U | 0.622 | 0.249 U | 2.161 U | 1.118 U | 2.476 U | 1.684 U | 0.391 U |
| 1,2,4-Trichlorobenzene | mg/kg OC | 0.81 | 1.8 | 1.674 U | 14.563 U | 1.583 U | 3.463 U | 0.597 U | 1.623 U | 1.295 U | 0.249 U | 2.161 U | 1.118 U | 2.476 U | 1.684 U | 0.391 U |
| Hexachlorobenzene | mg/kg OC | 0.38 | 2.3 | 1.674 U | 14.563 U | 1.583 U | 3.463 U | 0.597 U | 1.623 U | 1.295 U | 0.249 U | 2.161 U | 1.118 U | 2.476 U | 1.684 U | 0.391 U |
| **Phthalates (OC Normalized)** | | | | | | | | | | | | | | | | |
| Dimethyl phthalate | mg/kg OC | 53 | 53 | 1.674 U | 14.563 U | 1.583 U | 3.463 U | 0.597 U | 1.623 U | 10.363 | 0.249 U | 2.161 U | 0.395 | 2.476 U | 1.684 U | 0.391 U |
| Diethyl phthalate | mg/kg OC | 61 | 110 | 1.674 U | 14.563 U | 1.583 U | 3.463 U | 0.597 U | 1.623 U | 1.295 U | 0.249 U | 2.161 U | 1.118 U | 2.476 U | 1.684 U | 0.391 U |
| Dibutyl phthalate | mg/kg OC | 220 | 1700 | 1.674 U | 14.563 U | 0.792 J | 3.463 U | 0.597 U | 1.623 U | 0.725 | 0.249 U | 2.161 U | 0.548 | 2.476 U | 1.684 U | 0.391 U |
| Butyl benzyl phthalate | mg/kg OC | 4.9 | 64 | 2.174 | 14.563 U | 1.583 U | 3.463 U | 0.597 U | 1.623 U | 7.513 | 0.249 U | 2.161 U | 1.118 U | 2.476 U | 1.684 U | 0.391 U |
| Bis(2-Ethylhexyl) Phthalate | mg/kg OC | 47 | 78 | 14.783 J | 32.039 J | 4.583 J | 69.264 U | 11.932 U | 0.695 J | 12.435 | 0.187 | 19.492 | 8.333 | 13.592 | 1.368 D | 0.211 D |
| Di-N-Octyl Phthalate | mg/kg OC | 58 | 4500 | 1.674 U | 14.563 U | 1.583 U | 3.463 U | 0.597 U | 1.623 U | 0.246 U | 0.249 U | 2.161 U | 1.118 U | 2.476 U | 1.684 U | 0.391 U |

| Analyte | Units | SQS/LAET | CSL/2LAET | PS-2 | PS-4 | PS-7 | PS-13 | PS-16 | PS-20 | RI-1 | RI-2 | RI-3 | RI-4 | RI-5 | RI-6 | RI-7 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample ID: | PS-2 | PS-4 | PS-7 | PS-13 | PS-16 | PS-20 | RI-1-0-0.33 | RI-2-0-0.33 | RI-3-0-0.33 | RI-4-0-0.33 | RI-5-0-0.33 | RI-6-3.5-4.5 | RI-7-3-4 |
| | | | Sample Date: | 9/19/2003 | 9/19/2003 | 9/19/2003 | 9/19/2003 | 9/19/2003 | 9/19/2003 | 7/29/2004 | 7/29/2004 | 7/29/2004 | 7/29/2004 | 7/30/2004 | 7/30/2004 | 7/29/2004 |
| | | | Sample Depth (feet): | 0-0.5 | 0-0.5 | 0-0.5 | 0-0.5 | 0.25-0.5 | 0.25-0.5 | 0-0.33 | 0-0.33 | 0-0.33 | 0-0.33 | 0-0.33 | 3.5-4.5 | 3-4 |
| **Miscellaneous (OC Normalized)** | | | | | | | | | | | | | | | | |
| Dibenzofuran | mg/kg OC | 15 | 58 | 0.522 J | 281.553 | 0.854 J | 11.688 | 0.261 | 11.258 | 0.648 | 0.088 | 0.805 | 0.965 | 1.65 | 3.895 D | 0.367 D |
| Hexachlorobutadiene | mg/kg OC | 3.9 | 6.2 | 1.674 U | 14.563 U | 1.583 U | 3.463 U | 0.597 U | 1.623 U | 1.295 U | 0.249 U | 2.161 U | 1.118 U | 2.476 U | 1.684 U | 0.391 U |
| N-Nitrosodiphenylamine | mg/kg OC | 11 | 11 | 1.674 U | 14.563 U | 1.583 U | 3.463 U | 0.597 U | 8.278 U | 1.295 U | 0.249 U | 2.161 U | 1.118 U | 2.476 U | 1.684 U | 0.391 U |
| **Ionizable Organic Compounds (dry weight)** | | | | | | | | | | | | | | | | |
| Phenol | µg/kg | 420 | 1200 | 7.7 U | 150 U | 23 U | 160 U | 470 | 490 U | 15 U | 270 U | 160 U | 160 U | 160 U | 22 D | 24 D |
| o-Cresol (2-methylphenol) | ug/kg | 63 | 63 | 7.7 U | 150 U | 7.6 U | 160 U | 210 U | 2500 U | 50 U | 88 U | 51 U | 51 U | 51 U | 32 U | 50 U |
| p-Cresol (4-methylphenol) | ug/kg | 670 | 670 | 7.7 U | 150 U | 7.6 U | 160 U | 110 | 490 U | 23 U | 88 U | 51 U | 51 U | 51 U | 32 U | 50 U |
| 2,4-Dimethylphenol | ug/kg | 29 | 29 | 39 U | 150 U | 38 U | 800 U | 1100 U | 2500 U | 44 U | 440 U | 260 U | 260 U | 260 U | 160 U | 250 U |
| Pentachlorophenol | ug/kg | 360 | 690 | 26 J | 3200 | 100 | 800 U | 1100 U | 4700 | 160 | 180 | 510 U | 240 | 55 | 230 D | 750 D |
| Benzyl Alcohol | ug/kg | 57 | 73 | 7.7 U | 150 U | 7.6 U | 160 U | 210 U | 490 U | 29 U | 88 U | 51 U | 51 U | 51 U | 32 U | 50 U |
| Benzoic Acid | ug/kg | 650 | 650 | 160 U | 3000 U | 160 U | 3200 U | 4200 U | 9700 U | 1000 U | 1800 U | 1100 U | 1100 U | 1100 U | 630 U | 990 U |
| **Aromatic Hydrocarbons (dry weight)** | | | | | | | | | | | | | | | | |
| Total LPAH | ug/kg | 52000 | 61000 | 53.8 JT | 11820 T | 38.8 JT | 31120 T | 2987 T | 61100 T | 837 T | 536 T | 439 T | 1246 T | 1120 T | 2775 T | 2428 T |
| Naphthalene | ug/kg | 2100 | 2400 | 5.2 J | 1600 U | 5.1 J | 220 | 1100 | 1100 | 43 | 120 | 45 | 110 | 87 | 37 D | 260 D |
| Acenaphthylene | ug/kg | 1300 | 1300 | 5.4 J | 150 U | 5.5 J | 1100 | 300 | 4100 U | 120 | 32 | 31 | 120 | 160 | 18 D | 98 D |
| Acenaphthene | ug/kg | 500 | 730 | 4 J | 7300 | 12 | 2100 | 77 | 11000 | 25 | 29 | 29 | 56 | 31 | 300 D | 150 D |
| Fluorene | ug/kg | 540 | 1000 | 3.9 J | 2500 | 7.6 U | 2900 | 140 | 4300 | 59 | 41 | 39 | 120 | 82 | 220 D | 130 D |
| Phenanthrene | ug/kg | 1500 | 5400 | 28 | 1500 | 11 | 18000 | 1100 | 42000 | 470 | 250 | 230 | 640 | 620 | 1700 D | 1400 D |
| Anthracene | ug/kg | 960 | 4400 | 7.3 J | 520 | 5.2 | 6800 | 270 | 2700 | 120 | 64 | 65 | 200 | 140 | 500 D | 390 D |
| 2-Methylnaphthalene | ug/kg | 670 | 1400 | – | – | – | – | – | – | 32 | 41 | 35 | 99 | 53 | 39 D | 54 D |
| Total HPAH | ug/kg | 12000 | 17000 | 268.8 JT | 12320 T | 111.5 JT | 99800 T | 4770 T | 6880 JT | 4599 T | 2670 T | 1890 T | 4974 T | 4577 T | 6337 T | 9820 T |
| Fluoranthene | ug/kg | 1700 | 2500 | 45 | 3900 | 17 | 23000 | 1100 | 1600 | 710 | 320 | 220 | 680 | 700 | 1500 D | 1900 D |
| Pyrene | ug/kg | 2600 | 3300 | 40 | 1600 | 14 | 22000 | 1200 | 2600 | 1200 | 620 | 470 | 1300 | 1300 | 1500 D | 2100 D |
| Benzo(a)anthracene | ug/kg | 1300 | 1600 | 23 | 1300 | 7.5 J | 10000 | 390 | 580 | 380 | 240 | 170 | 440 | 350 | 630 D | 950 D |
| Chrysene | ug/kg | 1400 | 2800 | 28 | 1300 | 12 | 11000 | 470 | 520 | 470 | 280 | 210 | 520 | 470 | 660 D | 1100 D |
| Benzo(b)fluoranthene | ug/kg | | | 23 | 900 | 18 | 5100 | 270 | 220 J | 490 | 320 | 210 | 500 | 480 | 590 D | 1100 D |
| Benzo(k)fluoranthene | ug/kg | | | 21 | 720 | 7.6 U | 7000 | 340 | 330 J | 170 | 120 | 70 | 230 | 150 | 200 D | 340 D |
| Benzofluoranthenes (Sum) | ug/kg | 3200 | 3600 | 44 T | 1620 T | 18 T | 12100 T | 610 T | 550 JT | 660 T | 440 T | 280 T | 730 T | 630 T | 790 T | 1440 T |
| Benzo(a)pyrene | ug/kg | 1600 | 3000 | 29 | 1100 | 12 | 9100 | 400 | 400 J | 420 | 300 | 200 | 490 | 430 | 590 D | 970 D |
| Indeno(1,2,3-cd)pyrene | ug/kg | 600 | 690 | 23 | 680 | 13 | 5300 | 270 | 270 J | 340 | 220 | 150 | 350 | 310 | 340 D | 640 D |
| Dibenzo(a,h)anthracene | ug/kg | 230 | 540 | 5.8 J | 170 | 7.6 U | 1300 | 210 U | 490 U | 69 | 88 U | 51 U | 74 | 57 | 77 D | 130 D |
| Benzo(ghi)perylene | ug/kg | 670 | 720 | 31 | 650 | 18 | 6000 | 330 | 360 J | 350 | 250 | 190 | 390 | 330 | 250 D | 590 D |
| **Chlorinated Benzenes (dry weight)** | | | | | | | | | | | | | | | | |
| 1,2-Dichlorobenzene | ug/kg | 35 | 50 | 7.7 U | 150 U | 7.6 U | 160 U | 210 U | 490 U | 50 U | 88 U | 51 U | 51 U | 51 U | 32 U | 50 U |
| 1,3-Dichlorobenzene | ug/kg | – | – | 7.7 U | 150 U | 7.6 U | 160 U | 210 U | 490 U | 50 U | 88 U | 51 U | 51 U | 51 U | 32 U | 50 U |
| 1,4-Dichlorobenzene | ug/kg | 110 | 120 | 7.7 U | 150 U | 7.6 U | 160 U | 210 U | 490 U | 24 | 88 U | 51 U | 51 U | 51 U | 32 U | 50 U |
| 1,2,4-Trichlorobenzene | ug/kg | 31 | 51 | 7.7 U | 150 U | 7.6 U | 160 U | 210 U | 490 U | 50 U | 88 U | 51 U | 51 U | 51 U | 32 U | 50 U |
| Hexachlorobenzene | ug/kg | 70 | 130 | 7.7 U | 150 U | 7.6 U | 160 U | 210 U | 490 U | 50 U | 88 U | 51 U | 51 U | 51 U | 32 U | 50 U |
| **Phthalates (dry weight)** | | | | | | | | | | | | | | | | |
| Dimethyl phthalate | ug/kg | 71 | 160 | 7.7 U | 150 U | 7.6 U | 160 U | 210 U | 490 U | 400 | 88 U | 51 U | 18 | 51 U | 32 U | 50 U |
| Diethyl phthalate | ug/kg | 200 | 1200 | 7.7 U | 150 U | 7.6 U | 160 U | 210 U | 490 U | 50 U | 88 U | 51 U | 51 U | 51 U | 32 U | 50 U |
| Dibutyl phthalate | ug/kg | 1400 | 5100 | 7.7 U | 150 U | 3.8 J | 160 U | 210 U | 490 U | 28 | 88 U | 51 U | 25 | 51 U | 32 U | 50 U |
| Butyl benzyl phthalate | ug/kg | 63 | 900 | 10 | 150 U | 7.6 U | 160 U | 210 U | 490 U | 290 | 88 U | 51 U | 51 U | 51 U | 32 U | 50 U |
| Bis(2-Ethylhexyl) Phthalate | ug/kg | 1300 | 3100 | 68 J | 330 J | 22 J | 3200 U | 4200 U | 210 J | 480 | 66 | 460 | 380 | 280 | 26 D | 27 D |
| Di-N-Octyl Phthalate | ug/kg | 5200 | 6200 | 7.7 U | 150 U | 7.6 U | 160 U | 210 U | 490 U | 9.5 U | 88 U | 51 U | 51 U | 51 U | 32 U | 50 U |

| Analyte | Units | SQS/LAET | CSL/2LAET | PS-2 | PS-4 | PS-7 | PS-13 | PS-16 | PS-20 | RI-1 | RI-2 | RI-3 | RI-4 | RI-5 | RI-6 | RI-7 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample ID: | PS-2 | PS-4 | PS-7 | PS-13 | PS-16 | PS-20 | RI-1-0-0.33 | RI-2-0-0.33 | RI-3-0-0.33 | RI-4-0-0.33 | RI-5-0-0.33 | RI-6-3.5-4.5 | RI-7-3-4 |
| | | | Sample Date: | 9/19/2003 | 9/19/2003 | 9/19/2003 | 9/19/2003 | 9/19/2003 | 9/19/2003 | 7/29/2004 | 7/29/2004 | 7/29/2004 | 7/29/2004 | 7/30/2004 | 7/30/2004 | 7/29/2004 |
| | | | Sample Depth (feet): | 0-0.5 | 0-0.5 | 0-0.5 | 0-0.5 | 0.25-0.5 | 0.25-0.5 | 0-0.33 | 0-0.33 | 0-0.33 | 0-0.33 | 0-0.33 | 3.5-4.5 | 3-4 |
| **Miscellaneous (dry weight)** | | | | | | | | | | | | | | | | |
| Dibenzofuran | ug/kg | 540 | 700 | 2.4 J | 2900 | 4.1 J | 540 | 92 | 3400 | 25 | 31 | 19 | 44 | 34 | 74 D | 47 D |
| Hexachlorobutadiene | ug/kg | 11 | 120 | 7.7 U | 150 U | 7.6 U | 160 U | 210 U | 490 U | 50 U | 88 U | 51 U | 51 U | 51 U | 32 U | 50 U |
| N-Nitrosodiphenylamine | ug/kg | 28 | 40 | 7.7 U | 150 U | 7.6 U | 160 U | 210 U | 2500 U | 50 U | 88 U | 51 U | 51 U | 51 U | 32 U | 50 U |
| **Petroleum Hydrocarbons** | | | | | | | | | | | | | | | | |
| Diesel-range hydrocarbons | mg/kg | 200 | – | 150 J | 3200 | 490 | 42 | 9300 | 37000 | – | – | – | – | – | – | – |
| Heavy Oil-Range Hydrocarbons | mg/kg | 200 | – | 1600 | 160 | 9700 | 330 | 27000 | 13000 | – | – | – | – | – | – | – |
| Total TPH | mg/kg | 200 | – | 1750 JT | 3360 T | 10190 T | 372 T | 36300 T | 50000 T | – | – | – | – | – | – | – |
| **Dioxin Furans** | | | | | | | | | | | | | | | | |
| 2,3,7,8-TCDD | ng/kg | – | – | – | – | – | – | – | – | 4.466 | – | – | 3.337 | 1 U | – | – |
| 1,2,3,7,8-PeCDD | ng/kg | – | – | – | – | – | – | – | – | 17.029 | – | – | 18.63 | 5.92 | – | – |
| 1,2,3,4,7,8-HxCDD | ng/kg | – | – | – | – | – | – | – | – | 22.419 | – | – | 43.315 | 11.109 | – | – |
| 1,2,3,6,7,8-HxCDD | ng/kg | – | – | – | – | – | – | – | – | 104.875 | – | – | 255.038 | 67.371 | – | – |
| 1,2,3,7,8,9-HxCDD | ng/kg | – | – | – | – | – | – | – | – | 83.856 | – | – | 152.487 | 31.047 | – | – |
| 1,2,3,4,6,7,8-HpCDD | ng/kg | – | – | – | – | – | – | – | – | 3802.848 | – | – | 6574.716 | 1717.352 | – | – |
| OCDD | ng/kg | – | – | – | – | – | – | – | – | 56489.077 E | – | – | 71807.561 E | 21252.267 E | – | – |
| 2,3,7,8-TCDF | ng/kg | – | – | – | – | – | – | – | – | 6.325 C | – | – | 8.954 C | 3.499 C | – | – |
| 1,2,3,7,8-PeCDF | ng/kg | – | – | – | – | – | – | – | – | 7.991 | – | – | 26.243 | 4.615 | – | – |
| 2,3,4,7,8-PeCDF | ng/kg | – | – | – | – | – | – | – | – | 8.147 | – | – | 23.766 | 4.147 | – | – |
| 1,2,3,4,7,8-HxCDF | ng/kg | – | – | – | – | – | – | – | – | 39.014 | – | – | 125.048 | 24.498 | – | – |
| 1,2,3,6,7,8-HxCDF | ng/kg | – | – | – | – | – | – | – | – | 11.071 | – | – | 27.969 | 6.644 | – | – |
| 1,2,3,7,8,9-HxCDF | ng/kg | – | – | – | – | – | – | – | – | 12.695 | – | – | 49.985 | 8.341 | – | – |
| 2,3,4,6,7,8-HxCDF | ng/kg | – | – | – | – | – | – | – | – | 19.964 | – | – | 46.612 | 12.589 | – | – |
| 1,2,3,4,6,7,8-HpCDF | ng/kg | – | – | – | – | – | – | – | – | 406.277 | – | – | 1026.896 | 331.912 | – | – |
| 1,2,3,4,7,8,9-HpCDF | ng/kg | – | – | – | – | – | – | – | – | 21.489 | – | – | 60.229 | 19.414 | – | – |
| OCDF | ng/kg | – | – | – | – | – | – | – | – | 2578.235 | – | – | 6037.427 | 1937.107 | – | – |
| Dioxin/Furan TEQ ND=0 | ng/Kg | – | – | – | – | – | – | – | – | 114.22 | – | – | 200.8 | 40.52 | – | – |
| Dioxin/Furan TEQ ND=1/2 | ng/Kg | – | – | – | – | – | – | – | – | 114.22 | – | – | 200.8 | 51.96 | – | – |
| **Non-SMS SVOCs** | | | | | | | | | | | | | | | | |
| 1-Methylnaphthalene | ug/kg | – | – | 12 | 150 U | 9.5 | 170 | 140 | 4700 | – | – | – | – | – | – | – |
| Hexachloroethane | ug/kg | – | – | 7.7 U | 150 U | 7.6 U | 160 U | 210 U | 490 U | 50 U | 88 U | 51 U | 51 U | 51 U | 32 U | 50 U |
| 2,3,4,5-Tetrachlorophenol | ug/kg | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| 2,3,5,6-Tetrachlorophenol | ug/kg | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| 2,4,5-Trichlorophenol | ug/kg | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| 2,4,6-Trichlorophenol | ug/kg | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – |

