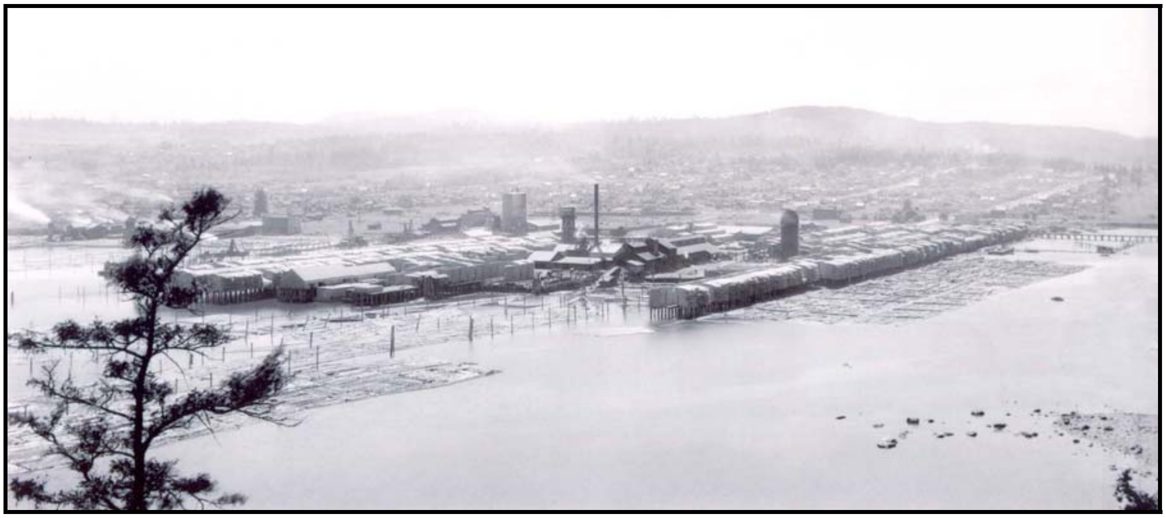

DRAFT CLEANUP ACTION PLAN (DCAP)

FORMER SCOTT PAPER COMPANY MILL SITE
ANACORTES, WASHINGTON

WASHINGTON STATE DEPARTMENT OF ECOLOGY

TOXICS CLEANUP PROGRAM

LACEY, WASHINGTON

December 5, 2008

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EXECUTIVE SUMMARY

Pending

1.0 INTRODUCTION

This document presents the Draft Cleanup Action Plan (DCAP) for upland properties and aquatic lands at the former Scott Paper Company Mill site (the Site) located in Anacortes, Washington (Figure 1). This DCAP was prepared as a collaborative effort by the Washington State Department of Ecology (Ecology) and the entities responsible for cleanup of the various portions of the Site: Port of Anacortes (Port), Kimberly-Clark Corporation (K-C), and MJB Properties (MJB). It has been prepared pursuant to the requirements of the Model Toxics Control Cleanup Act (MTCA) administered by Ecology under Chapter 173-340-360 of the Washington Administrative Code (WAC), and the requirements of the Sediment Management Standards (SMS) administered by Ecology under Chapter 173-204 WAC. This DCAP provides a general description of the proposed site-wide cleanup action and sets forth functional requirements that the cleanup must meet to achieve the cleanup action objectives for the Site.

1.1 Regulatory Framework

Between 2004 and 2008, detailed environmental investigations of the northern portion of the Site were performed pursuant to Consent Decree No. 03-2-00492-1 between the Port and Ecology (Consent Decree; Ecology 2003). The work required under the Consent Decree included preparation of a remedial investigation/feasibility study (RI/FS) that addressed soil at Port Parcels 1 and 3 (Figure 2), groundwater throughout the Port Uplands Area, and nearshore sediments adjacent to Port properties at the Site. Concurrent investigations of the southern portion of the Site were performed under Agreed Order No. DE 1783 between K-C and Ecology (Agreed Order; Ecology 2004). The work required under the K-C Agreed Order included preparation of an RI/FS for soil and groundwater at the MJB North Area and for marine sediments offshore of the MJB North Area. MJB (pursuant to agreements with K-C) performed upland soil and groundwater RI/FS tasks for the MJB North Area.

In addition to the required work described above, the Port Consent Decree and the K-C Agreed Order also required the Port and K-C, respectively, to address any remaining site-wide RI/FS issues. To ensure that site-wide issues were efficiently addressed, the Port, K-C, and MJB combined the various required elements of the Consent Decree and Agreed Order into a single site-wide RI/FS report. In August 2008, Ecology provided the draft final RI/FS report for public review. Responsiveness summaries to public and stakeholder comments were provided by Ecology in October and November 2008, respectively. Ecology approved the final RI/FS report in December 2008 (GeoEngineers et al. 2008).

1.2 Purpose

The purpose of this DCAP is to:

- Describe the Site, including a summary of its history and extent of contamination
- Identify site-specific cleanup levels and points of compliance for each hazardous substance and medium of concern
- Identify applicable state and federal laws for the proposed cleanup action
- Identify and describe the selected cleanup action alternative for the Site
- Summarize the other cleanup action alternatives evaluated in the RI/FS
- Discuss environmental covenants and Site use restrictions
- Discuss compliance monitoring requirements
- Present the schedule for implementing the cleanup action plan (*pending*)

2.0 SUMMARY OF SITE CONDITIONS

Various investigation and cleanup activities have been conducted at the Site since approximately 1990. The final RI/FS report prepared in November 2008 describes investigations conducted between 2004 and 2008 at the Site (GeoEngineers et al. 2008). The purpose of the investigations was to collect, develop, and evaluate sufficient information to allow the selection of an appropriate cleanup action for the Site. Because the Site includes upland areas and aquatic lands, as shown in Figure 2, the media investigated included soil, soil vapors, groundwater, and sediment. In addition to the 2004 to 2008 investigations, the scope and results of previous investigations were also described in the RI/FS report to provide a comprehensive summary of Site conditions (Anchor et al. 2002; contained in Appendix B of the RI/FS report). More recent (fall 2008) soil and sediment sampling data collected following completion of the RI/FS are presented in Appendices A and B, respectively, of this DCAP to provide further refinement of areas requiring cleanup. This section summarizes pertinent environmental conditions at the Site (i.e., nature and extent of contamination) and an overview of the conceptual site model. More detailed descriptions of Site conditions are provided in the RI/FS report and Appendices A and B of this DCAP.

2.1 Site History

The former Scott Paper Mill was located in Anacortes, Washington, on the west shore of Fidalgo Bay. The development of the shoreline as an industrial area began in the late 1800s. Prior to development of the Site, the area was largely a shallow tideland. In 1892, a lumber mill was built at the Site that extended on pilings into Fidalgo Bay. The lumber mill was located in the area referred to as the Port Uplands Area (Figure 2). Wharves and offshore log rafts were present in much of the northern portion of the Marine Area (extending from the shoreline to about the inner harbor line) until the late 1940s (see photograph on the cover of this DCAP). Between approximately 1890 and 1940, approximately 5 to 20 feet (ft) of fill materials including sawdust and mill refuse were placed throughout the former tide flat beneath and adjacent to the wharves, also extending into the MJB North Area.

In 1925, a pulp mill was constructed at the property referred to as the MJB North Area. Pulp was produced using an acid-sulfate process using byproducts from the lumber mill. In 1940, Scott Paper purchased the pulp and lumber mills, and operated the facilities until 1955. Process improvements by Scott Paper included the conversion to an ammonium sulfite process in 1952, the construction of a 16-inch effluent pipeline to Guemes Channel and an on-site surge pond for the pipeline in May 1951, and the addition of pulp bleaching facilities in 1955. Effluent was discharged directly into Fidalgo Bay from 1925 to 1951. A knots and tailings pond was constructed in 1959, on what is now Port Parcel 2, to reduce settleable solids in the mill's effluent. Materials known to have been utilized at the former pulp mill include petroleum, sulfur, anhydrous ammonia, ammonium hydroxide, and chlorine. Bunker C and diesel fuels were used to generate power and operate equipment. The pulp mill closed in 1978. Scott Paper was acquired by K-C in December 1995.

The former Scott Paper Mill operations were bounded by Cap Sante Boat Haven to the north, Fidalgo Bay to the east, and Q Avenue to the west. To the south, the maximum extent of former Scott Paper Mill operations was approximately 20th Street. Site boundaries are depicted in Figure 2. In 1978 and 1979, the Port purchased the northern portion of the Site. The southern portion of the Site was purchased by the Snelson-Anvil Corporation in 1979, and has been owned by MJB since 1990. In 1999, Sun Healthcare Systems, Inc. (SHS) purchased Parcel 2 from the Port and, following initial cleanup and redevelopment (see below), subsequently subdivided and sold Parcel 2 into four sub-lots. In 2008, the Port acquired a narrow strip of the Marine Area between the Port and MJB properties.

2.2 Port Uplands Area Redevelopment

After closure of the mill in 1978, little activity occurred on the Port Uplands Area until 1990 when the Port constructed and operated a log storage facility on Parcels 1 and 2 (Figure 2). The log storage yard was in operation through 1993. As part of the log storage yard construction, approximately 30,000 cubic yards (cy) of wood debris was removed from the west side of Parcel 1 and the excavations were backfilled with dredged materials obtained from the 1968 U.S. Army Corps of Engineers (USACE) expansion and dredging of the Cap Sante Marina. In 1994, an additional 100,000 cy of dredged sand from the Swinomish Channel was delivered by the USACE and used as geotechnical preload to support redevelopment of the Port Uplands Area. Since placement of the preload material, Parcels 2 and 3 have been developed. Construction of Seafarers' Memorial Park on Parcel 3 began in 1995. As part of the park construction, the park soil was capped with 0.5 to 1 ft of a topsoil mixture. The topsoil was prepared from the preload material mixed with wood debris remnants from the Port log storage yard. In 2000, SHS developed a campus/office park on Parcel 2.

2.3 MJB Property Redevelopment

The MJB North Area is the southern portion of the former Site operations area, and refers to the area between 17th and 20th Streets, east of R Avenue (Figure 2). In about 1982, the Snelson-Anvil Corporation reportedly removed wood debris and soft soils from much of the MJB North Area and backfilled the excavations with imported granular fill, particularly in areas where heavy Site operation loads were planned. Historical aerial photos indicate that portions of the MJB North Area, particularly in areas close to the shoreline, have not been significantly excavated since the time of the mill operations. Since 1982, the MJB North Area has been used for light industrial operations.

MJB North Channel 1, located immediately offshore of the MJB North Area, is an existing private navigation channel (Figure 2). North Channel 1 was originally dredged in 1975 to a depth of approximately 12 ft below mean lower low water (MLLW) for barge access and moorage of barges and other vessels. However, no maintenance dredging has been conducted in North Channel 1 since initial dredging.

2.4 Prior Cleanup Actions

Following detailed investigations of Port Parcel 2 (ThermoRetec 1999a) and subsequent preparation of a soil Cleanup Action Plan (CAP) for this area (ThermoRetec 1999b), cleanup at Parcel 2 was conducted by SHS, with oversight by Ecology under the MTCA Voluntary Cleanup Program (VCP). The Parcel 2 cleanup included, among other elements, removal and off-site landfill disposal of 3,469 tons of petroleum-contaminated soil (excavation areas are depicted in Figure 2), soil capping, and environmental covenants to prevent future exposure to subsurface soil at the property and to restrict groundwater use for drinking water. Work also included the installation of a sheetpile wall along the shoreline (near MW-112) for containment of residual contaminated soil, concurrently providing structural foundation support for the building constructed by

SHS. A project completion report for the Parcel 2 property was submitted to Ecology in 2000 (ThermoRetec 2000).

In 2000, Ecology issued a No Further Action (NFA) letter for diesel-range and oil-range petroleum hydrocarbons, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), dioxins/furans, wood debris, and metals in soil at Parcel 2 (Ecology 2000). The NFA letter was conditional to long-term groundwater monitoring to ensure continued environmental protection. However, in 2005 Ecology modified the type of written opinions it provides under the VCP, and no longer provides NFA letters for a single medium such as soil (Ecology 2005). Accordingly, Ecology subsequently rescinded the NFA letter, as the completed cleanup did not address all contamination in all media at the Site. This DCAP describes Ecology's selected site-wide cleanup remedy for the Site, including elements of the NFA letter as appropriate.

Storm-generated wave and current action has resulted in significant erosion at the filled shoreline since at least 1962, which has contributed to contaminant transport from the uplands to the marine area (GeoEngineers et al. 2008). The shoreline along parts of the Port and MJB properties has been temporarily reinforced to minimize this erosion, and protection of the shoreline has required routine maintenance by the Port and MJB. In February 2005, the Port completed a MTCA Bank Stabilization Interim Action along the Seafarers' Memorial Park shoreline under the Consent Decree (Landau Associates 2005).

In 2008, the Port installed two underground storage tanks at Parcel 3. An interim action was completed to address contaminated soils and wood debris excavated during the tank installation. An interim action completion report is currently being prepared by the Port to document the interim action activities (GeoEngineers 2009).

2.5 Summary of Environmental Conditions

This section summarizes environmental conditions at the Site for soil (including soil vapor), groundwater, and sediment media, based on the extensive RI/FS sampling and analysis efforts completed at the Site (GeoEngineers et al. 2008). Habitat features and aquatic resources of the Marine Area are also summarized. Further details and sources of the information presented in this section are provided in the final RI/FS report.

2.5.1 Soils

Site soils consist of multiple layers of fill overlying native marine sediment and glacial deposits. Shallow soil is predominantly gravel and sand fill material with occasional mixed wood debris. The deeper subsurface fill contains a heterogeneous mixture of soil and wood debris. Relatively extensive wood debris deposits of varying thickness are present throughout much of the Port Uplands Area, extending from 5 to 20 ft below ground surface (BGS), and continuing into the nearshore (intertidal and shallow subtidal) area of Fidalgo Bay. Fill material sometimes containing wood debris is also found in the MJB North Area along the shoreline. The thickness of the wood-containing fill material in the MJB North Area ranges from less than a foot near the former mill surge ponds to nearly 15 ft at the shoreline.

An empirical demonstration presented in the final RI/FS report (GeoEngineers et al. 2008) verified that, with the exception of localized diesel-range and oil-range petroleum hydrocarbon contamination in portions of Port Parcels 2 and 3, chemical concentrations present in soil are protective of groundwater and surface water (see Section 2.5.2 below). Therefore, soil chemicals of potential concern (COPCs) were generally identified based on potential direct human contact and terrestrial ecological exposures.

A range of metals (antimony, arsenic, chromium, copper, lead, mercury, nickel, and zinc), diesel-range and motor oil-range petroleum hydrocarbons, PCBs, carcinogenic PAHs (cPAHs), and dioxins/furans have been detected at the Port Uplands Area at concentrations above the preliminary cleanup levels established for the Site (GeoEngineers et al. 2008). In addition, metals (antimony, arsenic, chromium, copper, lead, nickel, thallium, and zinc) and cPAHs were identified in soil at the MJB North Area at concentrations above the preliminary cleanup levels. The specific depth intervals and COPCs detected in soils at concentrations exceeding preliminary cleanup levels are summarized in Figures 3 to 10.

The only constituent detected in shallow surface (0 to 2 ft BGS) soils in the Port Uplands Area above preliminary cleanup levels was arsenic, which was detected at concentrations higher than regional background levels (20 milligrams per kilogram [mg/kg]) at one location (LAI-S-4) in Seafarers' Memorial Park (Figure 3). Elevated arsenic, lead, and cPAH concentrations were also detected in the surface fill layer at a number of isolated locations throughout the MJB North Area (Figure 7).

At depths greater than 2 ft BGS, elevated concentrations of arsenic were detected in subsurface soils in an isolated area near the northeastern corner of Port Parcel 1 (Figure 5). Multiple constituents were detected in subsurface soil remaining at Port Parcel 2 at concentrations above the preliminary cleanup levels, including metals (antimony, arsenic, chromium, copper, lead, mercury, nickel, and zinc), diesel- and motor oil-range petroleum hydrocarbons, cPAHs, PCBs, and dioxins/furans. These exceedances were concentrated in two areas: 1) the rectangular parking lot near the center of Parcel 2 (elevated diesel- and motor oil-range petroleum hydrocarbon concentrations); and 2) in the area of the subsurface containment wall in the southeastern portion of Parcel 2. A similar range of COPCs was detected in subsurface soil at Parcel 3, particularly along parts of the shoreline of Seafarers' Memorial Park and near the present southern end of R Avenue (Figures 4 to 6). Likewise, elevated metal concentrations (antimony, arsenic, copper, lead, thallium, zinc) and cPAHs were detected in subsurface soil in the northeast and/or southeast portion of the MJB North Area, and appear to be limited to the wood layer and woody fill layers in the subsurface from roughly 4 to 10 ft BGS (Figures 8 to 10).

Soil vapors at Port Parcel 3, where subsurface wood debris accumulations are greatest at the Site, have been monitored for the presence of hydrogen sulfide and methane. No detectable concentrations of either of these gases were measured during the 2004 to 2008 investigations. Previous monitoring of soil vapors at Port Parcel 3 identified low concentrations of hydrogen sulfide in ambient air samples collected in 1993.

Based on the information presented in the RI/FS report (GeoEngineers et al. 2008), soil in parts of Port Parcels 1 and 3 and the MJB North Area required evaluation of cleanup action alternatives due to the presence of COPCs at concentrations exceeding the preliminary cleanup levels determined to be protective of human health and terrestrial ecological receptors. As discussed in Section 2.4, cleanup actions have been previously evaluated and implemented by SHS for soil at Port Parcel 2. In addition to soil excavation and off-site landfill disposal actions, SHS placed an indicator layer and clean soil cap over Parcel 2, constructed and activated a methane control system, implemented infiltration controls, installed a subsurface containment wall, and implemented environmental covenants (ThermoRetec 2000). However, because soil containing COPCs at concentrations exceeding preliminary cleanup levels remains in portions of Port Parcel 2, the need for additional cleanup at Parcel 2 was evaluated further in the RI/FS.

2.5.2 Groundwater

Two hydrogeologic units have been identified at the Site: 1) a shallow water-bearing unit; and 2) a deeper confining unit. The shallow water-bearing unit occurs in the fill material, and the depth to groundwater in this unit ranges from 3 to 12 ft BGS (7 to 15 ft saturated thickness) across the Site. The confining unit, which underlies the shallow water-bearing unit, consists of native marine silts and clays. The thickness of the confining unit is greater than 2 to 10 ft throughout the Site.

Predominant groundwater flow directions are to the north toward Cap Sante Waterway in the northern portion of the Site, and to the east and southeast toward Fidalgo Bay in other areas of the Site. Groundwater flow directions do not appear to be significantly affected by tidal fluctuations. However, groundwater level data suggest that hydraulic gradients decrease or possibly reverse temporarily at high tide in the vicinity of some of the shoreline wells.

To identify groundwater COPCs, chemical analytical results were compared with preliminary cleanup criteria that are protective of potential exposure by aquatic organisms to hazardous substances in groundwater and ingestion by Site users of marine organisms potentially contaminated by releases of affected Site groundwater (GeoEngineers et al. 2008). Groundwater data for diesel-range and motor oil-range petroleum hydrocarbons were compared with MTCA Method A groundwater (drinking water-based) cleanup levels [in accordance with WAC Chapter 173-340-730(3)(b)(iii)(C)], because regulatory criteria protective of marine surface water have not been established for petroleum hydrocarbons. Based on detailed evaluations presented in the RI/FS report, the nature and extent of groundwater contamination at the Site can be summarized as follows:

- **Port Area Interior Monitoring Wells**. Groundwater at interior wells in most of the Port Uplands Area contains low concentrations of COPCs (below preliminary cleanup levels). There was one marginal exceedance of dissolved arsenic above drinking water criteria at well MW-111 (see Figure 2). This exceedance was isolated and is not representative of groundwater conditions. Total and/or dissolved arsenic was also detected at concentrations above drinking water criteria during four monitoring events at well MW-102. Diesel-range and motor oil-range petroleum hydrocarbons were detected at concentrations above MTCA Method A cleanup levels during one monitoring event at well MW-110, and free product was observed during two monitoring events at this same well at measured thicknesses of 0.03 ft and 0.6 ft. In addition, diesel- and motor oil-range petroleum hydrocarbons were detected at concentrations above MTCA Method A cleanup levels in an unfiltered groundwater grab sample (GEI24-W) obtained from a direct-push boring completed at the southeast corner of the Seafarers' Park Building as part of the 2008 Port Uplands supplemental soil investigation (see Appendix A).
- **MJB Area Interior Monitoring Wells**. Groundwater at interior well MW-7 does not contain COPCs at concentrations above preliminary cleanup levels. At interior well MW-4, dissolved arsenic was detected in groundwater at concentrations exceeding drinking water criteria.
- **Port Area Shoreline Monitoring Wells**. Groundwater at shoreline wells on Port property, located landward from the groundwater/surface water

interface in the porewater discharge zone, has not been identified to contain detections of COPCs above preliminary cleanup levels. Although there were a few sporadic detections of ammonia, sulfide, and bis(2 ethylhexyl)phthalate, these were isolated occurrences and are not representative of groundwater conditions.

- **MJB Area Shoreline Monitoring Wells**. Similarly, groundwater at shoreline wells of MJB North Area property landward from the groundwater/surface water interface in the porewater discharge zone also does not contain COPCs at concentrations above preliminary cleanup levels.

As detailed in the final RI/FS report (GeoEngineers et al. 2008), direct human ingestion of hazardous substances in groundwater is not a potential exposure pathway, because groundwater at the Site or potentially affected by the Site is not a current or reasonably likely future source of drinking water.

Groundwater in the shoreline area at the Site was determined to be protective of marine surface water. However, because there were some exceedances of preliminary cleanup levels for arsenic and diesel-range and motor oil-range petroleum hydrocarbons at interior wells (including free-phase petroleum product observed at MW-110), remedial options for groundwater at the Port Uplands Area were evaluated in the RI/FS (GeoEngineers et al. 2008). Groundwater throughout the MJB North Area landward of the shoreline was determined to be protective of marine surface water. Consequently, the RI/FS did not evaluate remedial options for groundwater at the MJB North Area.

2.5.3 Sediments

Relatively low rates of sediment deposition occur within the Site area. These results are consistent with observed wave action that contributes to periodic sediment transport, maintaining a mixed sand/gravel/cobble intertidal substrate in much of the Site area (Antrim et al. 2000). The contact between fine-grained native sediments and overlying material occurs at an elevation ranging from approximately -3 to -8 ft MLLW. This is consistent with the filling of the tideflat that historically extended southward from the Cap Sante area. Overlying the native sediments in the northern portion of the Marine Area is fill that contains wood debris. This fill is thickest near the shoreline and tapers out in the Marine Area; the fill thickness in parts of the northern portion of the shoreline ranges from approximately 10 to 15 ft. Overlying the wood-containing fill along the northern portion of the shoreline is 10 to 15 ft of imported granular fill material consisting of poorly graded sand and silt or fine sand.

A debris field consisting of dimensional lumber, wood fragments, and other debris is present on the sediment surface, most extensively across the intertidal area of the northern Marine Area, extending to shoreline areas adjacent to the MJB North Area. The wood debris content (based on visual observations) of surface sediments ranges from greater than 75 percent near the shoreline to less than 5 percent near the inner harbor line. A number of decaying pilings are also present. Sediment bioassays were performed to develop site-specific cleanup levels for wood debris content and total volatile solids (TVS) that are protective of sediment habitats (see Section 3.3.3). The extent of site-specific cleanup level exceedances within the Marine Area is depicted in Figure 11.

Chemical analytical results for sediment samples collected throughout the Marine Area during 2004 to 2008 and previous investigations were compared in the RI/FS to SMS chemical criteria to identify COPCs for the offshore portions of the Site (GeoEngineers et al. 2008). Sediment samples collected from the intertidal beach area immediately offshore of the Site contained several metals (copper, lead, mercury, and zinc) and PCBs at concentrations above sediment quality standards (SQS) chemical criteria, which comprise the preliminary cleanup levels for sediments. The sampling data define a localized area of elevated metals and PCBs within the intertidal zone of the South Marine Area (Figure 11). As discussed in the RI/FS, an evaluation of available tissue sampling data conducted by Ecology, the U.S. Environmental Protection Agency (USEPA) and others showed no evidence of bioaccumulation of mercury, PCBs, or dioxins/furans in crabs or shellfish within the portion of Fidalgo Bay potentially affected by Site releases.

To ensure protection of human health, the RI/FS considered potential bioaccumulation risks associated with residual mercury and PCB exposure that may remain in the Marine Area following completion of the cleanup action. The potential bioaccumulation risks were assessed in the RI/FS report, and revealed that remediation of those Site sediments exceeding SQS chemical criteria would be protective of potential human health mercury and PCB bioaccumulation risks (see Section 3.3.3).

Based on the findings of the RI/FS, surface sediments in upper intertidal portions of the Marine Area immediately adjacent to portions of Port Parcel 3 and the MJB North Area required evaluation of cleanup action alternatives due to the presence of COPCs exceeding preliminary cleanup levels (GeoEngineers et al. 2008). A likely source of these localized contaminated sediment deposits is historical and potentially ongoing erosion of adjacent upland fill material comprising the shoreline. These fill materials have been documented to contain elevated metal and PCB chemical concentrations, similar to those identified in the adjacent sediments. As discussed in the RI/FS, shoreline stabilization performed by the Port in this area appears to have reduced transport of metals and PCBs to the South Marine Area in the last several years (Figure 11). Surface and subsurface woody debris deposits in this area also required evaluation of cleanup action alternatives due to the presence of these potentially deleterious substances at concentrations exceeding the preliminary cleanup levels established to protect aquatic ecological receptors at the Site.

Limited areas of the upper intertidal zone adjacent to the Site containing a mix of sand and gravel may provide suitable spawning habitat for sandlance (*Ammodytes hexapterus*) or surf smelt (*Hypomesus pretiosus*) (Antrim et al. 2000). Offshore areas contain limited areas of eelgrass (*Zostera* spp.) of varying densities. The eelgrass beds provide a number of ecological functions including support of prey species, substrate for spawning of Pacific herring (*Clupea pallasi*), and rearing for juvenile salmon and crab. As discussed in the RI/FS report (GeoEngineers et al. 2008), detailed eelgrass surveys of the areas offshore of the

MJB North Area and Port Uplands Area were performed during August 2004 and August 2007, respectively, and the results are summarized in Figure 11.

2.6 Conceptual Site Model

This section summarizes the conceptual model for the fate and transport of contamination at the Site as described in the RI/FS (GeoEngineers et al. 2008). The conceptual site model also describes the contaminant exposure pathways identified for the Site and the potential risks posed to human health and the environment by hazardous and/or deleterious substances in soil, groundwater, and/or sediment.

Soil impacts at the Site resulted from past releases of hazardous substances to soils, primarily during the 1890 to 1940 period when fill materials including sawdust and mill refuse were placed throughout the former tide flat area. Soil contamination has also resulted from the release of petroleum to Site soils from facilities located at the Site.

Sediment impacts have resulted from the direct deposition of deleterious substances in the Marine Area (e.g., from log rafting activities), potential past transport of contaminants in groundwater, erosion of hazardous substances in shoreline soils in the Port Uplands and MJB North Areas to Fidalgo Bay, and/or decay of wood debris present below the surface sediment. The conceptual site model illustrating potential contaminant transport mechanisms is shown in Figure 12.

2.6.1 Soil

Potential upland soil exposure pathways at the Site include:

- Contact (dermal, incidental ingestion, or inhalation) by visitors, workers (including excavation workers), and potential future residents or other Site users with hazardous substances in soil
- Contact (dermal, incidental ingestion, or inhalation) by terrestrial wildlife with hazardous substances in soil
- Contact by terrestrial plants and soil biota and/or food-web exposure to hazardous substances in soil

Site areas where COPCs were detected in soils at concentrations above preliminary cleanup levels for protection of human and terrestrial ecological receptors are shown in Figures 3 through 10. The majority of the soil exceedances occur between 6 and 10 ft BGS along parts of the shoreline at Seafarers' Memorial Park, the central parking lot at Parcel 2 (petroleum hydrocarbons), the area of the subsurface containment wall in the southeastern portion of Parcel 2, and in wood debris fill layers between 4 and 10 ft BGS in the northeastern portion of the MJB North Area. Elevated soil concentrations also occur in several locations along "R" Avenue.

2.6.2 Groundwater

Although arsenic and/or petroleum constituents were detected at interior monitoring wells at concentrations above levels protective of marine surface water, concentrations of these constituents at or near the groundwater/surface water interface in the porewater discharge zone are protective of Site receptors. Even at interior wells, relatively few constituents were found at concentrations above drinking water-based cleanup levels.

Human ingestion of hazardous substances in groundwater is not a potential exposure pathway because groundwater at the Site or potentially affected by the Site is not a current or reasonable future source of drinking water. The MTCA regulation (WAC 173-340-720[2][d]) states that even if groundwater is classified as a potential future source of drinking water because it is present in sufficient quantity, contains less than 10,000 milligrams per liter (mg/L) total dissolved solids, and is not too deep to recover, the groundwater may still be classified as non-potable due to its proximity to marine surface water. To be classified as non-potable on the basis of its proximity to marine surface water, the following conditions must also be met:

- The groundwater does not serve as a current source of drinking water
- Contaminated groundwater will not migrate to groundwater that is a current or potential future source of drinking water
- There are known points of entry of the groundwater into surface water

- The surface water is not classified as a suitable domestic water supply source
- The groundwater is sufficiently hydraulically connected the surface water that the groundwater is not practicable to use as a drinking water source

The shallow groundwater at the Site meets at least four, and likely all five, of these conditions. First, groundwater at the Site is not a current source of drinking water. Second, the groundwater migrates toward marine surface water and discharges at seeps in the intertidal and/or subtidal zone (GeoEngineers et al. 2008). Third, the marine surface water offshore of the Site is not classified as a suitable domestic water supply. Fourth, the Site groundwater is hydraulically connected to marine surface water, as evidenced by the tidal influence on groundwater levels in wells near the shoreline. Finally, migration of shallow groundwater to a lower aquifer that is a current or potential future source of drinking water is unlikely, due to the presence of a confining native silt/clay unit at the base of the shallow water-bearing unit at the Site (see the RI/FS report for further information regarding Site hydrogeology). Consequently, the Site groundwater qualifies as a non-potable water source.

At interior well MW-110, diesel-range and motor oil-range petroleum hydrocarbons have been detected above MTCA Method A cleanup levels. In addition, free product has been observed during two monitoring events at MW-110, at measured thicknesses of 0.03 ft and 0.6 ft. Petroleum hydrocarbons were also detected above MTCA Method A cleanup levels in an unfiltered groundwater sample collected from a direct-push soil boring as part of the 2008 Port Uplands Area supplemental soil investigation reported in Appendix A. However, as discussed in the RI/FS (GeoEngineers et al. 2008), groundwater COPC concentrations in other areas of the Site do not appear to be migrating to Fidalgo Bay and/or Cap Sante Waterway.

Porewater (0 to 10 centimeters [cm] below mudline) in intertidal sediment deposits complies with preliminary groundwater cleanup levels. Ammonia and sulfide were rarely detected in sediment porewater, and were well below the preliminary cleanup level for ammonia and the screening level for sulfide. These data are consistent with tidal mixing and associated oxidation of sediment porewater that occurs near the sediment/water interface. In the presence of dissolved oxygen, ammonia and sulfide both rapidly undergo chemical and biological oxidation to nitrate and sulfate, respectively. Thus, tidal mixing and associated oxidation processes attenuate potential ammonia and sulfide risks to benthic infauna at the Site.

2.6.3 Sediments

As discussed above, wave and current modeling of the Site has shown that storm-generated wave and current action has resulted in significant erosion of the filled shoreline since at least 1962. The shoreline along parts of the Port and MJB properties has been temporarily reinforced to minimize this erosion, and protection of the shoreline has required routine maintenance by the Port and MJB. Net sediment transport along the western shore of Fidalgo Bay, in the vicinity of the Site, appears to be predominantly in a southerly direction from the Port Marine Area to the MJB North Marine Area (City of Anacortes 1999). In February 2005, the Port completed a temporary Bank Stabilization Interim Action along the Seafarers' Memorial Park shoreline under the Port's Consent Decree (Landau Associates 2005). Monitoring suggests that shoreline bank erosion has now ceased in the Interim Action area. However, pea gravel placed on the large rock armoring continues to erode and will likely require future maintenance if no further remedial actions were to be implemented. The northeastern shoreline of the MJB property has experienced continued erosion during MJB's time of ownership (since 1990), with an apparent increased rate of erosion within the past five years.

Sediment impacts at the Site are attributed to historical direct deposition of woody debris and associated deleterious substances in the Marine Area and shoreline erosion of hazardous substances in soils the Port Uplands Area and the MJB North Area to Fidalgo Bay. Historical sources of woody debris at the Site include former log rafting operations, over-water storage of milled wood, placement of woody debris-containing fill materials (including sawdust, bark, and wood chips), and lumber/pilings remaining from the former pier structure. A range of surficial debris is present in the beach area, including dimensional lumber, bricks, and other construction materials. Debris accumulations are most evident within the intertidal and shallow subtidal zones extending from south of the Cap Sante Boat Haven breakwater to south of the existing kayak dock.

Nearshore chemical source areas exceeding sediment cleanup screening level (CSL) chemical criteria were depicted in the RI/FS report, and include soil in parts of the Port Uplands Area (Port Parcel 3) and a portion of the MJB North Area that contain elevated concentrations of metals and/or PCBs. Erosion of soil from these areas is the likely source of down-drift sediment contamination observed just to the south. Portions of these areas of the shoreline are currently armored with riprap.

Based on the available Site characterization data (summarized in RI/FS report), relatively extensive wood debris deposits are present throughout much of the upland areas of the Site, extending 10 to 30 ft BGS, and continuing into the nearshore (intertidal and shallow subtidal) area of Fidalgo Bay. Intertidal and shallow subtidal surface sediments offshore of the MJB North Area typically consist of a relatively thin layer of silt and sand sediments overlying the wood debris deposits. The thickness of the naturally developed sediment "cap" in this area of the Site is typically 0.5 to 1 ft at upper intertidal elevations, increasing in thickness at lower tidal elevations.

3.0 CLEANUP REQUIREMENTS

The MTCA cleanup regulations provide that a cleanup action must comply with cleanup levels for identified COPCs, points of compliance, and applicable or relevant and appropriate requirements (ARARs) based on federal and state laws (WAC 173-340-710). The Site cleanup levels, points of compliance, and ARARs for the selected cleanup remedy are briefly summarized in the following sections.

3.1 Human Health and Environmental Concerns

Because Site groundwater is not a current or reasonably likely future source of drinking water, cleanup levels for Site soil need not be protective of groundwater as drinking water. Additionally, an empirical demonstration presented in the RI/FS (GeoEngineers et al. 2008) verified that, excluding petroleum hydrocarbon releases in certain parts of the shoreline at the Port Parcel 3 Seafarers' Memorial Park and the central parking lot at Port Parcel 2, existing chemical concentrations in Site soils are protective of groundwater and marine surface water receptors. Although current soil concentrations in most areas of the Site are protective of groundwater, within the identified petroleum hydrocarbon release areas further soil and/or free product remediation is nonetheless necessary to ensure protection of human health and the environment.

3.1.1 Future Land Use Considerations

Soil cleanup levels for unrestricted land use were developed in accordance with WAC 173-340-740. The Port Uplands and MJB North Areas are currently zoned Commercial Marine 1 (CM1), which provides for a mix of commercial, industrial, and recreational uses. Because the Site is not zoned for strictly industrial use, soil cleanup levels were developed based on unrestricted land use, including the more stringent MTCA Method B cleanup levels that assume ground floor residential land use (WAC 173 340 740[3]).

Development of Port Parcel 1 (which is currently vacant) will be implemented concurrent with or immediately following cleanup of this area of the Site. As discussed above, SHS built an office park on Port Parcel 2 in 2000. SHS subsequently subdivided Parcel 2 into four sub-lots, sold these lots to four entities, and since then additional buildings have been constructed on these properties. Construction of Seafarers' Memorial Park on Port Parcel 3 began in 1995, and included grass, landscaped areas, and a community building, as well as asphalt-paved roads and parking areas. Parcel 3 and the adjacent Marine Area are part of Seafarers' Memorial Park. At present, there are no plans to modify the site use of Parcel 3.

MJB has made a preliminary determination that a water and water view-dependent mixed-use development, with a residential component, is a viable future development option for the MJB North Area. A mixed-use uplands development might include a hotel, retail shops, offices, restaurants, residences and parking structures. Residence styles would likely consist of townhouses, townhouses over flats, and/or stacked flats. These residences would primarily be situated above the lower non-residential levels or above an in-ground or above-ground parking structure. The uplands development area would be surfaced with concrete, asphalt, or structures, with localized and controlled landscaped areas. MJB has also considered a marina as a development option. The conceptual plan for the marina includes slips for pleasure boats and float planes, docks, and, potentially, a floating breakwater. A 12-ft-wide (approximate) promenade, adjacent to a 25-ft-wide landscaped set-back along the top of the bank, is planned as the transition from the offshore to the upland areas. The marina would also include upland support facilities (e.g., parking).

3.1.2 Ecological Risk Considerations

Terrestrial ecological evaluations (TEEs) were performed for both the Port Uplands and MJB North Areas, and are presented in the RI/FS (GeoEngineers et al. 2008). For the purposes of the TEEs, chemicals that exceeded unrestricted land use soil screening concentrations in WAC 173-340-900 (Table 749-2) were identified as COPCs.

For both the Port Uplands and MJB North Areas, the wildlife exposure model in WAC 173-340-900 (Table 749-4), supplemented with USEPA soil-worm bioaccumulation factor (BAF) values for copper, lead, and zinc, were used to calculate soil concentrations that are protective of terrestrial wildlife. The calculations for the MJB North Area are summarized in Appendix E of the FS report (GeoEngineers et al. 2008); similar methods were used for the Port Uplands Area. USEPA does not provide a BAF for nickel, so the value in WAC 173-340-900 (Table 749-5) was used. Protective soil concentrations were developed for three wildlife receptor groups (avian predator, mammalian predator, and mammalian herbivore). Site-specific ecological cleanup levels are discussed in Section 3.3.1 below.

The Port Uplands Area currently consists of paved surfaces, buildings, and controlled landscape areas over most of the property (Parcels 2 and 3) and planned construction concurrent with or immediately following Site cleanup (Parcel 1). These features are expected to be maintained into the future.

Except for COPCs that co-occur at concentrations exceeding the human health and/or ecological preliminary cleanup levels (which will be removed during remediation of the Site; see Section 4 below), copper, lead, mercury, zinc, diesel-range petroleum hydrocarbons, and dioxins/furans are the terrestrial ecological COPCs for the Port Uplands Area west of the shoreline zone. However, only copper, mercury, zinc, and dioxins/furans were identified as terrestrial ecological COPCs from 0 to 6 ft BGS, which corresponds to the biologically active zone using MTCA default assumptions. The MTCA regulation allows a conditional point of compliance to be established at 6 ft BGS for ecological-based soil cleanup levels, provided that environmental covenants are implemented to address potential excavation of deeper soil (WAC 173-340-7490[4][a]; GeoEngineers et al. 2008).

Similar to the Port Uplands Area, except for COPCs that co-occur at concentrations exceeding the human health and/or ecological preliminary cleanup levels (which will be removed during remediation of the Site; see Section 4 below), copper, nickel, and zinc are the only terrestrial ecological COPCs identified in the MJB North Area west of the shoreline zone. These three metals co-occur within the imported rock (surface fill) layer; however, nickel exceedances occur less frequently than copper or zinc.

The MJB North Area uplands currently provide low quality habitat for wildlife, and this condition is expected to continue under a future site development scenario. Much of this area is covered with a 1-ft-thick layer of quarry spalls (rock fragments) that contains little organic matter to support soil biota or surface vegetation. Plants are not considered to be at risk within the MJB North Area uplands. Currently, there is very little vegetation within this area, except for sparse blackberries, scotch broom, and grasses. Under a future development scenario, paved surfaces and buildings will cover most of the property except for controlled landscaped areas. Any future planting of vegetation within the area where COPCs exceed MTCA soil screening concentrations for plant exposures (WAC 173-340-900, Table 749-3) would require adding a minimum of 1 ft of topsoil over the existing quarry spalls to promote plant growth. The addition of clean soil would limit plant exposure to existing metal concentrations in the soil.

In accordance with WAC 173-340-7493(3)(b), the Port and K-C may conduct more detailed TEE soil bioassays and/or focused bioaccumulation testing in parts of the Port Uplands Area where 0 to 6 ft BGS soil concentrations only exceed preliminary TEE levels. Potential risks to plant life and soil biota in such target areas of the Site (i.e., where human health criteria are not exceeded and where the only soil exceedances are based on screening values listed in WAC 173-340-900, Table 749-2) may be assessed directly using tests described in the *Early Seedling Growth Protocol for Soil Toxicity Screening* (Ecology Publication No. 96-324) and the *Earthworm Bioassay Protocol for Soil Toxicity Screening* (Ecology Publication No. 96-327), respectively. The soil bioassay and bioaccumulation sampling is currently scheduled for late January 2009, and the results will be integrated into the final CAP.

3.1.3 Shoreline Stability Considerations

The shoreline at the Site is protected from northerly wind and waves by the Cap Sante Boat Haven and its breakwater. The wave action in the Site area is predominantly from the southeast and northeast, and is strong enough to ~~maintain~~ a mixed sand/gravel/cobble intertidal substrate (Antrim et al. 2000).

Empirical observations and hydrodynamic modeling of the Site have shown that since approximately 1962, storm-generated wave and current action have resulted in erosion and loss of up to approximately 75 feet of shoreline, particularly in parts of Port Parcel 3 (GeoEngineers et al. 2008). The shoreline at the Site has recently been temporarily reinforced to minimize this erosion, and protection of the shoreline has required routine maintenance by the Port and MJB. In February 2005, the Port completed a Bank Stabilization Interim Action along the Seafarers' Memorial Park shoreline under the Port's Consent Decree (Landau Associates 2005). Monitoring suggests that shoreline erosion has now ceased in the Interim Action area. However, a long-term shoreline remedy is needed for the Site that appropriately balances: 1) control of bank erosion and associated sediment ~~releases~~ from contaminated nearshore soils; 2) future land uses; and 3) habitat restoration. Ecology's selected cleanup action alternative for the Site described in Section 4 provides a reasonable balance of these and other MTCA and SMS objectives, including consideration of public and stakeholder preferences.

Detailed pre-remedial design (RD) shoreline stability modeling performed for the RI/FS demonstrated that within the North Marine Area, offshore wave attenuation structures would provide the most effective dissipation of wave energy along the Port Uplands Area shoreline by breaking incoming storm-generated waves and by preventing wave reflection from the existing Cap Sante Boat Haven breakwater. Construction of wave attenuation structures in the North Marine Area would also allow for permanent placement at the sediment surface of finer-grained (sand and gravel) habitat-suitable materials along the Port Uplands Area shoreline. Based on this information and other MTCA evaluations, Ecology's selected remedy for the North Marine Area includes construction of a permanent offshore wave attenuation structure (see Section 4).

The detailed pre-RD modeling also showed that for the South Marine Area offshore of the MJB North Area, application of beach armor rock would provide protection of the shoreline in a manner consistent with planned land uses. The cap would consist of a rock armor layer, with the interstices of the rock filled with gravel. This shoreline remedy would also be consistent with future development of the MJB North Area as a marina, subject to separate permitting requirements (see Section 3.1.1). Additional discussion of preliminary shoreline stabilization designs is presented in Section 4.

While the shoreline stabilization outlined above would control bank erosion in a manner consistent with land use and habitat restoration objectives (GeoEngineers et al. 2008), Ecology has determined that additional remediation of contaminated nearshore soils is necessary to meet MTCA threshold requirements for ~~permanent~~ protection of human health and the environment. Thus, Ecology's selected remedy includes removal to the maximum extent practicable of those contaminated soils from 0 to 10 ft BGS that are located within the existing shoreline buffer zone (up to 75 ft inland of the mean higher high water [MHHW] line) without adversely affecting existing buildings. Remediation levels in this application include sediment protection requirements, as discussed in more detail in Section 3.4.

3.2 Indicator Hazardous Substances

Under MTCA, "indicator hazardous substances" means the subset of hazardous substances present at a Site for monitoring and analysis during any phase of remedial action for the purpose of characterizing the Site or establishing cleanup requirements for that Site. Consistent with WAC 173-340-703, when defining cleanup requirements at a Site that is contaminated with a relatively large number of COPCs, Ecology may eliminate from consideration those hazardous substances that contribute a small percentage of the overall threat to human health and the environment. The remaining COPCs can then serve as indicator hazardous substances for purposes of defining Site cleanup requirements.

As outlined in Section 2.5, the list of COPCs (hazardous and/or deleterious substances) identified at the Site includes:

- Metals (antimony, arsenic, chromium, copper, lead, mercury, nickel, thallium and zinc)
- Wood debris (sediment wood percentage and TVS)

- Diesel- and motor oil-range petroleum hydrocarbons
- cPAHs
- PCBs
- Dioxins/furans
- 4-Methylphenol

Indicator hazardous substances selected by Ecology for the Site include all of the above COPCs with the exception of dioxins/furans and 4-methylphenol. Based on information presented in the RI/FS report (GeoEngineers et al. 2008), dioxins/furans contribute only a small percentage of the overall threat to human health and the environment at the Site, and exceedances of preliminary cleanup levels for these substances generally co-occur with other COPCs (see Figures 3 to 10 and Ecology 2008). Moreover, because of the relatively long turnaround times for reliable chemical analyses of dioxin/furan concentrations, near real-time compliance monitoring of dioxins/furans is problematic and was determined to be impracticable and unnecessary for this cleanup action. Accordingly, the final list of indicator hazardous substances at the Site excludes dioxins/furans.

Only one sediment sample collected at the Site (of 43 samples total) exceeded the SQS chemical criterion for 4-methylphenol, a common woody debris degradation product, and this COPC was not detected at levels of concern in Site soils or groundwater. Because sediment cleanup levels for wood debris (as measured by wood volume and TVS) were developed using site-specific biological assessments that include the effects of 4-methylphenol, a separate cleanup level for this COPC is not necessary. Accordingly, the final list of indicator hazardous substances at the Site excludes 4-methylphenol.

3.3 Cleanup Levels

Cleanup standards consist of 1) cleanup levels that are protective of human health and the environment; and 2) the point of compliance at which the cleanup levels must be met. Preliminary site-specific cleanup standards were developed in the RI/FS and detailed information regarding the derivation of cleanup levels can be found in the RI/FS report (GeoEngineers et al. 2008). Final media-specific cleanup levels and points of compliance are summarized below.

Site-specific cleanup levels for soil that are protective of human health and terrestrial ecological receptors, and cleanup levels for groundwater that are protective of marine surface water, were developed in accordance with MTCA requirements. Further testing of soil may be performed in selected portions of the Port Uplands Area to refine the evaluation of risk to terrestrial ecological receptors through soil bioassay and/or focused bioaccumulation testing. As discussed above, the soil bioassay and bioaccumulation results will be integrated into the final CAP.

Because Site groundwater is not a current or reasonably likely future source of drinking water, cleanup levels for Site soil need not be protective of groundwater as drinking water. Additionally, an empirical demonstration was used in the RI/FS and showed that existing chemical concentrations in Site soil are protective of groundwater as marine surface water at the proposed conditional point of compliance for groundwater.

Cleanup levels for sediments that are protective of benthic infauna were developed in accordance with MTCA and SMS requirements. Remediation levels for shoreline areas of the Site where erosion of soils could lead to deposition of contaminants in the Marine Area are discussed in Section 3.4.

Media-specific cleanup levels are discussed in the sections below.

3.3.1 Soil

Soil cleanup levels for unrestricted land use were developed in accordance with WAC 173-340-740, conservatively assuming potential future ground floor residential land use. Soil cleanup levels will apply to the soil from 0 to 15 ft BGS. Under MTCA Method B, soil cleanup levels must be as stringent as:

- Concentrations established under applicable state and federal laws
- Concentrations protective of terrestrial ecological receptors
- Concentrations protective of direct human contact with soil
- Concentrations protective of groundwater

Each of these criteria was considered during the development of soil cleanup levels, as detailed in the RI/FS report (GeoEngineers et al. 2008). Cleanup levels used in this DCAP for constituents detected in Site soil are presented in Table 1.

As discussed in Section 3.1.2, the Port and K-C may conduct more detailed TEE soil bioassays and/or focused bioaccumulation testing in parts of the Port Uplands Area where 0 to 6 ft BGS soil concentrations only exceed preliminary TEE levels. The soil bioassay and/or bioaccumulation results will be integrated into the final CAP.

3.3.2 Groundwater

As discussed in Section 2.6.2, human ingestion of hazardous substances in groundwater is not a potential exposure pathway because groundwater at the Site or potentially affected by the Site is not a current or reasonable future source of drinking water. Consequently, the Site groundwater qualifies as a non-potable water source.

Arsenic and/or petroleum constituents were detected at interior monitoring wells at concentrations above levels protective of marine surface water, though concentrations at or near the groundwater/surface water interface in the porewater discharge zone are protective of Site receptors. Site-specific groundwater cleanup levels for these indicator hazardous substances are as follows:

- Arsenic – 8 micrograms per liter (μg/L; based on PTI 1989)
- Diesel-range hydrocarbons – 500 μg/L (based on MTCA Method A)
- Motor oil-range hydrocarbons – 500 μg/L (based on MTCA Method A)

3.3.3 Sediment

Sediment cleanup levels were developed by Ecology according to MTCA and SMS requirements. Two SMS criteria are promulgated by Ecology (WAC 173-204-320). These include the SQS, the concentration below which effects to benthos are unlikely, and the CSL, the concentration above which more than minor adverse biological effects may be expected. The SQS and CSL values have been developed for a suite of hazardous substances. SQS criteria have been selected as sediment cleanup levels for the Site, although CSLs were used to develop appropriate shoreline soil remediation levels to ensure permanent sediment protection (see Section 3.4). A summary of the site-specific sediment cleanup levels for sediment indicator hazardous/deleterious substances is provided in Table 2.

There is no promulgated SMS criterion for wood debris in sediment. In fall 2007 and 2008, supplemental sediment investigations were performed in the Marine Area (GeoEngineers et al. 2008 and Appendix B to this DCAP). The primary objective of these supplemental investigations was to conduct a suite of confirmatory biological tests on synoptic surface sediment samples collected from locations representing the range of wood debris content at the Site with the potential for deleterious effects. These data were then used to develop sediment cleanup levels for wood debris at the Site. Based on interpretation of the available biological data, surface sediment TVS levels greater than 9.7 percent (dry weight basis) and/or wood debris levels greater than 25 percent (by volume) were identified as having the potential for site-specific deleterious effects exceeding SQS biological criteria.

There is also no promulgated SMS criterion for diesel and motor oil-range hydrocarbons. The Port and K-C will conduct more detailed site-specific biological testing, including focused bioassay testing of Site soil elutriates using Microtox® 15-minute reduction in bioluminescence (Ecology 1995), to support development of site-specific diesel and motor oil-range hydrocarbon soil remediation levels that ensure sediment protection. The focused soil/sediment bioassay sampling is currently scheduled for late January 2009, and the results will be integrated into the final CAP.

3.4 Upland Soil Remediation Levels

A remediation level defines a concentration of a hazardous substance in a particular medium above which a particular cleanup action component must be used (WAC 173-340-200). In practice, a remediation level is a contaminant concentration that is above a cleanup level. When soil contamination is above the soil remediation level, different cleanup actions may be employed than for contamination between the remediation level and the cleanup level. For example, soil with contamination above a remediation level may be excavated whereas soil with contamination below the remediation level but above the cleanup level may be managed on site using other technologies.

As discussed in Section 3.1.3, while the shoreline stabilization and capping actions included as part of the selected Site remedy would control bank erosion in a manner consistent with land use and habitat restoration objectives, additional remediation of contaminated nearshore soils is necessary to meet MTCA threshold requirements for permanent protection of human health and the environment and protection of sediment quality. Nearshore soil remediation levels were developed for this element of the remedy and will be used as the performance monitoring standard when excavating nearshore contaminated soils from 0 to 10 ft BGS that are located within the existing shoreline buffer zone (up to 75 ft inland of MHHW). Nearshore soil remediation levels in this application are based both on CSL chemical criteria for sediment indicator hazardous substances (applicable to the entire 0 to 10 ft BGS depth interval to ensure that adjacent sediments will not recontaminate above SQS chemical criteria, considering sediment transport conditions at the Site under a hypothetical future shoreline erosion scenario) and MTCA Method B (human health and ecological) cleanup levels (applicable to the 0 to 6 ft BGS depth interval; see Figures 17 to 19). A summary of the site-specific nearshore soil remediation levels that are applicable to the 0 to 6 and 6 to 10 ft BGS depth intervals is provided in Table 2.