| Analyte | Units | SQS/LAET | CSL/2LAET | RI-8 | IZ-MW-1 | IZ-MW-2 | IZ-MW-3 | IZ-MW-4 | IZ-DP-1 | SRI-1 | SRI-2 | SRI-3 | SRI-4 | SRI-5 | SS-01 | SS-02 | SS-03 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample ID: | RI-8-4.5-5.5 | IZ-MW-1-4-5 | IZ-MW-2-2-4 | IZ-MW-3-2-4 | IZ-MW-4-1-4 | IZ-DP-1-3-4 | SRI-1 | SRI-2 | SRI-3 | SRI-4 | SRI-5 | RGH-SS-01 | RGH-SS-02 | RGH-SS-03 |
| | | | Sample Date: | 7/29/2004 | 6/17/2004 | 6/17/2004 | 6/17/2004 | 6/17/2004 | 6/17/2004 | 9/8/2005 | 9/8/2005 | 9/8/2005 | 9/8/2005 | 9/8/2005 | 8/26/2008 | 8/26/2008 | 8/26/2008 |
| | | | Sample Depth (feet): | 4.5-5.5 | 4-5 | 2-4 | 2-4 | 1-4 | 3-4 | 0-0.5 | 0-0.5 | 0-0.5 | 0-0.5 | 0-0.5 | 0-0.39 | 0-0.39 | 0-0.39 |
| **Conventional Parameters** | | | | | | | | | | | | | | | | | |
| Ammonia | mg/kg | – | – | – | – | – | – | – | – | – | – | – | – | – | 3.39 | 5.01 | 6.34 |
| Sulfide | mg/kg | – | – | – | – | – | – | – | – | – | – | – | – | – | 1420 | 1190 | 503 |
| Total Organic Carbon | Percent | – | – | 8.13 | 5.66 | 66.9 | 20.2 | 18 | 4.49 | 0.78 | 4.26 | 6.9 | 3.07 | 2.68 | 4.13 | 2.38 | 2.2 |
| Total Solids | Percent | – | – | – | – | – | – | – | – | – | – | – | – | – | 79.3 | 80.3 | 64.5 |
| **Metals** | | | | | | | | | | | | | | | | | |
| Mercury | mg/kg | 0.41 | 0.59 | – | – | – | – | – | – | – | – | – | – | – | 0.1 | 0.05 | 0.13 |
| **Aromatic Hydrocarbons (OC Normalized)** | | | | | | | | | | | | | | | | | |
| Total LPAH | mg/kg OC | 370 | 780 | 36.039 T | 93.936 | 22.17 | 22.723 T | 17.911 T | 148.151 T | 50.897 T | 12.488 T | 20.101 T | 4.56 T | 5.97 T | 3.823 T | 6.891 T | 14.682 T |
| Naphthalene | mg/kg OC | 99 | 170 | 3.813 D | 60.247 E | 2.332 | 3.782 U | 1.833 | 7.35 U | 7.564 U | 1.925 | 1.884 | 1.954 U | 2.201 U | 0.363 T | 0.798 U | 1.136 |
| Acenaphthylene | mg/kg OC | 66 | 66 | 1.476 D | 1.24 | 0.472 | 3.782 U | 0.706 | 8.241 | 7.564 U | 1.362 U | 1.449 | 1.954 U | 2.201 U | 0.24 T | 0.798 U | 0.955 |
| Acenaphthene | mg/kg OC | 16 | 57 | 2.091 D | 0.77 | 1.809 | 3.782 U | 1.128 | 26.503 | 7.564 U | 1.362 U | 0.957 | 1.954 U | 2.201 U | 0.242 T | 0.42 T | 0.773 T |
| Fluorene | mg/kg OC | 23 | 79 | 1.845 D | 2.951 | 1.555 | 3.782 U | 1.311 | 30.067 | 7.564 U | 1.362 U | 0.884 | 1.954 U | 2.201 U | 0.46 U | 0.504 T | 1.045 |
| Phenanthrene | mg/kg OC | 100 | 480 | 20.91 D | 21.731 | 12.362 E | 17.277 | 10.944 | 71.715 | 39.744 | 7.981 | 11.449 | 4.56 | 5.97 | 2.421 | 5.042 | 8.636 |
| Anthracene | mg/kg OC | 220 | 1200 | 5.904 D | 3.958 | 3.139 | 5.446 | 1.989 | 11.626 | 11.154 | 2.582 | 3.478 | 1.954 U | 2.201 U | 0.557 | 0.924 | 2.136 |
| 2-Methylnaphthalene | mg/kg OC | 38 | 64 | 0.836 D | 3.039 | 0.501 | 3.782 U | 0.672 | 7.35 U | 7.564 U | 1.362 U | 1.116 | 1.954 U | 2.201 U | 0.363 T | 1.176 | 1.136 |
| Total HPAH (SMS) | mg/kg OC | 960 | 5300 | 152.399 T | 60.871 | 59.048 | 103.411 T | 66.3 T | 27.416 T | 293.846 T | 57.559 T | 83.754 T | 40.391 T | 38.507 T | 17.797 T | 28.445 T | 74.364 T |
| Fluoranthene | mg/kg OC | 160 | 1200 | 29.52 D | 18.198 | 14.948 E | 22.822 | 12.944 | 11.626 | 62.821 | 12.207 | 18.841 | 8.469 | 10.821 | 4.358 | 6.303 | 15.909 |
| Pyrene | mg/kg OC | 1000 | 1400 | 31.98 D | 15.265 | 11.136 E | 25.05 | 11.556 | 15.791 | 53.846 | 11.033 | 14.348 | 7.492 | 7.09 | 3.874 | 5.462 | 13.636 |
| Benzo(a)anthracene | mg/kg OC | 110 | 270 | 14.76 D | 3.004 | 5.65 | 11.881 | 6.667 | 7.35 U | 33.333 | 5.164 | 8.406 | 4.235 | 3.396 | 1.332 | 2.395 | 6.364 |
| Chrysene | mg/kg OC | 110 | 460 | 17.22 D | 3.392 | 5.546 | 13.168 | 7.722 | 7.35 U | 35.897 | 7.042 | 9.71 | 5.863 | 5.97 | 2.082 | 3.151 | 9.545 |
| Benzofluoranthenes (Sum) | mg/kg OC | 230 | 450 | 22.017 T | 9.452 T | 10.493 T | 13.416 T | 12.05 T | 7.35 UT | 51.282 T | 12.441 T | 17.826 T | 9.772 T | 8.134 T | 3.148 T | 5.714 T | 15.909 T |
| Benzo(a)pyrene | mg/kg OC | 99 | 210 | 14.76 D | 4.558 | 6.368 | 6.931 | 7.611 | 7.35 U | 32.051 | 6.338 | 9.275 | 4.56 | 3.097 | 1.525 | 3.319 | 8.182 |
| Indeno(1,2,3-cd)pyrene | mg/kg OC | 34 | 88 | 10.086 D | 2.438 | 1.928 | 4.5 | 3.011 | 7.35 U | 11.795 | 1.643 | 2.319 | 1.954 U | 2.201 U | 0.678 | 1.008 | 2.045 |
| Dibenzo(a,h)anthracene | mg/kg OC | 12 | 33 | 2.214 D | 0.553 | 0.961 | 3.782 U | 1.589 | 7.35 U | 7.564 U | 1.362 U | 0.855 | 1.954 U | 2.201 U | 0.46 U | 0.798 U | 0.455 T |
| Benzo(ghi)perylene | mg/kg OC | 31 | 78 | 9.84 D | 4.011 | 2.018 | 5.644 | 3.15 | 7.35 U | 12.821 | 1.69 | 2.174 | 1.954 U | 2.201 U | 0.799 | 1.092 | 2.318 |
| **Chlorinated Benzenes (OC Normalized)** | | | | | | | | | | | | | | | | | |
| 1,2-Dichlorobenzene | mg/kg OC | 2.3 | 2.3 | 0.615 U | – | – | – | – | – | 7.564 U | 1.362 U | 0.855 U | 1.954 U | 2.201 U | 0.46 U | 0.798 U | 0.864 U |
| 1,4-Dichlorobenzene | mg/kg OC | 3.1 | 9 | 0.615 U | – | – | – | – | – | 7.564 U | 1.362 U | 0.855 U | 1.954 U | 2.201 U | 0.46 U | 0.798 U | 0.864 U |
| 1,2,4-Trichlorobenzene | mg/kg OC | 0.81 | 1.8 | 0.615 U | – | – | – | – | – | 7.564 U | 1.362 U | 0.855 U | 1.954 U | 2.201 U | 0.46 U | 0.798 U | 0.864 U |
| Hexachlorobenzene | mg/kg OC | 0.38 | 2.3 | 0.615 U | – | – | – | – | – | 7.564 U | 1.362 U | 0.855 U | 1.954 U | 2.201 U | 0.46 U | 0.798 U | 0.864 U |
| **Phthalates (OC Normalized)** | | | | | | | | | | | | | | | | | |
| Dimethyl phthalate | mg/kg OC | 53 | 53 | 0.615 U | – | – | – | – | – | 7.564 U | 1.362 U | 0.855 U | 1.954 U | 2.201 U | 0.46 U | 0.798 U | 0.864 U |
| Diethyl phthalate | mg/kg OC | 61 | 110 | 0.615 U | – | – | – | – | – | 7.564 U | 1.362 U | 0.855 U | 1.954 U | 2.201 U | 0.46 U | 0.798 U | 0.864 U |
| Dibutyl phthalate | mg/kg OC | 220 | 1700 | 0.615 U | – | – | – | – | – | 9.359 | 1.362 U | 0.855 U | 1.954 U | 2.201 U | 0.46 U | 0.798 U | 0.864 U |
| Butyl benzyl phthalate | mg/kg OC | 4.9 | 64 | 0.615 U | – | – | – | – | – | 11.795 | 1.362 U | 0.855 U | 1.954 U | 2.201 U | 0.46 U | 0.798 U | 0.864 U |
| Bis(2-Ethylhexyl) Phthalate | mg/kg OC | 47 | 78 | 0.295 D | – | – | – | – | – | 15.385 | 6.103 | 6.522 | 4.886 | 4.104 | 3.39 | 1.05 | 3.909 |
| Di-N-Octyl Phthalate | mg/kg OC | 58 | 4500 | 0.615 U | – | – | – | – | – | 7.564 U | 1.362 U | 0.855 U | 1.954 U | 2.201 U | 0.46 U | 0.798 U | 0.864 U |

| | | | | RI-8 | IZ-MW-1 | IZ-MW-2 | IZ-MW-3 | IZ-MW-4 | IZ-DP-1 | SRI-1 | SRI-2 | SRI-3 | SRI-4 | SRI-5 | SS-01 | SS-02 | SS-03 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample ID: | RI-8-4.5-5.5 | IZ-MW-1-4-5 | IZ-MW-2-2-4 | IZ-MW-3-2-4 | IZ-MW-4-1-4 | IZ-DP-1-3-4 | SRI-1 | SRI-2 | SRI-3 | SRI-4 | SRI-5 | RGH-SS-01 | RGH-SS-02 | RGH-SS-03 |
| | | | Sample Date: | 7/29/2004 | 6/17/2004 | 6/17/2004 | 6/17/2004 | 6/17/2004 | 6/17/2004 | 9/8/2005 | 9/8/2005 | 9/8/2005 | 9/8/2005 | 9/8/2005 | 8/26/2008 | 8/26/2008 | 8/26/2008 |
| | | | Sample Depth (feet): | 4.5-5.5 | 4-5 | 2-4 | 2-4 | 1-4 | 3-4 | 0-0.5 | 0-0.5 | 0-0.5 | 0-0.5 | 0-0.5 | 0-0.39 | 0-0.39 | 0-0.39 |
| **Analyte** | **Units** | **SQS/LAET** | **CSL/2LAET** | | | | | | | | | | | | | | |
| **Miscellaneous (OC Normalized)** | | | | | | | | | | | | | | | | | |
| Dibenzofuran | mg/kg OC | 15 | 58 | 0.689 D | 5.83 U | 2.078 U | 3.782 U | 3.917 U | 7.35 U | 7.564 U | 1.362 U | 0.855 U | 1.954 U | 2.201 U | 0.46 U | 0.798 U | 0.636 T |
| Hexachlorobutadiene | mg/kg OC | 3.9 | 6.2 | 0.615 U | – | – | – | – | – | 7.564 U | 1.362 U | 0.855 U | 1.954 U | 2.201 U | 0.46 U | 0.798 U | 0.864 U |
| N-Nitrosodiphenylamine | mg/kg OC | 11 | 11 | 0.615 U | 5.83 U | 2.078 U | 7.129 | 3.917 U | 37.862 | 7.564 U | 1.362 U | 0.855 U | 1.954 U | 2.201 U | 0.46 U | 0.798 U | 0.864 U |
| **Ionizable Organic Compounds (dry weight)** | | | | | | | | | | | | | | | | | |
| Phenol | µg/kg | 420 | 1200 | 29 D | – | – | – | – | – | 59 U | 58 U | 59 U | 60 U | 59 U | 30 | 32 | 19 U |
| o-Cresol (2-methylphenol) | ug/kg | 63 | 63 | 50 U | – | – | – | – | – | 59 U | 58 U | 59 U | 60 U | 59 U | 19 U | 19 U | 19 U |
| p-Cresol (4-methylphenol) | ug/kg | 670 | 670 | 50 U | – | – | – | – | – | 59 U | 58 U | 59 U | 60 U | 59 U | 19 U | 19 U | 29 |
| 2,4-Dimethylphenol | ug/kg | 29 | 29 | 250 U | – | – | – | – | – | 59 U | 58 U | 59 U | 60 U | 59 U | 19 U | 19 U | 19 U |
| Pentachlorophenol | ug/kg | 360 | 690 | 990 D | 50 U | 211 U | 1160 U | 210 | 706 | 300 U | 290 U | 560 | 300 U | 300 U | 83 T | 51 T | 180 |
| Benzyl Alcohol | ug/kg | 57 | 73 | 50 U | – | – | – | – | – | 59 U | 58 U | 59 U | 60 U | 59 U | 19 U | 19 U | 19 U |
| Benzoic Acid | ug/kg | 650 | 650 | 990 U | – | – | – | – | – | 590 U | 580 U | 590 U | 600 U | 590 U | 190 U | 190 U | 190 U |
| **Aromatic Hydrocarbons (dry weight)** | | | | | | | | | | | | | | | | | |
| Total LPAH | ug/kg | 52000 | 61000 | 2930 T | 1734.8 T | 6226 T | 4590 T | 3224 T | 6652 T | 397 T | 532 T | 1387 T | 140 T | 160 T | 157.9 T | 164 T | 323 T |
| Naphthalene | ug/kg | 2100 | 2400 | 310 D | 3410 E | 1560 | 764 U | 330 | 330 U | 59 U | 82 | 130 | 60 U | 59 U | 15 T | 19 U | 25 |
| Acenaphthylene | ug/kg | 1300 | 1300 | 120 D | 70.2 | 316 | 764 U | 127 | 370 | 59 U | 58 U | 100 | 60 U | 59 U | 9.9 T | 19 U | 21 |
| Acenaphthene | ug/kg | 500 | 730 | 170 D | 43.6 | 1210 | 764 U | 203 | 1190 | 59 U | 58 U | 66 | 60 U | 59 U | 10 T | 10 T | 17 T |
| Fluorene | ug/kg | 540 | 1000 | 150 D | 167 | 1040 | 764 U | 236 | 1350 | 59 U | 58 U | 61 | 60 U | 59 U | 19 U | 12 T | 23 |
| Phenanthrene | ug/kg | 1500 | 5400 | 1700 D | 1230 | 8270 E | 3490 | 1970 | 3220 | 310 | 340 | 790 | 140 | 160 | 100 | 120 | 190 |
| Anthracene | ug/kg | 960 | 4400 | 480 D | 224 | 2100 | 1100 | 358 | 522 | 87 | 110 | 240 | 60 U | 59 U | 23 | 22 | 47 |
| 2-Methylnaphthalene | ug/kg | 670 | 1400 | 68 D | 172 | 335 | 764 U | 121 | 330 U | 59 U | 58 U | 77 | 60 U | 59 U | 15 T | 28 | 25 |
| Total HPAH | ug/kg | 12000 | 17000 | 12390 T | 3445.3 | 22053 | 20889 T | 11934 T | 1231 T | 2292 T | 2452 T | 5779 T | 1240 T | 1032 T | 735 T | 677 T | 1636 T |
| Fluoranthene | ug/kg | 1700 | 2500 | 2400 D | 1030 | 10000 E | 4610 | 2330 | 522 | 490 | 520 | 1300 | 260 | 290 | 180 | 150 | 350 |
| Pyrene | ug/kg | 2600 | 3300 | 2600 D | 864 | 7450 E | 5060 | 2080 | 709 | 420 | 470 | 990 | 230 | 190 | 160 | 130 | 300 |
| Benzo(a)anthracene | ug/kg | 1300 | 1600 | 1200 D | 170 | 3780 | 2400 | 1200 | 330 U | 260 | 220 | 580 | 130 | 91 | 55 | 57 | 140 |
| Chrysene | ug/kg | 1400 | 2800 | 1400 D | 192 | 3710 | 2660 | 1390 | 330 U | 280 | 300 | 670 | 180 | 160 | 86 | 75 | 210 |
| Benzo(b)fluoranthene | ug/kg | | | 1300 D | 187 | 4330 | 1360 | 1290 | 330 U | 210 | 270 | 590 | 170 | 120 | 68 | 69 | 200 |
| Benzo(k)fluoranthene | ug/kg | | | 490 D | 348 | 2690 | 1350 | 879 | 330 U | 190 | 260 | 640 | 130 | 98 | 62 | 67 | 150 |
| Benzofluoranthenes (Sum) | ug/kg | 3200 | 3600 | 1790 T | 535 T | 7020 T | 2710 T | 2169 T | 330 UT | 400 T | 530 T | 1230 T | 300 T | 218 T | 130 T | 136 T | 350 T |
| Benzo(a)pyrene | ug/kg | 1600 | 3000 | 1200 D | 258 | 4260 | 1400 | 1370 | 330 U | 250 | 270 | 640 | 140 | 83 | 63 | 79 | 180 |
| Indeno(1,2,3-cd)pyrene | ug/kg | 600 | 690 | 820 D | 138 | 1290 | 909 | 542 | 330 U | 92 | 70 | 160 | 60 U | 59 U | 28 | 24 | 45 |
| Dibenzo(a,h)anthracene | ug/kg | 230 | 540 | 180 D | 31.3 | 643 | 764 U | 286 | 330 U | 59 U | 58 U | 59 | 60 U | 59 U | 19 U | 19 U | 10 T |
| Benzo(ghi)perylene | ug/kg | 670 | 720 | 800 D | 227 | 1350 | 1140 | 567 | 330 U | 100 | 72 | 150 | 60 U | 59 U | 33 | 26 | 51 |
| **Chlorinated Benzenes (dry weight)** | | | | | | | | | | | | | | | | | |
| 1,2-Dichlorobenzene | ug/kg | 35 | 50 | 50 U | – | – | – | – | – | 59 U | 58 U | 59 U | 60 U | 59 U | 19 U | 19 U | 19 U |
| 1,3-Dichlorobenzene | ug/kg | – | – | 50 U | – | – | – | – | – | 59 U | 58 U | 59 U | 60 U | 59 U | 19 U | 19 U | 19 U |
| 1,4-Dichlorobenzene | ug/kg | 110 | 120 | 50 U | – | – | – | – | – | 59 U | 58 U | 59 U | 60 U | 59 U | 19 U | 19 U | 19 U |
| 1,2,4-Trichlorobenzene | ug/kg | 31 | 51 | 50 U | – | – | – | – | – | 59 U | 58 U | 59 U | 60 U | 59 U | 19 U | 19 U | 19 U |
| Hexachlorobenzene | ug/kg | 70 | 130 | 50 U | – | – | – | – | – | 59 U | 58 U | 59 U | 60 U | 59 U | 19 U | 19 U | 19 U |
| **Phthalates (dry weight)** | | | | | | | | | | | | | | | | | |
| Dimethyl phthalate | ug/kg | 71 | 160 | 50 U | – | – | – | – | – | 59 U | 58 U | 59 U | 60 U | 59 U | 19 U | 19 U | 19 U |
| Diethyl phthalate | ug/kg | 200 | 1200 | 50 U | – | – | – | – | – | 59 U | 58 U | 59 U | 60 U | 59 U | 19 U | 19 U | 19 U |
| Dibutyl phthalate | ug/kg | 1400 | 5100 | 50 U | – | – | – | – | – | 73 | 58 U | 59 U | 60 U | 59 U | 19 U | 19 U | 19 U |
| Butyl benzyl phthalate | ug/kg | 63 | 900 | 50 U | – | – | – | – | – | 92 | 58 U | 59 U | 60 U | 59 U | 19 U | 19 U | 19 U |
| Bis(2-Ethylhexyl) Phthalate | ug/kg | 1300 | 3100 | 24 D | – | – | – | – | – | 120 | 260 | 450 | 150 | 110 | 140 | 25 | 86 |
| Di-N-Octyl Phthalate | ug/kg | 5200 | 6200 | 50 U | – | – | – | – | – | 59 U | 58 U | 59 U | 60 U | 59 U | 19 U | 19 U | 19 U |

| Analyte | Units | SQS/LAET | CSL/2LAET | RI-8 | IZ-MW-1 | IZ-MW-2 | IZ-MW-3 | IZ-MW-4 | IZ-DP-1 | SRI-1 | SRI-2 | SRI-3 | SRI-4 | SRI-5 | SS-01 | SS-02 | SS-03 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample ID: | RI-8-4.5-5.5 | IZ-MW-1-4-5 | IZ-MW-2-2-4 | IZ-MW-3-2-4 | IZ-MW-4-1-4 | IZ-DP-1-3-4 | SRI-1 | SRI-2 | SRI-3 | SRI-4 | SRI-5 | RGH-SS-01 | RGH-SS-02 | RGH-SS-03 |
| | | | Sample Date: | 7/29/2004 | 6/17/2004 | 6/17/2004 | 6/17/2004 | 6/17/2004 | 6/17/2004 | 9/8/2005 | 9/8/2005 | 9/8/2005 | 9/8/2005 | 9/8/2005 | 8/26/2008 | 8/26/2008 | 8/26/2008 |
| | | | Sample Depth (feet): | 4.5-5.5 | 4-5 | 2-4 | 2-4 | 1-4 | 3-4 | 0-0.5 | 0-0.5 | 0-0.5 | 0-0.5 | 0-0.5 | 0-0.39 | 0-0.39 | 0-0.39 |
| **Miscellaneous (dry weight)** | | | | | | | | | | | | | | | | | |
| Dibenzofuran | ug/kg | 540 | 700 | 56 D | 330 U | 1390 U | 764 U | 705 U | 330 U | 59 U | 58 U | 59 U | 60 U | 59 U | 19 U | 19 U | 14 T |
| Hexachlorobutadiene | ug/kg | 11 | 120 | 50 U | – | – | – | – | – | 59 U | 58 U | 59 U | 60 U | 59 U | 19 U | 19 U | 19 U |
| N-Nitrosodiphenylamine | ug/kg | 28 | 40 | 50 U | 330 U | 1390 U | 1440 | 705 U | 1700 | 59 U | 58 U | 59 U | 60 U | 59 U | 19 U | 19 U | 19 U |
| **Petroleum Hydrocarbons** | | | | | | | | | | | | | | | | | |
| Diesel-range hydrocarbons | mg/kg | 200 | – | – | 49.3 | 2020 D | 2520 D | 1120 D | 811 D | – | – | – | – | – | 19 | 12 | 17 |
| Heavy Oil-Range Hydrocarbons | mg/kg | 200 | – | – | 89.8 | 3460 D | 2960 D | 1310 D | 145 | – | – | – | – | – | 69 | 42 | 63 |
| Total TPH | mg/kg | 200 | – | – | 139.1 T | 5480 T | 5480 T | 2430 T | 956 T | – | – | – | – | – | 88 T | 54 T | 80 T |
| **Dioxin Furans** | | | | | | | | | | | | | | | | | |
| 2,3,7,8-TCDD | ng/kg | – | – | – | – | – | 5 U | – | – | – | – | – | – | – | 1.9 | 28 | 6 |
| 1,2,3,7,8-PeCDD | ng/kg | – | – | – | – | – | 25 U | – | – | – | – | – | – | – | 8.5 | 42 | 22 |
| 1,2,3,4,7,8-HxCDD | ng/kg | – | – | – | – | – | 27.9 | – | – | – | – | – | – | – | 17 | 230 | 74 |
| 1,2,3,6,7,8-HxCDD | ng/kg | – | – | – | – | – | 638 | – | – | – | – | – | – | – | 120 | 85 | 170 |
| 1,2,3,7,8,9-HxCDD | ng/kg | – | – | – | – | – | 61.2 | – | – | – | – | – | – | – | 46 | 190 | 66 |
| 1,2,3,4,6,7,8-HpCDD | ng/kg | – | – | – | – | – | 19200 | – | – | – | – | – | – | – | 2900 E | 3000 E | 4500 E |
| OCDD | ng/kg | – | – | – | – | – | 191000 | – | – | – | – | – | – | – | 24000 E | 21000 E | 39000 E |
| 2,3,7,8-TCDF | ng/kg | – | – | – | – | – | 18.2 | – | – | – | – | – | – | – | 3.2 | 3.3 | 3.7 |
| 1,2,3,7,8-PeCDF | ng/kg | – | – | – | – | – | 44.9 | – | – | – | – | – | – | – | 6.8 | 8.5 | 8.9 |
| 2,3,4,7,8-PeCDF | ng/kg | – | – | – | – | – | 51.1 | – | – | – | – | – | – | – | 7.1 | 5.8 | 10 |
| 1,2,3,4,7,8-HxCDF | ng/kg | – | – | – | – | – | 238 | – | – | – | – | – | – | – | 41 | 35 | 60 |
| 1,2,3,6,7,8-HxCDF | ng/kg | – | – | – | – | – | 82.2 | – | – | – | – | – | – | – | 11 | 9.1 | 16 |
| 1,2,3,7,8,9-HxCDF | ng/kg | – | – | – | – | – | 25 U | – | – | – | – | – | – | – | 1.5 | 2.3 T | 1.7 T |
| 2,3,4,6,7,8-HxCDF | ng/kg | – | – | – | – | – | 126 | – | – | – | – | – | – | – | 6.6 | 5 | 11 |
| 1,2,3,4,6,7,8-HpCDF | ng/kg | – | – | – | – | – | 5640 | – | – | – | – | – | – | – | 590 | 390 | 730 |
| 1,2,3,4,7,8,9-HpCDF | ng/kg | – | – | – | – | – | 307 | – | – | – | – | – | – | – | 33 | 23 | 42 |
| OCDF | ng/kg | – | – | – | – | – | 34600 | – | – | – | – | – | – | – | 2300 | 1400 | 3100 E |
| Dioxin/Furan TEQ ND=0 | ng/Kg | – | – | – | – | – | 454.977 | – | – | – | – | – | – | – | 80.484 | 168.815 | 136.857 |
| Dioxin/Furan TEQ ND=1/2 | ng/Kg | – | – | – | – | – | 471.227 | – | – | – | – | – | – | – | 80.484 | 168.815 | 136.857 |
| **Non-SMS SVOCs** | | | | | | | | | | | | | | | | | |
| 1-Methylnaphthalene | ug/kg | – | – | – | – | – | – | – | – | – | – | – | – | – | 15 T | 26 | 25 |
| Hexachloroethane | ug/kg | – | – | 50 U | – | – | – | – | – | – | – | – | – | – | 19 U | 19 U | 19 U |
| 2,3,4,5-Tetrachlorophenol | ug/kg | – | – | – | 660 U | 2780 U | 1530 U | 1410 U | 660 U | – | – | – | – | – | – | – | – |
| 2,3,5,6-Tetrachlorophenol | ug/kg | – | – | – | 330 U | 1390 U | 764 U | 705 U | 330 U | – | – | – | – | – | – | – | – |
| 2,4,5-Trichlorophenol | ug/kg | – | – | – | 330 U | 1390 U | 764 U | 705 U | 330 U | – | – | – | – | – | – | – | – |
| 2,4,6-Trichlorophenol | ug/kg | – | – | – | 330 U | 1390 U | 764 U | 705 U | 330 U | – | – | – | – | – | – | – | – |

| Analyte | Units | SQS/LAET | CSL/2LAET | SC-01 | SC-01 | SC-01 | SC-02 | SC-02 | SC-02 | SC-03 | SC-03 | SC-03 | SC-04 | SC-04 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample ID: | RGH-SC-01-0-2' | RGH-SC-01-2-4' | RGH-SC-01-4-6' | RGH-SC-02-0-2' | RGH-SC-02-2-4' | RGH-SC-02-4-6' | RGH-SC-03-0-2' | RGH-SC-03-2-4' | RGH-SC-03-4-6' | RGH-SC-04-0-2' | RGH-SC-04-2-4' |
| | | | Sample Date: | 8/26/2008 | 8/26/2008 | 8/26/2008 | 8/26/2008 | 8/26/2008 | 8/26/2008 | 8/27/2008 | 8/27/2008 | 8/27/2008 | 8/27/2008 | 8/27/2008 |
| | | | Sample Depth (feet): | 0-2 | 2-4 | 4-6 | 0-2 | 2-4 | 4-6 | 0-2 | 2-4 | 4-6 | 0-2 | 2-4 |
| **Conventional Parameters** | | | | | | | | | | | | | | |
| Ammonia | mg/kg | – | – | – | – | – | – | – | – | – | – | – | – | – |
| Sulfide | mg/kg | – | – | – | – | – | – | – | – | – | – | – | – | – |
| Total Organic Carbon | Percent | – | – | 2.87 | 4.24 | 8.12 | 5.01 | 1.47 | 6.86 | 4.32 | 7.94 | 10.1 | 10.6 | 4.22 |
| Total Solids | Percent | – | – | 73.9 | 75.4 | 74.2 | 73.2 | 84.7 | 80 | 47.8 | 39.8 | 39.3 | 59.9 | 50.5 |
| **Metals** | | | | | | | | | | | | | | |
| Mercury | mg/kg | 0.41 | 0.59 | 0.13 | 0.27 | 0.16 | 0.08 | 0.07 | 0.08 | 0.48 | 0.7 | 1.59 | 0.23 | 0.11 |
| **Aromatic Hydrocarbons (OC Normalized)** | | | | | | | | | | | | | | |
| Total LPAH | mg/kg OC | 370 | 780 | 11.289 T | 42.17 T | 15.135 T | 15.449 T | 3.605 T | 0.933 T | 12.106 T | 14.295 T | 3.059 T | 33.821 T | 1.682 T |
| Naphthalene | mg/kg OC | 99 | 170 | 0.697 | 1.934 | 0.456 | 0.958 | 2.109 | 0.204 T | 0.532 | 0.504 | 1.188 U | 1.226 | 0.64 |
| Acenaphthylene | mg/kg OC | 66 | 66 | 0.732 | 0.613 | 0.16 T | 0.399 U | 1.293 U | 0.277 U | 0.579 | 0.856 | 1.188 U | 0.896 | 0.474 U |
| Acenaphthene | mg/kg OC | 16 | 57 | 0.488 T | 2.594 | 1.096 | 0.958 | 1.293 U | 0.277 U | 0.556 | 0.466 | 1.188 U | 1.038 | 0.474 U |
| Fluorene | mg/kg OC | 23 | 79 | 0.557 T | 3.774 | 1.478 | 1.357 | 1.293 U | 0.277 U | 0.718 | 0.756 | 1.188 U | 1.698 | 0.474 U |
| Phenanthrene | mg/kg OC | 100 | 480 | 6.969 | 25.943 | 8.374 | 9.78 | 1.497 | 0.569 | 8.102 | 8.438 | 2.277 | 25.472 | 0.806 |
| Anthracene | mg/kg OC | 220 | 1200 | 1.847 | 7.311 | 3.571 | 2.395 | 1.293 U | 0.16 T | 1.62 | 3.275 | 0.782 T | 3.491 | 0.237 T |
| 2-Methylnaphthalene | mg/kg OC | 38 | 64 | 0.906 | 2.241 | 1.601 | 1.257 | 1.293 U | 0.233 T | 0.671 | 0.416 | 1.188 U | 0.509 | 0.474 U |
| Total HPAH (SMS) | mg/kg OC | 960 | 5300 | 76.76 T | 143.892 T | 29.397 T | 50.479 T | 5.85 T | 6.803 T | 55.139 T | 154.156 T | 27.01 JT | 79.443 T | 4.526 T |
| Fluoranthene | mg/kg OC | 160 | 1200 | 18.467 | 37.736 | 8.867 | 10.978 | 1.837 | 1.429 | 12.037 | 50.378 | 5.446 J | 21.698 | 1.256 |
| Pyrene | mg/kg OC | 1000 | 1400 | 17.77 | 33.019 | 8.621 | 10.978 | 4.014 | 1.749 | 12.731 | 50.378 | 6.238 | 23.585 | 1.137 |
| Benzo(a)anthracene | mg/kg OC | 110 | 270 | 5.226 | 11.321 | 1.97 | 4.99 | 1.293 U | 0.408 | 3.704 | 4.282 | 2.574 J | 1.321 | 0.308 T |
| Chrysene | mg/kg OC | 110 | 460 | 9.408 | 15.566 | 2.833 | 5.389 | 1.293 U | 0.671 | 7.87 | 18.892 | 3.663 | 11.321 | 0.474 |
| Benzofluoranthenes (Sum) | mg/kg OC | 230 | 450 | 14.634 T | 24.292 T | 3.941 T | 10.18 T | 1.293 UT | 1.516 T | 11.574 T | 19.773 T | 5.248 T | 12.453 T | 0.924 T |
| Benzo(a)pyrene | mg/kg OC | 99 | 210 | 7.317 | 14.387 | 1.601 | 5.389 | 1.293 U | 0.685 | 5.093 | 6.171 | 2.277 | 5.189 | 0.427 T |
| Indeno(1,2,3-cd)pyrene | mg/kg OC | 34 | 88 | 1.707 | 3.066 | 0.69 T | 1.118 | 1.293 U | 0.141 T | 1.111 | 2.141 | 0.713 T | 1.792 | 0.474 U |
| Dibenzo(a,h)anthracene | mg/kg OC | 12 | 33 | 0.662 T | 1.439 | 0.727 U | 0.339 T | 1.293 U | 0.277 U | 0.463 U | 0.743 U | 1.188 U | 0.292 T | 0.474 U |
| Benzo(ghi)perylene | mg/kg OC | 31 | 78 | 1.568 | 3.066 | 0.874 | 1.118 | 1.293 U | 0.204 T | 1.019 | 2.141 | 0.851 T | 1.792 | 0.474 U |
| **Chlorinated Benzenes (OC Normalized)** | | | | | | | | | | | | | | |
| 1,2-Dichlorobenzene | mg/kg OC | 2.3 | 2.3 | 0.662 U | 0.472 U | 0.246 U | 0.399 U | 1.293 U | 0.277 U | 0.463 U | 0.252 U | 1.188 U | 0.189 U | 0.474 U |
| 1,4-Dichlorobenzene | mg/kg OC | 3.1 | 9 | 0.662 U | 0.472 U | 0.135 T | 0.399 U | 1.293 U | 0.277 U | 0.463 U | 0.252 U | 1.188 U | 0.189 U | 0.474 U |
| 1,2,4-Trichlorobenzene | mg/kg OC | 0.81 | 1.8 | 0.662 U | 0.472 U | 0.246 U | 0.399 U | 1.293 U | 0.277 U | 0.463 U | 0.252 U | 1.188 U | 0.189 U | 0.474 U |
| Hexachlorobenzene | mg/kg OC | 0.38 | 2.3 | 0.662 U | 0.472 U | 0.246 U | 0.399 U | 1.293 U | 0.277 U | 0.463 U | 0.252 U | 1.188 U | 0.189 U | 0.474 U |
| **Phthalates (OC Normalized)** | | | | | | | | | | | | | | |
| Dimethyl phthalate | mg/kg OC | 53 | 53 | 0.662 U | 0.33 T | 0.246 U | 0.339 T | 1.293 U | 8.601 | 0.463 U | 0.239 T | 1.188 U | 0.189 U | 0.474 U |
| Diethyl phthalate | mg/kg OC | 61 | 110 | 0.662 U | 0.472 U | 0.246 U | 0.399 U | 1.293 U | 0.277 U | 0.463 U | 0.252 U | 1.188 U | 0.189 U | 0.474 U |
| Dibutyl phthalate | mg/kg OC | 220 | 1700 | 0.662 U | 0.472 U | 0.246 U | 0.379 T | 1.293 U | 0.277 U | 0.463 U | 0.252 U | 1.188 U | 0.189 U | 0.474 U |
| Butyl benzyl phthalate | mg/kg OC | 4.9 | 64 | 0.662 U | 0.472 U | 0.246 U | 0.399 U | 1.293 U | 0.277 U | 0.463 U | 0.252 U | 0.683 JT | 0.189 U | 0.474 U |
| Bis(2-Ethylhexyl) Phthalate | mg/kg OC | 47 | 78 | 5.923 | 3.066 | 2.34 | 7.784 | 1.293 U | 3.936 | 4.398 | 8.06 | 4.653 J | 0.557 | 0.474 U |
| Di-N-Octyl Phthalate | mg/kg OC | 58 | 4500 | 0.662 U | 0.472 U | 0.246 U | 0.399 U | 1.293 U | 0.277 U | 0.463 U | 0.252 U | 1.188 U | 0.189 U | 0.474 U |

| Analyte | Units | SQS/LAET | CSL/2LAET | SC-01 | SC-01 | SC-01 | SC-02 | SC-02 | SC-02 | SC-03 | SC-03 | SC-03 | SC-04 | SC-04 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample ID: | RGH-SC-01-0-2' | RGH-SC-01-2-4' | RGH-SC-01-4-6' | RGH-SC-02-0-2' | RGH-SC-02-2-4' | RGH-SC-02-4-6' | RGH-SC-03-0-2' | RGH-SC-03-2-4' | RGH-SC-03-4-6' | RGH-SC-04-0-2' | RGH-SC-04-2-4' |
| | | | Sample Date: | 8/26/2008 | 8/26/2008 | 8/26/2008 | 8/26/2008 | 8/26/2008 | 8/26/2008 | 8/27/2008 | 8/27/2008 | 8/27/2008 | 8/27/2008 | 8/27/2008 |
| | | | Sample Depth (feet): | 0-2 | 2-4 | 4-6 | 0-2 | 2-4 | 4-6 | 0-2 | 2-4 | 4-6 | 0-2 | 2-4 |
| **Miscellaneous (OC Normalized)** | | | | | | | | | | | | | | |
| Dibenzofuran | mg/kg OC | 15 | 58 | 0.557 T | 1.981 | 0.382 | 0.838 | 1.293 U | 0.277 U | 0.486 | 0.315 | 1.188 U | 1.509 | 0.474 U |
| Hexachlorobutadiene | mg/kg OC | 3.9 | 6.2 | 0.662 U | 0.472 U | 0.246 U | 0.399 U | 1.293 U | 0.277 U | 0.463 U | 0.252 U | 1.188 U | 0.189 U | 0.474 U |
| N-Nitrosodiphenylamine | mg/kg OC | 11 | 11 | 0.662 U | 0.472 U | 1.478 U | 0.399 U | 1.293 U | 0.277 U | 0.463 U | 0.252 U | 1.188 U | 0.189 U | 0.474 U |
| **Ionizable Organic Compounds (dry weight)** | | | | | | | | | | | | | | |
| Phenol | µg/kg | 420 | 1200 | 41 | 20 U | 20 U | 20 U | 19 U | 19 U | 20 U | 18 T | 120 U | 22 | 20 U |
| o-Cresol (2-methylphenol) | ug/kg | 63 | 63 | 19 U | 20 U | 20 U | 20 U | 19 U | 19 U | 20 U | 20 U | 120 U | 20 U | 20 U |
| p-Cresol (4-methylphenol) | ug/kg | 670 | 670 | 19 U | 20 U | 16 T | 20 U | 19 U | 19 U | 20 U | 26 | 120 U | 46 | 20 U |
| 2,4-Dimethylphenol | ug/kg | 29 | 29 | 19 U | 20 U | 20 U | 20 U | 19 U | 19 U | 20 U | 20 U | 120 U | 20 U | 20 U |
| Pentachlorophenol | ug/kg | 360 | 690 | 380 | 270 | 530 | 230 | 96 U | 170 | 220 | 720 | 590 U | 130 | 99 U |
| Benzyl Alcohol | ug/kg | 57 | 73 | 19 U | 20 U | 20 U | 20 U | 19 U | 18 T | 20 U | 20 U | 120 U | 20 U | 20 U |
| Benzoic Acid | ug/kg | 650 | 650 | 190 U | 200 U | 200 U | 200 U | 190 U | 250 | 200 U | 200 U | 1200 U | 200 U | 200 U |
| **Aromatic Hydrocarbons (dry weight)** | | | | | | | | | | | | | | |
| Total LPAH | ug/kg | 52000 | 61000 | 324 T | 1788 T | 1229 T | 774 T | 53 T | 64 T | 523 T | 1135 T | 309 T | 3585 T | 71 T |
| Naphthalene | ug/kg | 2100 | 2400 | 20 | 82 | 37 | 48 | 31 | 14 T | 23 | 40 | 120 U | 130 | 27 |
| Acenaphthylene | ug/kg | 1300 | 1300 | 21 | 26 | 13 T | 20 U | 19 U | 19 U | 25 | 68 | 120 U | 95 | 20 U |
| Acenaphthene | ug/kg | 500 | 730 | 14 T | 110 | 89 | 48 | 19 U | 19 U | 24 | 37 | 120 U | 110 | 20 U |
| Fluorene | ug/kg | 540 | 1000 | 16 T | 160 | 120 | 68 | 19 U | 19 U | 31 | 60 | 120 U | 180 | 20 U |
| Phenanthrene | ug/kg | 1500 | 5400 | 200 | 1100 | 680 | 490 | 22 | 39 | 350 | 670 | 230 | 2700 | 34 |
| Anthracene | ug/kg | 960 | 4400 | 53 | 310 | 290 | 120 | 19 U | 11 T | 70 | 260 | 79 T | 370 | 10 T |
| 2-Methylnaphthalene | ug/kg | 670 | 1400 | 26 | 95 | 130 | 63 | 19 U | 16 T | 29 | 33 | 120 U | 54 | 20 U |
| Total HPAH | ug/kg | 12000 | 17000 | 2203 T | 6101 T | 2387 T | 2529 T | 86 T | 466.7 T | 2382 T | 12240 T | 2728 JT | 8421 T | 191 T |
| Fluoranthene | ug/kg | 1700 | 2500 | 530 | 1600 | 720 | 550 | 27 | 98 | 520 | 4000 | 550 J | 2300 | 53 |
| Pyrene | ug/kg | 2600 | 3300 | 510 | 1400 | 700 | 550 | 59 | 120 | 550 | 4000 | 630 | 2500 | 48 |
| Benzo(a)anthracene | ug/kg | 1300 | 1600 | 150 | 480 | 160 | 250 | 19 U | 28 | 160 | 340 | 260 J | 140 | 13 T |
| Chrysene | ug/kg | 1400 | 2800 | 270 | 660 | 230 | 270 | 19 U | 46 | 340 | 1500 | 370 | 1200 | 20 |
| Benzo(b)fluoranthene | ug/kg | | | 200 | 600 | 160 | 280 | 19 U | 52 | 210 | 740 | 320 | 750 | 18 T |
| Benzo(k)fluoranthene | ug/kg | | | 220 | 430 | 160 | 230 | 19 U | 52 | 290 | 830 | 210 | 570 | 21 |
| Benzofluoranthenes (Sum) | ug/kg | 3200 | 3600 | 420 T | 1030 T | 320 T | 510 T | 19 UT | 104 T | 500 T | 1570 T | 530 T | 1320 T | 39 T |
| Benzo(a)pyrene | ug/kg | 1600 | 3000 | 210 | 610 | 130 | 270 | 19 U | 47 | 220 | 490 | 230 | 550 | 18 T |
| Indeno(1,2,3-cd)pyrene | ug/kg | 600 | 690 | 49 | 130 | 56 T | 56 | 19 U | 9.7 T | 48 | 170 | 72 T | 190 | 20 U |
| Dibenzo(a,h)anthracene | ug/kg | 230 | 540 | 19 T | 61 | 59 U | 17 T | 19 U | 19 U | 20 U | 59 U | 120 U | 31 T | 20 U |
| Benzo(ghi)perylene | ug/kg | 670 | 720 | 45 | 130 | 71 | 56 | 19 U | 14 T | 44 | 170 | 86 T | 190 | 20 U |
| **Chlorinated Benzenes (dry weight)** | | | | | | | | | | | | | | |
| 1,2-Dichlorobenzene | ug/kg | 35 | 50 | 19 U | 20 U | 20 U | 20 U | 19 U | 19 U | 20 U | 20 U | 120 U | 20 U | 20 U |
| 1,3-Dichlorobenzene | ug/kg | – | – | 19 U | 20 U | 20 U | 20 U | 19 U | 19 U | 20 U | 20 U | 120 U | 20 U | 20 U |
| 1,4-Dichlorobenzene | ug/kg | 110 | 120 | 19 U | 20 U | 11 T | 20 U | 19 U | 19 U | 20 U | 20 U | 120 U | 20 U | 20 U |
| 1,2,4-Trichlorobenzene | ug/kg | 31 | 51 | 19 U | 20 U | 20 U | 20 U | 19 U | 19 U | 20 U | 20 U | 120 U | 20 U | 20 U |
| Hexachlorobenzene | ug/kg | 70 | 130 | 19 U | 20 U | 20 U | 20 U | 19 U | 19 U | 20 U | 20 U | 120 U | 20 U | 20 U |
| **Phthalates (dry weight)** | | | | | | | | | | | | | | |
| Dimethyl phthalate | ug/kg | 71 | 160 | 19 U | 14 T | 20 U | 17 T | 19 U | 590 | 20 U | 19 T | 120 U | 20 U | 20 U |
| Diethyl phthalate | ug/kg | 200 | 1200 | 19 U | 20 U | 20 U | 20 U | 19 U | 19 U | 20 U | 20 U | 120 U | 20 U | 20 U |
| Dibutyl phthalate | ug/kg | 1400 | 5100 | 19 U | 20 U | 20 U | 19 T | 19 U | 19 U | 20 U | 20 U | 120 U | 20 U | 20 U |
| Butyl benzyl phthalate | ug/kg | 63 | 900 | 19 U | 20 U | 20 U | 20 U | 19 U | 19 U | 20 U | 20 U | 69 JT | 20 U | 20 U |
| Bis(2-Ethylhexyl) Phthalate | ug/kg | 1300 | 3100 | 170 | 130 | 190 | 390 | 19 U | 270 | 190 | 640 | 470 J | 59 | 20 U |
| Di-N-Octyl Phthalate | ug/kg | 5200 | 6200 | 19 U | 20 U | 20 U | 20 U | 19 U | 19 U | 20 U | 20 U | 120 U | 20 U | 20 U |