As discussed in Section 3.3.3, the Port and K-C will conduct more detailed site-specific biological testing to support development of site-specific diesel and motor oil-range hydrocarbon soil remediation levels that ensure sediment protection. The results of the focused soil/sediment bioassay sampling will be integrated into the final CAP.

3.5 Points of Compliance

Under MTCA, the point of compliance is the point or location on a site where the cleanup levels must be attained. This section describes the points of compliance for soil, groundwater, and sediment.

3.5.1 Soil

The standard point of compliance for the soil cleanup levels shown in Table 1 will be throughout the soil column from the ground surface to 15 ft BGS, in accordance with WAC 173-340-740(6)(d) and WAC 173-340-7490(4)(b). For potential terrestrial ecological exposures, MTCA regulations allow a conditional point of compliance to be established from 0 to 6 ft BGS (the biologically active zone according to MTCA default assumptions), provided that environmental covenants are used to address potential excavation of deeper soil [WAC 173-340-7490(4)(a)]. Accordingly, in areas of the Site where potential ecological exposures are a concern, and where appropriate environmental covenants can be implemented, a conditional point of compliance for soil concentrations protective of terrestrial ecological receptors will apply throughout the soil column from 0 to 6 ft BGS.

Subject to final engineering and RD analyses, there will likely be limited areas of the Site where attainment of soil cleanup levels within the 0 to 6 ft BGS conditional point of compliance is impracticable, such as immediately adjacent to or beneath existing Site buildings. In such localized areas, and consistent with WAC 173-340-740(6)(f), other engineering approaches such as capping the soil with asphalt or concrete barriers, or placement of an indicator layer and clean soil cap (similar to remedial actions previously implemented at Port Parcel 2 (ThermoRetec 2000) may provide the necessary environmental protection. Cleanup specifications for these localized areas will be developed during RD, as appropriate.

3.5.2 Groundwater

Because groundwater cleanup levels are based on protection of marine surface water and not protection of groundwater as drinking water, the conditional point of compliance for the groundwater cleanup levels is the point of groundwater discharge to the Cap Sante Waterway and Fidalgo Bay. This corresponds to the groundwater/surface water interface at the Port Uplands Area and the MJB North Area. At the Port Uplands and MJB North Areas, shoreline wells will be used to evaluate compliance.

3.5.3 Sediment

For marine sediments potentially affected by hazardous substances, the point of compliance for protection of the environment is surface sediments within the biologically active surface water habitat zone, represented by samples collected across the top 10 cm (i.e., 0 to 0.3 ft) below the mudline.

3.6 Applicable Regulatory Requirements

In addition to the cleanup standards developed through the MTCA process and presented in Section 3.1, other regulatory requirements must be considered in the selection and implementation of the cleanup action. MTCA requires the cleanup standards to be "at least as stringent as all applicable state and federal laws" [WAC 173-340-700(6)(a)]. Besides establishing minimum requirements for cleanup standards, applicable state and federal laws may also impose certain technical and procedural requirements for performing cleanup actions. These requirements are described in WAC 173-340-710. Applicable state and federal laws are discussed below.

The cleanup action at the Site will be performed pursuant to MTCA under the terms of the Consent Decree between Ecology and the implementing Potentially Liable Parties (PLPs). Accordingly, the selected cleanup action meets the permit exemption provisions of MTCA, obviating the need to follow most procedural requirements of the various local and state regulations that would otherwise apply to the action. Ecology will determine the substantive provisions of state and local laws and regulations that are applicable to this project, following consultation with appropriate state and local regulators.

Similarly, the cleanup action also qualifies for a USACE Nationwide Permit 38 (NWP 38). Nevertheless, federal consultation under the Endangered Species Act, Section 401 Water Quality Certification, and other substantive requirements must still be met by the cleanup action. The USACE will separately be responsible for issuing approval of the project under NWP 38, following Endangered Species Act consultation with the federal Natural Resource Trustees, and also incorporating Ecology's 401 Water Quality Certification.

3.6.2 Solid and Hazardous Waste Management

The Washington Hazardous Waste Management Act and the implementing regulations, the Dangerous Waste Regulations (Chapter 173-303 WAC), would apply if dangerous wastes are generated during the cleanup action. There is no indication of listed wastes being generated or disposed of at the Site. Based on the analytical data generated during the RI/FS, only limited volumes of soil and/or sediment at the Site may be characterized as dangerous waste if excavated or dredged. The Dangerous Waste Regulations would be applicable only if post-removal sampling of excavated/dredged material (e.g., toxicity characteristic leaching procedure [TCLP] sampling, if required by the receiving landfill) or confirmation soil sampling indicated contaminant concentrations exceeding levels associated with dangerous waste characteristics or criteria. Related regulations include state and federal requirements for solid waste handling and disposal facilities (40 Code of Federal Regulations [CFR] 241, 257; Chapter 173-350 and -351 WAC) and land disposal restrictions (40 CFR 268; WAC 173-303-340).

3.6.3 Puget Sound Dredged Material Management Program

In Puget Sound, the open water disposal of sediments is managed under the DMMP. This program is administered jointly by the USACE, USEPA, the Washington Department of Natural Resources (WDNR), and Ecology. The DMMP developed the Puget Sound Dredge Disposal Analysis (PSDDA 2000) protocols, which include testing requirements to determine whether dredged sediments are appropriate for open water disposal. The DMMP has also designated disposal sites throughout Puget Sound. While initial characterization data collected during the RI/FS (GeoEngineers et al. 2008) indicates that sediment woody debris to be dredged from the Site is likely suitable for confined open-water disposal (e.g., at the Port Gardiner DMMP site), if this option is pursued by the implementing parties, additional characterization work would be required during RD to complete the suitability determination and permitting process. Use of PSDDA facilities would need to comply with other DMMP requirements including material approval, disposal requirements, and payment of disposal site fees.

3.6.4 State Environmental Policy Act

The State Environmental Policy Act (SEPA) (Revised Code of Washington [RCW] 43.21C; WAC 197-11) and the SEPA procedures (WAC 173-802) are intended to ensure that state and local government officials consider environmental values when making decisions. The SEPA process begins when an application for a permit is submitted to an agency, or an agency proposes to take some official action such as implementing a MTCA CAP. Prior to taking any action on a proposal, agencies must follow specific procedures to ensure that appropriate consideration has been given to the environment. The severity of potential environmental impacts associated with a project determines whether an Environmental Impact Statement is required. A SEPA checklist would be required prior to initiating remedial construction activities. Because the Site cleanup action will be performed under a Consent Decree, SEPA and MTCA requirements will be coordinated, if possible. The Port is the lead SEPA agency for this action.

3.6.5 Shoreline Management Act

The Shoreline Management Act (RCW 90.58) and its implementing regulations establish requirements for substantial developments occurring within water areas of the state or within 200 feet of the shoreline. The City of Anacortes has set forth requirements based on local considerations such as shoreline use, economic development, public access, circulation, recreation, conservation, and historical and cultural features. Local shoreline management plans are adopted under state regulations, creating an enforceable state law. Because the Site cleanup action will be performed under a Consent Decree, compliance with substantive requirements would be necessary, but a shoreline permit would not be required.

3.6.6 Washington Hydraulics Code

The Washington Hydraulics Code establishes regulations for the construction of any hydraulic project or the performance of any work that will use, divert, obstruct, or change the natural flow or bed of any of the salt or fresh water of the state. The code also creates a program requiring Hydraulic Project Approval (HPA) permits for any activities that could adversely affect fisheries and water resources. Timing restrictions and technical requirements under the hydraulics code are applicable to dredging and placement of cover sediments if necessary. The RI/FS was prepared using costs and durations that recognize potential fish closure periods, during which time dredging and any in-water work will not be permitted (GeoEngineers et al. 2008). Exact closure periods will be determined through agency consultation.

3.6.7 Water Quality Management

The Clean Water Act (CWA) is the primary federal law for protecting water quality from pollution. In addition to federal law, water quality is regulated by Ecology under the state water quality act, RCW 90.48. The CWA regulations provide requirements for the discharge of dredged or fill material to waters of the United States and are applicable to any in-water work. The CWA regulations also prescribe requirements for point source and non-point source discharges. Section 404 of the CWA requires permits from the USACE for discharges of dredged or fill material into waters of the United States, including wetlands. Requirements for all known, available, and reasonable technologies for treating wastewater prior to discharge to state waters are applicable to any dewatering of marine sediment prior to upland disposal. Section 401 of the CWA requires the state to certify that federal permits are consistent with state water quality standards. Because applicable provisions of state water quality standards are reflected in the Section 401 certification, the certification generally stands in the stead of a stand-alone determination by Ecology of state water quality provisions applicable to the cleanup action. The substantive requirements of a certification determination are applicable. State and federal standards for marine waters will be applicable to discharges to surface water during sediment dredging, and return flows (if necessary) to surface waters from dewatering operations.

Construction activities that disturb 1 acre or more of land need to comply with the provisions of state construction stormwater regulations, and a stormwater permit will be required for the cleanup action. A stormwater pollution prevention plan or equivalent MTCA construction quality assurance project plan (CQAPP) will be prepared prior to activities that would disturb 1 acre or more of soil. The CQAPP would document planned procedures designed to prevent stormwater pollution by controlling erosion of exposed soil and by containing soil stockpiles and other materials that could contribute pollutants to stormwater. It is anticipated that a CQAPP would be prepared as part of the remedial design process, and supplemented as appropriate by the remedial contractor.

3.6.8 Other Potentially Applicable Regulatory Requirements

The following is a list of other potentially applicable regulations for the cleanup action:

- Air Emissions – Applicable for site grading or excavation work that could generate dust. Controls would need to be in place during construction (e.g., wetting or covering exposed soils and stockpiles), as necessary, to meet the substantive restrictions on off-site transport of airborne particulates by the local agency, the Northwest Clean Air Agency.
- Archeological and Historical Preservation – The Archeological and Historical Preservation Act (16 USCA 496a-1) would be applicable if any subject materials are discovered during RD or site grading and excavation/dredging activities. A cultural resources assessment will be performed during RD to determine whether cleanup activities could affect historical archaeological remains that might be located in on-site fill, or affect prehistoric archaeological remains that could be located beneath the fill in past upland and marine locations. This information will be included in the USACE NWP 38 permit application.

- Health and Safety – Site cleanup-related construction activities would need to be performed in accordance with the requirements of the Washington Industrial Safety and Health Act (RCW 49.17) and the federal Occupational Safety and Health Act (29 CFR 1910, 1926). These applicable regulations include requirements that workers are to be protected from exposure to contaminants and that excavations are to be properly shored.

4.0 SELECTED SITE CLEANUP ACTION

The cleanup action selected by Ecology for the Site incorporates different actions targeted to different zones of the Site. The actions to be taken for each zone are interdependent. The following sections discuss the actions for each zone.

Many of the cleanup actions require soil excavation and backfilling to restore grade. All backfill soils must come from a source approved by Ecology and must have suitable geotechnical characteristics.

4.1 Port Uplands Interior Area Cleanup

Alternative PUA-4 has been selected as the cleanup action for the Port Uplands Area. This section describes the components of the cleanup action for those portions of the Port Uplands Area located landward of the shoreline buffer zone (Figure 13). Based on the evaluations presented in the RI/FS (GeoEngineers et al. 2008), PUA-4 has been selected as the remedy for this area of the Site, as described in more detail in Section 5 below. For the purpose of describing the cleanup action in this DCAP, the Port Uplands Area has been divided into two separate areas that address different exposure characteristics. The shoreline area consists of a buffer zone that extends inland from the MHHW level to approximately 75 ft west (upland) of the MHHW mark. Remedial actions in the shoreline zone are described along with sediment cleanup actions in Section 4.3 below. The remainder of the Port Uplands Area inland of the shoreline area addresses soil cleanup based on different exposure pathways and remediation levels and will be addressed separately from the shoreline area. These two adjacent areas are shown in Figure 13 and are described in the following sections.

The cleanup action for the Port Uplands Area, outside of the shoreline buffer zone, achieves removal to the maximum extent practicable of contaminated soil in the vicinity of MW-110 and focused removal of remaining contaminated soil at depths designed to address primary exposure pathways. The proposed cleanup action includes the following components:

- Excavate contaminated soil and overburden from areas of the Port Uplands Area west of the shoreline buffer zone, including:

  - Soil between 0 and 10 ft BGS at Port Parcel 1 containing metals at concentrations exceeding MTCA Method B cleanup levels
  - Soil between 0 and 15 ft BGS in the vicinity of monitoring well MW-110 containing free product, diesel-range hydrocarbons, or motor oil-range hydrocarbons exceeding the applicable soil TPH remediation level (TBD)
  - Soil between 0 and 6 ft BGS in remaining areas of the Port Uplands Area containing metals, diesel or motor oil-range hydrocarbons, or cPAHs at concentrations exceeding MTCA Method B cleanup levels
- Transport contaminated soil to appropriate disposal facility
- Backfill excavations with clean imported fill and restore original Site topography, features, and surfaces
- Develop environmental covenants to address remaining contaminated soil left in place below 6 ft BGS across the remainder of the Port Uplands Area
- Install a monitoring well network and monitor groundwater quarterly for at least one year

Prior to implementation, applicable regulatory requirements will be addressed as described in Section 3.6. The following sections provide further description of the components of the selected cleanup action for the Port Uplands Area.

4.1.1 Soil Removal

The anticipated areas and depths of soil removal activities associated with the selected cleanup action are depicted in Figure 13. Soil exceeding cleanup levels for metals, diesel and motor oil-range hydrocarbons, and cPAHs would be removed to varying degrees. Petroleum-contaminated soil adjacent to the Park Building would be excavated to the maximum practicable extent as generally shown on Figure 13. The existing Seafarers' Memorial Park building on Port Parcel 3 is expected to be preserved during remedial actions. It is anticipated that soils exceeding the remediation level for diesel and motor oil-range petroleum hydrocarbons (TBD), if found to be located below the building, would be left in place.

The soil removal associated with this cleanup action is expected to be performed using commonly available excavation techniques. The construction methods would be specified during the RD phase or by the selected cleanup contractor, but are likely to include the following:

- Excavation near buildings would utilize sheetpile walls or other equivalent shoring methods to protect the structural integrity of the buildings. Soil removal will be performed in a manner that will prevent demolition of the Park Building, potentially resulting in leaving inaccessible contaminated soil in place
- Excavations extending below 10 ft BGS would be completed using commonly available dewatering techniques to minimize the water content of the excavated materials to the extent possible
- The excavations would be completed in a manner that allows segregation and reuse of clean overburden soil, resulting in approximately 30 percent of excavated soil allowed to be reused as clean backfill
- Excavation of soil from areas on the upland side of the shoreline buffer zone as shown in Figure 13 results in approximately 21,600 cy excavated, including approximately 15,100 cy of contaminated soil and 6,500 cy of overburden soil assumed to be clean and suitable for on-site beneficial reuse.

4.1.2 Soil Disposal and Treatment

As noted above, it is assumed that the soil removal activities would be completed in a manner that allows segregation and reuse of clean overburden soil. The excavated soil would be characterized for disposal as required by MTCA and Washington State Dangerous Waste regulations and the selected disposal facility. Excavated contaminated soil is expected to fall into two categories: 1) non-dangerous waste suitable for disposal at a Subtitle D landfill; or 2) dangerous waste requiring either disposal at a Subtitle C (hazardous/dangerous waste) facility or treatment prior to disposal at a Subtitle D facility.

For soil to be categorized as non-dangerous waste and suitable for disposal at a Subtitle D landfill, it will be necessary to demonstrate that Site contaminants are not present at concentrations greater than ten times the Universal Treatment Standards (UTS), as defined in 40 CFR 268.48. This requirement includes the results of TCLP testing for metals.

It is expected that some of the excavated soil would be precluded from disposal at a Subtitle D landfill as non-dangerous waste based on exceeding ten times the UTS for lead. Lead has been detected in soil at the Port Uplands Area at concentrations that would potentially result in failure of this rule based on the TCLP. However, soil samples collected during the September 2008 supplemental sampling described in Appendix A indicated undetectable concentrations of lead in leachate samples of soil with total lead concentrations up to 680 mg/kg. Based on the TCLP results from the supplemental sampling, it is expected that the volume of upland soil that will fail TCLP for lead may be a small percentage of the total contaminated soil volume. Soil that fails TCLP as a result of disposal characterization will be transported to a permitted facility for off-site treatment and/or disposal.

4.2 MJB North Interior Upland Area Cleanup

Alternative MJB-4 has been selected as the cleanup action for the MJB North Area. Similar to Section 4.1, for the purpose of describing the cleanup action in this DCAP, the MJB North Area uplands have been divided into two separate areas that address different exposure characteristics. The shoreline area consists of a buffer zone that extends inland from the MHHW level to approximately 75 ft west (upland) of the MHHW mark. Remedial actions in the shoreline zone are described along with sediment remedial actions in Section 4.3 below. The remainder of the MJB upland area inland of the shoreline area addresses soil cleanup based on different exposure pathways.

Figure 14 presents the anticipated areas and depths of soil removal in Alternative MJB-4, which consists of the following elements for the upland area west of the 75 ft buffer zone:

- Remove shallow soil (0 to 6 ft BGS) with contaminant concentrations that exceed MTCA Method B cleanup levels throughout the uplands area

- Characterize and dispose of excavated soil in accordance with applicable regulations
- Perform confirmation sampling
- Backfill excavations with clean fill
- Develop environmental covenants to address remaining contaminated soil left in place below 6 ft BGS across the remainder of the MJB North Area
- Install a monitoring well network and monitor groundwater quarterly for at least one year

The estimated MJB North Area interior (i.e., west of the 75 ft buffer zone) excavation volume is approximately 3,500 cy. Excavation within the MJB interior under Alternative MJB-4 is not intended to extend below 6 ft BGS. However, localized areas of deeper soil contamination containing indicator hazardous substance concentrations above the cleanup levels listed in Table 1 may remain on-site. The 6 ft excavation depth will limit worker restrictions and concurrently limit the potential for terrestrial biota exposure. Furthermore, site characterization data presented in the RI/FS report (GeoEngineers et al. 2008) demonstrated that groundwater at the shoreline wells complies with the groundwater cleanup levels, indicating that leaching of subsurface (greater than 6 ft BGS) soil contaminants to groundwater is not an exposure pathway of concern. Therefore, soils left in place under this alternative will not be a source of mobile contamination that would affect marine surface water or sediments. The upland and marine area remedies (see Section 4.3) will be completed concurrently to minimize the amount of excavation dewatering needed and ensure as complete a removal as practicable within the designated areas.

Prior to implementation, applicable regulatory requirements will be addressed as described in Section 3.6. A utility locate will be conducted, the concrete rails on the east side of the property (Figure 14) will be demolished, and the existing monitoring wells (MW-1 through MW-7) abandoned except where they can be protected during cleanup and redevelopment activities. Approximately four post-construction monitoring events will likely be sufficient to confirm that groundwater at the MJB North Area has not been affected by Site contaminants.

4.3 Upland Buffer Zone and Marine Area Cleanup

Marine Alternative M-1 has been selected as the cleanup action for the Marine Area of the Site. This alternative removes surface sediments that exceed SQS chemical criteria in intertidal and subtidal areas, backfills all excavations with clean material, and provides for a protective cap throughout the intertidal area. Where the Marine Area connects to the shoreline buffer excavation area, a thickened cap edge will be created to provide additional armoring and prevent potential undermining of the cap from wave action along the shoreline. Erosion protection is provided by offshore wave attenuation structures along the Port property, and with armor rock along the MJB North Area property. Alternative M-1 also provides for mitigation of eelgrass disturbed by the remedial activities (as required by forthcoming permit actions), as well as potential on-site opportunities for additional eelgrass and/or macroalgae restoration.

The Marine Area cleanup action includes the following elements:

- Remove surficial debris in the intertidal area
- Remove the existing seasonal dock structure to allow for access
- Cut off or remove (as practicable) piles along the shoreline
- Dredge subtidal surface sediments exceeding SQS criteria
- Backfill subtidal excavations with clean sand to restore existing grades and manage anticipated dredge residuals within the excavation area
- Construct wave attenuation structures offshore of the Port Uplands Area and armored caps offshore of the MJB North Area to provide transitional slope cap protection (Figure 16)
- Excavate the shoreline transitional slope to facilitate cap placement while maintaining the approximate existing grades
- Transition shoreline buffer zone and Marine Area excavations as appropriate (Figures 17 to 19)
- Place a minimum of 2 ft of suitably-sized cap material (including a lower minimum 1-ft layer of quarry spalls) along the Port Uplands and MJB North Area shorelines that have been identified as potential erosional sources of localized contaminated sediment deposits
- Restore the existing seasonal dock structure.

The Marine Area dredge and excavation volume is approximately 30,200 cy, and the shoreline buffer excavation volume is approximately 10,600 cy (5,100 cy in the Port Uplands Area and 5,500 cy in the MJB North Area). Approximately 3,000 to 4,000 cy of this shoreline buffer excavation volume is anticipated to be clean soil potentially suitable for on-site beneficial reuse as backfill.

MJB and K-C will conduct supplemental soil sampling in parts of the shoreline buffer zone (including near PP-12 and PP-19), primarily to refine characterization of cPAH concentrations in soils between 0 and 6 ft BGS. These additional data may result in minor modifications to the shoreline buffer excavation boundary and volume in the MJB North Area. The focused soil sampling is currently scheduled for late January 2009, and the results will be integrated into the final CAP.

4.3.1 Shoreline Buffer Zone Excavation

The intent of the shoreline buffer zone remediation is to ensure that the cleanup action protects human health and ecological receptors, prevents recontamination of marine sediments, and supports habitat development along the shoreline. Figure 15 presents the anticipated areas of shoreline soil and marine sediment removal associated with the selected site-wide cleanup action. This selected cleanup action removes contaminated nearshore soil (exceeding cleanup and/or remediation levels, as appropriate) to a depth of 10 feet BGS as practicable within the shoreline buffer zone; this is the soil considered most likely to impact marine sediments if the shoreline erodes. Deeper contaminated soil within the shoreline buffer zone will either be left in place below existing clean soil or will be covered by clean fill following excavation of overlying contaminated soil. Shoreline soil within the upper 6 ft that exceeds MTCA Method B soil cleanup levels, CSLs, or (forthcoming) site-specific petroleum remediation levels (see Figures 17 to 19) will be excavated for off-site disposal under this alternative. Similarly, shoreline soil within the 6 to 10 ft BGS interval that exceeds CSLs or petroleum remediation levels will be excavated for off-site disposal. Clean soil overlying deeper contaminated soil will be stockpiled, sampled, and re-used if it is determined to be chemically and geotechnically suitable.

4.3.2 Intertidal Area Shoreline Transitional Slope Cleanup

In the intertidal area, the selected cleanup action includes excavation of sediment, wood debris and brick, along with removal or cutting of piles, to facilitate placement of a ~~nominal~~ 2-ft-thick cap to contain the thicker wood debris deposits located in the shoreline transitional slope (Figure 16). Removal and disposal methods are similar to those described for the subtidal area.

Where the intertidal area connects to the shoreline buffer zone excavation (as shown in Figures 17 and 19), the intertidal excavation will be performed to an elevation sufficient to provide for an armor layer to minimize the potential for erosion at the edge of the cap from breaking waves on the slope. While the wave attenuation and armoring schemes described in Section 4.3.5 are designed to prevent cap erosion, the armored intertidal cap section in the Port Marine Area will provide extra protection (e.g., quarry spalls will comprise the lower 1 ft of the cap). The 10 ft BGS excavation at the MHHW line will extend offshore at an approximate 1H:1V slope up to the bottom of the proposed offshore cap prior to backfilling and capping (see Figures 17 and 19). At the MHHW line, the intertidal excavation will connect directly to the 75 ft shoreline buffer zone excavation. Supplemental characterization of the Port Parcel 2 soils immediately east of the existing sheetpile wall is planned for January/February 2009. The results of this supplemental sampling will be integrated into the final CAP to ensure that shoreline contamination that may exist in this area is appropriately addressed.

Adjacent to the northern and central Port Uplands Area, the transitional intertidal slope cap will be a minimum of 2 ft thick, consisting of a lower 1-ft layer of quarry spalls covered with a 1-ft layer of surficial sand and gravel mixture. The cap does not extend into subtidal areas (Figure 16). Along the contiguous northern portion of the MJB North Area south of the influence of the wave attenuation structure, a 2-ft-thick armored cap will be placed, consisting of a thicker base layer of rock armor material with an overlying surface layer of sand and gravel. Detailed cap designs for various areas of the Site will be developed during RD. The current contours of the shoreline will be re-established by backfilling once the transitional slope excavation has been completed.

4.3.3 Subtidal Zone Dredging

The selected cleanup action includes dredging of surficial sediment and wood debris in the subtidal area that exceeds SQS criteria (Figure 15). A nominal 2-ft thickness of sediment will be excavated using either land- and/or water-based equipment depending on work area and tidal conditions. After excavation, sediment will be handled using one of the following three options:

- Sediment will be offloaded and transported to an approved off-site location for beneficial reuse (e.g., for use in regional topsoil products)
- Sediment will be transported by barge and disposed of at a suitable open-water disposal site such as the Port Gardner non-dispersive DMMP disposal site after larger wood and debris greater than 2 ft in any dimension is removed
- If neither of the above options is determined to be practicable, sediment will be offloaded, transported, and disposed of at an approved upland landfill

During RD, sediment within the prospective dredge prism will be further characterized to verify its suitability for open-water disposal. Potential disposal and upland beneficial reuse opportunities for these materials will also be finalized during RD. Based on these RD evaluations, one or more of the three options above may be implemented.

The majority of the subtidal dredged areas will be backfilled to approximate the existing grade with clean materials of differing grain size, depending on stable grain sizes and habitat design specifications for specific locations within the Marine Area. Grain size and other engineering specifications for the backfill material will be determined during RD, following USEPA, USACE, and other relevant design guidance (e.g., Palermo et al. 1998).

4.3.4 Erosion Protection

As described in the RI/FS report, the present wave environment in the Marine Area has resulted in significant erosion along the Port Uplands Area and MJB North Area shorelines. Erosion of soil from these shoreline areas is the likely source of down-drift sediment contamination observed just to the south, and erosion protection is thus a key element of the cleanup action. Integrated shoreline erosion and source control objectives will be achieved under the cleanup action using offshore wave attenuation and cap armoring as described below.

Offshore Wave Attenuation

To protect the Port Uplands Area shoreline from future erosion, offshore wave attenuation structures will be constructed to provide permanent and effective wave attenuation as described in the RI/FS, at the locations shown in Figure 16. By reducing incoming wave energy, a permanently stable shoreline cap can be constructed using sand and gravel materials in lieu of larger armor substrate materials.

Numerical modeling of wave conditions in the Marine Area is described in the FS. The numerical modeling evaluated both armored cap and wave attenuator alternatives for shoreline protection. The modeling results showed that the wave attenuation structures will more effectively dissipate the wave energy along the Port Uplands Area shoreline by breaking incoming storm-generated waves and by preventing wave reflection from the existing Cap Sante Boat Haven breakwater. The wave attenuation structure will allow for permanent placement of sand and gravel materials along the shoreline.

The wave attenuation structure will be constructed using imported rock with crest elevations ranging up to +12 ft MLLW.

Armored Cap

Along the Port Upland Area, the lower portion of the transition slope cap will be comprised of a quarry spall armor layer with a minimum thickness of 1 ft. This armor layer will provide long-term protection of the confined underlying sediments from direct wave-break action when exposed by tides. The armor layer will be covered by a minimum of 1 ft of sand and gravel material as shown on Figures 17 and 18.

Along the MJB North Area shoreline, the shoreline cap will be protected from erosion with a rock armor layer placed along the shoreline. Armored caps will be constructed to the extents shown in the Figure 16 plan view. The cap will include a 2-ft-thick rock armor layer along with a nominal 0.5-ft-thick top-dressing of sand and gravel that will be placed in the interstices of the rock.

4.3.5 Eelgrass and Macroalgae Restoration Opportunities

Disturbance of existing eelgrass beds is anticipated during construction of the remedy. Subtidal sediments in the dredge area will be excavated and replaced with clean sand and gravel in areas of existing eelgrass. Eelgrass beds disturbed by the cleanup action will be re-planted after backfilling and capping have been completed. There are potential opportunities for additional eelgrass and macroalgae restoration and placement of "mixed fine beach material" on the surface of the ~~breakwater~~ within the protected area provided by the wave attenuation structures, as shown in Figure 16.

4.4 Contamination Remaining On-Site Following Remedy

The selected cleanup action for the Port and MJB Uplands Areas is expected to contain soil in place at several locations across the Site with hazardous substance concentrations exceeding MTCA Method B soil cleanup levels listed in Table 1 for the respective properties.

As described in Section 4.2.1 above, the cleanup strategy for the Port Uplands Area relies on removing contaminated soil to varying depths across the Site for the purpose of removing particular exposure pathways. These areas of residual contaminated soil will be documented following completion of the cleanup action and will continue to be addressed through the use of confirmation monitoring and environmental covenants implemented at the Site, as described in Sections 4.5 and 4.7 below. The anticipated areas where contaminated soil will be contained in place at the Port Uplands Area include the following:

- **Park Building** – Soil contaminated with petroleum hydrocarbons, lead, and cPAHs is expected to underlie the Park Building. If encountered, the contaminated soil will be left in place under the current Park Building and at a distance from the building established to ensure the structural integrity of the building rather than demolishing the building to achieve complete removal. The contaminated soil under the building is expected to extend to a depth of 15 ft BGS or greater, based on data collected from the perimeter of the building.
- **Monitoring Well MW-102** – Soil in the vicinity of monitoring well MW-102 on the east side of R Avenue has arsenic concentrations above cleanup levels. Soil in this location will be removed to the extent possible. However, it is suspected that the arsenic-contaminated soil may extend under the Anacortes Concepts, L.L.C building to the east as well as below R Avenue. The excavation of this location will be performed so as not to impact the structural integrity of the building or the roadway, resulting in the potential to leave contaminated soil in place.
- **Northwest Educational Service Building** – The east end of the Northwest Educational Service Building was constructed over deep contaminated soil present near the southern end of the subsurface containment wall installed adjacent to the shoreline in Parcel 2. The excavation activity performed in the vicinity of this building is expected to leave contaminated soil in place underneath the building and at a distance from the building established to ensure the structural integrity of the structure.
- **Other Areas Below 6-ft BGS** – The cleanup goal for the areas of the Port Uplands Area outside of the shoreline buffer zone, the deep hydrocarbon removal area adjacent to the Park Building, and the Parcel 1 arsenic removal area is to remove contaminated soil in the upper 6 ft that exceeds cleanup levels. There are areas of soil contamination below 6 ft BGS that will be left in place. These areas are either currently underneath a 6-ft column of clean soil, or will be below 6 ft of clean backfill following soil removal activities in the upper 6 ft.

In the MJB North Area, the estimated maximum depth of contamination is approximately 16 ft BGS along the shoreline, which is the maximum depth of the fill material. Because excavation for Alternative MJB-4 will not extend below 10 ft BGS, localized areas of deeper soil contamination will remain at the MJB North Area at concentrations exceeding soil cleanup levels, particularly within portions of the shoreline buffer zone.

In both the Port Uplands and MJB North Areas, post-excavation confirmation samples will be collected and will be used to verify the remaining contaminant mass at the Site following completion of remedial actions (see Section 4.5 below). The remaining contamination will be protected from erosion by up to 10 ft of clean shoreline backfill.

Section 4.9 below discusses environmental covenants required for the portions of the Port and MJB North Areas where complete removal of soil exceeding applicable cleanup levels (Table 1) will not be achieved.

4.5 Construction Performance Monitoring

Performance monitoring following excavation and/or dredging will initially include topographic or bathymetric surveys to verify that at least 90 percent of the excavation/dredge area has achieved the required cut elevations, with the caveat that "high-spots" above the required elevations (i.e., up to 10 percent of the area) are relatively isolated (i.e., non-contiguous), and not the result of intentional bias during implementation.

Once required excavation or dredging elevations have been verified as outlined above, performance monitoring will involve collecting soil or sediment samples from the base and sidewalls of the upland excavations to confirm that soil remediation and/or cleanup levels have been achieved and/or to document concentrations of contaminants remaining on site. Performance monitoring activities will include the following:

- Collect discrete grab samples from the final limits of the upland and sediment remedial excavations, with the sampling density appropriately tailored to the location and size of the excavation.

- The confirmatory soil and sediment samples will be submitted for analysis of indicator hazardous substances and wood debris indicators listed on Tables 1 and 2, respectively to verify that the excavation actions are complete or to document remaining contaminant mass at the Site.
- Samples will be analyzed on a short turnaround basis to allow the results to be compared with soil remediation and/or cleanup levels shown in Tables 1 and 2 to evaluate whether the final limits of the remedial excavations have been achieved.
- Within certain Site areas including the shoreline buffer zone, the base of the excavations will be dictated by the design excavation depth rather than achievement of cleanup or remediation levels. In these areas, the excavation base samples will be used to document the extent of contamination remaining following completion of the excavation.

Performance samples exceeding the cleanup levels will be evaluated using Ecology's Statistical Guidance for Site Managers (Ecology 1992). For shallow upland excavations in the MJB North Area, the statistics will be completed using all of the post-excavation performance samples in the remaining upland area to obtain a large enough sample set to achieve statistical significance.

In addition to the remedial excavation performance samples described above, sampling of dewatering effluent may be performed if this water is discharged to the City of Anacortes sewer system. Samples of water that is pumped from the excavations by the construction dewatering system would be collected on a periodic basis as required by the City of Anacortes. The treated dewatering effluent sample results will be evaluated by the Port for compliance with the City's water quality standards for discharge to the sanitary sewer.

4.6 Post-Construction Confirmational Monitoring

The limited groundwater impacts identified at several interior monitoring wells within the Port Uplands Area are directly associated with areas of soil contamination that will be addressed by the selected cleanup action. The soil removal included as part of the remedy is expected to result in a reduction of contaminant concentrations in groundwater, thereby obviating the need for active groundwater remediation.

However, to verify that the proposed cleanup action is protective of groundwater, a network of monitoring wells will be installed at the Site and sampled for Site indicator hazardous substances. Approximately six monitoring wells are anticipated to be installed at locations along the Port Uplands Area shoreline, and two monitoring wells are proposed to be installed within the footprint of the proposed deep excavation adjacent to the Park Building. An additional five new and/or existing monitoring wells will be installed or redeveloped along the MJB North Area shoreline. The exact locations will be determined in the field based on the final dimensions of the excavation areas.

Groundwater will be sampled on a quarterly basis at each of the 12 monitoring wells either retained or installed following remedy implementation for a minimum of four consecutive quarters. Groundwater samples will be analyzed for the full list of soil indicator hazardous substances, including dissolved metals (see Table 1), diesel- and motor oil-range hydrocarbons, PCBs, and PAHs. Following completion of four consecutive quarters of groundwater sampling that indicate cleanup levels are being met, the quarterly groundwater sampling schedule will be discontinued. Long-term groundwater monitoring may be necessary if initial groundwater monitoring indicates the potential for contaminant transfer from remaining contaminated soil to groundwater over time.

4.7 Contingency Actions

Post-excavation performance sampling will ensure that contaminated soils are removed, as practicable. Groundwater monitoring will ensure that deeper contaminated soils left in place do not pose a hazard to marine surface water via soil to groundwater migration. Investigations completed during the RI/FS demonstrated that groundwater at the shoreline wells complies with the proposed groundwater cleanup levels, indicating that leaching of soil contaminants to groundwater is not an exposure pathway of concern. However, the remedial efforts along the shoreline may create soil disturbances that mobilize deeper contaminants. If contaminants exceed the cleanup levels in groundwater samples after four quarters of confirmational monitoring, semi-annual groundwater monitoring will be conducted for an additional two years. If the groundwater samples continue to exceed the groundwater cleanup levels after two years without abating, additional actions will be considered.

4.8 Future Site Use

The selected site-wide cleanup action is compatible with future expected land use for both the Port and MJB properties, and provides significant public access opportunities. The future expected land use of the MJB property is commercial/residential on the uplands, with possible marina use in the adjacent Marine Area. The selected cleanup action allows for this expected future development activity and provides opportunities for enhanced public access, including shoreline public access.

The selected cleanup action would also provide significantly enhanced public access to Fidalgo Bay at the Port Uplands Area. The Port Uplands Area is expected to continue to be used in its current configuration, with commercial uses on Parcels 1 and 2, and Seafarers' Memorial Park on Parcel 3. The selected cleanup action, including environmental covenants, is compatible with this continued pattern of land use. In addition, the cleanup action will provide opportunities for enhanced shoreline public access amenities as part of an integrated habitat/landscape architecture plan for the Port Uplands Area, and a new focus on small boat use at Seafarers' Memorial Park. The enhanced small boat use would be facilitated by the new beach and calm water area created by the wave attenuation structures, allowing safe launching/landing of small watercraft and an inviting public space for staging small boat excursions and events.

4.9 Environmental Covenants

The proposed cleanup action will leave soil exceeding MTCA Method B cleanup levels (Table 1) in place below 6 ft BGS in portions of the Port Uplands Area and MJB North Area, and potentially below existing structures such as the Park Building. While the contaminated soil below 6 ft BGS is deep enough to not pose current risks to human health and terrestrial ecological receptors, future development within areas of the contaminated soil could potentially generate conditions requiring appropriate safe handling procedures, stormwater controls, and consideration of disposal options for the specific indicator hazardous substances and concentrations encountered.

Environmental covenants will be required for the portions of the Port and MJB North Areas where complete removal of soil exceeding applicable cleanup levels (Table 1) will not be achieved. The covenants will identify specific contaminated soil locations and depths that will require special management if disturbed, unless the soil contamination is removed at a later time. Soil management plans will be required that instruct property owners on Ecology's requirements for performing invasive work in areas of remaining contaminated soil. The environmental covenants will be recorded following completion of excavation activities described in the CAP.

4.10 Potential Habitat Restoration Opportunities

Under the Puget Sound Initiative, MTCA cleanup actions are expected, where appropriate, to coincidentally enhance and/or restore habitat. The selected site-wide cleanup action provides significant habitat restoration opportunities and would restore almost 14 acres of currently degraded intertidal and subtidal habitat.

Existing riprap and degraded sediments in the intertidal parts of the Marine Area will be replaced with clean sand and gravel beaches that will provide higher quality habitat, particularly for forage fish. In the North Marine Area, degraded sediments within the transitional beach area protected by the wave attenuation structures will be replaced with clean sand and gravel to provide high quality substrate, and eelgrass will be planted in the areas protected by the wave attenuators. This area currently supports little to no eelgrass because of degraded sediment quality.

5.0 ALTERNATIVES CONSIDERED AND BASIS FOR REMEDY SELECTION

A range of potential site-wide cleanup action alternatives were evaluated in the final RI/FS report (GeoEngineers et al. 2008). This section summarizes the cleanup technologies and alternatives considered, and the basis for selection of the site-wide remedy.

5.1 Cleanup Technologies

The RI/FS report presents a detailed screening evaluation of potentially applicable general response actions and remediation technologies. The screening evaluation was carried out for each of the environmental media (soil, groundwater, and sediment) requiring cleanup action evaluation. During the development of the RI/FS, cleanup action alternatives were developed by assembling the technologies that were carried forward from this screening evaluation.

5.2 Feasibility Study Alternatives

The RI/FS presents a detailed evaluation of a range of potential cleanup action alternatives for the Port Uplands Area (PUA-1 to -4), MJB North Area (MJB-1 to -4), and Marine Area (M-1 to -2), which are summarized in Tables 3, 6 and 9, respectively. The RI/FS also presents detailed evaluations of each alternative, which are summarized in Section 5.3 below.

5.3 MTCA Disproportionate Cost Analysis

The MTCA disproportionate cost analysis (DCA) is used to evaluate which of the alternatives that meet MTCA threshold requirements are permanent to the maximum extent practicable. This analysis compares the relative benefits and costs of cleanup alternatives in selecting the alternative whose incremental cost is not disproportionate to the incremental benefits. Seven criteria are used in the disproportionate cost analysis as specified in WAC 173-340-360(2) and (3):

- Protectiveness
- Permanence
- Cost
- Long-Term Effectiveness
- Management of Short-Term Risks

- Implementability
- Consideration of Public Concerns

The comparison of benefits relative to costs may be quantitative, but will often be qualitative. Costs are disproportionate to the benefits if the incremental costs of a more permanent alternative exceed the incremental degree of benefits achieved by a lower-cost alternative [WAC 173-340-360(3)(e)(i)]. When two or more alternatives are equal in benefits, Ecology shall select the less costly alternative [WAC 173-340-360(3)(e)(ii)(C)].

The comparison of benefits relative to costs may be quantitative or qualitative based on the availability of quantitative data, such as mass of contaminants removed, estimated areas that will be contained, and volume of contaminated soils remaining on the Site. However, the benefits for some of the categories will be qualitative. For this reason, Ecology's analysis of which alternative is permanent to the maximum extent practicable is largely qualitative. The MTCA regulation allows Ecology to use best professional judgment to assess benefits qualitatively, and use its discretion to favor or disfavor qualitative benefits and use that information in selecting a cleanup action [WAC 173-340-360 (3)(e)(ii)(C)]. In order to document Ecology's qualitative analysis for the Site, Ecology assigned weighing factors to each of the six non-cost benefits criteria. The weighting factors represent Ecology's opinion on the importance of each benefit criterion at the Site, relative to protection of human health and the environment. The factors weighed for each of the criteria are briefly discussed in the following section and presented in Tables 3 to 11.

Protectiveness

The overall protectiveness of a cleanup action alternative is evaluated based on several factors, including the extent to which human health and the environment are protected and the degree to which overall risk at a site is reduced [WAC 173-340-360(3)(f)(i)]. Both on-site and off-site reductions in risk resulting from implementing the alternative are considered. Protectiveness is determined by evaluating the degree of improvement in overall environmental quality. At this Site, Ecology believes a weighting factor of 30 percent is appropriate for protectiveness. This represents the greatest value of all categories and is necessary based on the overall importance of protection of human health and the environment, especially in relation to Ecology's goal of restoring the health of Puget Sound.

Permanence

Under MTCA, the permanence of an alternative is evaluated based on the degree to which the remedy permanently reduces the toxicity, mobility, or mass of hazardous substances, including the effectiveness of the alternative in destroying hazardous substances, the reduction or elimination of hazardous substance releases and sources of releases, the degree of irreversibility of waste treatment processes, and the characteristics and quantity of treatment residuals generated [WAC 173-340-360(3)(f)(ii)]. Based on the importance of the restoration of Puget Sound, Ecology believes this factor to be second only to protectiveness in importance and used a weighting factor of 20 percent for this evaluation criterion.

Cost

The analysis of cleanup action alternative costs under MTCA includes consideration of all costs associated with implementing an alternative, including design, construction, long-term monitoring, and environmental covenants [WAC 173-340-360(3)(f)(iii)]. Costs are intended to be comparable among different alternatives to assist in the overall analysis of relative costs and benefits of the alternatives. Costs are compared against benefits to assess cost-effectiveness and practicability of the cleanup action alternatives. No weighting factor is applied to this quantitative category, as costs are compared against the numeric analysis.

Long-Term Effectiveness

Long-term effectiveness expresses the degree of certainty that the alternative will be successful in maintaining compliance with cleanup standards over the long-term [WAC 173-340-360(3)(f)(iv)]. The MTCA regulations contain a specific preference ranking for different types of technologies that is to be considered as part of the comparative analysis. The ranking places the highest preference on technologies such as reuse/recycling, treatment, immobilization/solidification, and disposal in an engineered, lined, and monitored facility. Lower preference rankings are applied to technologies such as on-site isolation/containment with attendant engineered controls, and environmental covenants and monitoring. The regulations recognize that, in most cases, the selected cleanup remedy will combine multiple technologies. The MTCA preference ranking must be considered along with other site-specific factors in the evaluation of long-term effectiveness. Ecology considers a weighting for this factor of 20 percent to be appropriate at this Site.

Management of Short-term Risks

This criterion is a measure of the relative magnitude and complexity of actions required to maintain protection of human health and the environment during implementation of the cleanup action [WAC 173-340-360-(3)(f)(v)]. Cleanup actions carry short-term risks, such as potential mobilization of contaminants during construction, or safety risks typical of large construction projects. In-water dredging and excavation of contaminated soils along the shoreline carry a risk of temporary water quality degradation and potential sediment recontamination. Some short-term risks can be managed through the use of best management practices during the project design and construction, while other risks are inherent to certain project alternatives. A weighting factor of 10 percent is being used for this Site. This lower rating is based on the limited timeframe associated with the risks and the general ability to modify any alternative to reduce short-term risks during construction without significant effect on human health and the environment.

Implementability

Implementability is the ability to implement the selected remedy. It measures the overall relative difficulty and uncertainty of implementing the cleanup action. It includes technical factors such as the availability of proven technologies and experienced contractors to accomplish the cleanup work [WAC 173-340-360(3)(f)(vi)]. It also includes administrative factors associated with permitting and completing the cleanup. The weighting factor Ecology used for implementability is 10 percent. Implementability is less associated with the primary goal of the cleanup action, protection of human health and the environment, and therefore has a lower weighting factor. In addition, the issues associated with the implementability of a remedy are often duplicated in the remedy costs. Engineering design considerations are often of primary importance in this category and often refined during the development of the engineering design report.

Consideration of Public Concerns

The public involvement process under MTCA is used to identify potential public concerns regarding cleanup action alternatives [WAC 173-340-360(3)(f)(vi)]. The extent to which an alternative addresses those concerns is considered as part of the remedy selection process. This includes concerns raised by individuals, community groups, local governments, tribes, federal and state agencies, and other organizations that may have an interest in or knowledge of the Site. A weighting factor of 10 percent is being used for the evaluation of this category. The public concerns voiced during the public involvement process can also be included in the other categories identified above such as protectiveness and long-term effectiveness. Public concerns that can be incorporated into alternative categories are more appropriately considered in the scoring of those other categories. In particular, the public concerns for this Site would generally be associated with environmental concerns and performance of the cleanup action, which are addressed under other criteria such as protectiveness and permanence.

5.4 Evaluation and Comparison of Port Uplands Area Alternatives

This section provides a comparative analysis of the remedial alternatives considered for the Port Uplands Areas. The MTCA evaluation criteria discussed in Section 5.4 were used to evaluate the each remedial alternative, with the alternatives then ranked based on their expected performance under each criterion. Table 3 presents the details about the Port Uplands Areas remedial alternatives. The details of evaluation and their results are presented in Tables 4 and 5, respectively.

Threshold Requirements

Based on the review of final RI/FS report (GeoEngineers et al. 2008), Ecology determined that Port Alternative PUA-3 does not meet threshold requirements under MTCA for cleanup actions [WAC 173-340-360(2)], because this alternative does not address soil contamination present between 6 and 10 ft BGS along the shoreline. Thus, this alternative is not considered for the DCA.

The other three remaining alternatives (PUA-1, PUA-2, and PUA-4) meet MTCA threshold requirements, because they address the contamination present at the Site to varying degrees, including the contamination present between 6 to 10 ft BGS along the shoreline and at other locations on the Site. The details of depths, quantity of excavation, and costs are presented in Table 3.

5.4.1 Comparison of Port Uplands Areas Alternatives by Criteria

The evaluation of disproportionate cost is based on a comparative analysis of costs against the remaining six MTCA evaluation criteria. Relative rankings of each alternative for these six criteria are summarized in Table 4. These rankings are briefly discussed below:

Protectiveness

Alternatives PUA-2 and PUA-4 are less protective than Alternative PUA-1. Alternative PUA-1 is the most protective because it removes all contaminated soils to the maximum extent practicable. Alternatives PUA-2 and PUA-4 receive the same ranking, since these remove contaminated soils to varying depths, resulting in leaving some subsurface contamination, and both rely on environmental covenants to prevent exposure to the contaminated soils left in place. Alternative PUA-1 ranks the highest for the overall protectiveness, and both Alternatives PUA-2 and PUA-4 rank 80 percent in overall protectiveness compared with PUA-1.

Permanence

Alternative PUA-1 achieves the highest level of performance relative to other two alternatives, since it includes the removal of soil contamination to the maximum extent practicable. However, Alternatives PUA-2 and PUA-4 are also considered to be permanent because they will be implemented in conjunction with the in-water remedy that includes shoreline protection. Alternatives PUA-2 and PUA-4 rank at 80 percent for permanence compared with Alternative PUA-1.

Long-Term Effectiveness

Alternative PUA-1 achieves a higher degree of long-term effectiveness than the other two alternatives as a result of the greater amount of contaminated removed under that alternative, and is assigned a ranking of 5. Alternatives PUA-2 and PUA-4 are assigned rankings of 4 and 3 respectively, since lesser amounts of contaminated soils will be removed under those alternatives compared to PUA-1. The ranking order for long-term effectiveness from highest to lowest is PUA-1, PUA-2, and PUA-4. Alternatives PUA-2 and PUA-4 rank 80 percent and 60 percent in long-term effectiveness compared with PUA-1, respectively.

Management of Short Term-Risks

Alternative PUA-1 receives the lowest ranking for this category, since a greater amount of contaminated soils will be removed under this alternative along the shoreline, near the Park Building relative to the other two alternatives. In addition, excavation of deep soils along the shoreline may require extensive shoring and dewatering. Alternatives PUA-2 and PUA-4 received a higher score for the management of short-term risks, relative to Alternative PUA-1, as a result of the reduced extent of soil excavation.

Implementability

The lowest score for implementability was assigned to Alternative PUA-1, which received a score of 2. This is as a result of the extensive excavation, including the deep excavation along the shoreline, which may require extensive shoring and dewatering. Both Alternatives PUA-2 and PUA-4 received a higher score of 3 for implementability relative to PUA-1 because of the reduced extent and difficulty of soil removal associated with these alternatives.

Consideration of Public Comments

Public concerns were identified based on the public comments received on the draft RI/FS report. No public concerns were expressed concerning Alternative PUA-1, since it is the most protective alternative. Alternative PUA-1 was therefore assigned a score of 5 for consideration of public concerns. Alternatives PUA-2 and PUA-4 leave some residual soils contamination below 10 ft BGS, so they were assigned a score of 4 for this category. The rankings provided in Table 4 are intended to reflect on balance, how well the alternatives address the cross-section of public comments received. Alternative PUA-4 is relatively responsive to public concerns that have been raised and receives a moderately high score of 4. This alternative makes significant use of removal of contamination between 6 to 10 ft BGS that is present along the shoreline and in the vicinity of the Park Building. Favorable public comments were received for Alternative PUA-4 with respect to its balancing of cost and environmental benefits.

5.4.2 Reasonable Restoration Time Frame

The restoration time pertains to the time required to meet cleanup levels. The restoration time for all three of the Port Uplands Area alternatives is in the order of 2 to 3 years. This includes project design, permitting, construction, and closure activities. Alternatives PUA-2 and PUA-4 would leave some residual contamination in place requiring long-term monitoring and consequently could extend the duration of time for monitoring to confirm that cleanup levels are being maintained.

5.4.3 Overall Comparison of Remedy Costs and Benefits

Tables 3 and 4 and Figure 20 summarize costs and remedy benefits for each Port Uplands Area alternative. The estimated costs of the alternatives range from $9.1 to $18.3 million. The RI/FS report (GeoEngineers et al. 2008) presents detailed cost estimates for the Port Uplands Area alternatives. These costs are expressed in 2008 dollars without adjustment to future cost inflation and without present value discount of future costs. The probable remedy costs are expected to vary with a range of +50 percent to -30 percent.

The overall benefits associated with each alternative using a composite ranking are presented in Table 5 and Figure 20. The calculated benefits using the categorical weighting factors are in Table 4. The calculated benefits integrate the rankings for each evaluation criterion discussed above, multiplied by the weighting within that category and summed to reach the benefits total. As per MTCA requirements, the relative benefits and cost of each alternative are compared to the Alternative PUA-1, since PUA-1 represents the most permanent remedial alternative evaluated. It therefore represents the benchmark for comparison of the other remedies' incremental benefits and costs.