| Analyte | Units | SQS/LAET | CSL/2LAET | SC-01 | SC-01 | SC-01 | SC-02 | SC-02 | SC-02 | SC-03 | SC-03 | SC-03 | SC-04 | SC-04 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample ID: | RGH-SC-01-0-2' | RGH-SC-01-2-4' | RGH-SC-01-4-6' | RGH-SC-02-0-2' | RGH-SC-02-2-4' | RGH-SC-02-4-6' | RGH-SC-03-0-2' | RGH-SC-03-2-4' | RGH-SC-03-4-6' | RGH-SC-04-0-2' | RGH-SC-04-2-4' |
| | | | Sample Date: | 8/26/2008 | 8/26/2008 | 8/26/2008 | 8/26/2008 | 8/26/2008 | 8/26/2008 | 8/27/2008 | 8/27/2008 | 8/27/2008 | 8/27/2008 | 8/27/2008 |
| | | | Sample Depth (feet): | 0-2 | 2-4 | 4-6 | 0-2 | 2-4 | 4-6 | 0-2 | 2-4 | 4-6 | 0-2 | 2-4 |
| **Miscellaneous (dry weight)** | | | | | | | | | | | | | | |
| Dibenzofuran | ug/kg | 540 | 700 | 16 T | 84 | 31 | 42 | 19 U | 19 U | 21 | 25 | 120 U | 160 | 20 U |
| Hexachlorobutadiene | ug/kg | 11 | 120 | 19 U | 20 U | 20 U | 20 U | 19 U | 19 U | 20 U | 20 U | 120 U | 20 U | 20 U |
| N-Nitrosodiphenylamine | ug/kg | 28 | 40 | 19 U | 20 U | 120 U | 20 U | 19 U | 19 U | 20 U | 20 U | 120 U | 20 U | 20 U |
| **Petroleum Hydrocarbons** | | | | | | | | | | | | | | |
| Diesel-range hydrocarbons | mg/kg | 200 | -- | 37 | 43 | 220 | 32 | 18 | 25 | 46 | 180 | 110 | 28 | 13 |
| Heavy Oil-Range Hydrocarbons | mg/kg | 200 | -- | 110 | 120 | 450 | 100 | 100 | 92 | 140 | 510 | 240 | 75 | 28 |
| Total TPH | mg/kg | 200 | -- | 147 T | 163 T | 670 T | 132 T | 118 T | 117 T | 186 T | 690 T | 350 T | 103 T | 41 T |
| **Dioxin Furans** | | | | | | | | | | | | | | |
| 2,3,7,8-TCDD | ng/kg | -- | -- | 4 | 3.1 | -- | 39 | 3.3 | -- | 58 | -- | -- | 19 | -- |
| 1,2,3,7,8-PeCDD | ng/kg | -- | -- | 17 | 25 | -- | 34 | 14 | -- | 110 | -- | -- | 39 | -- |
| 1,2,3,4,7,8-HxCDD | ng/kg | -- | -- | 68 | 66 | -- | 250 | 24 | -- | 260 | -- | -- | 68 | -- |
| 1,2,3,6,7,8-HxCDD | ng/kg | -- | -- | 160 | 310 | -- | 160 | 99 | -- | 580 | -- | -- | 230 | -- |
| 1,2,3,7,8,9-HxCDD | ng/kg | -- | -- | 57 | 100 | -- | 110 | 44 | -- | 150 | -- | -- | 72 | -- |
| 1,2,3,4,6,7,8-HpCDD | ng/kg | -- | -- | 4500 | 7900 E | -- | 4400 | 2700 E | -- | 15000 | -- | -- | 5500 | -- |
| OCDD | ng/kg | -- | -- | 40000 E | 63000 E | -- | 36000 E | 23000 E | -- | 220000 E | -- | -- | 49000 E | -- |
| 2,3,7,8-TCDF | ng/kg | -- | -- | 3.1 J | 9.5 | -- | 5.5 | 1.2 J | -- | 22 | -- | -- | 8.4 | -- |
| 1,2,3,7,8-PeCDF | ng/kg | -- | -- | 10 | 20 | -- | 13 | 5.3 | -- | 32 | -- | -- | 14 | -- |
| 2,3,4,7,8-PeCDF | ng/kg | -- | -- | 10 | 19 | -- | 8.6 | 5.8 | -- | 32 | -- | -- | 14 | -- |
| 1,2,3,4,7,8-HxCDF | ng/kg | -- | -- | 62 | 130 | -- | 48 | 38 | -- | 210 | -- | -- | 72 | -- |
| 1,2,3,6,7,8-HxCDF | ng/kg | -- | -- | 17 | 42 | -- | 12 | 9.3 | -- | 51 | -- | -- | 24 | -- |
| 1,2,3,7,8,9-HxCDF | ng/kg | -- | -- | 4.7 | 8.2 | -- | 5.6 | 2.9 | -- | 7.2 | -- | -- | 6.4 | -- |
| 2,3,4,6,7,8-HxCDF | ng/kg | -- | -- | 10 | 22 | -- | 7.5 | 5.7 | -- | 31 | -- | -- | 13 | -- |
| 1,2,3,4,6,7,8-HpCDF | ng/kg | -- | -- | 860 | 1500 | -- | 710 | 480 | -- | 2600 | -- | -- | 910 | -- |
| 1,2,3,4,7,8,9-HpCDF | ng/kg | -- | -- | 47 | 85 | -- | 40 | 26 | -- | 140 J | -- | -- | 51 | -- |
| OCDF | ng/kg | -- | -- | 3200 | 5300 | -- | 3200 | 2200 | -- | 13000 | -- | -- | 3400 | -- |
| Dioxin/Furan TEQ ND=0 | ng/Kg | -- | -- | 129.51 | 218.51 | -- | 199.09 | 81.229 | -- | 556.98 | -- | -- | 192.33 | -- |
| Dioxin/Furan TEQ ND=1/2 | ng/Kg | -- | -- | 129.51 | 218.51 | -- | 199.09 | 81.229 | -- | 556.98 | -- | -- | 192.33 | -- |
| **Non-SMS SVOCs** | | | | | | | | | | | | | | |
| 1-Methylnaphthalene | ug/kg | -- | -- | 22 | 84 | 140 | 60 | 19 U | 12 T | 30 | 24 | 120 U | 55 | 20 U |
| Hexachloroethane | ug/kg | -- | -- | 19 U | 20 U | 20 U | 20 U | 19 U | 19 U | 20 U | 20 U | 120 U | 20 U | 20 U |
| 2,3,4,5-Tetrachlorophenol | ug/kg | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2,3,5,6-Tetrachlorophenol | ug/kg | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2,4,5-Trichlorophenol | ug/kg | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2,4,6-Trichlorophenol | ug/kg | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

| Analyte | Units | SQS/LAET | CSL/2LAET | SC-04 | SC-05 | SC-05 | SC-05 | SC-06 | SC-06 | SC-06 | SC-07 | SC-07 | SC-07 | SC-08 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample ID: | RGH-SC-04-4-6' | RGH-SC-05-0-2' | RGH-SC-05-2-4' | RGH-SC-05-4-6' | RGH-SC-06-0-2' | RGH-SC-06-2-4' | RGH-SC-06-4-6' | RGH-SC-07-0-2' | RGH-SC-07-2-4' | RGH-SC-07-4-6.8' | RGH-SC-08-0-2' |
| | | | Sample Date: | 8/27/2008 | 8/27/2008 | 8/27/2008 | 8/27/2008 | 8/27/2008 | 8/27/2008 | 8/27/2008 | 9/24/2008 | 9/24/2008 | 9/24/2008 | 9/24/2008 |
| | | | Sample Depth (feet): | 4-6 | 0-2 | 2-4 | 4-6 | 0-2 | 2-4 | 4-6 | 0-2 | 2-4 | 4-6.8 | 0-2 |
| **Conventional Parameters** | | | | | | | | | | | | | | |
| Ammonia | mg/kg | – | – | – | – | – | – | – | – | – | – | – | – | – |
| Sulfide | mg/kg | – | – | – | – | – | – | – | – | – | – | – | – | – |
| Total Organic Carbon | Percent | – | – | 1.64 | 4.8 | 2.38 | 6.39 | 4.08 | 3.89 | 8.08 | 11.3 | 38.6 | 22.6 | 14.9 |
| Total Solids | Percent | – | – | 56.1 | 44.7 | 45 | 44.1 | 44.3 | 48.4 | 44.3 | 53.8 | 29.7 | 35.6 | 38.4 |
| **Metals** | | | | | | | | | | | | | | |
| Mercury | mg/kg | 0.41 | 0.59 | 0.09 | 0.3 | 0.09 | 0.29 | 0.2 | 0.74 | 0.83 J | 0.2 | 0.2 U | 0.09 U | 1 |
| **Aromatic Hydrocarbons (OC Normalized)** | | | | | | | | | | | | | | |
| Total LPAH | mg/kg OC | 370 | 780 | 2.561 T | 16.729 T | 0.504 T | 10.094 T | 5.123 T | 8.638 T | 72.649 T | 13.327 T | 18.671 T | 4.991 T | 1.396 T |
| Naphthalene | mg/kg OC | 99 | 170 | 0.854 T | 1.042 | 0.84 U | 0.454 | 0.931 | 3.085 | 5.941 | 5.929 | 15.285 | 3.717 | 0.087 T |
| Acenaphthylene | mg/kg OC | 66 | 66 | 1.22 U | 0.771 | 0.84 U | 0.25 T | 0.49 U | 0.411 T | 5.446 | 0.319 | 0.285 | 0.146 | 0.114 T |
| Acenaphthene | mg/kg OC | 16 | 57 | 1.22 U | 0.896 | 0.84 U | 0.313 U | 0.49 U | 0.386 T | 1.361 | 0.416 | 0.233 | 0.075 T | 0.074 T |
| Fluorene | mg/kg OC | 23 | 79 | 1.22 U | 0.896 | 0.84 U | 0.313 | 0.27 T | 0.437 T | 5.446 | 0.558 | 0.44 | 0.142 | 0.087 T |
| Phenanthrene | mg/kg OC | 100 | 480 | 1.707 | 10 | 0.504 T | 7.355 | 3.186 | 3.599 | 40.842 | 5.133 | 2.176 | 0.796 | 0.805 |
| Anthracene | mg/kg OC | 220 | 1200 | 1.22 U | 3.125 | 0.84 U | 1.721 | 0.735 | 0.72 | 13.614 | 0.973 | 0.251 | 0.115 | 0.228 |
| 2-Methylnaphthalene | mg/kg OC | 38 | 64 | 1.22 U | 0.292 T | 0.84 U | 0.313 U | 0.49 U | 2.416 | 2.475 | 0.336 | 0.544 | 0.155 | 0.134 U |
| Total HPAH (SMS) | mg/kg OC | 960 | 5300 | 5.671 T | 67.979 T | 1.513 T | 36.933 T | 17.77 T | 16.735 T | 279.208 T | 25.965 JT | 2.482 T | 1.389 T | 6.819 T |
| Fluoranthene | mg/kg OC | 160 | 1200 | 1.89 | 15.208 | 0.714 T | 10.642 | 4.412 | 3.085 | 51.98 | 6.726 | 1.269 | 0.575 | 1.409 |
| Pyrene | mg/kg OC | 1000 | 1400 | 1.585 | 13.333 | 0.798 T | 9.546 | 4.412 | 3.599 | 63.119 | 5.31 | 0.648 | 0.394 | 1.007 |
| Benzo(a)anthracene | mg/kg OC | 110 | 270 | 1.22 U | 5.833 | 0.84 U | 2.504 | 1.275 | 1.388 | 25.99 | 1.858 | 0.062 | 0.088 U | 0.738 |
| Chrysene | mg/kg OC | 110 | 460 | 0.671 T | 7.083 | 0.84 U | 3.912 | 1.887 | 1.979 | 28.465 | 3.451 J | 0.07 | 0.088 U | 0.872 |
| Benzofluoranthenes (Sum) | mg/kg OC | 230 | 450 | 0.854 T | 14.583 T | 0.84 UT | 4.225 T | 2.402 T | 2.622 T | 40.842 T | 3.628 T | 0.181 T | 0.186 T | 1.409 T |
| Benzo(a)pyrene | mg/kg OC | 99 | 210 | 0.671 T | 7.917 | 0.84 U | 2.66 | 1.495 | 1.851 | 29.703 | 2.743 | 0.109 | 0.119 | 0.805 |
| Indeno(1,2,3-cd)pyrene | mg/kg OC | 34 | 88 | 1.22 U | 1.688 | 0.84 U | 1.44 | 0.858 | 0.977 | 16.089 | 0.841 | 0.049 T | 0.049 T | 0.228 |
| Dibenzo(a,h)anthracene | mg/kg OC | 12 | 33 | 1.22 U | 0.667 | 0.84 U | 0.282 T | 0.49 U | 0.514 U | 5.693 | 0.345 | 0.052 U | 0.088 U | 0.094 T |
| Benzo(ghi)perylene | mg/kg OC | 31 | 78 | 1.22 U | 1.667 | 0.84 U | 1.721 | 1.029 | 1.234 | 17.327 | 1.062 | 0.093 | 0.066 T | 0.255 |
| **Chlorinated Benzenes (OC Normalized)** | | | | | | | | | | | | | | |
| 1,2-Dichlorobenzene | mg/kg OC | 2.3 | 2.3 | 1.22 U | 0.417 U | 0.84 U | 0.313 U | 0.49 U | 0.514 U | 0.73 U | 0.177 U | 0.052 U | 0.088 U | 0.134 U |
| 1,4-Dichlorobenzene | mg/kg OC | 3.1 | 9 | 1.22 U | 0.417 U | 0.84 U | 0.313 U | 0.49 U | 0.514 U | 0.73 U | 0.177 U | 0.052 U | 0.088 U | 0.134 U |
| 1,2,4-Trichlorobenzene | mg/kg OC | 0.81 | 1.8 | 1.22 U | 0.417 U | 0.84 U | 0.313 U | 0.49 U | 0.514 U | 0.73 U | 0.177 U | 0.052 U | 0.088 U | 0.134 U |
| Hexachlorobenzene | mg/kg OC | 0.38 | 2.3 | 1.22 U | 0.417 U | 0.84 U | 0.313 U | 0.49 U | 0.514 U | 0.73 U | 0.177 U | 0.052 U | 0.088 U | 0.134 U |
| **Phthalates (OC Normalized)** | | | | | | | | | | | | | | |
| Dimethyl phthalate | mg/kg OC | 53 | 53 | 1.22 U | 0.417 U | 0.84 U | 0.313 U | 0.49 U | 0.514 U | 0.73 U | 1.593 | 0.052 U | 0.088 U | 0.201 |
| Diethyl phthalate | mg/kg OC | 61 | 110 | 1.22 U | 0.417 U | 0.84 U | 0.313 U | 0.49 U | 0.514 U | 0.73 U | 0.177 U | 0.052 U | 0.088 U | 0.134 U |
| Dibutyl phthalate | mg/kg OC | 220 | 1700 | 1.22 U | 0.417 U | 0.84 U | 0.313 U | 0.49 U | 0.514 U | 0.73 U | 0.177 U | 0.052 U | 0.088 U | 0.121 T |
| Butyl benzyl phthalate | mg/kg OC | 4.9 | 64 | 1.22 U | 0.417 U | 0.84 U | 0.313 U | 0.49 U | 0.514 U | 0.73 U | 0.177 U | 0.052 U | 0.088 U | 0.738 |
| Bis(2-Ethylhexyl) Phthalate | mg/kg OC | 47 | 78 | 1.22 U | 0.229 T | 0.84 U | 0.313 U | 0.49 U | 0.36 T | 0.73 U | 0.885 | 0.052 U | 0.088 U | 0.564 |
| Di-N-Octyl Phthalate | mg/kg OC | 58 | 4500 | 1.22 U | 0.417 U | 0.84 U | 0.313 U | 0.49 U | 0.514 U | 0.73 U | 0.177 U | 0.052 U | 0.088 U | 0.134 U |

| Analyte | Units | SQS/LAET | CSL/2LAET | SC-04 | SC-05 | SC-05 | SC-05 | SC-06 | SC-06 | SC-06 | SC-07 | SC-07 | SC-07 | SC-08 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample ID: | RGH-SC-04-4-6' | RGH-SC-05-0-2' | RGH-SC-05-2-4' | RGH-SC-05-4-6' | RGH-SC-06-0-2' | RGH-SC-06-2-4' | RGH-SC-06-4-6' | RGH-SC-07-0-2' | RGH-SC-07-2-4' | RGH-SC-07-4-6.8' | RGH-SC-08-0-2' |
| | | | Sample Date: | 8/27/2008 | 8/27/2008 | 8/27/2008 | 8/27/2008 | 8/27/2008 | 8/27/2008 | 8/27/2008 | 9/24/2008 | 9/24/2008 | 9/24/2008 | 9/24/2008 |
| | | | Sample Depth (feet): | 4-6 | 0-2 | 2-4 | 4-6 | 0-2 | 2-4 | 4-6 | 0-2 | 2-4 | 4-6.8 | 0-2 |
| **Miscellaneous (OC Normalized)** | | | | | | | | | | | | | | |
| Dibenzofuran | mg/kg OC | 15 | 58 | 1.22 U | 0.438 | 0.84 U | 0.172 T | 0.49 U | 0.823 | 2.228 | 0.336 | 0.415 | 0.142 | 0.134 U |
| Hexachlorobutadiene | mg/kg OC | 3.9 | 6.2 | 1.22 U | 0.417 U | 0.84 U | 0.313 U | 0.49 U | 0.514 U | 0.73 U | 0.177 U | 0.052 U | 0.088 U | 0.134 U |
| N-Nitrosodiphenylamine | mg/kg OC | 11 | 11 | 1.22 U | 0.417 U | 0.84 U | 0.313 U | 0.49 U | 0.514 U | 0.73 U | 0.177 U | 0.052 U | 0.088 U | 0.134 U |
| **Ionizable Organic Compounds (dry weight)** | | | | | | | | | | | | | | |
| Phenol | µg/kg | 420 | 1200 | 20 U | 20 U | 20 U | 21 | 20 U | 15 T | 56 T | 18 T | 40 | 31 | 20 U |
| o-Cresol (2-methylphenol) | ug/kg | 63 | 63 | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 59 U | 20 U | 32 | 20 U | 20 U |
| p-Cresol (4-methylphenol) | ug/kg | 670 | 670 | 20 U | 19 T | 20 U | 23 | 22 | 89 | 230 | 34 | 44 | 13 J | 18 T |
| 2,4-Dimethylphenol | ug/kg | 29 | 29 | 20 U | 20 U | 20 U | 20 U | 20 U | 15 T | 59 U | 20 U | 42 | 20 U | 20 U |
| Pentachlorophenol | ug/kg | 360 | 690 | 98 U | 99 U | 98 U | 98 U | 98 U | 98 U | 300 U | 98 U | 99 U | 97 U | 150 |
| Benzyl Alcohol | ug/kg | 57 | 73 | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 59 U | 20 U | 20 U | 20 U | 20 U |
| Benzoic Acid | ug/kg | 650 | 650 | 200 U | 200 U | 200 U | 200 U | 200 U | 200 U | 590 U | 200 U | 200 U | 200 U | 200 U |
| **Aromatic Hydrocarbons (dry weight)** | | | | | | | | | | | | | | |
| Total LPAH | ug/kg | 52000 | 61000 | 42 T | 803 T | 12 T | 645 T | 209 T | 336 T | 5870 T | 1506 T | 7207 T | 1128 T | 208 T |
| Naphthalene | ug/kg | 2100 | 2400 | 14 T | 50 | 20 U | 29 | 38 | 120 | 480 | 670 | 5900 | 840 | 13 T |
| Acenaphthylene | ug/kg | 1300 | 1300 | 20 U | 37 | 20 U | 16 T | 20 U | 16 T | 440 | 36 | 110 | 33 | 17 T |
| Acenaphthene | ug/kg | 500 | 730 | 20 U | 43 | 20 U | 20 U | 20 U | 15 T | 110 | 47 | 90 | 17 T | 11 T |
| Fluorene | ug/kg | 540 | 1000 | 20 U | 43 | 20 U | 20 | 11 T | 17 T | 440 | 63 | 170 | 32 | 13 T |
| Phenanthrene | ug/kg | 1500 | 5400 | 28 | 480 | 12 T | 470 | 130 | 140 | 3300 | 580 | 840 | 180 | 120 |
| Anthracene | ug/kg | 960 | 4400 | 20 U | 150 | 20 U | 110 | 30 | 28 | 1100 | 110 | 97 | 26 | 34 |
| 2-Methylnaphthalene | ug/kg | 670 | 1400 | 20 U | 14 T | 20 U | 20 U | 20 U | 94 | 200 | 38 | 210 | 35 | 20 U |
| Total HPAH | ug/kg | 12000 | 17000 | 93 T | 3263 T | 36 T | 2360 T | 725 T | 651 T | 22560 T | 2934 JT | 958 T | 314 T | 1016 T |
| Fluoranthene | ug/kg | 1700 | 2500 | 31 | 730 | 17 T | 680 | 180 | 120 | 4200 | 760 | 490 | 130 | 210 |
| Pyrene | ug/kg | 2600 | 3300 | 26 | 640 | 19 T | 610 | 180 | 140 | 5100 | 600 | 250 | 89 | 150 |
| Benzo(a)anthracene | ug/kg | 1300 | 1600 | 20 U | 280 | 20 U | 160 | 52 | 54 | 2100 | 210 | 24 | 20 U | 110 |
| Chrysene | ug/kg | 1400 | 2800 | 11 T | 340 | 20 U | 250 | 77 | 77 | 2300 | 390 J | 27 | 20 U | 130 |
| Benzo(b)fluoranthene | ug/kg | | | 14 T | 340 | 20 U | 120 | 40 | 52 | 2100 | 220 | 35 | 22 | 110 |
| Benzo(k)fluoranthene | ug/kg | | | 20 U | 360 | 20 U | 150 | 58 | 50 | 1200 | 190 | 35 | 20 | 100 |
| Benzofluoranthenes (Sum) | ug/kg | 3200 | 3600 | 14 T | 700 T | 20 UT | 270 T | 98 T | 102 T | 3300 T | 410 T | 70 T | 42 T | 210 T |
| Benzo(a)pyrene | ug/kg | 1600 | 3000 | 11 T | 380 | 20 U | 170 | 61 | 72 | 2400 | 310 | 42 | 27 | 120 |
| Indeno(1,2,3-cd)pyrene | ug/kg | 600 | 690 | 20 U | 81 | 20 U | 92 | 35 | 38 | 1300 | 95 | 19 T | 11 T | 34 |
| Dibenzo(a,h)anthracene | ug/kg | 230 | 540 | 20 U | 32 | 20 U | 18 T | 20 U | 20 U | 460 | 39 | 20 U | 20 U | 14 T |
| Benzo(ghi)perylene | ug/kg | 670 | 720 | 20 U | 80 | 20 U | 110 | 42 | 48 | 1400 | 120 | 36 | 15 T | 38 |
| **Chlorinated Benzenes (dry weight)** | | | | | | | | | | | | | | |
| 1,2-Dichlorobenzene | ug/kg | 35 | 50 | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 59 U | 20 U | 20 U | 20 U | 20 U |
| 1,3-Dichlorobenzene | ug/kg | – | – | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 59 U | 20 U | 20 U | 20 U | 20 U |
| 1,4-Dichlorobenzene | ug/kg | 110 | 120 | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 59 U | 20 U | 20 U | 20 U | 20 U |
| 1,2,4-Trichlorobenzene | ug/kg | 31 | 51 | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 59 U | 20 U | 20 U | 20 U | 20 U |
| Hexachlorobenzene | ug/kg | 70 | 130 | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 59 U | 20 U | 20 U | 20 U | 20 U |
| **Phthalates (dry weight)** | | | | | | | | | | | | | | |
| Dimethyl phthalate | ug/kg | 71 | 160 | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 59 U | 180 | 20 U | 20 U | 30 |
| Diethyl phthalate | ug/kg | 200 | 1200 | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 59 U | 20 U | 20 U | 20 U | 20 U |
| Dibutyl phthalate | ug/kg | 1400 | 5100 | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 59 U | 20 U | 20 U | 20 U | 18 T |
| Butyl benzyl phthalate | ug/kg | 63 | 900 | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 59 U | 20 U | 20 U | 20 U | 110 |
| Bis(2-Ethylhexyl) Phthalate | ug/kg | 1300 | 3100 | 20 U | 11 T | 20 U | 20 U | 20 U | 14 T | 59 U | 100 | 20 U | 20 U | 84 |
| Di-N-Octyl Phthalate | ug/kg | 5200 | 6200 | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 59 U | 20 U | 20 U | 20 U | 20 U |

| Analyte | Units | SQS/LAET | CSL/2LAET | SC-04 | SC-05 | SC-05 | SC-05 | SC-06 | SC-06 | SC-06 | SC-07 | SC-07 | SC-07 | SC-08 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample ID: | RGH-SC-04-4-6' | RGH-SC-05-0-2' | RGH-SC-05-2-4' | RGH-SC-05-4-6' | RGH-SC-06-0-2' | RGH-SC-06-2-4' | RGH-SC-06-4-6' | RGH-SC-07-0-2' | RGH-SC-07-2-4' | RGH-SC-07-4-6.8' | RGH-SC-08-0-2' |
| | | | Sample Date: | 8/27/2008 | 8/27/2008 | 8/27/2008 | 8/27/2008 | 8/27/2008 | 8/27/2008 | 8/27/2008 | 9/24/2008 | 9/24/2008 | 9/24/2008 | 9/24/2008 |
| | | | Sample Depth (feet): | 4-6 | 0-2 | 2-4 | 4-6 | 0-2 | 2-4 | 4-6 | 0-2 | 2-4 | 4-6.8 | 0-2 |
| **Miscellaneous (dry weight)** | | | | | | | | | | | | | | |
| Dibenzofuran | ug/kg | 540 | 700 | 20 U | 21 | 20 U | 11 T | 20 U | 32 | 180 | 38 | 160 | 32 | 20 U |
| Hexachlorobutadiene | ug/kg | 11 | 120 | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 59 U | 20 U | 20 U | 20 U | 20 U |
| N-Nitrosodiphenylamine | ug/kg | 28 | 40 | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 59 U | 20 U | 20 U | 20 U | 20 U |
| **Petroleum Hydrocarbons** | | | | | | | | | | | | | | |
| Diesel-range hydrocarbons | mg/kg | 200 | -- | 8.8 U | 120 | 12 | 41 | 61 | 50 | 110 | 63 | 210 | 330 | 210 |
| Heavy Oil-Range Hydrocarbons | mg/kg | 200 | -- | 18 U | 200 | 21 U | 72 | 99 | 64 | 190 | 170 | 190 | 650 | 670 |
| Total TPH | mg/kg | 200 | -- | 18 UT | 320 T | 12 T | 113 T | 160 T | 114 T | 300 T | 233 T | 400 T | 980 T | 880 T |
| **Dioxin Furans** | | | | | | | | | | | | | | |
| 2,3,7,8-TCDD | ng/kg | -- | -- | -- | 1.4 | -- | -- | 0.78 T | 0.23 U | -- | -- | -- | -- | -- |
| 1,2,3,7,8-PeCDD | ng/kg | -- | -- | -- | 5.1 T | -- | -- | 2.7 T | 0.49 U | -- | -- | -- | -- | -- |
| 1,2,3,4,7,8-HxCDD | ng/kg | -- | -- | -- | 11 | -- | -- | 6.5 | 0.35 U | -- | -- | -- | -- | -- |
| 1,2,3,6,7,8-HxCDD | ng/kg | -- | -- | -- | 45 | -- | -- | 28 | 1.2 T | -- | -- | -- | -- | -- |
| 1,2,3,7,8,9-HxCDD | ng/kg | -- | -- | -- | 13 | -- | -- | 9.3 | 1.1 T | -- | -- | -- | -- | -- |
| 1,2,3,4,6,7,8-HpCDD | ng/kg | -- | -- | -- | 1500 | -- | -- | 990 | 26 | -- | -- | -- | -- | -- |
| OCDD | ng/kg | -- | -- | -- | 10000 E | -- | -- | 7500 E | 250 | -- | -- | -- | -- | -- |
| 2,3,7,8-TCDF | ng/kg | -- | -- | -- | 6.4 | -- | -- | 5.1 | 1.4 U | -- | -- | -- | -- | -- |
| 1,2,3,7,8-PeCDF | ng/kg | -- | -- | -- | 3.9 T | -- | -- | 2.2 T | 0.7 T | -- | -- | -- | -- | -- |
| 2,3,4,7,8-PeCDF | ng/kg | -- | -- | -- | 4.1 T | -- | -- | 2.4 T | 0.72 U | -- | -- | -- | -- | -- |
| 1,2,3,4,7,8-HxCDF | ng/kg | -- | -- | -- | 12 | -- | -- | 8 | 1.7 T | -- | -- | -- | -- | -- |
| 1,2,3,6,7,8-HxCDF | ng/kg | -- | -- | -- | 4.2 T | -- | -- | 2.5 U | 0.64 T | -- | -- | -- | -- | -- |
| 1,2,3,7,8,9-HxCDF | ng/kg | -- | -- | -- | 1.3 T | -- | -- | 2.3 T | 0.25 T | -- | -- | -- | -- | -- |
| 2,3,4,6,7,8-HxCDF | ng/kg | -- | -- | -- | 2.6 T | -- | -- | 1.9 T | 0.74 T | -- | -- | -- | -- | -- |
| 1,2,3,4,6,7,8-HpCDF | ng/kg | -- | -- | -- | 130 | -- | -- | 89 | 6.5 | -- | -- | -- | -- | -- |
| 1,2,3,4,7,8,9-HpCDF | ng/kg | -- | -- | -- | 7.4 | -- | -- | 5.4 T | 0.43 U | -- | -- | -- | -- | -- |
| OCDF | ng/kg | -- | -- | -- | 570 | -- | -- | 420 | 12 | -- | -- | -- | -- | -- |
| Dioxin/Furan TEQ ND=0 | ng/Kg | -- | -- | -- | 36.942 | -- | -- | 23.596 | 0.9876 | -- | -- | -- | -- | -- |
| Dioxin/Furan TEQ ND=1/2 | ng/Kg | -- | -- | -- | 36.942 | -- | -- | 23.721 | 1.54525 | -- | -- | -- | -- | -- |
| **Non-SMS SVOCs** | | | | | | | | | | | | | | |
| 1-Methylnaphthalene | ug/kg | -- | -- | 20 U | 12 T | 20 U | 20 U | 20 U | 64 | 170 | 38 | 230 | 34 | 20 U |
| Hexachloroethane | ug/kg | -- | -- | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 59 U | 20 U | 20 U | 20 U | 20 U |
| 2,3,4,5-Tetrachlorophenol | ug/kg | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2,3,5,6-Tetrachlorophenol | ug/kg | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2,4,5-Trichlorophenol | ug/kg | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2,4,6-Trichlorophenol | ug/kg | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

| Analyte | Units | SQS/LAET | CSL/2LAET | SC-08 | SC-08 | SC-09 | SC-09 | SC-09 | 6B-03-SS | 6B-04-SS | 6B-01-DC | 6B-01-DC | 6B-02-DC | 6B-02-DC | AN-SS-29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample ID: | RGH-SC-08-2-4' | RGH-SC-08-4-5.5' | RGH-SC-09-0-2' | RGH-SC-09-2-4' | RGH-SC-09-4-5.5' | 6B-03-SS | 6B-04-SS | 6B-01-DC-1-2 | 6B-01-DC-2-3 | 6B-02-DC-1-2 | 6B-02-DC-2-3 | AN-SS-29 |
| | | | Sample Date: | 9/24/2008 | 9/24/2008 | 9/24/2008 | 9/24/2008 | 9/24/2008 | 8/22/2008 | 8/22/2008 | 4/30/2009 | 4/30/2009 | 4/30/2009 | 4/30/2009 | 6/7/2002 |
| | | | Sample Depth (feet): | 2-4 | 4-5.5 | 0-2 | 2-4 | 4-5.5 | 0-0.39 | 0-0.39 | 1-2 | 2-3 | 1-2 | 2-3 | 0-0.39 |
| **Conventional Parameters** | | | | | | | | | | | | | | | |
| Ammonia | mg/kg | – | – | – | – | – | – | – | 16.6 J | 16.9 J | – | – | – | – | – |
| Sulfide | mg/kg | – | – | – | – | – | – | – | 1960 | 2680 | – | – | – | – | – |
| Total Organic Carbon | Percent | – | – | 27.3 | 18.9 | 3.69 | 7.41 | 5.32 | 3.06 | 2.98 | – | – | 3.34 | 3.01 | 2.4 |
| Total Solids | Percent | – | – | 33.8 | 29.3 | 43.4 | 42.1 | 41.3 | 34.8 | 37.6 | – | – | 42.2 | 42.8 | 45 |
| **Metals** | | | | | | | | | | | | | | | |
| Mercury | mg/kg | 0.41 | 0.59 | 0.9 | 11.3 | 0.56 | 1.5 | 1.9 | 0.3 | 0.31 | 0.62 | 2.49 | 0.45 | – | – |
| **Aromatic Hydrocarbons (OC Normalized)** | | | | | | | | | | | | | | | |
| Total LPAH | mg/kg OC | 370 | 780 | 1.136 T | 8.471 T | 4.607 T | 3.941 T | 21.917 T | 2.549 T | 8.02 T | – | – | 0.689 T | 0.365 JT | – |
| Naphthalene | mg/kg OC | 99 | 170 | 0.099 | 0.444 | 0.407 T | 0.432 | 1.278 | 0.654 U | 0.772 | – | – | 0.599 U | 0.664 U | – |
| Acenaphthylene | mg/kg OC | 66 | 66 | 0.095 | 0.196 T | 0.379 T | 0.256 T | 1.654 | 0.654 U | 0.671 U | – | – | 0.599 U | 0.664 U | – |
| Acenaphthene | mg/kg OC | 16 | 57 | 0.062 T | 0.741 | 0.542 U | 0.189 T | 1.109 | 0.654 U | 0.671 U | – | – | 0.599 U | 0.664 U | – |
| Fluorene | mg/kg OC | 23 | 79 | 0.07 T | 0.582 | 0.325 T | 0.324 | 1.335 | 0.654 U | 0.872 | – | – | 0.599 U | 0.664 U | – |
| Phenanthrene | mg/kg OC | 100 | 480 | 0.659 | 4.127 | 2.602 | 1.619 | 12.782 | 1.863 | 4.362 | – | – | 0.689 | 0.365 J | – |
| Anthracene | mg/kg OC | 220 | 1200 | 0.15 | 2.381 | 0.894 | 1.12 | 3.759 | 0.686 | 2.013 | – | – | 0.599 U | 0.664 U | – |
| 2-Methylnaphthalene | mg/kg OC | 38 | 64 | 0.117 | 0.952 | 0.325 T | 0.351 | 1.316 | 0.654 U | 0.671 U | – | – | 0.599 U | 0.664 U | – |
| Total HPAH (SMS) | mg/kg OC | 960 | 5300 | 6.44 T | 28.127 T | 22.764 T | 19.946 T | 82.838 T | 16.667 T | 59.463 JT | – | – | 5.269 JT | 3.389 JT | – |
| Fluoranthene | mg/kg OC | 160 | 1200 | 1.209 | 10.582 | 4.607 | 5.398 | 22.556 | 3.268 | 9.396 | – | – | 1.138 | 0.731 | – |
| Pyrene | mg/kg OC | 1000 | 1400 | 0.916 | 5.82 | 3.523 | 3.374 | 13.346 | 2.451 | 6.711 | – | – | 1.377 | 0.897 | – |
| Benzo(a)anthracene | mg/kg OC | 110 | 270 | 0.696 | 2.593 | 2.629 | 2.564 | 5.827 | 1.83 | 5.369 | – | – | 0.539 J | 0.399 J | – |
| Chrysene | mg/kg OC | 110 | 460 | 0.806 | 3.28 | 4.336 | 3.104 | 9.774 | 2.941 | 23.154 | – | – | 0.838 | 0.598 J | – |
| Benzofluoranthenes (Sum) | mg/kg OC | 230 | 450 | 1.429 T | 3.175 T | 4.255 T | 3.104 T | 15.977 T | 3.889 T | 9.06 T | – | – | 0.958 JT | 0.764 JT | – |
| Benzo(a)pyrene | mg/kg OC | 99 | 210 | 0.879 | 1.799 | 2.114 | 1.484 | 9.023 | 1.503 | 3.356 | – | – | 0.419 J | 0.664 U | – |
| Indeno(1,2,3-cd)pyrene | mg/kg OC | 34 | 88 | 0.256 | 0.349 | 0.623 | 0.459 | 2.632 | 0.654 U | 0.805 | – | – | 0.599 U | 0.664 U | – |
| Dibenzo(a,h)anthracene | mg/kg OC | 12 | 33 | 0.073 U | 0.317 U | 0.542 U | 0.27 U | 0.883 | 0.784 | 0.94 J | – | – | 0.599 U | 0.664 U | – |
| Benzo(ghi)perylene | mg/kg OC | 31 | 78 | 0.249 | 0.529 | 0.678 | 0.459 | 2.82 | 0.654 U | 0.671 | – | – | 0.599 U | 0.664 U | – |
| **Chlorinated Benzenes (OC Normalized)** | | | | | | | | | | | | | | | |
| 1,2-Dichlorobenzene | mg/kg OC | 2.3 | 2.3 | 0.073 U | 0.317 U | 0.542 U | 0.27 U | 0.376 U | 0.199 U | 0.205 U | – | – | 0.599 U | 0.664 U | – |
| 1,4-Dichlorobenzene | mg/kg OC | 3.1 | 9 | 0.073 U | 0.317 U | 0.542 U | 0.27 U | 0.376 U | 0.654 U | 0.671 U | – | – | 0.599 U | 0.664 U | – |
| 1,2,4-Trichlorobenzene | mg/kg OC | 0.81 | 1.8 | 0.073 U | 0.317 U | 0.542 U | 0.27 U | 0.376 U | 0.199 U | 0.205 U | – | – | 0.599 U | 0.664 U | – |
| Hexachlorobenzene | mg/kg OC | 0.38 | 2.3 | 0.073 U | 0.317 U | 0.542 U | 0.27 U | 0.376 U | 0.199 U | 0.205 U | – | – | 0.599 U | 0.664 U | – |
| **Phthalates (OC Normalized)** | | | | | | | | | | | | | | | |
| Dimethyl phthalate | mg/kg OC | 53 | 53 | 0.073 U | 0.582 | 0.542 U | 0.27 U | 0.226 T | 0.654 U | 0.671 U | – | – | 0.599 U | 0.664 U | – |
| Diethyl phthalate | mg/kg OC | 61 | 110 | 0.073 U | 0.317 U | 0.542 U | 0.243 T | 0.376 U | 0.654 U | 0.671 U | – | – | 0.599 U | 0.664 U | – |
| Dibutyl phthalate | mg/kg OC | 220 | 1700 | 0.073 U | 1.005 | 0.542 U | 0.27 U | 0.376 U | 0.654 U | 0.671 U | – | – | 0.599 U | 0.664 U | – |
| Butyl benzyl phthalate | mg/kg OC | 4.9 | 64 | 0.073 U | 0.317 U | 0.542 U | 0.27 U | 0.376 U | 0.49 U | 0.537 | – | – | 0.599 U | 0.664 U | – |
| Bis(2-Ethylhexyl) Phthalate | mg/kg OC | 47 | 78 | 0.916 | 4.974 | 3.252 | 2.429 | 3.759 | 0.654 U | 1.141 | – | – | 0.359 J | 0.664 U | – |
| Di-N-Octyl Phthalate | mg/kg OC | 58 | 4500 | 0.22 U | 1.058 U | 0.542 U | 0.796 U | 1.109 U | 0.654 U | 0.671 U | – | – | 0.599 U | 0.664 U | – |

| Analyte | Units | SQS/LAET | CSL/2LAET | SC-08 | SC-08 | SC-09 | SC-09 | SC-09 | 6B-03-SS | 6B-04-SS | 6B-01-DC | 6B-01-DC | 6B-02-DC | 6B-02-DC | AN-SS-29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample ID: | RGH-SC-08-2-4' | RGH-SC-08-4-5.5' | RGH-SC-09-0-2' | RGH-SC-09-2-4' | RGH-SC-09-4-5.5' | 6B-03-SS | 6B-04-SS | 6B-01-DC-1-2 | 6B-01-DC-2-3 | 6B-02-DC-1-2 | 6B-02-DC-2-3 | AN-SS-29 |
| | | | Sample Date: | 9/24/2008 | 9/24/2008 | 9/24/2008 | 9/24/2008 | 9/24/2008 | 8/22/2008 | 8/22/2008 | 4/30/2009 | 4/30/2009 | 4/30/2009 | 4/30/2009 | 6/7/2002 |
| | | | Sample Depth (feet): | 2-4 | 4-5.5 | 0-2 | 2-4 | 4-5.5 | 0-0.39 | 0-0.39 | 1-2 | 2-3 | 1-2 | 2-3 | 0-0.39 |
| **Miscellaneous (OC Normalized)** | | | | | | | | | | | | | | | |
| Dibenzofuran | mg/kg OC | 15 | 58 | 0.073 U | 0.582 | 0.542 U | 0.202 T | 0.789 | 0.654 U | 0.705 | – | – | 0.599 U | 0.664 U | – |
| Hexachlorobutadiene | mg/kg OC | 3.9 | 6.2 | 0.073 U | 0.317 U | 0.542 U | 0.27 U | 0.376 U | – | – | – | – | – | – | – |
| N-Nitrosodiphenylamine | mg/kg OC | 11 | 11 | 0.073 U | 0.317 U | 0.542 U | 0.27 U | 0.376 U | 0.199 U | 0.225 U | – | – | 0.599 U | 0.664 U | – |
| **Ionizable Organic Compounds (dry weight)** | | | | | | | | | | | | | | | |
| Phenol | µg/kg | 420 | 1200 | 15 T | 60 U | 20 U | 260 | 22 | 20 U | 20 U | – | – | 20 U | 20 U | – |
| o-Cresol (2-methylphenol) | ug/kg | 63 | 63 | 20 U | 60 U | 20 U | 20 U | 20 U | 6.1 U | 6.1 U | – | – | 20 U | 20 U | – |
| p-Cresol (4-methylphenol) | ug/kg | 670 | 670 | 21 | 48 T | 20 U | 76 | 27 | 20 U | 24 | – | – | 20 U | 20 U | – |
| 2,4-Dimethylphenol | ug/kg | 29 | 29 | 20 U | 60 U | 20 U | 20 U | 20 U | 6.1 UJ | 6.1 UJ | – | – | 20 U | 20 U | – |
| Pentachlorophenol | ug/kg | 360 | 690 | 450 | 4100 | 91 T | 260 | 420 | 56 | 86 | – | – | 99 U | 100 U | – |
| Benzyl Alcohol | ug/kg | 57 | 73 | 20 U | 60 U | 20 U | 20 U | 20 U | 20 UJ | 20 UJ | – | – | 20 U | – | – |
| Benzoic Acid | ug/kg | 650 | 650 | 200 U | 600 U | 200 U | 200 U | 200 U | 200 UJ | 200 UJ | – | – | 200 U | 200 UJ | – |
| **Aromatic Hydrocarbons (dry weight)** | | | | | | | | | | | | | | | |
| Total LPAH | ug/kg | 52000 | 61000 | 310 T | 1601 T | 170 T | 292 T | 1166 T | 78 T | 239 T | – | – | 23 T | 11 JT | – |
| Naphthalene | ug/kg | 2100 | 2400 | 27 | 84 | 15 T | 32 | 68 | 20 U | 23 | – | – | 20 U | 20 U | – |
| Acenaphthylene | ug/kg | 1300 | 1300 | 26 | 37 T | 14 T | 19 T | 88 | 20 U | 20 U | – | – | 20 U | 20 U | – |
| Acenaphthene | ug/kg | 500 | 730 | 17 T | 140 | 20 U | 14 T | 59 | 20 U | 20 U | – | – | 20 U | 20 U | – |
| Fluorene | ug/kg | 540 | 1000 | 19 T | 110 | 12 T | 24 | 71 | 20 U | 26 | – | – | 20 U | 20 U | – |
| Phenanthrene | ug/kg | 1500 | 5400 | 180 | 780 | 96 | 120 | 680 | 57 | 130 | – | – | 23 | 11 J | – |
| Anthracene | ug/kg | 960 | 4400 | 41 | 450 | 33 | 83 | 200 | 21 | 60 | – | – | 20 U | 20 U | – |
| 2-Methylnaphthalene | ug/kg | 670 | 1400 | 32 | 180 | 12 T | 26 | 70 | 20 U | 20 U | – | – | 20 U | 20 U | – |
| Total HPAH | ug/kg | 12000 | 17000 | 1758 T | 5316 T | 840 T | 1478 T | 4407 T | 510 T | 1772 JT | – | – | 176 JT | 102 JT | – |
| Fluoranthene | ug/kg | 1700 | 2500 | 330 | 2000 | 170 | 400 | 1200 | 100 | 280 | – | – | 38 | 22 | – |
| Pyrene | ug/kg | 2600 | 3300 | 250 | 1100 | 130 | 250 | 710 | 75 | 200 | – | – | 46 | 27 | – |
| Benzo(a)anthracene | ug/kg | 1300 | 1600 | 190 | 490 | 97 | 190 | 310 | 56 | 160 | – | – | 18 J | 12 J | – |
| Chrysene | ug/kg | 1400 | 2800 | 220 | 620 | 160 | 230 | 520 | 90 | 690 | – | – | 28 | 18 J | – |
| Benzo(b)fluoranthene | ug/kg | | | 220 | 330 | 80 | 120 | 440 | 69 | 160 | – | – | 18 J | 12 J | – |
| Benzo(k)fluoranthene | ug/kg | | | 170 | 270 | 77 | 110 | 410 | 50 | 110 | – | – | 14 J | 11 J | – |
| Benzofluoranthenes (Sum) | ug/kg | 3200 | 3600 | 390 T | 600 T | 157 T | 230 T | 850 T | 119 T | 270 T | – | – | 32 JT | 23 JT | – |
| Benzo(a)pyrene | ug/kg | 1600 | 3000 | 240 | 340 | 78 | 110 | 480 | 46 | 100 | – | – | 14 J | 20 U | – |
| Indeno(1,2,3-cd)pyrene | ug/kg | 600 | 690 | 70 | 66 | 23 | 34 | 140 | 20 U | 24 | – | – | 20 U | 20 U | – |
| Dibenzo(a,h)anthracene | ug/kg | 230 | 540 | 20 U | 60 U | 20 U | 20 U | 47 | 24 | 28 J | – | – | 20 U | 20 U | – |
| Benzo(ghi)perylene | ug/kg | 670 | 720 | 68 | 100 | 25 | 34 | 150 | 20 U | 20 | – | – | 20 U | 20 U | – |
| **Chlorinated Benzenes (dry weight)** | | | | | | | | | | | | | | | |
| 1,2-Dichlorobenzene | ug/kg | 35 | 50 | 20 U | 60 U | 20 U | 20 U | 20 U | 6.1 U | 6.1 U | – | – | 20 U | 20 U | – |
| 1,3-Dichlorobenzene | ug/kg | – | – | 20 U | 60 U | 20 U | 20 U | 20 U | 20 U | 20 U | – | – | 20 U | 20 U | – |
| 1,4-Dichlorobenzene | ug/kg | 110 | 120 | 20 U | 60 U | 20 U | 20 U | 20 U | 20 U | 20 U | – | – | 20 U | 20 U | – |
| 1,2,4-Trichlorobenzene | ug/kg | 31 | 51 | 20 U | 60 U | 20 U | 20 U | 20 U | 6.1 U | 6.1 U | – | – | 20 U | 20 U | – |
| Hexachlorobenzene | ug/kg | 70 | 130 | 20 U | 60 U | 20 U | 20 U | 20 U | 6.1 U | 6.1 U | – | – | 20 U | 20 U | – |
| **Phthalates (dry weight)** | | | | | | | | | | | | | | | |
| Dimethyl phthalate | ug/kg | 71 | 160 | 20 U | 110 | 20 U | 20 U | 12 T | 20 U | 20 U | – | – | 20 U | 20 U | – |
| Diethyl phthalate | ug/kg | 200 | 1200 | 20 U | 60 U | 20 U | 18 T | 20 U | 20 U | 20 U | – | – | 20 U | 20 U | – |
| Dibutyl phthalate | ug/kg | 1400 | 5100 | 20 U | 190 | 20 U | 20 U | 20 U | 20 U | 20 U | – | – | 20 U | 20 U | – |
| Butyl benzyl phthalate | ug/kg | 63 | 900 | 20 U | 60 U | 20 U | 20 U | 20 U | 15 U | 16 | – | – | 20 U | 20 U | – |
| Bis(2-Ethylhexyl) Phthalate | ug/kg | 1300 | 3100 | 250 | 940 | 120 | 180 | 200 | 20 U | 34 | – | – | 12 J | 20 U | – |
| Di-N-Octyl Phthalate | ug/kg | 5200 | 6200 | 60 U | 200 U | 20 U | 59 U | 59 U | 20 U | 20 U | – | – | 20 U | 20 U | – |