Alternative PUA-1 receives an overall benefit score of 4.4, because it uses the greatest extent of contaminated soils excavation and off-site disposal. The remedy is considered to provide high benefit rankings under protectiveness, performance and long-term effectiveness. However, this alternative has a low ranking for short-term risks management and implementability. The calculated score of 4.4 for PUA-1 is slightly higher than that for Alternative PUA-2. However, Alternative PUA-1 is substantially more costly than PUA-2 (60 percent more). Because the cost of Alternative PUA-1 is substantially higher ($6.8 million) than that of Alternative PUA-2, whereas the benefit level is only slightly greater (0.6), the incremental cost of Alternative PUA-1 is disproportionate to the incremental environmental benefits gained.

Alternative PUA-2 achieves a calculated benefit score of 3.8. This alternative has a high score for protectiveness, performance, and long-term effectiveness, although its scores are generally lower than those for Alternative PUA-1. It has a medium ranking for the management of short-term risk, implementability, and consideration of public concerns. This alternative is consistent with the Port's future land use plans.

Alternative PUA-4 receives an overall benefit score of 3.9. This alternative has a relatively high score for protectiveness, performance, and long-term effectiveness, although generally lower than Alternative PUA-1. It receives a moderate score for the management of short-term risk and implementability. However, it received favorable public comments with respect to balancing the cost to the overall environmental benefits. This alternative is also designed to accommodate for the Port's future land use plans.

The calculated ranking of Alternative PUA-4 (3.7) is slightly lower than that of Alternative PUA-1 (4.4). Rankings for Alternatives PUA-2 and PUA-4 were nearly identical (3.8 and 3.7 respectively); however, both ranked lower for protectiveness, permanence, and long-term effectiveness relative to Alternative PUA-1, since PUA-2 and PUA-4 do not remove all the contaminated soils to the maximum extent practicable. Estimated costs of Alternatives PUA-2 and PUA-4 are $11.5 million and $9.1 million respectively. Though the overall score for these two alternatives is almost the same, Alternative PUA-4 provides a relatively high level of benefits as measured against MTCA criteria, because of the higher cost associated with Alternative PUA-2.

Figure 20 presents a graphical comparison between remedy costs and benefits for each of the alternatives. Remedy benefits are plotted in gray using the calculated rankings from Table 5 and hatched portion of the graph represents the costs of alternatives. The relative costs and benefits are graphically represented by a line.

A substantial increase in costs among Alternatives PUA-4, PUA-2, and PUA-1 is apparent from this graph. Since the increase in cost is not accompanied by a corresponding increase in remedy benefits, Alternative PUA-1 is impractical (incremental costs are disproportionate to the incremental environmental benefits gained) and lower cost alternatives should be considered.

The overall benefit score for Alternatives PUA-2 and PUA-4 are almost the same (3.8 and 3.7 respectively). However, Alternative PUA-2 costs $2.4 million (20 percent) more than Alternative PUA-4. Hence, Alternative PUA-4 has a greater degree of overall environmental benefits per unit of incremental cost than Alternative PUA-2. In addition, this alternative is considered permanent to the maximum extent practicable under MTCA.

5.4.4 Conclusions

Based on the above DCA evaluation per MTCA requirements, Alternative PUA-4 is identified as the preferred alternative for the Port Uplands Area. This alternative uses a high-performance technology (removal) and provides a high level of calculated ranking, achieving the highest degree of environmental benefits for the unit of incremental cost while still remaining practical. The high costs of contaminated soil removal under this alternative are appropriately targeted at the soils that;

- Have the highest contamination levels (i.e., source areas)
- Can be removed safely without an excessive level of short-term risk
- Consider the community concerns raised during the public comment period

Alternative PUA-4 is permanent to the maximum extent practicable and hence identified as the preferred alternative for the Port Uplands Area.

5.5 Evaluation and Comparison of MJB North Area Upland Alternatives

Comparative analyses of remedial alternatives considered for the MJB North Area are discussed in this section. The MTCA evaluation criteria as discussed in Section 5.4 were used to evaluate the each remedial alternative and compared to each other relative to their expected performances under each criterion. Table 6 presents the details on each of the MJB North Area remedial alternatives. The details of the evaluation and their results are presented in Tables 7 and 8, respectively.

Threshold Requirements

Based on review of the RI/FS report, Ecology determined that Alternatives MJB-1 and MJB-4 meet the MTCA threshold requirements for cleanup actions. However, Ecology determined that Alternatives MJB-2 and MJB-3 do not meet MTCA threshold requirements because these alternatives would leave a significant amount of contaminated soil exceeding cleanup levels in place between 6 and 10 ft BGS along the shoreline. Consequently, Alternatives MJB-2 and MJB-3 are not carried through the DCA.

Alternatives MJB-1 and MJB-4 are evaluated and compared with respect to MTCA criteria described in Section 5.4. Table 7 presents a summary of criteria used in the evaluation of above two alternatives.

5.5.1 Comparison of MJB North Area Alternatives by Criteria

The evaluation of disproportionate cost is based on a comparative analysis of costs against six criteria. Relative rankings of each alternative for these six criteria are summarized in Table 7. These rankings are briefly discussed below:

Protectiveness

Alternative MJB-1 removes the soil contamination to the maximum extent practicable, and consequently receives the highest score in this category. Alternative MJB-4 receives a lower ranking than Alternative MJB-1, since some of the localized deeper soil contamination will be left in place under MJB-4. However, Alternative MJB-4 reduces terrestrial ecological risks within the remaining uplands area by reducing constituent concentrations to protective levels. Alternative MJB-4 ranks 80 percent in performance compared to Alternative MJB-1.

Permanence

Alternative MJB-1 is rated highest for this criterion because it reduces the contaminant mass, toxicity, and volume to the greatest extent by the removal of all contaminated soils present along the shoreline. Alternative MJB-4 removes less contaminant volume than Alternative MJB-1, and thus receives a lower (medium) score than Alternative MJB-1. Contaminated soils removed under both alternatives would be placed in an off-site landfill. Alternative MJB-4 ranks 80 percent in performance compared to Alternative MJB-1.

Long-Term Effectiveness

Both alternatives would produce wastes requiring off-site management. Alternative MJB-1 receives the highest score, since it is expected to excavate all the contaminated soils along the shoreline and uplands. Alternative MJB-4 would leave some deeper contaminated soils in place, and as a result is ranked lower than Alternative MJB-1. Alternative MJB-4 ranks 80 percent in long-term effectiveness compared to Alternative MJB-1.

Management of Short-Term Risks

Alternative MJB-1 ranked lowest for this criterion, since the greatest volume of soil disturbed/excavated including below the water table may require shoring and dewatering. Alternative MJB-4 ranked higher than Alternative MJB-1 as a result of the reduced amount of soil disturbance/excavation and consequently reduced risk during the excavation and in transportation.

Technical and Administrative Implementability

Both alternatives can be implemented. Alternative MJB-4 would be easier to implement than Alternative MJB-1, as MJB-1 would require excavation of soil below the water table, which may require shoring and dewatering. Consequently, Alternative MJB-4 is ranked higher than Alternative MJB-1 for this criterion.

Consideration of Public Comments

Alternative MJB-1 provides the most complete removal and therefore has high level of public acceptance, as a result scored higher than Alternative MJB-4. Alternative MJB-4 leaves some contaminated soils in place. Both alternatives are acceptable to the public. However, based on the public comments received, Alternative MJB-4 was favored because of balancing the cost and environmental benefits.

5.5.2 Reasonable Restoration Time Frame

Both Alternatives MJB-1 and MJB-4 require approximately two to three years for implementation, and therefore have the same initial restoration timeframe. Since Alternative MJB-4 would leave some contaminated soil in place, and would require long-term monitoring and environmental covenants to meet cleanup goals, Alternative MJB-4 may require a longer restoration time.

5.5.3 Overall Comparison of Remedy Costs and Benefits

Alternative MJB-1 removes a greater volume of contaminated soils than Alternative MJB-4. However, both alternatives are protective of human health and the environment because both will meet the final soil cleanup levels at the standard point of compliance or at a conditional point of compliance through the excavation of contaminated soils along the shoreline and in other upland areas of the Site.

The MJB North Area alternative costs and benefits are summarized in Tables 6 and 7 and Figure 21. The estimated costs of Alternatives MJB-1 and MJB-4 are $7.0 million and $4.8 million respectively. The RI/FS report presents detailed cost estimates for the MJB North Area alternatives. These costs are expressed in 2008 dollars without adjustment to future cost inflation and without present value discount of future costs. The probable remedy costs are expected to vary with a range of +50 percent to -30 percent.

Alternative MJB-1 represents the most permanent remedial alternative evaluated, owing to excavation of all contaminated soils exceeding soil cleanup levels at the standard point of compliance required by MTCA (soil between 0 and 15 ft BGS), whereas Alternative MJB-4 is capable of meeting soil cleanup levels at a conditional point of compliance corresponding the upper 10 ft BGS in soil. Hence, Alternative MJB-1 is considered as the bench mark against which the relationship between incremental remedy benefits and incremental costs are evaluated.

Alternative MJB-4 receives an overall score of 3.8. This alternative has a relatively high score for protectiveness and performance, and a medium score for long-term effectiveness, lower than Alternative MJB-1. It received a moderate score for the management of short-term risks and implementability, which are the same or higher than Alternative MJB-1. Nonetheless, this alternative received favorable comments from the public with respect to balancing the cost and environmental benefits. This alternative is also consistent with the future land use plans.

The overall calculated ranking of Alternatives MJB-1 and MJB-4 are 4.5 and 3.8, respectively. Alternative costs are $7.0 million and $4.8 million respectively. While the overall ranking of Alternative MJB-1 (4.5) is slightly higher than that of

Alternative MJB-4 (3.8), Alternative MJB-1 costs $2.2 million more than the Alternative MJB-4. Thus, Alternative MJB-1 costs 50 percent more, but overall environmental benefit gained is relatively small (0.7).

Figure 21 presents a graphical comparison between remedy costs and benefits for each of MJB North Area alternatives. Remedy benefits are plotted in gray using the calculated rankings from Table 8 and the hatched portion of the graph represents the costs of alternatives. The relative costs and benefits are graphically represented by a line.

The increase in costs between Alternative MJB-1 and MJB-4 is apparent in Figure 21. However, both alternatives provide appropriate human health and environmental protection, permanent solution to the maximum extent practicable, and reasonable restoration time. Hence, the increase in cost ($2.2 million) of Alternative MJB-1 is not accompanied by a corresponding increase in remedy benefits (0.7). Therefore, as per MTCA, Alternative MJB-1 is impractical and lower cost alternatives should be considered. Ecology considers the incremental cost of Alternative MJB-1 to be substantial and disproportionate to the negligible degree of environmental benefits achieved by this alternative. Thus, Alternative MJB-4 has a greater degree of overall benefits achieved for incremental unit cost than Alternative MJB-1. This alternative is also considered permanent to the maximum extent practicable under MTCA.

5.5.4 Conclusions

Based on the above DCA evaluation per MTCA requirements, Alternative MJB-4 is identified as the preferred remedial alternative for the MJB North Area. This alternative uses high performance technologies and provides a high level of calculated ranking, achieving the highest environmental benefits to the unit incremental cost while remaining practical.

The high costs of contaminated soil removal under this alternative are appropriately targeted at the soils that:

- Have the highest contaminants levels (i.e., source areas)

- Have medium metal concentrations for soil homogenization
- Can be removed and/or homogenized safely without an excessive level of short-term risk
- Considers the community concerns raised during the public comment

Alternative MJB-4 is permanent to the maximum extent practicable and hence is identified as the preferred alternative for the MJB North Area.

5.6 Evaluation and Comparison of Marine Area Alternatives

Comparative analyses of remedial alternatives considered for the site-wide Marine Area are discussed in this section. The MTCA evaluation criteria as discussed in Section 5.4 were used to evaluate the each remedial alternative and compared to each other relative to their expected performances under each criterion. Table 9 presents the details on each of the Marine Area remedial alternatives. The details of the evaluation and their results are presented in Tables 10 and 11, respectively.

Threshold Requirements

Based on review of the RI/FS report, Ecology determined that both Alternatives M-1 and M-2 meet the MTCA threshold requirements for cleanup actions. Alternatives M-1 and M-2 are evaluated and compared with respect to MTCA criteria described in Section 5.4. Table 10 presents a summary of criteria used in the evaluation of above two alternatives.

5.6.1 Comparison of Marine Area Alternatives by Criteria

The evaluation of disproportionate cost is based on a comparative analysis of costs against six criteria. Relative rankings of each alternative for these six criteria are summarized in Table 10. These rankings are briefly discussed below:

Protectiveness

Alternatives M-1 and M-2 are both protective and provide risk reduction because contamination is removed from the aquatic area. Alternative M-1 ranks higher than Alternative M-2 because it removes a greater volume of impacted sediment (Table 9).

Permanence

Neither alternative achieves permanent destruction of metals or organic constituents (including wood debris). Where upland disposal is used, considerations about long-term management of sediments in the landfill are the same as those described for the upland soils. However, both alternatives achieve a permanent risk reduction in the aquatic environment by removing impacted sediments. Alternative M-1 achieves marginally greater permanence because it removes sediments above the SQS; however, the greater increment of permanence is achieved at additional cost (see below). For both alternatives, the unavoidable generation of dredge residuals requires the placement of a nominal 0.5-ft-thick sand layer to ensure a clean post-dredge surface and achieve cleanup standards in a reasonable timeframe.

The wave attenuation structures offshore of the Port property will allow for placement of permanent caps consisting of finer-grained, habitat-enhancing materials. These caps will not require long-term maintenance and will allow for a stable environment for aquatic habitat to develop.

Long-Term Effectiveness

Alternative M-1 is considered marginally more effective than Alternative M-2 in the long term because it removes a greater volume of potentially harmful sediment from the aquatic environment. However, due to the greater volume of dredging in Alternative M-1, there may be an increased potential for dredge residuals compared to Alternative M-2. In both alternatives, residuals would be managed using a post-dredge cover of clean material.

Management of Short-Term Risks

Alternative M-1 entails a greater volume of dredging and post-dredge cover placement. The construction duration is longer. During construction, there would be a greater potential for short-term water quality impacts associated with dredging, backfilling, capping, and cover placement. In comparison, Alternative M-2 requires a lower volume of dredging, backfill, capping, and cover materials.

Thus, Alternative M-2 ranks marginally higher than Alternative M-1 for management of short-term risks.

Implementability

Both alternatives are technically possible to implement relative to complexity, administrative/regulatory requirements, size, access, and integration with existing operations. Alternative M-1 entails removing a greater volume of material from the dredge area, and consequently requires management of more excavated material for disposal or beneficial reuse. Without considering beneficial reuse, both Alternatives M-1 and M-2 are considered to rank equally for technical and administrative implementability. If a beneficial reuse option for wood debris material were to become available and determined to be practicable during RD, Alternative M-1 would rank lower for implementability because as the dredge volume increases, a greater area of upland space would be needed for staging beneficial reuse activities.

5.6.2 Reasonable Restoration Time Frame

Both Alternatives M-1 and M-2 require approximately two to three years for implementation, and therefore have the same initial restoration timeframe. Since Alternative M-2 would leave some contaminated sediment in place, and would require long-term monitoring and environmental covenants to meet cleanup goals, Alternative M-2 may require a longer restoration time.

5.6.3 Overall Comparison of Remedy Costs and Benefits

Alternative M-1 removes a greater volume of contaminated sediments than Alternative M-2. However, both alternatives are protective of human health and the environment because both will meet the final sediment cleanup levels at the standard point of compliance at the Site.

The Marine Area alternative costs and benefits are summarized in Tables 9 and 10. The estimated costs of Alternatives M-1 and M-2 are $7.1 million and $5.8 million, respectively. The RI/FS report presents detailed cost estimates for the Marine Area alternatives. These costs are expressed in 2008 dollars without adjustment to future cost inflation and without present value discount of future costs. The probable remedy costs are expected to vary with a range of +50 percent to -30 percent.

Alternative M-1 has the highest cost, while Alternative M-2 is approximately 20 percent lower. Therefore, Alternative M-2 ranks higher for cost. However, overall environmental benefit score associated with Alternative M-1 (4.7) is also approximately 20 percent higher than Alternative M-2 (3.9; Table 11).

5.6.4 Conclusions

Based on the above DCA evaluation per MTCA requirements, Alternative M-1 is identified as the preferred remedial alternative for the Marine Area. This alternative uses high performance technologies and provides a high level of calculated ranking, achieving the highest environmental benefits that are proportionate to the unit incremental costs while remaining practical.

6.0 IMPLEMENTATION OF THE CLEANUP ACTION

Pending

7.0 COMPLIANCE MONITORING

Compliance monitoring and contingency responses (as needed) will be implemented in accordance with WAC 173-340-410, Compliance Monitoring Requirements. Detailed requirements will be described in the Construction Quality Assurance Plan (CQAP) and Operations, Maintenance, and Monitoring Plan (OMMP) to be prepared as a part of RD. The objective of these plans is to confirm that cleanup standards have been achieved, and also to confirm the long-term effectiveness of cleanup actions at the Site. The plans will contain discussions on duration and frequency of monitoring, the trigger for contingency response actions, and the rationale for terminating monitoring. The three types of compliance monitoring to be conducted include:

- **Protection Monitoring** to confirm that human health and the environment are adequately protected during the construction period of the cleanup action
- **Performance Monitoring** to confirm that the cleanup action has attained cleanup standards and other performance standards
- **Confirmation Monitoring** to confirm the long-term effectiveness of the cleanup action once performance standards have been attained

Cleanup levels and associated points of compliance for the cleanup action are described above in Section 3.

7.1 Monitoring Objectives and Rationale

The cleanup action incorporates monitoring to determine whether cleanup standards have been achieved during and after the cleanup action. Three broad categories of compliance monitoring will be undertaken at the Site as follows:

- **Water Quality (Protection and Confirmation Monitoring)** – During the cleanup action, construction controls and protection monitoring will be implemented as practicable to ensure surface water quality protection within the Site area. As discussed in Section 4.6, following completion of remedial actions, groundwater will be sampled on a quarterly basis at each of the 12 monitoring wells either retained or installed following remedy implementation for a minimum of four consecutive quarters. Following completion of four consecutive quarters of groundwater sampling that indicate cleanup levels are being met, the quarterly confirmation groundwater sampling schedule will be discontinued. As discussed in Section 4.7, if contaminants exceed the cleanup levels in groundwater samples after four quarters of confirmational monitoring, semi-annual groundwater monitoring may be conducted for an additional two years. If the groundwater samples continue to exceed the groundwater cleanup levels after two years without abating, additional actions will be considered.

- **Physical Limits and Integrity (Performance and Confirmation Monitoring)** – As discussed in Section 4.5, topographic and bathymetric performance monitoring will be conducted during the cleanup action to guide the limits of construction activities. In Years 1 and 4 following completion of construction, physical confirmation monitoring of upland and intertidal sediment cap surfaces will be performed to verify that caps are not substantially eroded over time by natural and/or anthropogenic forces. During these confirmation monitoring events, sediment cap thickness will be assessed and compared with the minimum required thickness determined during RD to ensure integrity of the caps to protect human health and the environment (Palermo et al. 1998).
- **Soil and Sediment Quality (Performance and Confirmation Monitoring)** – As discussed in Section 4.5, once required excavation or dredging elevations have been verified, performance monitoring will involve collecting soil or sediment samples from the base and/or sidewalls of excavations to confirm that cleanup and remediation levels have been achieved and to document concentrations of contaminants remaining on site. If individual samples exceed cleanup or remediation levels (e.g., in sidewalls of upland excavations or at the base of offshore dredge prisms), a statistical analysis of the data will be performed to assess the extent and degree of exceedance(s) (Ecology 1992). Following Ecology approval, response actions will be implemented as appropriate, including:
    - No further action (i.e., cleanup determined to be successful within a given grid area)
    - Additional wood debris indicator and/or chemical sampling to further characterize residual contamination within and/or adjacent to the excavation and dredge areas
    - Placement of a clean sand cover as necessary to address identified sediment residuals

- Placement of a confining cap layer or backfill to achieve isolation of underlying contaminants
- Supplemental excavation or dredging as practicable, followed by additional post-construction performance sampling, as appropriate

During Years 1 and 4 following completion of construction, confirmation monitoring of surface sediments within the shoreline cap area will be conducted. Chemical monitoring will be performed to verify that these areas achieve and maintain SQS chemical and woody debris criteria (Table 2).

All selected remedial actions to be implemented within the Site use demonstrated technologies with at least a 15 to 20-year record of successful performance. Additional research is not necessary to demonstrate the effectiveness of the technologies. Accordingly, long-term monitoring is appropriately focused toward routine maintenance objectives and verification that the cleanup action is achieving its intended goals.

8.0 FIVE-YEAR REVIEW

Pending

9.0 REFERENCES

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TABLES

TABLE 1
SOIL CLEANUP LEVELS FOR INDICATOR HAZARDOUS SUBSTANCES
FORMER SCOTT PAPER COMPANY MILL SITE

Constituent	Concentration Protective of Direct Human Contact (a)	Concentration Protective of Groundwater as Marine Surface Water (b)	Concentration Protective of Terrestrial Ecological Receptors (c)	MTCA Method A Cleanup Level (Unrestricted Land Use)	Typical PQL	Natural Background Concentration (d)	Site-Specific MTCA Level B Soil Cleanup Level
METALS (mg/kg)							
Antimony	32	580	--	--	1.1	5	32
Arsenic	20 (e)	20 (e)	20	20	5.9	7	20
Chromium (total)	240	19	42 (f)	19	0.03	117 (f)(g)	117
Copper	2,960	1.4	100 to 366	--	0.4	36	100 to 366
Lead	250 (e)	1,600	220	250	1.2	17	220
Mercury	24	0.026	9	2	0.03	0.07	9
Nickel	1,600	11	100	--	3.8	38	100
Thallium	5.6	0.67	--	--	0.12	--	5.6
Zinc	24,000	101	270 to 662	--	3.4	86	270 to 662
TOTAL PETROLEUM HYDROCARBONS (mg/kg)							
Diesel-Range	2,000 (e)	2,000 (e)	460	2,000	18	--	TBD (j)
Motor Oil-Range	2,000 (e)	2,000 (e)	--	2,000	24	--	TBD (j)
PAHs (ug/kg)							
Total cPAHs - TEQ	140	350	30,000 (h)	100 (h)	--	--	140
PCBs (ug/kg)							
Total PCBs	1,000 (e)(i)	--	2,000	1,000 (i)	--	--	1,000

Notes:

(a) Washington State Department of Ecology Cleanup Levels and Risk Calculations (CLARC) MTCA Method B standard formula values, except as noted.

(b) Calculated using fixed parameter three-phase partitioning model [WAC 173-340-747(4)] and preliminary groundwater cleanup levels shown in Table 4 of the RI report. Concentrations protective of groundwater as marine surface water were not selected as proposed cleanup levels because groundwater is addressed through an emperical demonstration.

(c) Concentrations based on simplified terrestrial ecological evaluation in WAC 173-340-7492; concentration range includes values listed in Table 749-2 (unrestricted land use values) and values listed in Table 749-3 of WAC 173-340-900. Wildlife values calculated using exposure model provided in Table 749-4 and MTCA default BAF_{worm} values listed in Table 749-5. Calculated using wildlife exposure model provided in Table 749-4 of WAC 173-340-900 and BAF_{worm} values derived from EPA Eco-SSL guidance (EPA 2007; see Table 2). Default toxicity reference values and plant uptake coefficients from Table 749-5 were used in the calculations. The lowest of the calculated avian predator and mammalian predator and herbivore values is listed. Further testing will be performed during development of the final CAP to refine TEE-based soil cleanup levels.

(d) Source: *Natural Background Soil Metals Concentrations in Washington State,* Ecology 1994. Listed values (except chromium) are statewide 90th percentile values.

(e) MTCA Method A value shown.

(f) Listed value is for total chromium; other values are based on hexavalent chromium.

(g) Site-specific natural background concentration, calculated per WAC 173-340-709 and guidance in *Natural Background Soil Metals Concentrations in Washington State,* Ecology 1994.

(h) Listed value is for benzo(a)pyrene.

(i) Concentration based on federal Toxic Substances Control Act (40 CFR 761.61).