| | | | | SC-08 | SC-08 | SC-09 | SC-09 | SC-09 | 6B-03-SS | 6B-04-SS | 6B-01-DC | 6B-01-DC | 6B-02-DC | 6B-02-DC | AN-SS-29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample ID: | RGH-SC-08-2-4' | RGH-SC-08-4-5.5' | RGH-SC-09-0-2' | RGH-SC-09-2-4' | RGH-SC-09-4-5.5' | 6B-03-SS | 6B-04-SS | 6B-01-DC-1-2 | 6B-01-DC-2-3 | 6B-02-DC-1-2 | 6B-02-DC-2-3 | AN-SS-29 |
| | | | Sample Date: | 9/24/2008 | 9/24/2008 | 9/24/2008 | 9/24/2008 | 9/24/2008 | 8/22/2008 | 8/22/2008 | 4/30/2009 | 4/30/2009 | 4/30/2009 | 4/30/2009 | 6/7/2002 |
| | | | Sample Depth (feet): | 2-4 | 4-5.5 | 0-2 | 2-4 | 4-5.5 | 0-0.39 | 0-0.39 | 1-2 | 2-3 | 1-2 | 2-3 | 0-0.39 |
| **Analyte** | **Units** | **SQS/LAET** | **CSL/2LAET** | | | | | | | | | | | | |
| **Miscellaneous (dry weight)** | | | | | | | | | | | | | | | |
| Dibenzofuran | ug/kg | 540 | 700 | 20 U | 110 | 20 U | 15 T | 42 | 20 U | 21 | – | – | 20 U | 20 U | – |
| Hexachlorobutadiene | ug/kg | 11 | 120 | 20 U | 60 U | 20 U | 20 U | 20 U | – | – | – | – | – | – | – |
| N-Nitrosodiphenylamine | ug/kg | 28 | 40 | 20 U | 60 U | 20 U | 20 U | 20 U | 6.1 U | 6.7 U | – | – | 20 U | 20 U | – |
| **Petroleum Hydrocarbons** | | | | | | | | | | | | | | | |
| Diesel-range hydrocarbons | mg/kg | 200 | – | 320 | 670 | 300 | 130 | 360 | – | – | – | – | – | – | – |
| Heavy Oil-Range Hydrocarbons | mg/kg | 200 | – | 800 | 690 | 500 | 300 | 950 | – | – | – | – | – | – | – |
| Total TPH | mg/kg | 200 | – | 1120 T | 1360 T | 800 T | 430 T | 1310 T | – | – | – | – | – | – | – |
| **Dioxin Furans** | | | | | | | | | | | | | | | |
| 2,3,7,8-TCDD | ng/kg | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| 1,2,3,7,8-PeCDD | ng/kg | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| 1,2,3,4,7,8-HxCDD | ng/kg | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| 1,2,3,6,7,8-HxCDD | ng/kg | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| 1,2,3,7,8,9-HxCDD | ng/kg | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| 1,2,3,4,6,7,8-HpCDD | ng/kg | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| OCDD | ng/kg | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| 2,3,7,8-TCDF | ng/kg | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| 1,2,3,7,8-PeCDF | ng/kg | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| 2,3,4,7,8-PeCDF | ng/kg | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| 1,2,3,4,7,8-HxCDF | ng/kg | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| 1,2,3,6,7,8-HxCDF | ng/kg | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| 1,2,3,7,8,9-HxCDF | ng/kg | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| 2,3,4,6,7,8-HxCDF | ng/kg | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| 1,2,3,4,6,7,8-HpCDF | ng/kg | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| 1,2,3,4,7,8,9-HpCDF | ng/kg | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| OCDF | ng/kg | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| Dioxin/Furan TEQ ND=0 | ng/Kg | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| Dioxin/Furan TEQ ND=1/2 | ng/Kg | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| **Non-SMS SVOCs** | | | | | | | | | | | | | | | |
| 1-Methylnaphthalene | ug/kg | – | – | 27 | 120 | 10 T | 25 | 58 | 20 U | 20 U | – | – | 20 U | 20 U | – |
| Hexachloroethane | ug/kg | – | – | 20 U | 60 U | 20 U | 20 U | 20 U | 20 U | 20 U | – | – | 20 U | 20 U | – |
| 2,3,4,5-Tetrachlorophenol | ug/kg | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| 2,3,5,6-Tetrachlorophenol | ug/kg | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| 2,4,5-Trichlorophenol | ug/kg | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| 2,4,6-Trichlorophenol | ug/kg | – | – | – | – | – | – | – | – | – | – | – | – | – | – |

**Notes:**

**Bold** indicates that the analyte was detected.

(yellow) Value is greater than SQS/LAET

(orange) Value is greater than CSL/2LAET

(light blue) Detection Limit great than Screening Level

mg/kg = milligrams per kilogram

mg/kg-oc = milligrams per kilogram organic carbon normalized

ng/kg = nanograms per kilogram

ug/kg = micrograms per kilogram

C = Result confirmed on second confirmation column.

D = The reported result is from dilution.

E = Estimated result, concentration exceeds calibration range.

J = Estimated value

U = Not detected at or above identified value.

UJ = Compound analyzed, but not detected above estimated detection limit.

T = Value is between the method reporting limit and the method detection limit.

-- = Sample was not submitted for chemical analyses

SQS = Sediment Management Standards Sediment Quality Standard (Chapter 173-204-320)

CSL = Sediment Management Standards Cleanup Screening Level (Chapter 173-204-520)

LAET = Lowest Apparent Effects Threshold (1988 Puget Sound Estuary Program)

2LAET = Second Lowest Effects Threshold (1988 Puget Sound Estuary Program)

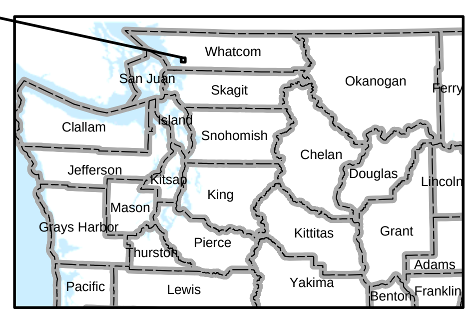
Total LPAHs are the total of Napthalene, Acenapthylene, Acenapthene, Fluorene, Phenanthrene and Anthracene; 2-Methylnapthalene is not included in the sum of LPAHs.

Total HPAHs are the total of Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzofluoranthenes, Benzo(a)pyrene, Indeno(1,2,3-c-d)pyrene, Dibenzo(a,h)anthracene and Benzo(g,h,i)perylene.

Benzo(j)fluoranthene is included in the total of benzo(b&k)fluoranthenes

Totals are calculated for LPAH and HPAH as the sum of all detected results.  If all are undetected results, the highest reporting limit value is reported as the sum.

Non-organic carbon normalized samples with TOC results outside of the 0.5-3.5% range were screened against the 1988 Puget Sound Estuary Program Apparent Effects Threshold values (i.e., LAET and 2LAET).


0 1,000 2,000 Feet

N

All locations are approximate.

Lambert Conformal Conic
Washington State Plane North
North American Datum 1983

Data Sources: Interstates, state routes, and roads from TIGER 2000.
County boundaries, cities, and waterbodies from Department of Ecology.

Map Revised: February 24, 2006

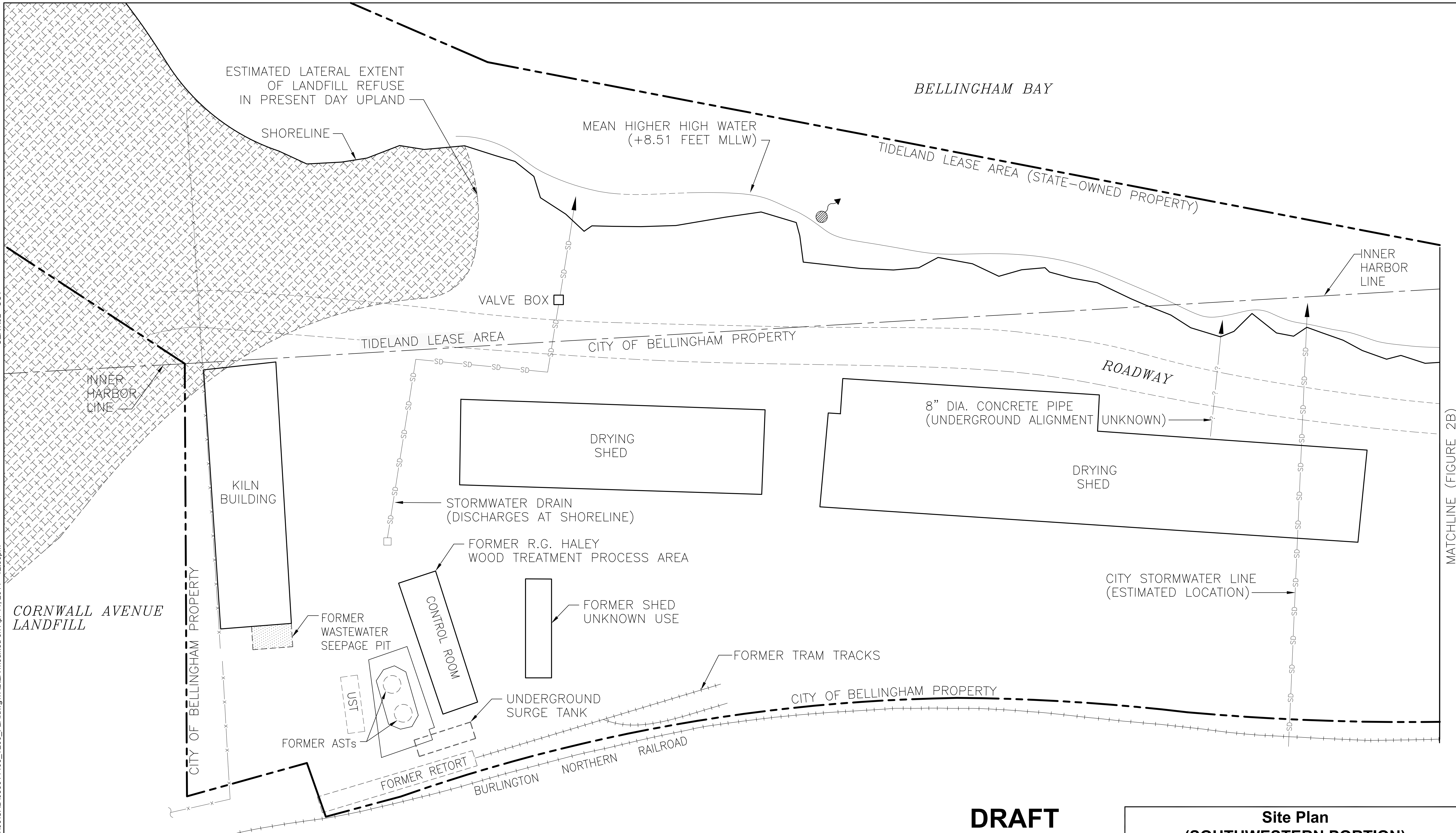
Path: P:\0\0257002\01\CAD\0257000201_VM_Fig1.pdf

Office: SEA

GEOENGINEERS

**VICINITY MAP**

**FIGURE 1**




Notes: 1. The locations of all features shown are approximate.

2. This figure is for informational purposes only. It is intended to assist in the identification of features discussed in a related document. Data were compiled from sources as listed in this figure. 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. This figure is a copy of a master document. The master hard copy is stored by GeoEngineers, Inc. and will serve as the official document of record.

References: Ronald T. Jepson and Associates, April 1990, April 2000. Ecology and Environment, May 1986.

EXPLANATION:

- LANDFILL REFUSE
- FORMER OIL SEEP
- AST ABOVEGROUND STORAGE TANK
- UST UNDERGROUND STORAGE TANK

**Site Plan (SOUTHWESTERN PORTION)**

R.G. Haley International Site
Bellingham, Washington

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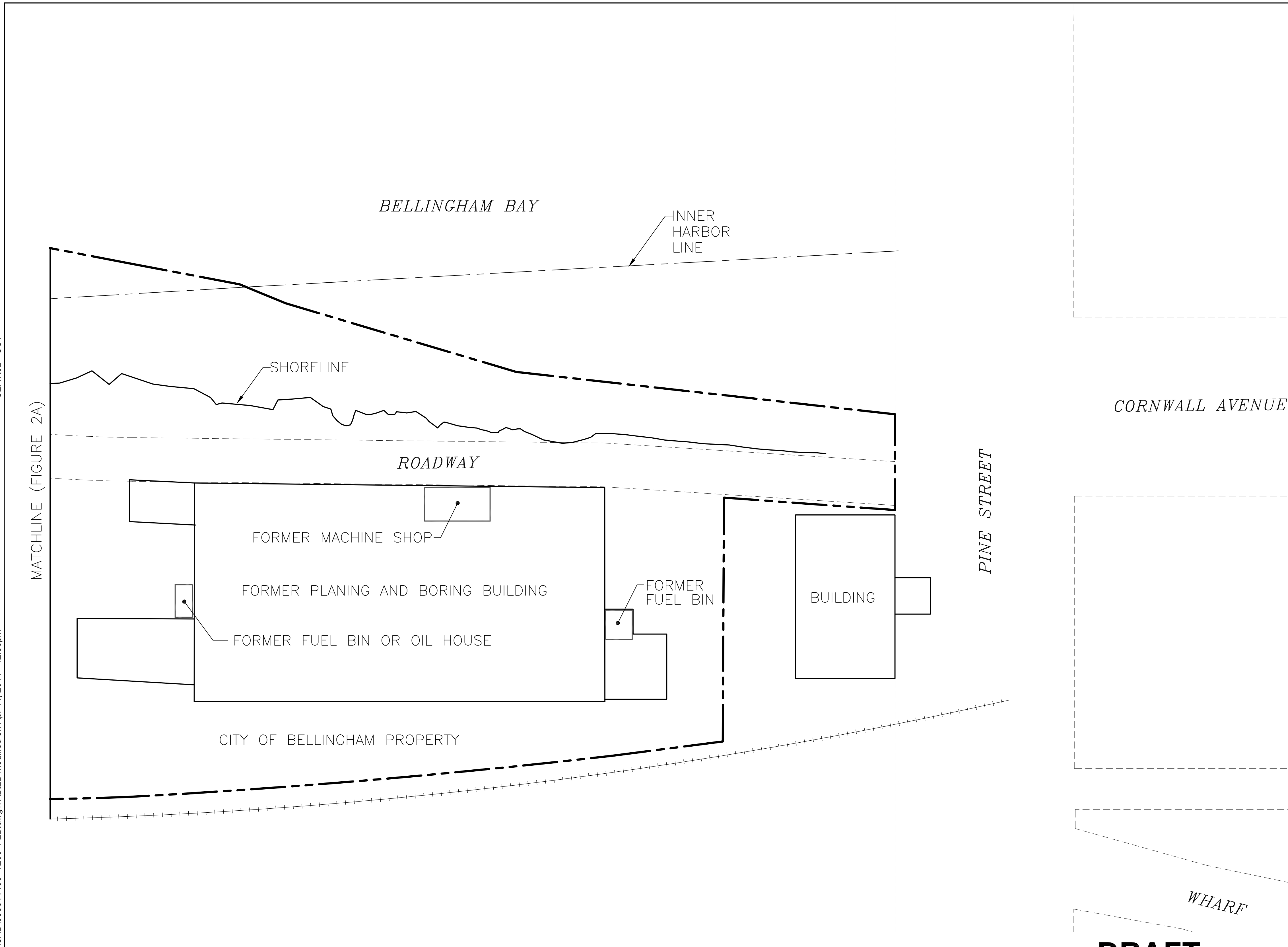
**Figure 2A**

D:\PROJECT\SEATTLE\0356114\06\CAD\035611406_T200_F2A.dwg\TAB:2A modified on Apr 11, 2011 - 12:56pm

SEAT:JL : SCY




Notes: 1. The locations of all features shown are approximate.
2. This figure is for informational purposes only. It is intended to assist in the identification of features discussed in a related document. Data were compiled from sources as listed in this figure. The data sources do not guarantee these data are accurate or complete. There may have been updates to thedata since the publication of this figure. This figure is a copy of a master document. The master hard copy is stored by GeoEngineers, Inc. and will serve as the official document of record.

References: Ronald T. Jepson and Associates, April 1990, April 2000. Ecology and Environment, May 1986.

**Site Plan (NORTHEASTERN PORTION)**

R.G. Haley International Site
Bellingham, Washington

GEOENGINEERS

**Figure 2B**

D:\PROJECT\SEATTLE\0356114\06\CAD\035611406_T200_F2B.dwg\TAB:2B modified on Apr 11, 2011 - 12:56pm

SEAT:JL : SCY


Map Revised: April 21, 2011 AMM

Path: W:\Tacoma\Projects\0\0356114\GIS\0356114\06_SedSampleLocs_Aerial.mxd

Office: TACO

Reference: Bing Maps Aerial Imagery, 2010. Walker and Associates Photograph, 1950.
Extent of Cornwall Landfill refuse approximated from Figure 8-2 of Ecology Review Draft, Cornwall Avenue Landfill Remedial Investigation/Feasibility Study. Bellingham, WA, Landau Associates Inc, 2009.

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.

0 200
Feet

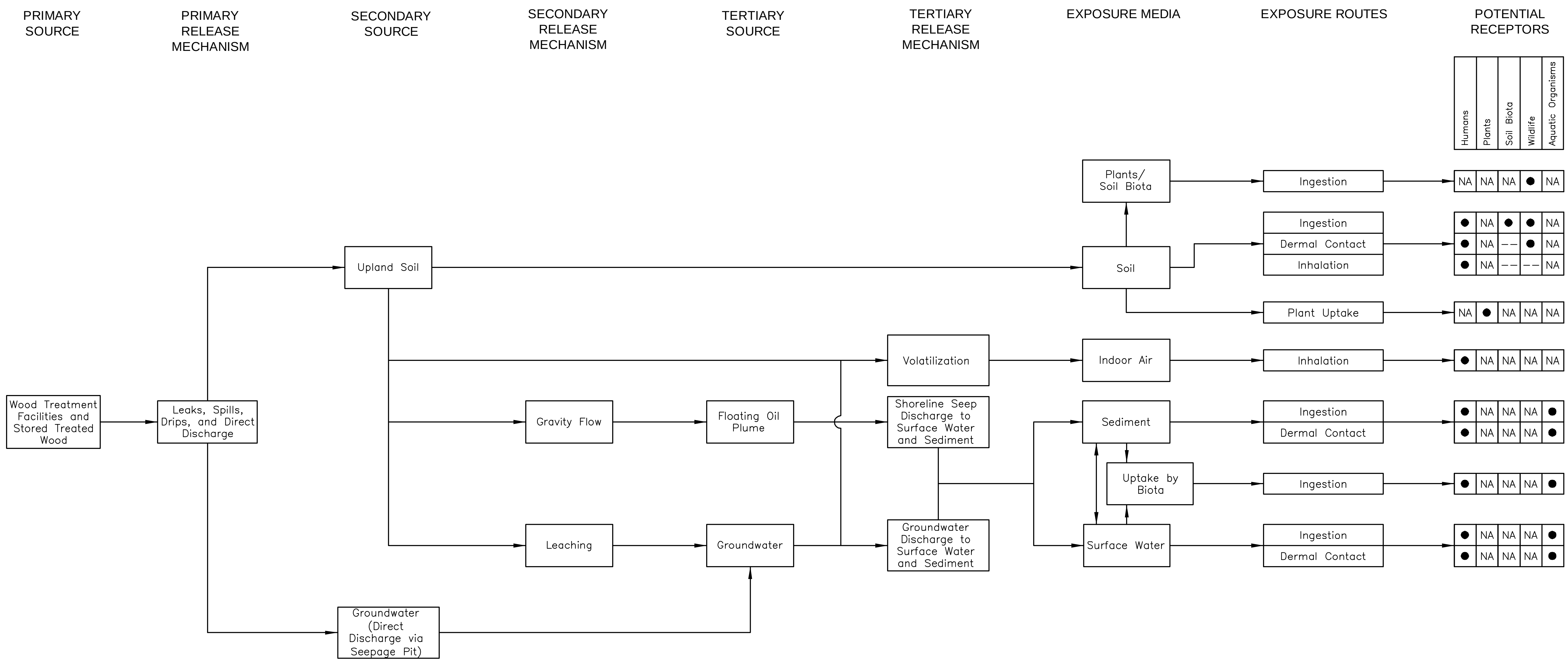
- Features Associated with Former R.G. Haley International Operations
- Existing Sheetpile Barrier
- Current Shoreline
- Storm Drains

**Historical Features: 1950 Aerial Photograph Overlay on 2008 Aerial Photograph**

R. G. Haley International Site
Bellingham, Washington

GeoEngineers

**Figure 3**




EXPLANATION:

● POTENTIALLY COMPLETE EXPOSURE PATHWAY

–– POTENTIALLY COMPLETE, BUT INSIGNIFICANT, EXPOSURE PATHWAY

NA NOT APPLICABLE

Notes:
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**Conceptual Site Exposure Model**

R.G. Haley International Site
Bellingham, Washington

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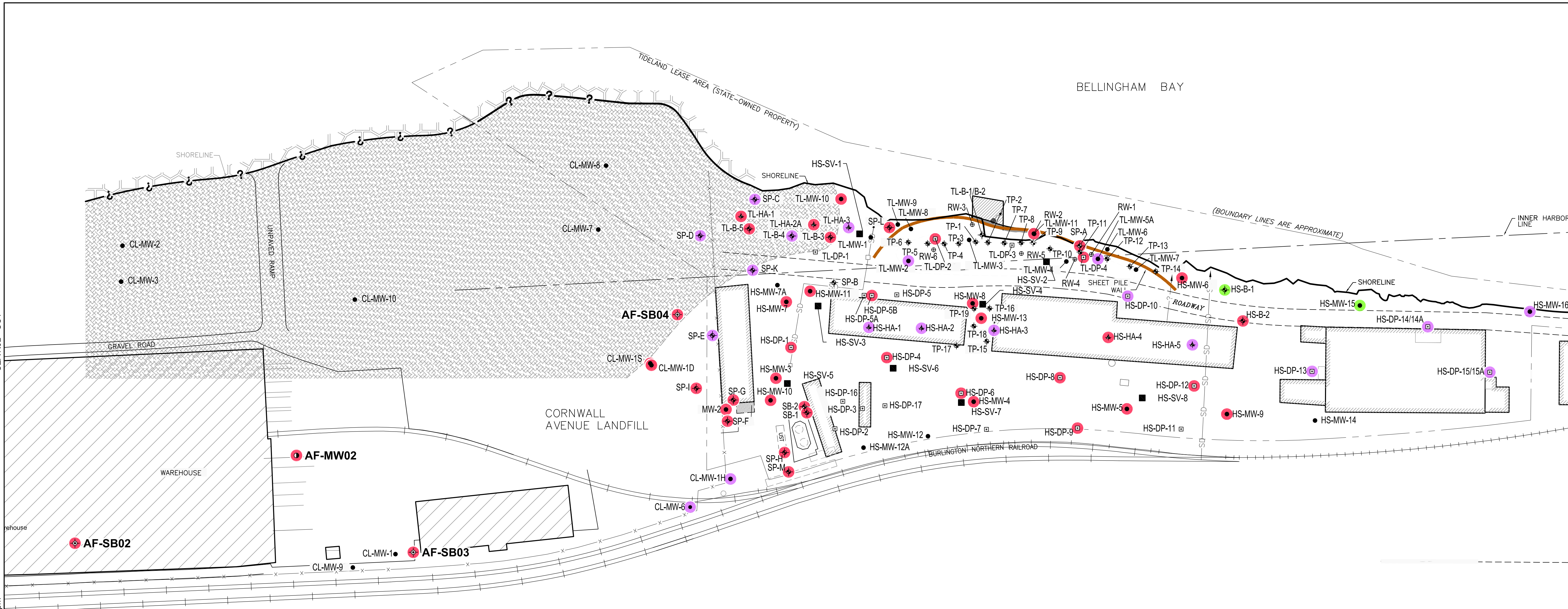
**Figure 4**




## Legend

| | |
|---|---|
| AF-MW01 | Approximate Location of Aspect Consulting Monitoring Well (2004) |
| AF-SB01 | Approximate Location of Aspect Consulting Boring (2004) |
| HS-MW-1 | Exploratory Borehole for Monitoring Well |
| HS/SB/SP | Boring |
| HS-DP-4 | Direct Push Boring |
| HS-SV-1 | Soil Vapor Sample Location |
| HS-HA-1 | Hand Auger |
| RW-1 | Recovery Well |
| B-1 | Temporary Groundwater Sampling Point |
| TP-15 | Test Pit |
| | Former Oil Seep |
| UST | Underground Storage Tank |
| | Sheetpile Barrier |
| | Estimated extent of upland refuse based on Landau Associates, January 27, 2003, Ecology Review Draft RI/FS Cornwall Avenue landfill, Bellingham, Washington, Figure 3-8 |
| | Riprap Shoreline |

## Preliminary Comparison of 2007 Haley RI Soil Analytical Results to Revised Soil Screening Levels

- Explorations in which one or more soil constituents exceed revised screening levels
- Explorations in which soil constituents are less than revised screening levels
- Explorations with insufficient soil analytical data

# DRAFT

120 0 120
FEET

## Notes

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

Reference: CAD files "R2000geoeng_haleybase50x" revised 07/28/04 by Pacific Survey & Engineering Inc., file "Fig3-8" dated August 2002 by Landau Associates, and files "027500201T1LM" and "027500201T1A" dated 03/29/04 by GeoEngineers.