(j) Further bioassay testing will be perfomed during development of the final CAP to detemine cleanup levels for these substances.

cPAHs = Carcinogenic polycyclic aromatic hydrocarbons
PCBs = Polychlorinated biphenyls
PQL = Practical quantitation limit
TEQ = Toxicity Equivalent Quotient
-- = Not applicable
mg/kg = milligrams per kilogram
ug/kg = micrograms per kilogram

TABLE 2
SEDIMENT CLEANUP LEVELS AND NEARSHORE SOIL REMEDIATION LEVELS
FOR SEDIMENT CHEMICALS OF POTENTIAL CONCERN
FORMER SCOTT PAPER COMPANY MILL SITE

Chemicals	Site-Specific Sediment Cleanup Level (1)	Site-Specific Nearshore Soil Remediation Level (2)
Conventionals (%)		
Wood debris (by volume)	25 (3)	--
Total volatile solids (%)	12.2 (3)	--
Metals (mg/kg)		
Copper	390	390 (4)
Lead	450	530 (4)
Mercury	0.41	0.59 (4)
PCBs (mg/kg)		
Total PCBs	12 mg/kg OC	1.3 (5)
Total Petroleum Hydrocarbons (mg/kg)		
Diesel-Range	TBD (6)	TBD (6)
Motor Oil-Range	TBD (6)	TBD (6)

Notes:
(1) Proposed cleanup levels are based on the SQS (Sediment Quality Standards - WAC 173-204-320).
(2) Nearshore soil excavation criteria (0 to 10 ft BGS) located within the 75-ft shoreline buffer zone; see Section 3.4.
(3) Wood debris and total volatile solids criteria based on site-specific bioassays.
(4) Based on sediment CSL chemical criteria.
(5) Based on sediment CSL chemical criteria, normalized to the average Site sediment TOC level of 2%.
(6) Further bioassay testing will be performed during development of the final CAP to determine cleanup and remediation levels for these substances.
-- = Not applicable
mg/kg = milligrams per kilogram

TABLE 3
DESCRIPTION OF CLEANUP ACTION ALTERNATIVES: PORT UPLANDS AREA
FORMER SCOTT PAPER COMPANY MILL SITE

Site Subunit	Matrix	Contaminants Exceeding Proposed Cleanup Levels	Objective	CLEANUP ACTION ALTERNATIVE COMPONENTS			
				Alternative PUA-1	Alternative PUA-2	Alternative PUA-3	Alternative PUA-4
Shoreline Buffer Zone (1)	Soil Exceeding Human Health and Terrestrial Ecological Cleanup Levels and Sediment Quality Standards for Mercury, Lead, and Copper	TPH, PAHs, Metals	Prevent terrestrial ecological and human contact with soil containing contaminants above proposed cleanup levels based on risk to respective receptors. Remove source material with potential to cause contamination of adjacent Marine Area sediments. Restore shoreline habitat.	- Excavate to the extent feasible, soil between 0 and 15 ft BGS exceeding human health and terrestrial ecological cleanup levels in a shoreline buffer zone between the MHHW line and 100 ft inland from the MHHW line. Within the shoreline buffer zone, excavation would also achieve the sediment quality standard for mercury, lead, and copper. - Dispose of contaminated soil at approved off-site disposal facility based on contaminant concentrations. - Backfill to restore original land topography, restore site features and surfaces. - Restore shoreline habitat.	- Excavate to the extent feasible, soil between 0 and 15 ft BGS exceeding human health and terrestrial ecological cleanup levels in a shoreline buffer zone between the MHHW line and 100 ft inland from the MHHW line. Within the shoreline buffer zone, excavation would also achieve the sediment quality standard for mercury, lead, and copper. - Dispose of contaminated soil at approved off-site disposal facility based on contaminant concentrations. - Backfill to restore original land topography, restore site features and surfaces. - Restore shoreline habitat.	- Excavate to the extent feasible, soil between 0 and 6 ft BGS exceeding human health and terrestrial ecological cleanup levels in a shoreline buffer zone between the MHHW line and 100 ft inland from the MHHW line. Within the shoreline buffer zone, excavation would also achieve the sediment quality standard for mercury, lead, and copper. - Dispose of contaminated soil at approved off-site disposal facility based on contaminant concentrations. - Backfill to restore original land topography, restore site features and surfaces. - Restore shoreline habitat. - Develop institutional controls in the form of restrictive covenants to ensure current and future property owners are aware of remaining contaminated soil and the requirements for protection of future site workers and terrestrial ecological receptors.	- Excavate to the extent feasible, soil between 0 and 10 ft BGS exceeding human health and terrestrial ecological cleanup levels in a shoreline buffer zone between the MHHW line and 75 ft inland from the MHHW line. Within the shoreline buffer zone, excavation would also achieve the sediment quality standard for mercury, lead, and copper. - Dispose of contaminated soil at approved off-site disposal facility based on contaminant concentrations. - Backfill to restore original land topography, restore site features and surfaces. - Restore shoreline habitat. - Develop institutional controls in the form of restrictive covenants to ensure current and future property owners are aware of remaining contaminated soil and the requirements for protection of future site workers and terrestrial ecological receptors.
Remaining Upland Areas	Soil - 0 to 6 ft BGS Exceeding Human Health and Terrestrial Ecological Cleanup Levels	TPH, PAHs, Metals	Prevent terrestrial ecological and human contact with soil containing contaminants above proposed cleanup levels based on risk to respective receptors.	- Excavate to the extent feasible, soil exceeding human health and terrestrial ecological cleanup levels. - Disposal and site restoration as per shoreline buffer zone description. - Additional soil bioassay testing to be performed may show that terrestrial ecological risks are not present in certain areas of the Site.	- Excavate to the extent feasible, soil exceeding human health and terrestrial ecological cleanup levels. - Disposal and site restoration as per shoreline buffer zone description. - Additional soil bioassay testing to be performed may show that terrestrial ecological risks are not present in certain areas of the Site.	- Excavate to the extent feasible, soil exceeding human health and terrestrial ecological cleanup levels. - Disposal and site restoration as per shoreline buffer zone description. - Additional soil bioassay testing to be performed may show that terrestrial ecological risks are not present in certain areas of the Site.	- Excavate to the extent feasible, soil exceeding human health and terrestrial ecological cleanup levels. - Disposal and site restoration as per shoreline buffer zone description. - Additional soil bioassay testing to be performed may show that terrestrial ecological risks are not present in certain areas of the Site.
	Soil - 6 to 15 ft BGS Exceeding Human Health and Terrestrial Ecological Cleanup Levels	TPH, PAHs, Metals	Prevent terrestrial ecological and human contact with soil containing contaminants above proposed cleanup levels based on risk to respective receptors.	- Excavate to the extent feasible, soil exceeding human health and terrestrial ecological cleanup levels. - Disposal and site restoration as per shoreline buffer zone description.	- Excavate soil at sample location ET-TP03 on Parcel 1 that exceeds human health cleanup level for arsenic (approximately 10 ft BGS). - Disposal and site restoration as per shoreline buffer zone description. - Develop institutional controls in the form of restrictive covenants to ensure current and future property owners (Parcels 2 and 3) are aware of remaining contaminated soil and the requirements for protection of future site workers and terrestrial ecological receptors.	- Excavate soil at sample location ET-TP03 on Parcel 1 that exceeds human health cleanup level for arsenic (approximately 10 ft BGS). - Develop institutional controls in the form of restrictive covenants to ensure current and future property owners are aware of remaining contaminated soil and the requirements for protection of future site workers and terrestrial ecological receptors.	- Excavate soil at sample location ET-TP03 on Parcel 1 that exceeds human health cleanup level for arsenic (approximately 10 ft BGS). - Disposal and site restoration as per shoreline buffer zone description. - Develop institutional controls in the form of restrictive covenants to ensure current and future property owners (Parcels 2 and 3) are aware of remaining contaminated soil and the requirements for protection of future site workers and terrestrial ecological receptors.
			Remove source of free-phase petroleum product in MW-110. Prevent contamination of groundwater and surface water through potential transfer of TPH from soil to groundwater.	-Excavate to the extent feasible, soil containing TPH and free product exceeding human health cleanup levels in the vicinity of monitoring well MW-110. - Disposal and site restoration as per shoreline buffer zone description.	-Excavate to the extent feasible, soil containing TPH and free product exceeding human health cleanup levels in the vicinity of monitoring well MW-110. - Disposal and site restoration as per shoreline buffer zone description.	-Excavate to the extent feasible, soil containing TPH and free product exceeding human health cleanup levels in the vicinity of monitoring well MW-110. - Disposal and site restoration as per shoreline buffer zone description.	-Excavate to the extent feasible, soil containing TPH and free product exceeding human health cleanup levels in the vicinity of monitoring well MW-110. - Disposal and site restoration as per shoreline buffer zone description.
	Groundwater Exceeding Cleanup Levels Protective of Marine Surface Water	TPH, Arsenic	Confirm no migration of contaminated groundwater to adjacent soil and sediment or future impacts to surface water.	Install new monitoring well network and monitor a minimum of quarterly for one year.	Install new monitoring well network and monitor a minimum of quarterly for one year; perform long-term monitoring as required by Ecology.	Install new monitoring well network and monitor a minimum of quarterly for one year; perform long-term monitoring as required by Ecology.	Install new monitoring well network and monitor a minimum of quarterly for one year; perform long-term monitoring as required by Ecology.
			Estimated Alternative Cost (+50%/-30%, rounded)	$18,300,000	$11,500,000	$4,800,000	$9,100,000
			Estimated Volume of Contaminated Soil Removed	53,000 cubic yards	31,000 cubic yards	15,500 cubic yards	23,500 cubic yards
			Estimated Timeframe to Closure (2)	Two to three years	Two to three years	Two to three years	Two to three years

Notes:
(1) 100-ft zone inland from MHHW for Alternatives PUA-1, PUA-2, and PUA-3; 75-ft zone inland from MHHW for Alternative PUA-4. Buffer zones established by Ecology.
(2) From initiation of remedial design through construction completion.

TABLE 4
EVALUATION OF CLEANUP ACTION ALTERNATIVES: PORT UPLANDS AREA
FORMER SCOTT PAPER COMPANY MILL SITE

	Alternative PUA-1	Alternative PUA-2	Alternative PUA-3	Alternative PUA-4
	- Excavate to the extent feasible, soil between 0 and 15 ft BGS in the shoreline buffer zone exceeding human health and terrestrial ecological cleanup levels. - Excavate to the extent feasible, soil between 0 and 15 ft BGS in the remaining upland areas exceeding human health and terrestrial ecological cleanup levels. - Dispose of contaminated soil at approved off-site disposal facility based on contaminant concentrations.	- Excavate to the extent feasible, soil between 0 and 15 ft BGS in the shoreline buffer zone exceeding human health and terrestrial ecological cleanup levels. - Excavate soil at sample location ET-TP03 on Parcel 1 that exceeds human health cleanup level for arsenic (approximately 10 ft BGS). - Remove TPH-contaminated soil to a depth of up to 15 ft BGS in vicinity of monitoring well MW-110. - Excavate to the extent feasible, soil between 0 and 6 ft BGS in the remaining upland areas exceeding human health and terrestrial ecological cleanup levels to establish a conditional point of compliance.	- Excavate to the extent feasible, soil between 0 and 6 ft BGS throught site exceeding human health and terrestrial ecological cleanup levels. - Remove TPH-contaminated soil to a depth of up to 15 ft BGS in vicinity of monitoring well MW-110. - Excavate soil at sample location ET-TP03 on Parcel 1 that exceeds human health cleanup level for arsenic (approximately 10 ft BGS). - Dispose of contaminated soil at approved off-site disposal facility based on contaminant concentrations. - Backfill to restore original land topography, restore site features and surfaces.	- Excavate to the extent feasible, soil between 0 and 10 ft BGS in a 75-foot shoreline buffer zone exceeding human health and terrestrial ecological cleanup levels. Within the shoreline buffer zone, excavation would also achieve the sediment quality standard for mercury, lead, and copper. - Excavate soil at sample location ET-TP03 on Parcel 1 that exceeds human health cleanup level for arsenic (approximately 10 ft BGS). - Remove TPH-contaminated soil to a depth of up to 15 ft BGS in vicinity of monitoring well MW-110. - Excavate to the extent feasible, soil between 0 and 6 ft BGS in the remaining upland areas exceeding human health and terrestrial ecological cleanup levels to establish a conditional point of compliance.
	- Backfill to restore original land topography, restore site features and surfaces. - Install new monitoring well network and monitor a minimum of quarterly for one year. - Restore shoreline habitat.	- Dispose of contaminated soil at approved off-site disposal facility based on contaminant concentrations. - Backfill to restore to original land topography, restore site features and surfaces. - Install new monitoring well network and monitor a minimum of quarterly for one year; perform long-term groundwater monitoring as required by Ecology. - Administer institutional controls (restrictive covenants) to prevent future human (site worker) and terrestrial ecological exposure to, and ensure proper disposal of, soil left in place below 6 ft BGS containing contaminants above proposed cleanup levels. - Restore shoreline habitat.	- Install new monitoring well network and monitor a minimum of quarterly for one year; perform long-term groundwater monitoring as required by Ecology. - Administer institutional controls (restrictive covenants) to prevent future human (site worker) and terrestrial ecological exposure to, and ensure proper disposal of, soil left in place below 6 ft BGS containing contaminants above proposed cleanup levels. - Restore shoreline habitat.	- Dispose of contaminated soil at approved off-site disposal facility based on contaminant concentrations. - Backfill to restore original land topography, restore site features and surfaces. - Install new monitoring well network and monitor a minimum of quarterly for one year; perform long-term groundwater monitoring as required by Ecology. - Administer institutional controls (restrictive covenants) to prevent future human (site worker) and terrestrial ecological exposure to, and ensure proper disposal of, soil left in place below 6 ft BGS containing contaminants above proposed cleanup levels. - Restore shoreline habitat.
Alternative Ranking Under MTCA				
1. Compliance with MTCA Threshold Criteria				
Protection of Human Health and the Environment	Yes - Alternative would protect human health and the environment.	Yes - Alternative would protect human health and the environment through a combination of removal and institutional controls.	No - Ecology has determined that this alternative would not be protective of human health and the environment because it would leave a significant amount of contaminated soil in place below 6 ft BGS along the shoreline.	Yes - Alternative would protect human health and the environment through a combination of removal and institutional controls.
Compliance With Cleanup Standards	Yes - Alternative is expected to comply with cleanup standards as negotiated with Ecology.	Yes - Alternative is expected to comply with cleanup standards as negotiated with Ecology. This alternative utilizes institutional controls to prevent exposure to soil left in place below 6 ft BGS containing contaminants exceeding human health and terrestrial ecological cleanup levels. Compliance would rely on long-term monitoring and maintenance of intitutional controls. Future development of property could potentially require additional environmental cleanup or special provisions.	No - Ecology has determined that this alternative would not comply with cleanup standards because it would leave a significant amount of contaminated soil in place below 6 ft BGS along the shoreline.	Yes - Alternative is expected to comply with cleanup standards as negotiated with Ecology. This alternative utilizes institutional controls to prevent exposure to soil left in place below 6 ft and/or 10 ft BGS containing contaminants exceeding human health and terrestrial ecological cleanup levels. Marine wave attenuation would be necessary to prevent potential erosion of contaminated soil left in place in the shoreline buffer zone. Compliance would rely on long-term monitoring and maintenance of intitutional controls. Future development of property could potentially require additional environmental cleanup or special provisions.
Compliance With Applicable State and Federal Regulations	Yes - Alternative complies with applicable state and federal regulations.	Yes - Alternative complies with applicable state and federal regulations. Future development of property could potentially require additional environmental cleanup or special provisions.	No - Ecology has determined that this alternative would not comply with applicable state and federal regulations because it would leave a significant amount of contaminated soil in place below 6 ft BGS along the shoreline.	Yes - Alternative complies with applicable state and federal regulations. Future development of property could potentially require additional environmental cleanup or special provisions.
Provision for Compliance Monitoring	Yes - Alternative includes provisions for compliance monitoring.	Yes - Alternative includes provisions for compliance monitoring.	Yes - Alternative includes provisions for compliance monitoring.	Yes - Alternative includes provisions for compliance monitoring.
2. Restoration Time Frame				
	Restoration time frame is relatively short. This alternative is expected to require two to three years for design and construction and would result in no need for additional remedial action.	Initial restoration time frame is relatively short. This alternative is expected to require two to three years for design and construction. The time frame for long-term monitoring is unknown. Potential future maintenance of institutional controls and coordination of proper handling and disposal of contaminated soil during future site development may extend the restoration time frame of this alternative.	Initial restoration time frame is relatively short. This alternative is expected to require two to three years for design and construction. The time frame for long-term monitoring is unknown. Potential future maintenance of institutional controls and coordination of proper handling and disposal of contaminated soil during future site development may extend the restoration time frame of this alternative.	Initial restoration time frame is relatively short. This alternative is expected to require two to three years for design and construction. The time frame for long-term monitoring is unknown. Potential future maintenance of institutional controls and coordination of proper handling and disposal of contaminated soil during future site development may extend the restoration time frame of this alternative.

TABLE 4
EVALUATION OF CLEANUP ACTION ALTERNATIVES: PORT UPLANDS AREA
FORMER SCOTT PAPER COMPANY MILL SITE

	Alternative PUA-1	Alternative PUA-2	Alternative PUA-3	Alternative PUA-4
3. Disproportionate Cost Analysis Relative Benefits Ranking (Scored from 1-lowest to 5-highest)				
Protectiveness	Score = 5 Achieves a high level of overall protectiveness as a result of removal of the soil that poses risk to human and ecological receptors at the Site.	Score = 4 Achieves a medium-high level of overall protectiveness as a result of removal of the near-surface soil that poses risk to human and ecological receptors at the Site. However, this alternative would leave in place deeper contaminated soil, and protectiveness would rely on maintenance of institutional controls to prevent exposure.	Not Applicable - Alternative does not meet MTCA threshold criteria	Score = 4 Achieves a medium-high level of overall protectiveness as a result of removal of the near-surface soil that poses risk to human and ecological receptors at the Site. However, this alternative would leave in place deeper contaminated soil, including along the shoreline, and protectiveness would rely on maintenance of institutional controls to prevent exposure and implementation of appropriate marine remedy to prevent erosion.
Permanence	Score = 5 Achieves a high level of permanent reduction of mass, toxicity, and mobility of hazardous substances at the Site through direct removal and disposal of the excavated material at appropriate off-site facilities. However, the elemental nature of some contaminants (i.e., metals) precludes the MTCA preference for destruction of contaminants. This alternative would reduce to the extent feasible the need to perform additional actions as the result of future development.	Score = 4 Achieves permanent reduction of mass, toxicity, and mobility of hazardous substances at the Site, but to a lower degree than Alternative PUA-1. The quantity of impacted soil allowed to remain on site is greater than with Alternative PUA-1. Future development may require modification of the remedy.	Not Applicable - Alternative does not meet MTCA threshold criteria	Score = 4 Achieves permanent reduction of mass, toxicity, and mobility of hazardous substances at the Site, but to a lower degree than Alternative PUA-1. Would rely on wave attenuation to prevent erosion of shoreline contaminants. The quantity of impacted soil left in place would be greater than with Alternatives PUA-1 and PUA-2. Future development may require modification of the remedy.
Long-Term Effectiveness	Score = 5 Removes hazardous substances from the Site to the greatest degree feasible and utilizes approved off-site disposal facilities for final disposition.	Score = 4 Removes the majority of hazardous substances from the Site and utilizes approved off-site disposal facilities for final disposition. Achieves complete removal of impacted soil along shoreline, to the extent feasible, but leaves deeper soil in place in areas across the remainder of the site that exceeds cleanup levels. The use of institutional controls reduces the risk to human health and the environment from the residual contamination left in place. Future development may require modification of the remedy.	Not Applicable - Alternative does not meet MTCA threshold criteria	Score = 3 Removes the majority of hazardous substances from the Site and utilizes approved off-site disposal facilities for final disposition, but leaves soil on site that exceeds cleanup levels. The use of institutional controls reduces the risk to human health and the environment from the residual contamination left in place. This alternative also relies on implementation of appropriate wave energy attenuation to prevent erosion of deeper impacted soil remaining at the shoreline. Future development may require modification of the remedy.
Management of Short-Term Risks	Score = 2 Involves extensive soil removal across the Site, including excavation near occupied buildings and across areas of park land currently used by the public. However, the excavation methods required to achieve the level of removal under this alternative are well established and capable of reducing short-term risks.	Score = 3 Involves extensive soil removal across the Site, including excavation near occupied buildings and across areas of park land currently used by the public. However, the excavation methods required to achieve the level of removal under this alternative are well established and capable of minimizing short-term risks.	Not Applicable - Alternative does not meet MTCA threshold criteria	Score = 3 Involves extensive soil removal across the Site, including excavation near occupied buildings and across areas of park land currently used by the public. However, the excavation methods required to achieve the level of removal under this alternative are well established and capable of minimizing short-term risks.
Technical and Admin. Implementability	Score = 2 Involves extensive soil removal across the Site, including the need for significant shoring and dewatering to achieve removal of deeper soil and soil adjacent to or under buildings. However, while complex, the excavation activities required for this alternative are common and feasible. Temporary site closure to public would allow facilitation of project.	Score = 3 Utilizes the same general construction methods as Alternative PUA-1, but on a smaller scale. Temporary site closure to public would allow facilitation of project.	Not Applicable - Alternative does not meet MTCA threshold criteria	Score = 3 Utilizes the same general construction methods as Alternatives PUA-1 and PUA-2, with less need for shoring and dewatering to achieve removal. However, the shoring required for the deeper shoreline excavation is greater than required with Alternative PUA-3. Temporary site closure to public would allow facilitation of project.
Consideration of Public Concerns	Score = 5 Provides for complete removal of contaminated soil from the Site, addressing public concerns associated with exposure to contaminants and restriction on future use and development of Site.	Score = 4 Addresses the most accessible soil that poses the greatest risk to human health and the environment. The remaining contaminated soil left in place would require maintenance of institutional controls and impose limitations on future use and development of the Port public property.	Not Applicable - Alternative does not meet MTCA threshold criteria	Score = 5 Addresses the most accessible soil that poses the greatest risk to human health and the environment. The remaining contaminated soil left in place would require maintenance of institutional controls and impose limitations on future use and development of the Port public property.

TABLE 5
SUMMARY OF MTCA EVALUATION AND RANKING OF CLEANUP ACTION ALTERNATIVES:
PORT UPLANDS AREA
FORMER SCOTT PAPER COMPANY MILL SITE

Alternative Number	**PUA-1**	**PUA-2**	**PUA-3**	**PUA-4**
Alternative Ranking Under MTCA				
1. Compliance with MTCA Threshold Criteria (1)	YES	YES	NO	YES
2. Restoration Time Frame	Two to three years	Two to three years	Two to three years	Two to three years
3. DCA Relative Benefits Ranking	1st	2nd	--	3rd
Protectiveness (weighted as 30%)	1.5	1.2	--	1.20
Permanence (weighted as 20%)	1.00	0.80	--	0.80
Long-Term Effectiveness (weighted as 20%)	1.00	0.80	--	0.60
Management of Short-Term Risks (weighted as 10%)	0.20	0.30	--	0.30
Technical and Administrative Implementability (weighted as 10%)	0.20	0.30	--	0.30
Consideration of Public Concerns (weighted as 10%)	0.50	0.40	--	o.50
Total of Scores	**4.4**	**3.8**	--	**3.7**
4. Disproportionate Cost Analysis (DCA)				
Probable Remedy Cost (+50%/-30%, rounded)	$18,300,000	$11,500,000	--	$9,100,000
Costs Disproportionate to Incremental Benefits	YES	YES	--	NA (2)
Practicability of Remedy	Practicable	Practicable	--	Practicable
Remedy Permanent to Maximum Extent Practicable	Yes	Yes (3)	--	Yes (3)
Overall Alternative Ranking	**3rd**	**2nd**	**--**	**1st**

Notes
1 Non-compliant alternatives were not considered in the DCA (items 3 and 4 in this table).
2 Not applicable since this is the lowest cost alternative.
3 May require modification due to future land use or development.

TABLE 6
DESCRIPTION OF CLEANUP ACTION ALTERNATIVES: MJB NORTH UPLAND AREA
FORMER SCOTT PAPER COMPANY MILL SITE

Site Subunit	Matrix	Contaminants Exceeding Proposed Cleanup Levels	Objective	CLEANUP ACTION ALTERNATIVE COMPONENTS			
				Alternative MJB-1	Alternative MJB-2	Alternative MJB-3	Alternative MJB-4
Shoreline Buffer Zone (1)	Soil - 0' to 6' BGS Exceeding Proposed Human Health or Terrestrial Ecological Cleanup Levels	Metals, PAHs	Prevent terrestrial ecological and human contact with soil containing contaminants above proposed cleanup levels. Prevent contamination of adjacent Marine Area sediments due to releases from contaminated soil. Remove soil exceeding SQS criteria that co-exists with affected soil exceeding proposed cleanup levels.	- Excavate, to the extent practicable, soil exceeding proposed human health and/or terrestrial ecological cleanup levels. - Characterize and dispose of contaminated soil at an approved off-site disposal facility in accordance with applicable regulations. - Backfill with clean soil to restore to original land topography and site drainage. - Construct walkway and riparian habitat.	- Excavate, to the extent practicable, soil exceeding proposed human health and/or terrestrial ecological cleanup levels. - Characterize and dispose of contaminated soil at an approved off-site disposal facility in accordance with applicable regulations. - Backfill with clean soil to restore to original land topography and site drainage. - Construct walkway and riparian habitat.	- Excavate, to the extent practicable, soil exceeding proposed human health and/or terrestrial ecological cleanup levels. - Characterize and dispose of contaminated soil at an approved off-site disposal facility in accordance with applicable regulations. - Backfill with clean soil to restore to original land topography and site drainage. - Construct walkway and riparian habitat.	- Excavate, to the extent practicable, soil exceeding proposed human health and/or terrestrial ecological cleanup levels to a maximum depth of 10' BGS. - Characterize and dispose of contaminated soil at an approved, off-site disposal facility in accordance with applicable regulations. - Backfill with clean soil to restore to original land topography and site drainage. - Construct walkway and riparian habitat.
	Soil 6' - 15' BGS Exceeding Proposed Human Health or Terrestrial Ecological Cleanup Levels	Metals, PAHs	Prevent terrestrial ecological and human contact with soil containing contaminants above proposed cleanup levels. Prevent contamination of adjacent Marine Area sediments due to releases from contaminated soil.	- Excavate, to the extent practicable, soil exceeding human health and/or terrestrial ecological cleanup levels. - Characterize and dispose of contaminated soil at an approved off-site disposal facility in accordance with applicable regulations. - Backfill with clean soil	- Affected soils at depths greater than 6' BGS will remain in place. - Ensure the sediment remedy adequately caps affected soils remaining in place. - Establish environmental covenants noting the location and depth of affected soil exceeding proposed cleanup levels and establishing safeguards to protect human health.	- Affected soils at depths greater than 6' BGS will remain in place. - Ensure the sediment remedy adequately caps affected soils remaining in place. - Establish environmental covenants noting the location and depth of affected soil exceeding proposed cleanup levels and establishing safeguards to protect human health.	- Affected soils at depths greater than 10' BGS will remain in place. - Ensure the sediment remedy adequately caps affected soils remaining in place. - Establish environmental covenants noting the location and depth of affected soil exceeding proposed cleanup levels and establishing safeguards to protect human health.
Remaining Upland Areas	Soil - 0' to 6' BGS Exceeding Proposed Human Health or Terrestrial Ecological Cleanup Levels	Metals, PAHs	Prevent terrestrial ecological and human contact with soil containing contaminants above proposed cleanup levels.	- Excavate, to the extent practicable, soil exceeding proposed human health or terrestrial ecological cleanup levels. - Characterize and dispose of contaminated soil at an approved off-site disposal facility in accordance with applicable regulations. - Backfill with clean soil and restore the site surface consistent with planned site use.	- Excavate, to the extent practicable, soil exceeding proposed human health cleanup levels. - Homogenize contaminated soil with clean soil to reduce soil contaminant levels to terrestrial ecological cleanup levels. - Characterize and dispose of contaminated soil at an approved off-site disposal facility in accordance with applicable regulations. - Backfill excavated areas with clean soil. - Restore the site surface consistent with planned site use.	- Excavate, to the extent practicable, soil exceeding proposed human health cleanup levels. - Provide cover (asphalt or concrete pavement) over soil with contaminant levels exceeding terrestrial ecological cleanup levels. - Characterize and dispose of contaminated soil at an approved off-site disposal facility in accordance with applicable regulations. - Backfill excavated areas with clean soil. - Restore the site surface consistent with planned site use.	- Excavate, to the extent practicable, soil exceeding proposed human health and terrestrial ecological cleanup levels to a maximum depth of 6' BGS. - Characterize and dispose of excavated soil at an approved off-site disposal facility in accordance with applicable regulations. - Backfill excavated areas with clean soil. - Restore the site surface consistent with planned site use.
	Soil - 6' to 15' BGS Exceeding Proposed Human Health or Terrestrial Ecological Cleanup Levels	Metals, PAHs	Prevent terrestrial ecological and human contact with soil containing contaminants above proposed cleanup levels.	- Excavate, to the extent practicable, soil exceeding proposed human health or terrestrial ecological cleanup levels. - Characterize and dispose of contaminated soil at an approved off-site disposal facility in accordance with applicable regulations. - Backfill with clean soil and restore the site surface consistent with planned site use.	- Affected soils at depths greater than 6' BGS will remain in place. - Establish environmental covenants noting the location and depth of affected soil exceeding proposed cleanup levels and establishing safeguards to protect human health.	- Affected soils at depths greater than 6' BGS will remain in place. - Establish environmental covenants noting the location and depth of affected soil exceeding proposed cleanup levels and establishing safeguards to protect human health.	- Affected soils at depths greater than 6' BGS will remain in place. - Establish environmental covenants noting the location and depth of affected soil exceeding proposed cleanup levels and establishing safeguards to protect human health.
Estimated Alternative Cost (+50%/-30%, rounded)				$7,000,000	$3,700,000	$3,600,000	$4,800,000
Estimated Implementation Timeframe (2)				Two to three years	Two to three years	Two to three years	Two to three years

Notes:
1. Buffer zone established for MJB alternatives in January 23, 2008 and subsequent meetings. The buffer zone for Alternatives MJB-1, -2, and -3 extends 100 ft inland from MHHW. The buffer zone for Alternative MJB-4 extends 75 feet inland from MHHW.
2. From initiation of construction.

TABLE 7
EVALUATION OF CLEANUP ACTION ALTERNATIVES: MJB NORTH UPLAND AREA
FORMER SCOTT PAPER COMPANY MILL SITE

	Alternative MJB-1	**Alternative MJB-2**	**Alternative MJB-3**	**Alternative MJB-4**
Alternative Description	- Excavate to the extent practicable, soil exceeding proposed human health and terrestrial ecological cleanup levels in the Shoreline Buffer Zone. - Excavate to the extent practicable, soil exceeding human health and terrestrial ecological cleanup levels in the Remaining Upland Area. - Characterize and dispose of contaminated soil at approved, permitted, off-site disposal facility in accordance with applicable regulations. - Backfill and restore excavated areas to support planned use of the property. - Construct a pedestrian path and improve riparian habitat.	- Excavate to the extent practicable, soil exceeding proposed human health and terrestrial ecological cleanup levels in the Shoreline Buffer Zone to a depth of 6 feet bgs. - Excavate to the extent practicable, soil exceeding human health and terrestrial ecological cleanup levels in the Remaining Upland Area (assumed to be within 2 feet of ground surface). - Homogenize, to the extent practicable, soil exceeding terrestrial ecological cleanup levels in the Remaining Upland Area. - Backfill excavations and/or replace homogenized soil to support planned use of the property. - Install new monitoring wells as necessary to establish four monitoring wells along the shoreline to support monitoring of groundwater downgradient of impacted soils remaining onsite. - Environmental covenants to prevent future site worker and terrestrial ecological exposure to impacted soils and to ensure proper disposal of, impacted soil that may be excavated in the future. - Construct a pedestrian path and improve riparian habitat.	- Excavate to the extent practicable, soil exceeding proposed human health and terrestrial ecological cleanup levels in the Shoreline Buffer Zone to a depth of 6 feet bgs. - Excavate to the extent practicable, soil exceeding human health and terrestrial ecological cleanup levels in the Remaining Upland Area (assumed to be within 2 feet of ground surface). - Place an asphalt cover over soil exceeding terrestrial ecological cleanup levels in the Remaining Upland Area. - Backfill excavated areas to support planned use of the property. - Install new monitoring wells as necessary to establish four monitoring wells along the shoreline to support monitoring of groundwater downgradient of impacted soils remaining onsite. - Environmental covenants to prevent future site worker and terrestrial ecological exposure to impacted soils and to ensure proper disposal of, impacted soil that may be excavated in the future. - Construct a pedestrian path and improve riparian habitat.	- Excavate to the extent practicable, soil exceeding proposed human health and terrestrial ecological cleanup levels in the 75-Ft Shoreline Buffer Zone to a maximum depth of 10 feet BGS. - Excavate to the extent practicable, soil exceeding human health and terrestrial ecological cleanup levels in the Remaining Upland Area (assumed to generally be limited to within 2 feet of ground surface) to a maximum depth of 6 ft BGS. - Backfill excavations and/or compact and grade homogenized soil to support planned use of the property. - Install new monitoring wells as necessary to establish four monitoring wells along the shoreline to support monitoring of groundwater downgradient of impacted soils remaining onsite. - Environmental covenants to prevent future site worker and terrestrial ecological exposure to impacted soils and to ensure proper disposal of, impacted soil that may be excavated in the future. - Construct a pedestrian path and improve riparian habitat.
Alternative Ranking Under MTCA				
1. Compliance with MTCA Threshold Criteria				
Protection of Human Health and the Environment	Yes - Alternative would protect human health and the environment. Relies on long-term landfill containment to limit exposure to Site contaminants.	No - Ecology has determined that this alternative would not be protective of human health and the environment because it would leave a significant amount of contaminated soil in place below 6 ft BGS along the shoreline.	No - Ecology has determined that this alternative would not be protective of human health and the environment because it would leave a significant amount of contaminated soil in place below 6 ft BGS along the shoreline.	Yes - Alternative would protect human health and the environment. Relies on Site environmental covenants and long-term landfill containment to limit exposure to Site contaminants.
Compliance With Cleanup Standards	Yes - Alternative is expected to comply with MTCA cleanup standards. If practicable, this alternative may attain the standard point of compliance.	No - Ecology has determined that this alternative would not comply with cleanup standards because it would leave a significant amount of contaminated soil in place below 6 ft BGS along the shoreline.	No - Ecology has determined that this alternative would not comply with cleanup standards because it would leave a significant amount of contaminated soil in place below 6 ft BGS along the shoreline.	Yes - Alternative is expected to comply with MTCA cleanup standards. Alternative relies on environmental covenants and a conditional point of compliance. Future development of property may require actions specified under environmental covenants to manage impacted soils remaining onsite.
Compliance With Applicable State and Federal Regulations	Yes - Alternative can be designed and implemented in compliance with applicable state and federal regulations.	No - Ecology has determined that this alternative would not comply with applicable state and federal regulations because it would leave a significant amount of contaminated soil in place below 6 ft BGS along the shoreline.	No - Ecology has determined that this alternative would not comply with applicable state and federal regulations because it would leave a significant amount of contaminated soil in place below 6 ft BGS along the shoreline.	Yes - Alternative complies with applicable state and federal regulations. Future development of property may require additional environmental cleanup or special provisions.
Provision for Compliance Monitoring	No. Monitoring is not required, as contaminated media would be removed from site.	Yes - Alternative includes provisions for compliance monitoring.	Yes - Alternative includes provisions for compliance monitoring.	Yes - Alternative includes provisions for compliance monitoring.
2. Restoration Time Frame				
	Restoration time frame is relatively short. This alternative is expected to require two to three years for design and construction and would likely result in no need for environmental covenants or long-term monitoring and maintenance.	Initial restoration time frame is relatively short. This alternative is expected to require two to three years for design and construction. Post-remediation monitoring would be necessary to confirm effectiveness of remedy. Relies on environmental covenants for long-term protectiveness.	Initial restoration time frame is relatively short. This alternative is expected to require two to three years for design and construction. Post-remediation monitoring and cover maintenance would be necessary to confirm and maintain effectiveness of remedy. Relies on engineering and environmental covenants for long-term protectiveness.	Initial restoration time frame is relatively short. This alternative is expected to require two to three years for design and construction. Post-remediation monitoring would be necessary to confirm effectiveness of remedy. Relies on environmental covenants for long-term protectiveness.
3. Disproportionate Cost Analysis Relative Benefits Ranking (Scored from 1-lowest to 5-highest)				
Protectiveness	Score = 5 Achieves a high level of overall protectiveness as a result of removal of the soil that poses risk to human and ecological receptors at the Site. Under this alternative, only impacted soils that are not directly accessible for removal using standard methods (i.e., under buildings or other structures) would be left in place. Some residual risk would remain due to long-term containment of Site contaminants in an engineered offsite landfill.	Not Applicable - Alternative does not meet MTCA threshold criteria	Not Applicable - Alternative does not meet MTCA threshold criteria	Score = 4 Achieves a medium level of overall protectiveness as a result of removal of the near-surface soil that poses risk to human and ecological receptors at the Site. However, this alternative leaves in place deeper contaminated soil, and protectiveness would rely on maintenance of environmental covenants to prevent exposure.

TABLE 7
EVALUATION OF CLEANUP ACTION ALTERNATIVES: MJB NORTH UPLAND AREA
FORMER SCOTT PAPER COMPANY MILL SITE

	Alternative MJB-1	Alternative MJB-2	Alternative MJB-3	Alternative MJB-4
Permanence	Score = 5 Achieves nearly complete reduction of mass and toxicity for hazardous substances remaining at the Site through direct removal of affected soil. Does not permanently destroy Site COCs; relies on long-term containment of persistent COCs in an engineered, offsite landfill. As monitoring data shows Site COCs are not mobile, this alternative does not affect contaminant mobility. This alternative reduces to the extent practicable the potential for future corrective actions at the MJB North Area.	Not Applicable - Alternative does not meet MTCA threshold criteria	Not Applicable - Alternative does not meet MTCA threshold criteria	Score = 4 Achieves partial, but significant reduction (more than MJB-2 in Shoreline Buffer Zone) of mass and toxicity for hazardous substances remaining at the Site through direct removal of affected soil. Does not permanently destroy Site COCs, but permanently reduces terrestrial ecological risks over much of the Remaining Upland Area. Relies on long-term containment of persistent COCs in an engineered, offsite landfill. As monitoring data shows Site COCs are not mobile, this alternative does not affect contaminant mobility. Since affected soils exceeding proposed cleanup levels remain under this alternative, there would be some potential for future corrective actions at the MJB North Area.
Long-Term Effectiveness	Score = 5 Removes hazardous substances from the Site to the greatest degree practicable and utilizes engineered, offsite landfill containment for long-term risk management. If hazardous substances remain at the Site (such as below buildings) they would pose minimal risk to human health and the environment.	Not Applicable - Alternative does not meet MTCA threshold criteria	Not Applicable - Alternative does not meet MTCA threshold criteria	Score = 4 Removes affected soil causing the greatest risks from the MJB North Area and utilizes engineered, offsite landfill containment for long-term risk management of excavated soil. Utilizes onsite management of deep contaminated soil that exceeds proposed cleanup levels; The demonstrated low mobility of Site COCs and the environmental covenants would minimize residual risks to human health and the environment under this alternative. Alternatives MJB-2 and MJB-4 permanently reduce toxicity over much of the property via soil homogenization; thiese are alternatives considered with any permanent risk reduction, and both alternatives provide the same level of permanence in the Remaining Upland Area.
Management of Short-Term Risks	Score = 2 Substantial short term risks would be created by the extensive soil removal across the MJB North Area and transportation of a large volume contaminated soil through the City of Anacortes and on public roadways. These risks can be mitigated, however, using proven earthwork and transportation methods capable of minimizing short-term risks.	Not Applicable - Alternative does not meet MTCA threshold criteria	Not Applicable - Alternative does not meet MTCA threshold criteria	Score = 3 Involves extensive soil removal and soil handling across the MJB North Area. Requires less shipment of contaminated soil through the City of Anacortes and on public roadways than Alternative MJB-1. These risks can be mitigated, however, using proven earthwork and transportation methods capable of minimizing short-term risks.
Technical and Admin. Implementability	Score = 3 Requires extensive soil removal across the MJB North Area. The excavation activities required for this alternative are common and practicable, but there may be technical difficulty in accessing deeper soil, especially along the shoreline. No administrative implementability issues are anticipated.	Not Applicable - Alternative does not meet MTCA threshold criteria	Not Applicable - Alternative does not meet MTCA threshold criteria	Score = 3 Requires substantial soil removal from the MJB North Area at shallower depths than Alternative MJB-1. Soil homogenization work would be similar to the excavation included in Alternative MJB-1. The excavation activities required for this alternative are common and implementable. No administrative implementability issues are anticipated, although regulatory acceptance would require negotiation.
Consideration of Public Concerns	Score = 5 Provides the maximum removal of contaminated soil from the MJB North Area, which may address some public concerns associated with Site contamination. Since a significant volume of contaminated soil must be transported by truck through the City of Anacortes and on public roadways, some public concern for wear and tear of roadways and congestion may accrue. Public concerns can be mitigated through an effective communications program.	Not Applicable - Alternative does not meet MTCA threshold criteria	Not Applicable - Alternative does not meet MTCA threshold criteria	Score = 4 Although contaminated soil that poses the greatest risk to human health and the environment would be removed under this alternative, some public concern may result due to the deep soil left in place at the MJB North Area. Since substantially less soil would require truck transport from the Site, public concerns related to transportation of contaminated soil are expected to be lower than for Alternative MJB-1. Public concerns can be mitigated through an effective communications program.

TABLE 8
SUMMARY OF MTCA EVALUATION AND RANKING OF CLEANUP ACTION ALTERNATIVES:
MJB NORTH UPLAND AREA
FORMER SCOTT PAPER COMPANY MILL SITE

Alternative Number	**MJB-1**	**MJB-2**	**MJB-3**	**MJB-4**
Alternative Ranking Under MTCA				
1. Compliance with MTCA Threshold Criteria (1)	YES	NO	NO	YES
2. Restoration Time Frame	Two to three years	Two to three years	Two to three years	Two to three years
3. DCA Relative Benefits Ranking	1st	--	--	2nd
Protectiveness (weighted as 30%)	1.5	--	--	1.2
Permanence (weighted as 20%)	1	--	--	0.8
Long-Term Effectiveness (weighted as 20%)	1	--	--	0.8
Management of Short-Term Risks (weighted as 10%)	0.2	--	--	0.3
Technical and Administrative Implementability (weighted as 10%)	0.3	--	--	0.3
Consideration of Public Concerns (weighted as 10%)	0.5	--	--	0.4
Total of Scores	**4.5**	**--**	**--**	**3.8**
4. Disproportionate Cost Analysis (DCA)				
Probable Remedy Cost (+50%/-30%, rounded)	$7,000,000	--	--	$4,800,000
Costs Disproportionate to Incremental Benefits	YES	--	--	NA (2)
Practicability of Remedy	Practicable	--	--	Practicable
Remedy Permanent to Maximum Extent Practicable	Yes	--	--	Yes (3)
Overall Alternative Ranking	**2nd**	**--**	**--**	**1st**

Notes
1 Non-compliant alternatives were not considered in the DCA (items 3 and 4 in this table).
2 Not applicable since this is the lowest cost alternative.
3 May require modification due to future land use or development.

TABLE 9
DESCRIPTION OF CLEANUP ACTION ALTERNATIVES: MARINE AREA
FORMER SCOTT PAPER COMPANY MILL SITE

Site Subunit	Matrix	Contaminants Exceeding Proposed Cleanup Levels	Objective	CLEANUP ACTION ALTERNATIVE COMPONENTS	
				Alternative M-1	Alternative M-2
Intertidal Area	Sediment	PCBs, Metals, Wood Debris	Prevent aquatic ecological exposure to sediment containing contaminants above proposed cleanup levels based on risks to benthic and food web (bioaccumulation) receptors.	-Remove surficial debris and piling along shoreline -Excavate buried wood debris to the extent necessary to facilitate placement of 2-ft thick cap -Dispose of excavated debris at upland landfill and suitable dredge material at open-water disposal site -Place clean cap material within excavation -Protect shoreline from erosion using two methods: (a) Adjacent to MJB property install armored cap (b) Adjacent to Port property create offshore wave attenuation structure on Port property to dissipate the wave energy before it reaches the Port property shoreline	-Remove surficial debris and piling along shoreline -Excavate buried wood debris to the extent necessary to facilitate placement of 2-ft thick cap -Dispose of excavated debris at upland landfill, and suitable dredge material at open-water disposal site -Place clean cap material within excavation -Protect shoreline from future erosion using two methods: (a) Adjacent to MJB property install armored cap (b) Adjacent to Port property create offshore wave attenuation structure on Port property to obstruct and dissipate the wave energy before it reaches the Port property shoreline
Subtidal Area	Sediment	Wood Debris	Prevent aquatic ecological exposure to sediment containing contaminants above proposed cleanup levels based on risks to benthic receptors.	-Excavate surface and subsurface wood debris and sediments exceeding SQS criteria -Dispose of excavated debris at upland landfill, and suitable dredge material at open-water disposal site -Backfill excavation with clean sand and gravel -Place post-dredge residuals cover to 100 ft beyond the water-side edge of the dredge footprint	-Excavate surface and subsurface wood debris and sediments exceeding CSL criteria -Dispose of excavated debris at upland landfill, and suitable dredge material at open-water disposal site -Backfill excavation with clean sand and gravel -Place post-dredge residuals cover over areas exceeding SQS criteria or to a minimum of 100 ft beyond the edge of the dredge footprint, whichever is further
			Estimated Alternative Cost (+50%/-30%, rounded)	$7,100,000	$5,800,000
			Estimated Volume of Contaminated Sediment Removed	31,900 cubic yards	19,900 cubic yards
			Estimated Timeframe to Closure (1)	Two to three years	Two to three years

TABLE 10
EVALUATION OF CLEANUP ACTION ALTERNATIVES: MARINE AREA
FORMER SCOTT PAPER COMPANY MILL SITE

	Alternative M-1	**Alternative M-2**
Alternative Description	- Remove subtidal sediment and debris exceeding SQS chemical criteria in the marine areas below MHHW. Excavate surface and subsurface wood debris exceeding SQS criteria. - Dispose excavated debris at upland landfill and suitable dredge material at open-water disposal site. - Backfill subtidal excavations and dredged areas with clean sand and gravel to restore to original grade. - Place post-dredge residuals cover to 100 feet beyond the water-side edge of the dredge footprint. - Protect shoreline on Port property with habitat reefs; protect MJB property with armored cap. - Dredge shoreline transitional slope to facilitate cap placement while maintaining the approximate existing grades; place a minimum of 2 ft of cap material along the Port shoreline and 2 ft of cap material along the MJB property shoreline. - Restore eelgrass. - Monitor cap.	- Remove subtidal sediment and debris exceeding CSL chemical criteria in the marine areas below MHHW. Excavate surface and subsurface wood debris exceeding CSL criteria. - Dispose excavated debris at upland landfill and suitable dredge material at open-water disposal site. - Backfill subtidal excavations and dredged areas with clean sand and gravel to restore to original grade. - Place post-dredge residuals cover to 100 feet beyond the water-side edge of the dredge footprint, or over the SQS footprint, whichever is greater. - Protect shoreline on Port property with habitat reefs; protect MJB property with armored cap. - Dredge shoreline transitional slope to facilitate cap placement while maintaining the approximate existing grades; place a minimum of 2 ft of cap material along the Port shoreline and 2 ft of cap material between the drift sills along the MJB property shoreline. - Restore eelgrass. - Monitor cap.
Alternative Ranking Under MTCA		
1. Compliance with MTCA Threshold Criteria		
Protection of Human Health and the Environment	Yes - Alternative will protect human health and the environment without site use restrictions	Yes - Alternative will protect human health and the environment without site use restrictions
Compliance With Cleanup Standards	Yes - Alternative is expected to comply with marine (SQS) cleanup standards to be selected by Ecology.	Yes - Alternative is expected to comply with marine (CSL) cleanup standards to be selected by Ecology.
Compliance With Applicable State and Federal Regulations	Yes - Alternative complies with applicable state and federal regulations.	Yes - Alternative complies with applicable state and federal regulations.
Provision for Compliance Monitoring	Yes - Alternative includes provisions for compliance monitoring.	Yes - Alternative includes provisions for compliance monitoring.
2. Restoration Time Frame		
	This alternative is expected to require two to three years for design, permitting and construction	This alternative is expected to require two to three years for design, permitting and construction
3. Disproportionate Cost Analysis Relative Benefits Ranking (Scored from 1-lowest to 5-highest)		
Protectiveness	Score = 5 Achieves a high level of overall protectiveness as a result of removal sediment that poses risk to human and ecological receptors by addressing sediments exceeding SQS criteria.	Score = 4 Achieves a medium level of overall protectiveness as a result of removal of sediments that pose risk to human and ecological receptors by addressing sediments exceeding CSL criteria.

TABLE 10
EVALUATION OF CLEANUP ACTION ALTERNATIVES: MARINE AREA
FORMER SCOTT PAPER COMPANY MILL SITE

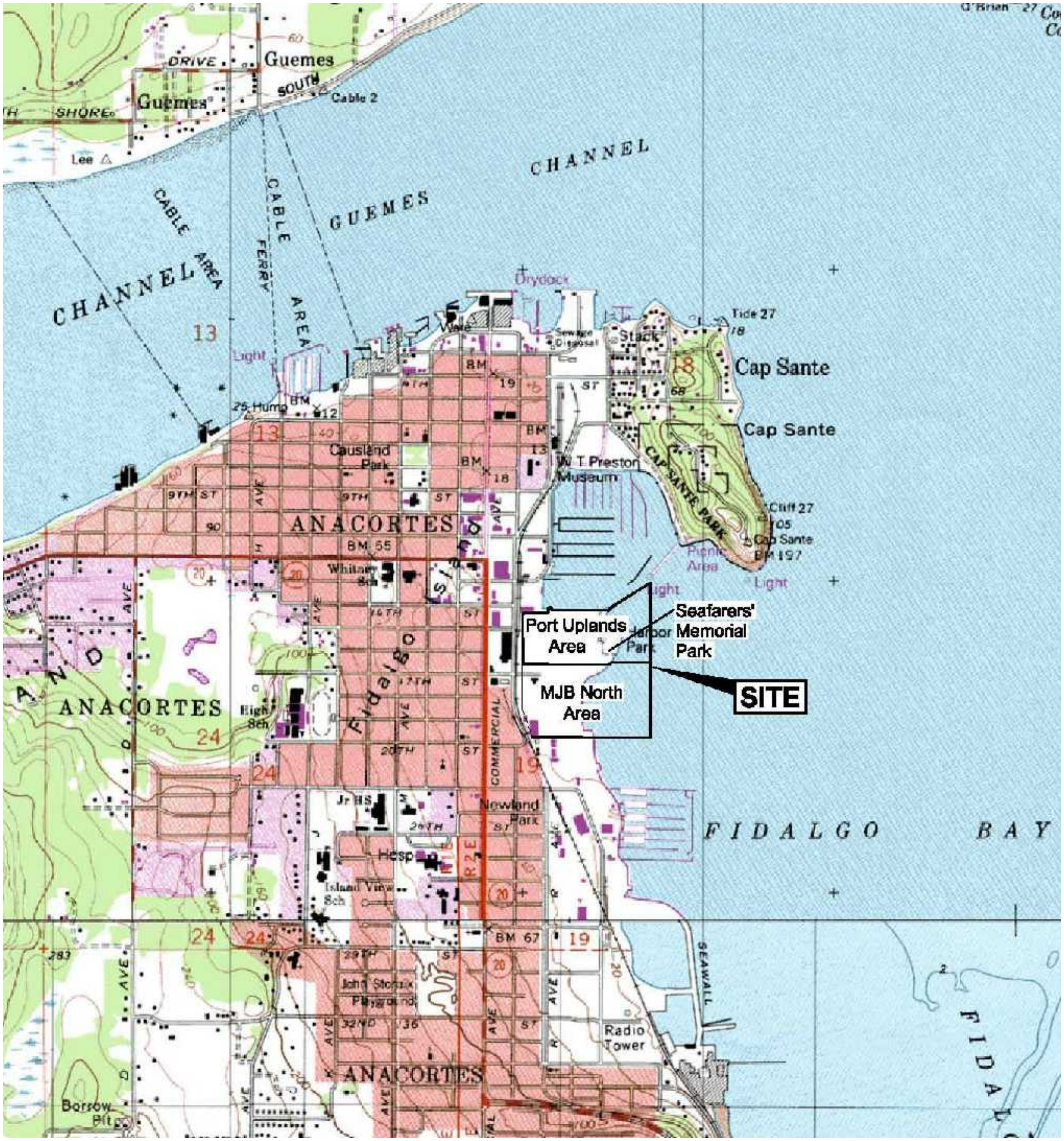
	Alternative M-1	Alternative M-2
Permanence	Score = 5 Achieves risk reduction in the marine area through direct removal and disposal of the excavated material at appropriate off-site facilities. However, landfill disposal precludes the MTCA preference for destruction of contaminants.	Score = 4 Achieves risk reduction in the marine area through direct removal and disposal of the excavated material at appropriate off-site facilities. However, landfill disposal precludes the MTCA preference for destruction of contaminants. The quantity of impacted sediment allowed to remain on site is greater than with Alternative M-1 and will require periodic monitoring.
Long-Term Effectiveness	Score = 5 Residual contaminant concentrations and associated risks are anticipated to be low. This alternative removes hazardous substances from the marine area to the greatest degree possible and utilizes approved off-site disposal facilities for final disposition. If hazardous substances remain at the Site (such as deeply buried wood debris) they will pose little risk to human health and the environment. Wave attenuation structures and armored caps will reduce the potential for contaminant exposure associated with cap erosion along the transitional slope.	Score = 4 Removes the majority of hazardous substances from the marine area and utilizes approved off-site disposal facilities for final disposition, but leaves some sediment in the marine area that exceeds Sediment Quality standards. Wave attenuation structures and armored caps will reduce the potential for contaminant exposure associated with cap erosion along the transitional slope.
Management of Short-Term Risks	Score = 3 Involves extensive sediment removal with a potential for generating dredge residuals. However, the excavation methods required to achieve the level of removal under this alternative are well established and capable of minimizing short-term risks.	Score = 3 Involves sediment removal with a potential for generating dredge residuals. However, the excavation methods required to achieve the level of removal under this alternative are well established and capable of minimizing short-term risks.
Technical and Admin. Implementability	Score = 5 Involves extensive sediment removal at the Site, with a potential for dredge residuals. Dredge residuals would be managed using a post-dredge cover of clean material. The excavation activities required for this alternative are common and feasible but would need to use equipment, staging, and phasing that is compatible with working in a shallow, tidally-influenced environment. Temporary site closure to public will allow facilitation of project.	Score = 5 Involves less sediment removal at the Site, with a potential for dredge residuals. Dredge resduals would be managed using a post-dredge cover of clean material. The excavation activities required for this alternative are common and feasible but would need to use equipment, staging, and phasing that is compatible with working in a shallow, tidally-influenced environment. Temporary site closure to public will allow facilitation of project.
Consideration of Public Concerns	Score = 4 Provides for complete removal of contaminated sediment from the subtidal portion of the marine area, addressing public concerns associated with exposure to contaminants and restriction on future use and development of Site. However, the excavation volume is greater than Alternative M-2, so local traffic impacts from upland disposal activities would be greater.	Score = 3 Addresses the highest level sediment that poses the greatest risk to human health and the environment. However, sediments below the CSL would remain on site.
Restoration Time Frame and Additional SMS Evaluation Criteria	See Sections 7.3.4 and 7.3.5	See Sections 7.3.4 and 7.3.5

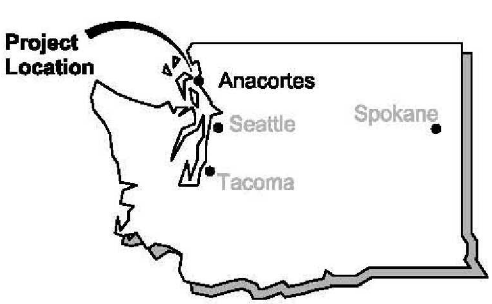
TABLE 11
SUMMARY OF MTCA EVALUATION AND RANKING OF CLEANUP ACTION ALTERNATIVES: MARINE AREA
FORMER SCOTT PAPER COMPANY MILL SITE

Alternative Number	M-1	M-2
Alternative Ranking Under MTCA		
1. Compliance with MTCA Threshold Criteria (1)	YES	YES
2. Restoration Time Frame	Two to three years	Two to three years
3. DCA Relative Benefits Ranking	1st	2nd
Protectiveness (weighted as 30%)	1.5	1.2
Permanence (weighted as 20%)	1	0.8
Long-Term Effectiveness (weighted as 20%)	1	0.8
Management of Short-Term Risks (weighted as 10%)	0.3	0.3
Technical and Administrative Implementability (weighted as 10%)	0.5	0.5
Consideration of Public Concerns (weighted as 10%)	0.4	0.3
Total of Scores	**4.7**	**3.9**
4. Disproportionate Cost Analysis		
Probable Remedy Cost (+50%/-30%, rounded)	$7,100,000	$5,800,000
Costs Disproportionate to Incremental Benefits	No	NA (2)
Practicability of Remedy	Practicable	Practicable
Remedy Permanent to Maximum Extent Practicable	Yes	Yes
Overall Alternative Ranking	1st	2nd

Notes
1 Non-compliant alternatives were not considered in this evaluation.
2 Not applicable since this is the lowest cost alternative.