**Summary of 2007 Haley RI Soil Results**

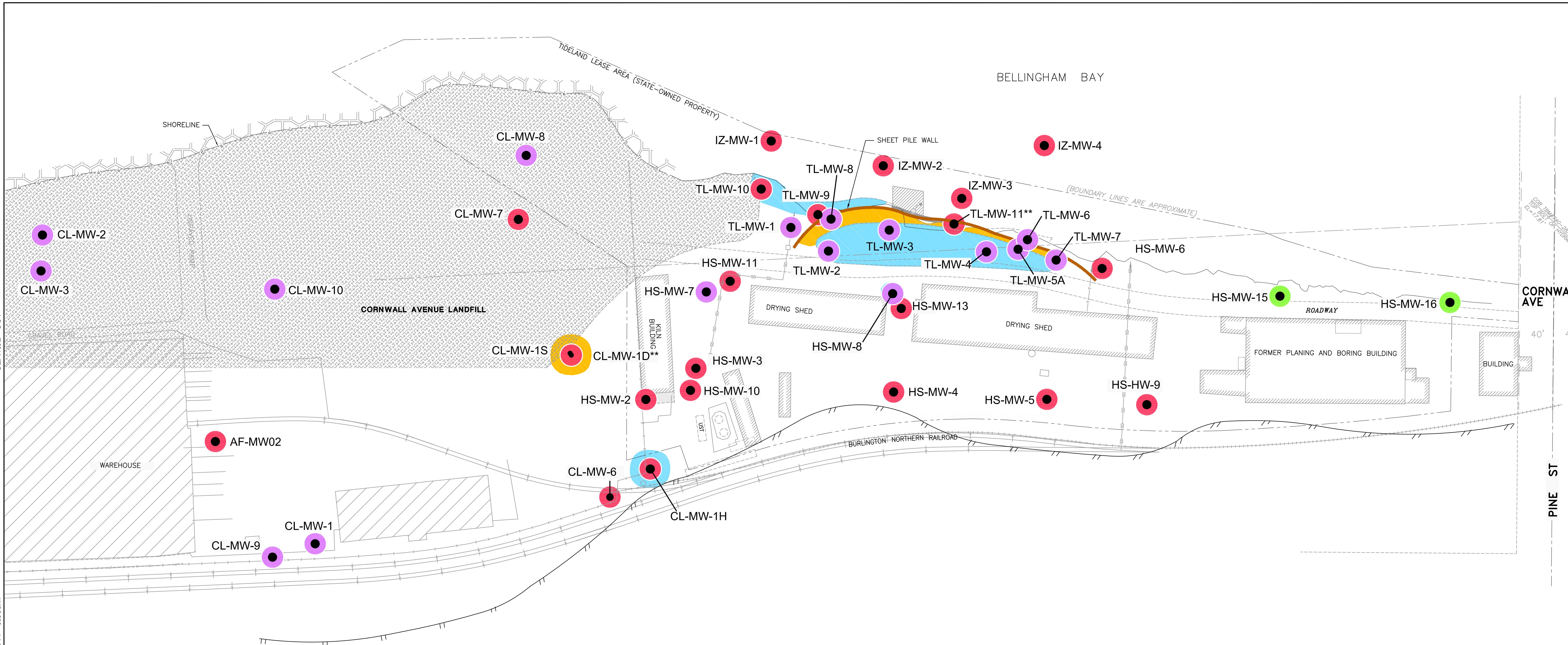
R.G. Haley International Site
Bellingham, Washington

GEOENGINEERS

**Figure 5**

D:\PROJECTS\SEATTLE\0356114\06\CAD\035611406_T200_F5.dwg\TAB:F5 modified on Apr 11, 2011 - 1:35pm

SEAT:JL : SCY




## Legend

IZ-MW-1 ● Monitoring Well

Interpolated area with past occurrence of measureable floating free product

Interpolated area with past occurrence of trace floating free product

UST Underground Storage Tank

Upgradient Extent of Shallow Aquifer

Sheetpile Barrier

Estimated extent of upland refuse based on Landau Associates, January 27, 2003, Ecology Review Draft RI/FS Cornwall Avenue landfill, Bellingham, Washington, Figure 3-8

Riprap Shoreline

## Preliminary Comparison of 2007 Haley RI Groundwater Results to Revised Groundwater Screening Levels

Monitoring wells in which one or more constituents exceed revised screening levels

Monitoring wells in which constituents are less than revised screening levels

Monitoring wells with insufficient groundwater analytical data

**DRAFT**

120 0 120
FEET

## Notes

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

Reference: CAD files "R2000geoeng_haleybase50x" revised 07/28/04 by Pacific Survey & Engineering Inc., file "Fig3-8" dated August 2002 by Landau Associates, and files "027500201T1LM" and "027500201T1A" dated 03/29/04 by GeoEngineers.

**Summary of 2007 Haley RI Groundwater Results**

R.G. Haley International Site
Bellingham, Washington

GEOENGINEERS

**Figure 6**

D:\PROJECT\SEATTLE\0356114\06\CAD\035611406_T200_F6.dwg\TAB:F6 modified on Apr 21, 2011 - 9:39am

SEAT:JL : SCY


Reference: Imagery from Bing Maps, ESRI Data Online.

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.

**Sample Type**

- Surface Sediment Sample Location With Sample Analysis
- Subsurface Sediment Sample Location With Sample Analysis
- Surface and Subsurface Sediment Sample Location With Sample Analysis
- Surface and/or Subsurface Sediment Sample Location With Visual Characterization

**Sample Study Source**

- RG Haley Preliminary Screening Study Sample Location (GeoEngineers 2003)
- RG Haley Remedial Investigation Sample Location (GeoEngineers 2004)
- RG Haley Supplemental Remedial Investigation Sample Location (GeoEngineers 2005)
- RG Haley and Bellingham Bay Piling Study Sample Location (Hart Crowser 2008)
- Whatcom Waterway Pre-Remedial Design Evaluation Sample Location (Anchor 2002)
- Whatcom Waterway Pre-remedial Design Investigation Sample Location (Anchor QEA 2010)
- Whatcom Waterway Remedial Investigation Sample Location (Anchor and Hart Crowser 1996)

**RG Haley Sediment Sample Locations and Whatcom Waterway and Cornwall Landfill Remediation Boundaries**

R. G. Haley International Site
Bellingham, Washington

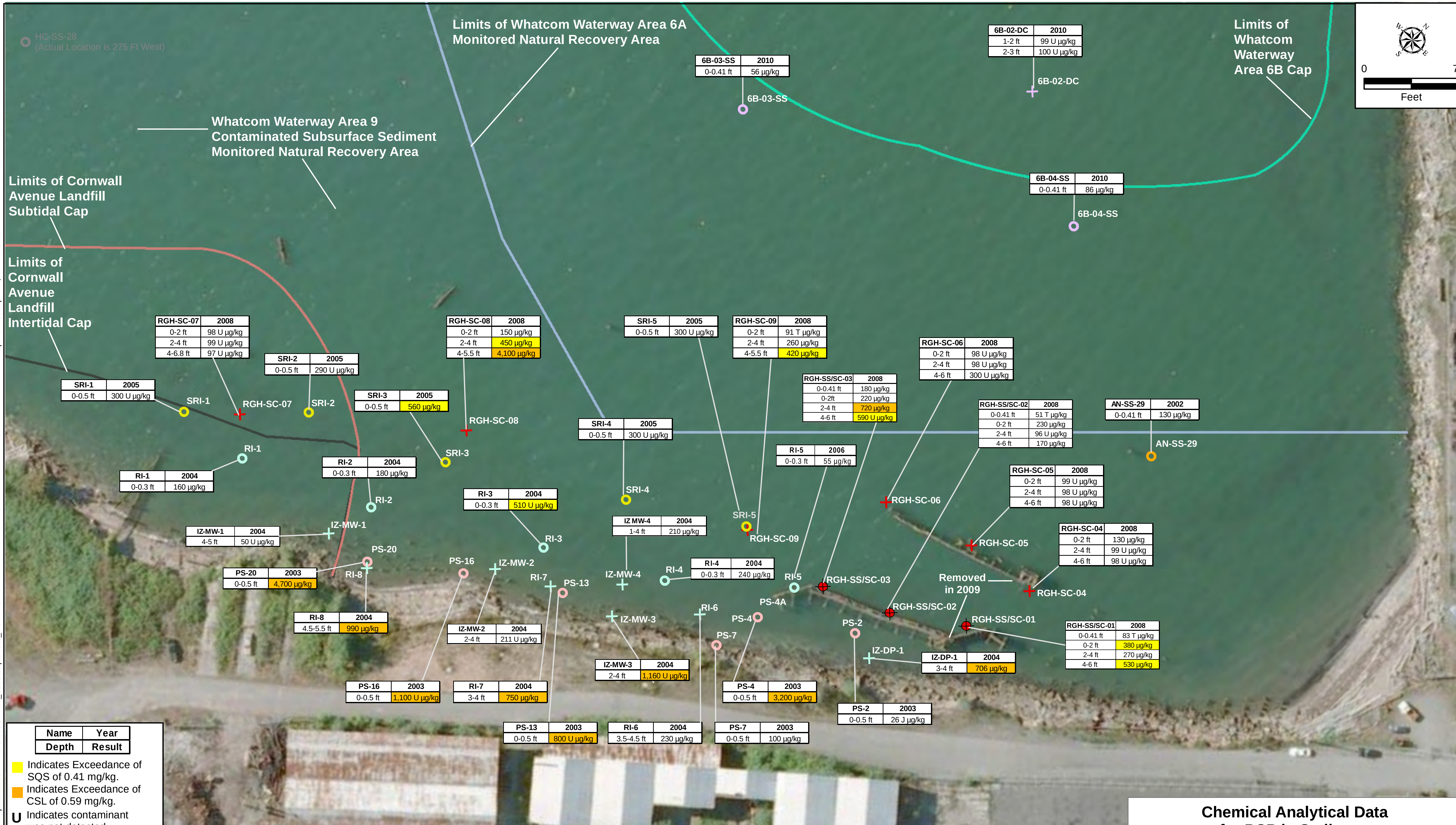
GEOENGINEERS

**Figure 7**

Map Revised: April 21, 2011 CRC:AMM

Path: W:\Tacoma\Projects\0\0356114\GIS\035611406_SedSampleLocs.mxd

Office: TACO




CRC:AMM

Map Revised: April 21, 2011

Path: W:\Tacoma\Projects\0\0356114\GIS\035611406_SedSampleLocs_PCP.mxd

Office: TACO

Reference: Imagery from Bing Maps, ESRI Data Online.

Notes:
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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.

Note: Sample location symbols and designations are gray for locations where the test presented in the figure has not been performed.

**Sample Type**

- Surface Sediment Sample Location With Sample Analysis
- Subsurface Sediment Sample Location With Sample Analysis
- Surface and Subsurface Sediment Sample Location With Sample Analysis

**Sample Study Source**

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- RG Haley Remedial Investigation Sample Location (GeoEngineers 2004)
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- Whatcom Waterway Pre-remedial Design Investigation Sample Location (Anchor QEA 2010)
- Whatcom Waterway Remedial Investigation Sample Location (Anchor and Hart Crowser 1996)

## Chemical Analytical Data for PCP in Sediment

R. G. Haley International Site
Bellingham, Washington

GeoEngineers

**Figure 8**


| RGH-SC-07 | | 2008 | |
|---|---|---|---|
| Depth | Diesel | Oil | Total |
| 0-2 ft | 63 mg/kg | 170 mg/kg | 233 mg/kg |
| 2-4 ft | 210 mg/kg | 190 mg/kg | 400 mg/kg |
| 4-6.8 ft | 330 mg/kg | 650 mg/kg | 980 mg/kg |

| RGH-SC-08 | | 2008 | |
|---|---|---|---|
| Depth | Diesel | Oil | Total |
| 0-2 ft | 210 mg/kg | 670 mg/kg | 880 mg/kg |
| 2-4 ft | 320 mg/kg | 800 mg/kg | 1,120 mg/kg |
| 4-5.5 ft | 570 mg/kg | 790 mg/kg | 1,360 mg/kg |

| RGH-SS/SC-03 | | 2008 | |
|---|---|---|---|
| Depth | Diesel | Oil | Total |
| 0-0.41 ft | 17 mg/kg | 63 mg/kg | 80 mg/kg |
| 0-2 ft | 46 mg/kg | 140 mg/kg | 186 mg/kg |
| 2-4 ft | 180 mg/kg | 510 mg/kg | 690 mg/kg |
| 4-6 ft | 110 mg/kg | 240 mg/kg | 350 mg/kg |

| RGH-SC-06 | | 2008 | |
|---|---|---|---|
| Depth | Diesel | Oil | Total |
| 0-2 ft | 61 mg/kg | 99 mg/kg | 160 mg/kg |
| 2-4 ft | 50 mg/kg | 64 mg/kg | 114 mg/kg |
| 4-6 ft | 110 mg/kg | 190 mg/kg | 300 mg/kg |

| RGH-SC-05 | | 2008 | |
|---|---|---|---|
| Depth | Diesel | Oil | Total |
| 0-2 ft | 120 mg/kg | 200 mg/kg | 320 mg/kg |
| 2-4 ft | 12 mg/kg | 21 U mg/kg | 12 mg/kg |
| 4-6 ft | 41 mg/kg | 72 mg/kg | 113 mg/kg |

| IZ-MW-4 | | 2004 | |
|---|---|---|---|
| Depth | Diesel | Oil | Total |
| 1-4 ft | 1,120 mg/kg | 1,310 mg/kg | 2,430 mg/kg |

| RGH-SC-09 | | 2008 | |
|---|---|---|---|
| Depth | Diesel | Oil | Total |
| 0-2 ft | 300 mg/kg | 500 mg/kg | 800 mg/kg |
| 2-4 ft | 130 mg/kg | 300 mg/kg | 430 mg/kg |
| 4-5.5 ft | 360 mg/kg | 950 mg/kg | 1,310 mg/kg |

| IZ-MW-3 | | 2004 | |
|---|---|---|---|
| Depth | Diesel | Oil | Total |
| 2-4 ft | 2,520 mg/kg | 2,960 mg/kg | 5,480 mg/kg |

| RGH-SC-04 | | 2008 | |
|---|---|---|---|
| Depth | Diesel | Oil | Total |
| 0-2 ft | 28 mg/kg | 75 mg/kg | 103 mg/kg |
| 2-4 ft | 13 mg/kg | 28 mg/kg | 41 mg/kg |
| 4-6 ft | 8.8 U mg/kg | 18 U mg/kg | 18 U mg/kg |

| IZ-MW-1 | | 2004 | |
|---|---|---|---|
| Depth | Diesel | Oil | Total |
| 4-5 ft | 49.3 mg/kg | 89.8 mg/kg | 139.2 mg/kg |

| PS-20 | | 2003 | |
|---|---|---|---|
| Depth | Diesel | Oil | Total |
| 0-0.5 ft | 37,000 mg/kg | 13,000 mg/kg | 50,000 mg/kg |

| PS-16 | | 2003 | |
|---|---|---|---|
| Depth | Diesel | Oil | Total |
| 0-0.5 ft | 9,300 mg/kg | 27,000 mg/kg | 36,300 mg/kg |

| RGH-SS/SC-01 | | 2008 | |
|---|---|---|---|
| Depth | Diesel | Oil | Total |
| 0-0.41 ft | 19 mg/kg | 69 mg/kg | 88 mg/kg |
| 0-2 ft | 37 mg/kg | 110 mg/kg | 147 mg/kg |
| 2-4 ft | 43 mg/kg | 120 mg/kg | 163 mg/kg |
| 4-6 ft | 220 mg/kg | 450 mg/kg | 670 mg/kg |

| IZ-MW-2 | | 2004 | |
|---|---|---|---|
| Depth | Diesel | Oil | Total |
| 2-4 ft | 2,020 mg/kg | 3,460 mg/kg | 5,480 mg/kg |

| PS-7 | | 2003 | |
|---|---|---|---|
| Depth | Diesel | Oil | Total |
| 0-0.5 ft | 490 mg/kg | 9700 mg/kg | 10190 mg/kg |

| PS-13 | | 2003 | |
|---|---|---|---|
| Depth | Diesel | Oil | Total |
| 0-0.5 ft | 42 mg/kg | 330 mg/kg | 372 mg/kg |

| PS-4 | | 2003 | |
|---|---|---|---|
| Depth | Diesel | Oil | Total |
| 0-0.5 ft | 3200 mg/kg | 160 mg/kg | 3360 mg/kg |

| IZ-DP-1 | | 2004 | |
|---|---|---|---|
| Depth | Diesel | Oil | Total |
| 1-4 ft | 811 mg/kg | 145 mg/kg | 956 mg/kg |

| RGH-SS/SC-02 | | 2008 | |
|---|---|---|---|
| Depth | Diesel | Oil | Total |
| 0-0.47 ft | 12 mg/kg | 42 mg/kg | 54 mg/kg |
| 0-2 ft | 32 mg/kg | 100 mg/kg | 132 mg/kg |
| 2-4 ft | 18 mg/kg | 100 mg/kg | 118 mg/kg |
| 4-6 ft | 25 mg/kg | 92 mg/kg | 117 mg/kg |

| PS-2 | | 2003 | |
|---|---|---|---|
| Depth | Diesel | Oil | Total |
| 0-0.5 ft | 150 J mg/kg | 1600 mg/kg | 1750 mg/kg |

| Location | | Year | |
|---|---|---|---|
| Depth | Result | Result | Result |

Indicates Exceedance of Screening Level of 200mg/kg.

U Indicates contaminant was not detected.

Map Revised: April 8, 2011 CBC:AMM

Path: W:\Tacoma\Projects\0\0356114\GIS\0356114\06_SedSampleLocs_TPH.mxd

Office: TACO

Reference: Imagery from Bing Maps, ESRI Data Online.

Notes:
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Note: Sample location symbols and designations are gray for locations where the test presented in the figure has not been performed.

Sample Type
- Surface Sediment Sample Location With Sample Analysis
- Subsurface Sediment Sample Location With Sample Analysis
- Surface and Subsurface Sediment Sample Location With Sample Analysis

Sample Study Source
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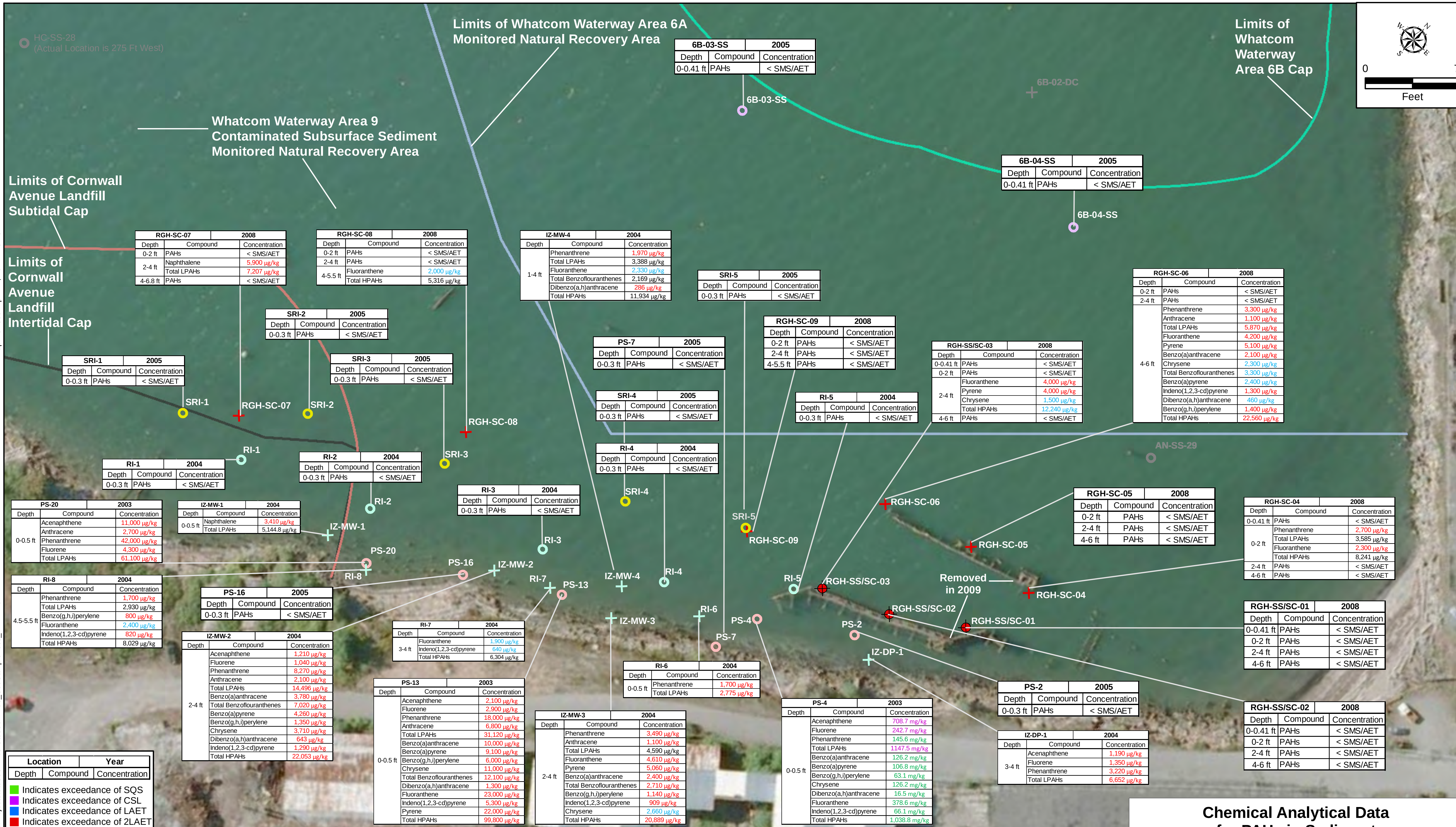
- RG Haley and Bellingham Bay Piling Study Sample Location (Hart Crowser 2008)
- Whatcom Waterway Pre-Remedial Design Evaluation Sample Location (Anchor 2002)
- Whatcom Waterway Pre-remedial Design Investigation Sample Location (Anchor QEA 2010)
- Whatcom Waterway Remedial Investigation Sample Location (Anchor and Hart Crowser 1996)

## Chemical Analytical Data for TPH in Sediment

R. G. Haley International Site
Bellingham, Washington

GeoEngineers

Figure 9




| 6B-03-SS | 2005 | |
|---|---|---|
| Depth | Compound | Concentration |
| 0-0.41 ft | PAHs | < SMS/AET |

| 6B-04-SS | 2005 | |
|---|---|---|
| Depth | Compound | Concentration |
| 0-0.41 ft | PAHs | < SMS/AET |

| RGH-SC-07 | 2008 | |
|---|---|---|
| Depth | Compound | Concentration |
| 0-2 ft | PAHs | < SMS/AET |
| 2-4 ft | Naphthalene | 5,900 µg/kg |
| | Total LPAHs | 7,207 µg/kg |
| 4-6.8 ft | PAHs | < SMS/AET |

| RGH-SC-08 | 2008 | |
|---|---|---|
| Depth | Compound | Concentration |
| 0-2 ft | PAHs | < SMS/AET |
| 2-4 ft | PAHs | < SMS/AET |
| 4-5.5 ft | Fluoranthene | 2,000 µg/kg |
| | Total HPAHs | 5,316 µg/kg |

| IZ-MW-4 | 2004 | |
|---|---|---|
| Depth | Compound | Concentration |
| 1-4 ft | Phenanthrene | 1,970 µg/kg |
| | Total LPAHs | 3,388 µg/kg |
| | Fluoranthene | 2,330 µg/kg |
| | Total Benzoflouranthenes | 2,169 µg/kg |
| | Dibenzo(a,h)anthracene | 286 µg/kg |
| | Total HPAHs | 11,934 µg/kg |

| SRI-5 | 2005 | |
|---|---|---|
| Depth | Compound | Concentration |
| 0-0.3 ft | PAHs | < SMS/AET |

| RGH-SC-06 | 2008 | |
|---|---|---|
| Depth | Compound | Concentration |
| 0-2 ft | PAHs | < SMS/AET |
| 2-4 ft | PAHs | < SMS/AET |
| 4-6 ft | Phenanthrene | 3,300 µg/kg |
| | Anthracene | 1,100 µg/kg |
| | Total LPAHs | 5,870 µg/kg |
| | Fluoranthene | 4,200 µg/kg |
| | Pyrene | 5,100 µg/kg |
| | Benzo(a)anthracene | 2,100 µg/kg |
| | Chrysene | 2,300 µg/kg |
| | Total Benzoflouranthenes | 3,300 µg/kg |
| | Benzo(a)pyrene | 2,400 µg/kg |
| | Indeno(1,2,3-cd)pyrene | 1,300 µg/kg |
| | Dibenzo(a,h)anthracene | 460 µg/kg |
| | Benzo(g,h,i)perylene | 1,400 µg/kg |
| | Total HPAHs | 22,560 µg/kg |

| SRI-2 | 2005 | |
|---|---|---|
| Depth | Compound | Concentration |
| 0-0.3 ft | PAHs | < SMS/AET |

| RGH-SC-09 | 2008 | |
|---|---|---|
| Depth | Compound | Concentration |
| 0-2 ft | PAHs | < SMS/AET |
| 2-4 ft | PAHs | < SMS/AET |
| 4-5.5 ft | PAHs | < SMS/AET |

| PS-7 | 2005 | |
|---|---|---|
| Depth | Compound | Concentration |
| 0-0.3 ft | PAHs | < SMS/AET |

| RGH-SS/SC-03 | 2008 | |
|---|---|---|
| Depth | Compound | Concentration |
| 0-0.41 ft | PAHs | < SMS/AET |
| 0-2 ft | PAHs | < SMS/AET |
| 2-4 ft | Fluoranthene | 4,000 µg/kg |
| | Pyrene | 4,000 µg/kg |
| | Chrysene | 1,500 µg/kg |
| | Total HPAHs | 12,240 µg/kg |
| 4-6 ft | PAHs | < SMS/AET |

| SRI-1 | 2005 | |
|---|---|---|
| Depth | Compound | Concentration |
| 0-0.3 ft | PAHs | < SMS/AET |

| SRI-3 | 2005 | |
|---|---|---|
| Depth | Compound | Concentration |
| 0-0.3 ft | PAHs | < SMS/AET |

| SRI-4 | 2005 | |
|---|---|---|
| Depth | Compound | Concentration |
| 0-0.3 ft | PAHs | < SMS/AET |

| RI-5 | 2004 | |
|---|---|---|
| Depth | Compound | Concentration |
| 0-0.3 ft | PAHs | < SMS/AET |

| RI-2 | 2004 | |
|---|---|---|
| Depth | Compound | Concentration |
| 0-0.3 ft | PAHs | < SMS/AET |

| RI-4 | 2004 | |
|---|---|---|
| Depth | Compound | Concentration |
| 0-0.3 ft | PAHs | < SMS/AET |

| RI-1 | 2004 | |
|---|---|---|
| Depth | Compound | Concentration |
| 0-0.3 ft | PAHs | < SMS/AET |

| RI-3 | 2004 | |
|---|---|---|
| Depth | Compound | Concentration |
| 0-0.3 ft | PAHs | < SMS/AET |

| RGH-SC-05 | 2008 | |
|---|---|---|
| Depth | Compound | Concentration |
| 0-2 ft | PAHs | < SMS/AET |
| 2-4 ft | PAHs | < SMS/AET |
| 4-6 ft | PAHs | < SMS/AET |

| RGH-SC-04 | 2008 | |
|---|---|---|
| Depth | Compound | Concentration |
| 0-0.41 ft | PAHs | < SMS/AET |
| 0-2 ft | Phenanthrene | 2,700 µg/kg |
| | Total LPAHs | 3,585 µg/kg |
| | Fluoranthene | 2,300 µg/kg |
| | Total HPAHs | 8,241 µg/kg |
| 2-4 ft | PAHs | < SMS/AET |
| 4-6 ft | PAHs | < SMS/AET |

| PS-20 | 2003 | |
|---|---|---|
| Depth | Compound | Concentration |
| 0-0.5 ft | Acenaphthene | 11,000 µg/kg |
| | Anthracene | 2,700 µg/kg |
| | Phenanthrene | 42,000 µg/kg |
| | Fluorene | 4,300 µg/kg |
| | Total LPAHs | 61,100 µg/kg |

| IZ-MW-1 | 2004 | |
|---|---|---|
| Depth | Compound | Concentration |
| 0-0.5 ft | Naphthalene | 3,410 µg/kg |
| | Total LPAHs | 5,144.8 µg/kg |

| RI-8 | 2004 | |
|---|---|---|
| Depth | Compound | Concentration |
| 4.5-5.5 ft | Phenanthrene | 1,700 µg/kg |
| | Total LPAHs | 2,930 µg/kg |
| | Benzo(g,h,i)perylene | 800 µg/kg |
| | Fluoranthene | 2,400 µg/kg |
| | Indeno(1,2,3-cd)pyrene | 820 µg/kg |
| | Total HPAHs | 8,029 µg/kg |

| PS-16 | 2005 | |
|---|---|---|
| Depth | Compound | Concentration |
| 0-0.3 ft | PAHs | < SMS/AET |

| RGH-SS/SC-01 | 2008 | |
|---|---|---|
| Depth | Compound | Concentration |
| 0-0.41 ft | PAHs | < SMS/AET |
| 0-2 ft | PAHs | < SMS/AET |
| 2-4 ft | PAHs | < SMS/AET |
| 4-6 ft | PAHs | < SMS/AET |

| IZ-MW-2 | 2004 | |
|---|---|---|
| Depth | Compound | Concentration |
| 2-4 ft | Acenaphthene | 1,210 µg/kg |
| | Fluorene | 1,040 µg/kg |
| | Phenanthrene | 8,270 µg/kg |
| | Anthracene | 2,100 µg/kg |
| | Total LPAHs | 14,496 µg/kg |
| | Benzo(a)anthracene | 3,780 µg/kg |
| | Total Benzoflouranthenes | 7,020 µg/kg |
| | Benzo(a)pyrene | 4,260 µg/kg |
| | Benzo(g,h,i)perylene | 1,350 µg/kg |
| | Chrysene | 3,710 µg/kg |
| | Dibenzo(a,h)anthracene | 643 µg/kg |
| | Indeno(1,2,3-cd)pyrene | 1,290 µg/kg |
| | Total HPAHs | 22,053 µg/kg |

| RI-7 | 2004 | |
|---|---|---|
| Depth | Compound | Concentration |
| 3-4 ft | Fluoranthene | 1,900 µg/kg |
| | Indeno(1,2,3-cd)pyrene | 640 µg/kg |
| | Total HPAHs | 6,304 µg/kg |

| RI-6 | 2004 | |
|---|---|---|
| Depth | Compound | Concentration |
| 0-0.5 ft | Phenanthrene | 1,700 µg/kg |
| | Total LPAHs | 2,775 µg/kg |

| PS-13 | 2003 | |
|---|---|---|
| Depth | Compound | Concentration |
| 0-0.5 ft | Acenaphthene | 2,100 µg/kg |
| | Fluorene | 2,900 µg/kg |
| | Phenanthrene | 18,000 µg/kg |
| | Anthracene | 6,800 µg/kg |
| | Total LPAHs | 31,120 µg/kg |
| | Benzo(a)anthracene | 10,000 µg/kg |
| | Benzo(a)pyrene | 9,100 µg/kg |
| | Benzo(g,h,i)perylene | 6,000 µg/kg |
| | Chrysene | 11,000 µg/kg |
| | Total Benzoflouranthenes | 12,100 µg/kg |
| | Dibenzo(a,h)anthracene | 1,300 µg/kg |
| | Fluoranthene | 23,000 µg/kg |
| | Indeno(1,2,3-cd)pyrene | 5,300 µg/kg |
| | Pyrene | 22,000 µg/kg |
| | Total HPAHs | 99,800 µg/kg |

| PS-2 | 2005 | |
|---|---|---|
| Depth | Compound | Concentration |
| 0-0.3 ft | PAHs | < SMS/AET |

| RGH-SS/SC-02 | 2008 | |
|---|---|---|
| Depth | Compound | Concentration |
| 0-0.41 ft | PAHs | < SMS/AET |
| 0-2 ft | PAHs | < SMS/AET |
| 2-4 ft | PAHs | < SMS/AET |
| 4-6 ft | PAHs | < SMS/AET |

| PS-4 | 2003 | |
|---|---|---|
| Depth | Compound | Concentration |
| 0-0.5 ft | Acenaphthene | 708.7 mg/kg |
| | Fluorene | 242.7 mg/kg |
| | Phenanthrene | 145.6 mg/kg |
| | Total LPAHs | 1147.5 mg/kg |
| | Benzo(a)anthracene | 126.2 mg/kg |
| | Benzo(a)pyrene | 106.8 mg/kg |
| | Benzo(g,h,i)perylene | 63.1 mg/kg |
| | Chrysene | 126.2 mg/kg |
| | Dibenzo(a,h)anthracene | 16.5 mg/kg |
| | Fluoranthene | 378.6 mg/kg |
| | Indeno(1,2,3-cd)pyrene | 66.1 mg/kg |
| | Total HPAHs | 1,038.8 mg/kg |

| IZ-DP-1 | 2004 | |
|---|---|---|
| Depth | Compound | Concentration |
| 3-4 ft | Acenaphthene | 1,190 µg/kg |
| | Fluorene | 1,350 µg/kg |
| | Phenanthrene | 3,220 µg/kg |
| | Total LPAHs | 6,652 µg/kg |

| IZ-MW-3 | 2004 | |
|---|---|---|
| Depth | Compound | Concentration |
| 2-4 ft | Phenanthrene | 3,490 µg/kg |
| | Anthracene | 1,100 µg/kg |
| | Total LPAHs | 4,590 µg/kg |
| | Fluoranthene | 4,610 µg/kg |
| | Pyrene | 5,060 µg/kg |
| | Benzo(a)anthracene | 2,400 µg/kg |
| | Total Benzoflouranthenes | 2,710 µg/kg |
| | Benzo(g,h,i)perylene | 1,140 µg/kg |
| | Indeno(1,2,3-cd)pyrene | 909 µg/kg |
| | Chrysene | 2,660 µg/kg |
| | Total HPAHs | 20,889 µg/kg |

| Location | Year | |
|---|---|---|
| Depth | Compound | Concentration |

Indicates exceedance of SQS

Indicates exceedance of CSL

Indicates exceedance of LAET

Indicates exceedance of 2LAET

Reference: Imagery from Bing Maps, ESRI Data Online.

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.

Note: Sample location symbols and designations are gray for locations where the test presented in the figure has not been performed.

Sample Type
- Surface Sediment Sample Location With Sample Analysis
- Subsurface Sediment Sample Location With Sample Analysis
- Surface and Subsurface Sediment Sample Location With Sample Analysis

Sample Study Source
- RG Haley Preliminary Screening Study Sample Location (GeoEngineers 2003)
- RG Haley Remedial Investigation Sample Location (GeoEngineers 2004)
- RG Haley Supplemental Remedial Investigation Sample Location (GeoEngineers 2005)
- RG Haley and Bellingham Bay Piling Study Sample Location (Hart Crowser 2008)
- Whatcom Waterway Pre-Remedial Design Evaluation Sample Location (Anchor 2002)
- Whatcom Waterway Pre-remedial Design Investigation Sample Location (Anchor QEA 2010)
- Whatcom Waterway Remedial Investigation Sample Location (Anchor and Hart Crowser 1996)

# Chemical Analytical Data for PAHs in Sediment

R. G. Haley International Site
Bellingham, Washington

GeoEngineers

**Figure 10**

Office: TACO Path: W:\Tacoma\Projects\0\0356114\GIS\035611406_SedSampleLocs_PAH.mxd Map Revised: April 21, 2011 CRC:AMM


Map Revised: April 21, 2011 CRC:AMM

Path: W:\Tacoma\Projects\0\0356114\GIS\035611406_SedSampleLocs_Dioxin_TEQ.mxd

Office: TACO

Reference: Imagery from Bing Maps, ESRI Data Online.

Notes:
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Note: Sample location symbols and designations are gray for locations where the test presented in the figure has not been performed.

Sample Type
- Surface Sediment Sample Location With Sample Analysis
- Subsurface Sediment Sample Location With Sample Analysis
- Surface and Subsurface Sediment Sample Location With Sample Analysis

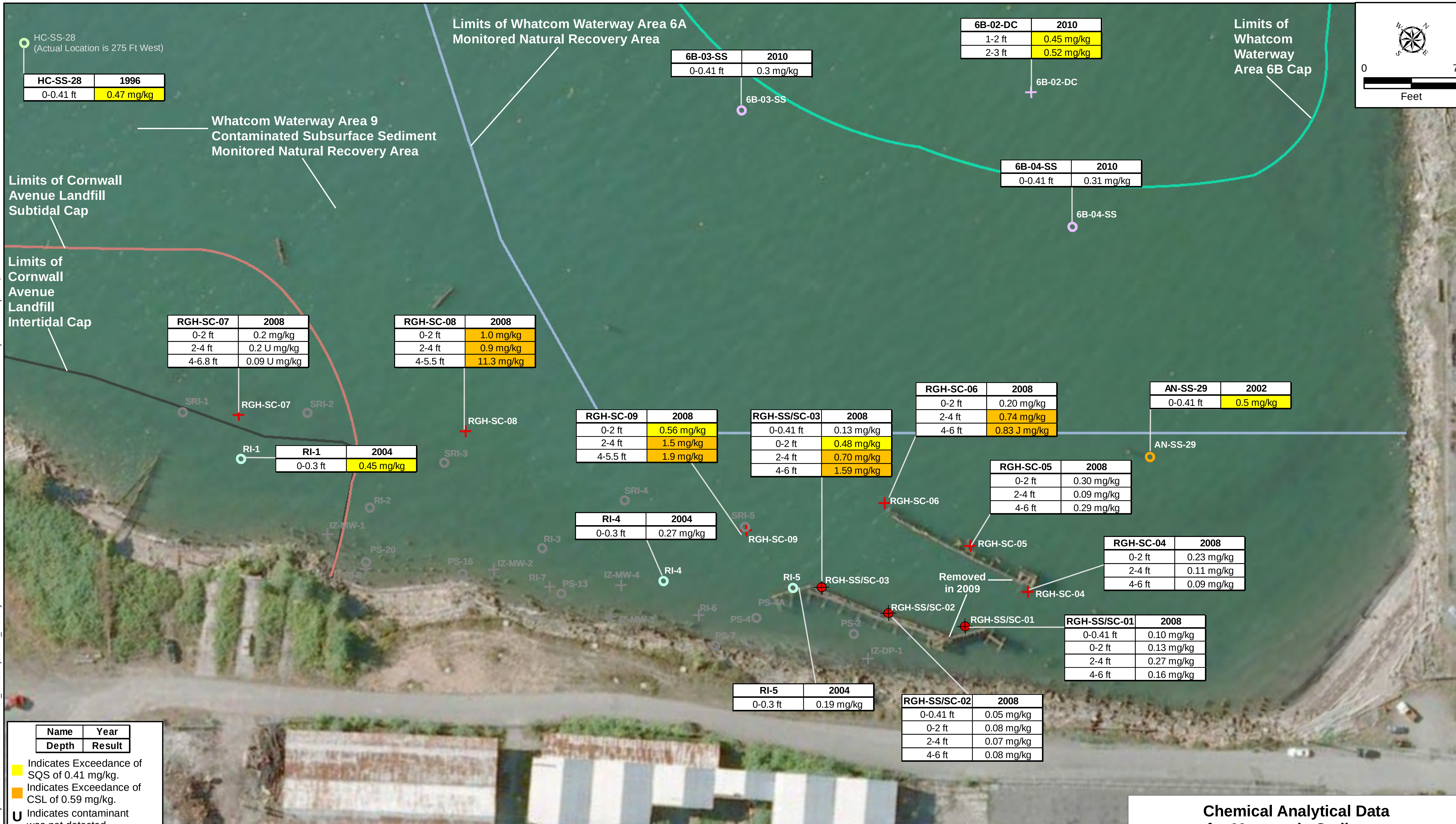
Sample Study Source
- RG Haley Preliminary Screening Study Sample Location (GeoEngineers 2003)
- RG Haley Remedial Investigation Sample Location (GeoEngineers 2004)
- RG Haley Supplemental Remedial Investigation Sample Location (GeoEngineers 2005)
- RG Haley and Bellingham Bay Piling Study Sample Location (Hart Crowser 2008)
- Whatcom Waterway Pre-Remedial Design Evaluation Sample Location (Anchor 2002)
- Whatcom Waterway Pre-remedial Design Investigation Sample Location (Anchor QEA 2010)
- Whatcom Waterway Remedial Investigation Sample Location (Anchor and Hart Crowser 1996)

# Chemical Analytical Data for Dioxin/Furans in Sediment

R. G. Haley International Site
Bellingham, Washington

GEOENGINEERS

Figure 11




Reference: Imagery from Bing Maps, ESRI Data Online.

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.

Note: Sample location symbols and designations are gray for locations where the test presented in the figure has not been performed.

**Sample Type**

- Surface Sediment Sample Location With Sample Analysis
- Subsurface Sediment Sample Location With Sample Analysis
- Surface and Subsurface Sediment Sample Location With Sample Analysis

**Sample Study Source**

- RG Haley Preliminary Screening Study Sample Location (GeoEngineers 2003)
- RG Haley Remedial Investigation Sample Location (GeoEngineers 2004)
- RG Haley Supplemental Remedial Investigation Sample Location (GeoEngineers 2005)
- RG Haley and Bellingham Bay Piling Study Sample Location (Hart Crowser 2008)
- Whatcom Waterway Pre-Remedial Design Evaluation Sample Location (Anchor 2002)
- Whatcom Waterway Pre-remedial Design Investigation Sample Location (Anchor QEA 2010)
- Whatcom Waterway Remedial Investigation Sample Location (Anchor and Hart Crowser 1996)

**Chemical Analytical Data for Mercury in Sediment**

R. G. Haley International Site
Bellingham, Washington

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**Figure 12**


| Location | | Depth |
|---|---|---|
| Depth | Result | Result |

- Indicates Exceedance of SQS Bioassay Criteria (yellow)
- Indicates Exceedance of CSL Bioassay Criteria (orange)

Reference: Imagery from Bing Maps, ESRI Data Online.

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.

Note: Sample location symbols and designations are gray for locations where the test presented in the figure has not been performed.

**Sample Type**
- ○ Surface Sediment Sample Location With Sample Analysis
- + Subsurface Sediment Sample Location With Sample Analysis
- ⊕ Surface and Subsurface Sediment Sample Location With Sample Analysis

**Sample Study Source**
- RG Haley Preliminary Screening Study Sample Location (GeoEngineers 2003)
- RG Haley Remedial Investigation Sample Location (GeoEngineers 2004)
- RG Haley Supplemental Remedial Investigation Sample Location (GeoEngineers 2005)
- RG Haley and Bellingham Bay Piling Study Sample Location (Hart Crowser 2008)
- Whatcom Waterway Pre-Remedial Design Evaluation Sample Location (Anchor 2002)
- Whatcom Waterway Pre-remedial Design Investigation Sample Location (Anchor QEA 2010)
- Whatcom Waterway Remedial Investigation Sample Location (Anchor and Hart Crowser 1996)

**Sediment Bioassay Data**

R. G. Haley International Site
Bellingham, Washington

GeoEngineers

**Figure 13**

Office: TACO Path: W:\Tacoma\Projects\0\0356114\GIS\035611406_SedSampleLocs_Bioassay.mxd Map Revised: April 21, 2011 CRC:AMM