FIGURES





N
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2000 0 2000
Feet

Source: PDF of Figure 1, Vicinity Map, provided by Landau Associates, dated 10/05/06.

Vicinity Map

Scott Paper Mill
Anacortes, Washington

Figure 1

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Source: AutoCAD figure provided by Landau Associates, dated September 2006. Base map source: David C. Smith and Associates, July 2004.

Legend

MW-111 ⊕ Monitoring Well with Designation

N E S W

0 200 400

Scale in Feet

Site Plan

Scott Paper Mill
Anacortes, Washington

Figure 2

P:\15\1470071031\CAD\REPORT PARTS\1470070 3F2.DWG\TAB:FIG 2 MODIFIED BY TMICHAUD ON NOV 06, 2008 - 10:14

Reference Information

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Source: AutoCAD drawing entitled "ES-4, Port Uplands Area Preliminary Soil Cleanup Level Exceedance Locations (0-2 ft BGS)", dated 9/18/2006, provided by Landau Associates. Base map source: Port of Anacortes, June 2004.

DRAFT

N W E S

0 120 240
Scale in Feet

Port Uplands Area Preliminary Soil Cleanup Level Exceedance Locations (0-2 ft BGS)

Scott Paper Mill
Anacortes, Washington

Figure 3

P:\5\5147007\03\CAD\REPORT PARTS\514700703F3.DWG\TAB:FIG 3 MODIFIED BY THICHAUD ON NOV 06, 2008 - 10:10

Reference Information

1. The locations of all features shown are approximate.
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Source: AutoCAD drawing entitled "ES-5, Port Uplands Area Preliminary Soil Cleanup and Remediation Level Exceedance Locations (2-6 ft BGS)", dated 9/18/2006, provided by Landau Associates. Base map source: Port of Anacortes, June 2004.

DRAFT

N W E S

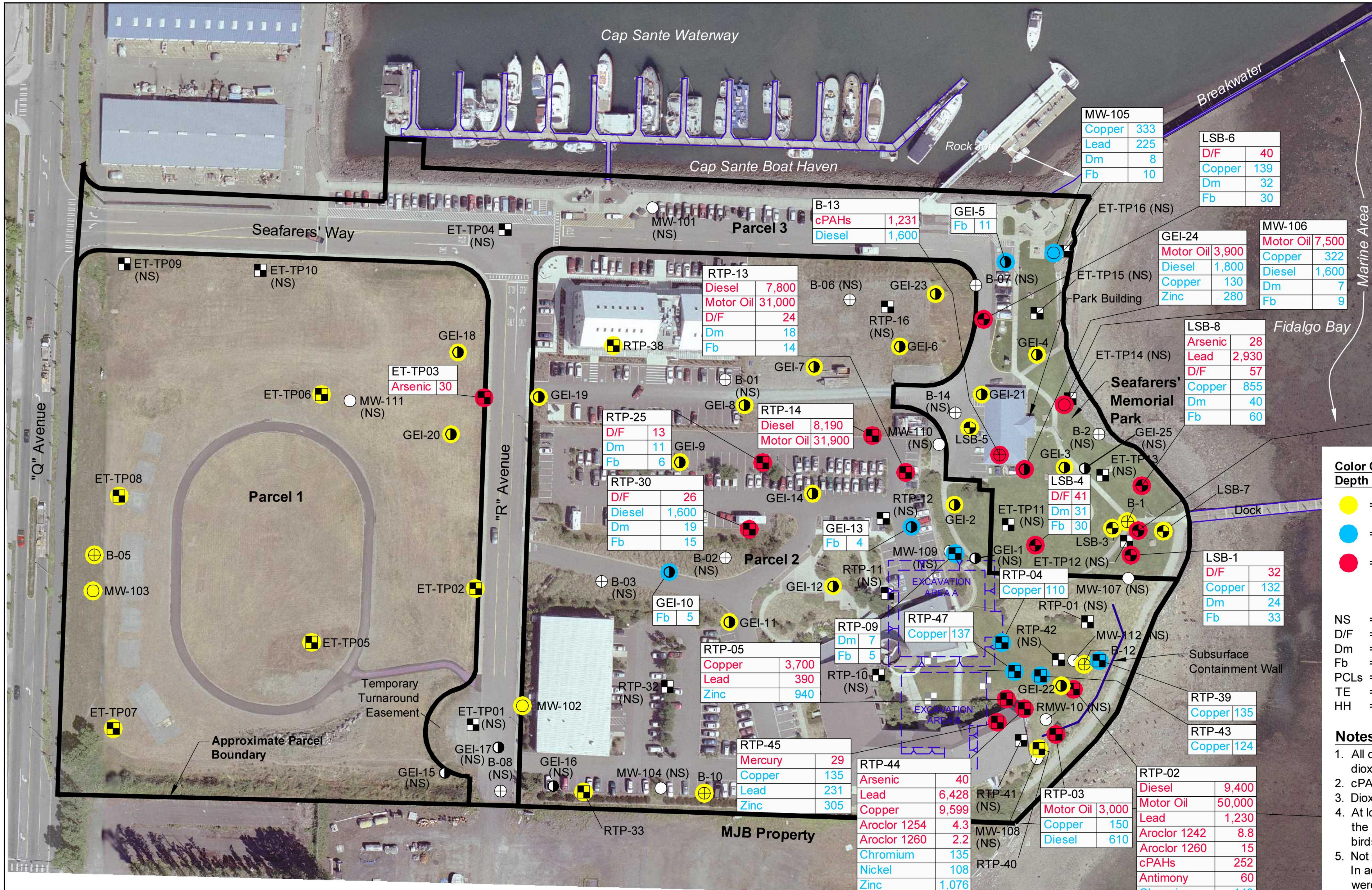
0 120 240

Scale in Feet

Port Uplands Area Preliminary Soil Cleanup Level Exceedance Locations (2-6 ft BGS)

Scott Paper Mill
Anacortes, Washington

Figure 4



Legend

- Soil Boring Location (Pre 2004)
- Test Pit Location (Pre 2004)
- Uplands Area RI Soil Boring Location (2004)
- Uplands Area RI Monitoring Well Location (2004)
- September 2008 Soil Boring Location

LSB-1	
D/F	32

Sample Location Identification, Constituent, and Concentration that Exceeds Preliminary Cleanup Level

Color Coding for Locations Sampled Within Designated Depth Interval:

- (yellow) = Location Does Not Exceed PCLs
- (blue) = Location Exceeds MTCA TE Criteria Only
- (red) = Location Exceeds MTCA TE and HH Criteria, or HH Criteria Only (if no TE Criteria Established or if TE Criteria > HH Criteria)

NS = Not Sampled
D/F = Total Dioxins/Furans - Human Health
Dm = Total Dioxins - Mammals
Fb = Total Furans - Birds
PCLs = Preliminary Cleanup Levels
TE = Terrestrial Ecological
HH = Human Health

Notes

1. All concentrations in mg/kg except cPAHs and dioxins/furans.
2. cPAH concentrations in µg/kg TEQ.
3. Dioxin/furan concentrations in ng/kg TEQ.
4. At locations with ecological dioxin/furan exceedances, only the highest receptor-specific TEQ value (mammals or birds) is shown.
5. Not all locations were tested for the same set of analytes. In accordance with the investigation work plans, analytes were chosen based on site history, field screening, and investigation objectives.

Reference Information

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.

Source: AutoCAD drawing entitled "ES-6, Port Uplands Area Preliminary Soil Cleanup and Remediation Level Exceedance Locations (6-10 ft BGS)", dated 9/18/2006, provided by Landau Associates. Base map source: Port of Anacortes, June 2004.

N E S W

0 120 240
Scale in Feet

DRAFT

Port Uplands Area Preliminary Soil Cleanup Level Exceedance Locations (6-10 ft BGS)

Scott Paper Mill
Anacortes, Washington

Figure 5

P:\5\5147007\03\CAD\REPORT PARTS\514700703F4.DWG\TAB:FIG 4 MODIFIED BY THICHAUD ON NOV 06, 2008 - 10:02

Notes

1. All concentrations in mg/kg except cPAHs and dioxins/furans.
2. cPAH concentrations in µg/kg TEQ.
3. Dioxin/furan concentrations in ng/kg TEQ.
4. At locations with ecological dioxin/furan exceedances, only the highest receptor-specific TEQ value (mammals or birds) is shown.
5. Not all locations were tested for the same set of analytes. In accordance with the investigation work plans, analytes were chosen based on site history, field screening, and investigation objectives.

Reference Information

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.

Source: AutoCAD drawing entitled "ES-7, Port Uplands Area Preliminary Soil Cleanup and Remediation Level Exceedance Locations (10-15 ft BGS)", dated 9/18/2006, provided by Landau Associates. Base map source: Port of Anacortes, June 2004.

DRAFT

N W E S

0 120 240
Scale in Feet

Port Uplands Area Preliminary Soil Cleanup Level Exceedance Locations (10-15 ft BGS)

Scott Paper Mill
Anacortes, Washington

Figure 6

P:\5\5147007\03\CAD\Report Parts\514700703F5.dwg\TAB:Fig 5 modified by THICHAUD on Nov 06, 2008 - 9:50

EXPLANATION

- ○ Monitoring Well Location
- ● Push Probe Soil Sample Location
- ◆ Test Pit Sample Location
- ▲ Soil Sample Location
- ⊕ Soil Boring Location
- Property Line
- Fence Line
- Proposed Security Fence
- Parking or Tree Area

Color Coding for Locations Sampled Within Designated Depth Interval:

- Yellow: Location Does Not Exceed PCLs (4 or More Constituents analyzed)
- Blue: Location Exceeds MTCA TE Criteria Only
- Red: Location Exceeds MTCA TE and HH Criteria, or HH Criteria Only (if no TE Criteria Established or if TE > HH Criteria)

Notes:

1. Soil Samples not highlighted were below PCL's and fewer than 4 constituent analytes.
2. Not all locations were tested for the same set of analytes. In accordance with the investigation work plans, analytes were chosen based on site history, field screening, and investigation objectives.
3. Results shown in mg/kg.
4. Aerial photograph from City of Anacortes (2003).

0 60 120
APPROXIMATE SCALE IN FEET

MJB NORTH AREA
SOIL CLEANUP LEVEL EXCEEDANCE LOCATIONS
(0-2 ft BGS)
Anacortes, Washington

By: APS with AMEC Geomatrix	Date: 11/25/08	Figure 7

Plot Date: 11/25/08 - 11:44am, Plotted by: adam.stenberg
Drawing Path: S:\10131\005_DCAP\AMEC Geomatrix\, Drawing Name: MJB Uplands Prelim Soil Cleanup 0-2ft_112508.dwg

EXPLANATION

- ○ Monitoring Well Location
- ● Push Probe Soil Sample Location
- ◆ Test Pit Sample Location
- ▲ Soil Sample Location
- ⊕ Soil Boring Location
- Property Line
- Fence Line
- Proposed Security Fence
- Parking or Tree Area

Color Coding for Locations Sampled Within Designated Depth Interval:

- Location Does Not Exceed PCLs (4 or More Constituents analyzed)
- Location Exceeds MTCA TE Criteria Only
- Location Exceeds MTCA TE and HH Criteria, or HH Criteria Only (if no TE Criteria Established or if TE > HH Criteria)

Notes:

1. Soil Samples not highlighted were below PCL's and fewer than 4 constituent analytes.
2. Not all locations were tested for the same set of analytes. In accordance with the investigation work plans, analytes were chosen based on site history, field screening, and investigation objectives.
3. Results shown in mg/kg.
4. Aerial photograph from City of Anacortes (2003)

N

0 60 120

APPROXIMATE SCALE IN FEET

MJB NORTH AREA
SOIL CLEANUP LEVEL EXCEEDANCE LOCATIONS
(2-6 ft BGS)
Anacortes, Washington

By: APS with AMEC Geomatrix	Date: 11/25/08	Figure 8

Plot Date: 11/25/08 - 11:48am, Plotted by: adam.stenberg
Drawing Path: S:\10131\005_DCAP\AMEC Geomatrix\, Drawing Name: MJB Uplands Prelim Soil Cleanup 2-6ft_112508.dwg

EXPLANATION

- ○ Monitoring Well Location
- ● Push Probe Soil Sample Location
- ◆ Test Pit Sample Location
- ▲ Soil Sample Location
- ⊕ Soil Boring Location
- Property Line
- Fence Line
- Proposed Security Fence
- Parking or Tree Area

Color Coding for Locations Sampled Within Designated Depth Interval:

- Yellow: Location Does Not Exceed PCLs (4 or More Constituents analyzed)
- Blue: Location Exceeds MTCA TE Criteria Only
- Red: Location Exceeds MTCA TE and HH Criteria, or HH Criteria Only (if no TE Criteria Established or if TE > HH Criteria)

Notes:

1. Soil Samples not highlighted were below PCL's and fewer than 4 constituent analytes.
2. Not all locations were tested for the same set of analytes. In accordance with the investigation work plans, analytes were chosen based on site history, field screening, and investigation objectives.
3. Results shown in mg/kg.
4. Aerial photograph from City of Anacortes (2003)

MJB NORTH AREA
SOIL CLEANUP LEVEL EXCEEDANCE LOCATIONS
(6-10 ft BGS)
Anacortes, Washington

By: APS with AMEC Geomatrix | Date: 11/25/08 | Figure 9

Plot Date: 11/25/08 - 11:51am, Plotted by: adam.stenberg
Drawing Path: S:\10131\005_DCAP\AMEC Geomatrix\, Drawing Name: MJB Uplands Prelim Soil Cleanup 6-10ft_112508.dwg

EXPLANATION

- ○ Monitoring Well Location
- ● Push Probe Soil Sample Location
- ◆ Test Pit Sample Location
- ▲ Soil Sample Location
- ⊕ Soil Boring Location
- Property Line
- Fence Line
- Proposed Security Fence
- Parking or Tree Area

Color Coding for Locations Sampled Within Designated Depth Interval:

- Yellow: Location Does Not Exceed PCLs (4 or More Constituents analyzed)
- Blue: Location Exceeds MTCA TE Criteria Only
- Red: Location Exceeds MTCA TE and HH Criteria, or HH Criteria Only (if no TE Criteria Established or if TE > HH Criteria)

Notes:

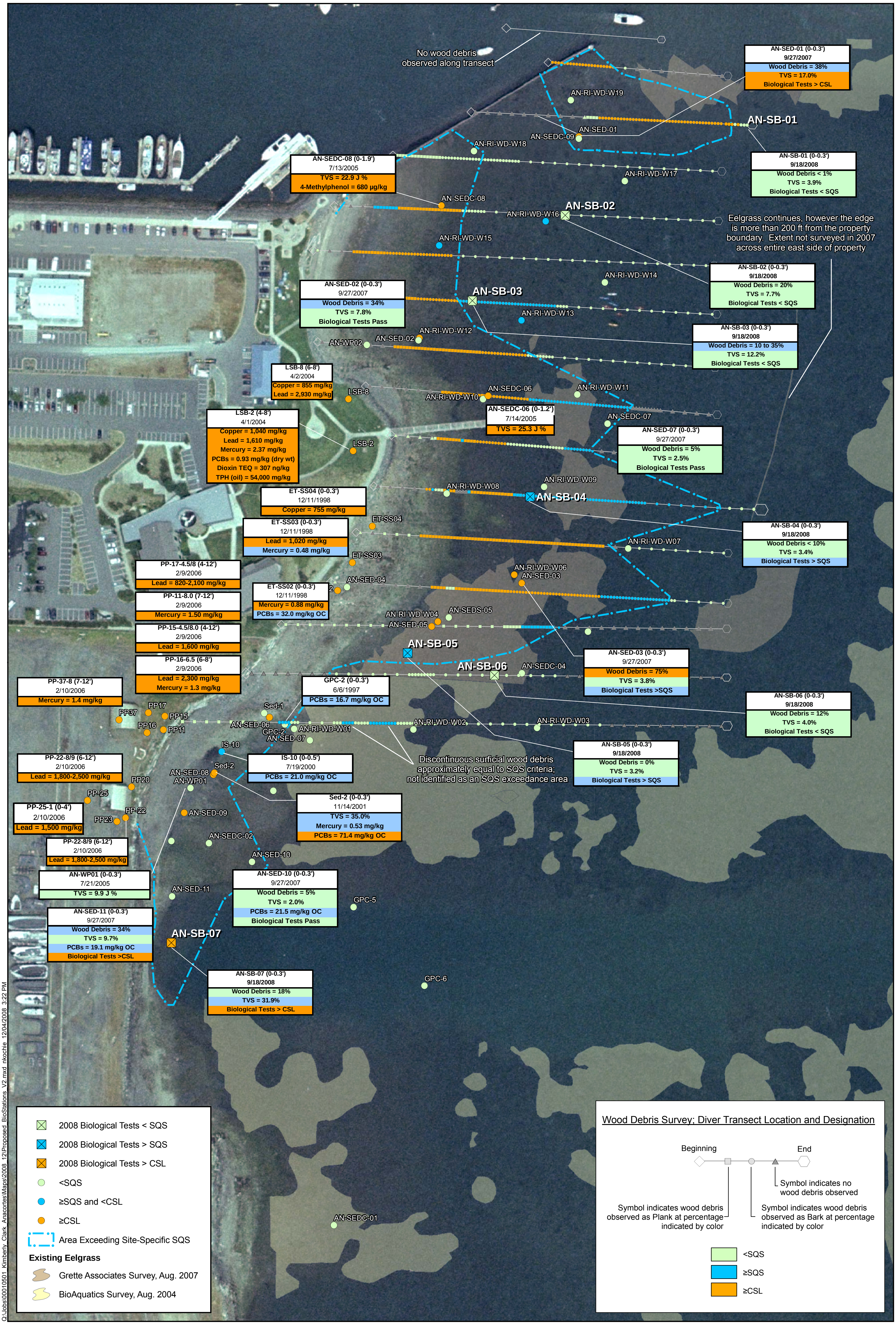
1. Soil Samples not highlighted were below PCL's and fewer than 4 constituent analytes.
2. Not all locations were tested for the same set of analytes. In accordance with the investigation work plans, analytes were chosen based on site history, field screening, and investigation objectives.
3. Results shown in mg/kg.
4. Aerial photograph from City of Anacortes (2003).

0 60 120
APPROXIMATE SCALE IN FEET

MJB NORTH AREA
SOIL CLEANUP LEVEL EXCEEDANCE LOCATIONS
(10-15 ft BGS)
Anacortes, Washington

By: APS with AMEC Geomatrix	Date: 11/25/08	Figure 10

Plot Date: 11/25/08 - 12:12pm, Plotted by: adam.stenberg
Drawing Path: S:\10131\005_DCAP\AMEC Geomatrix\, Drawing Name: MJB Uplands Prelim Soil Cleanup 10-15ft_112508.dwg



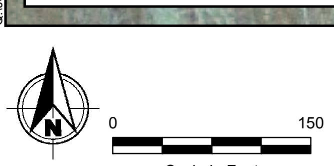
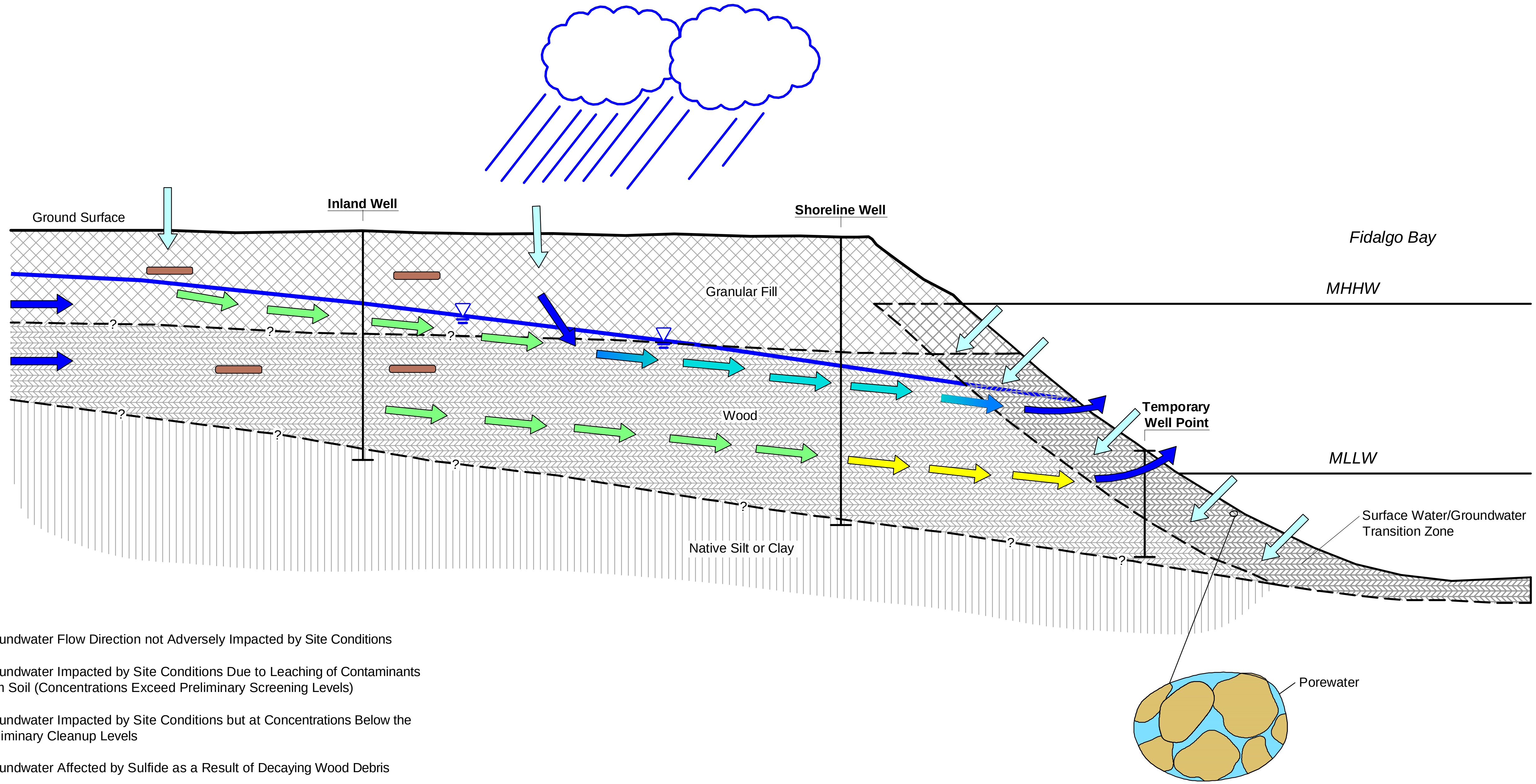


Figure 11
Shoreline Buffer Zone Soil and Sediment SMS Exceedances
Site-Wide Marine Area, Former Scott Paper Mill



Legend

- Groundwater Flow Direction not Adversely Impacted by Site Conditions
- Groundwater Impacted by Site Conditions Due to Leaching of Contaminants from Soil (Concentrations Exceed Preliminary Screening Levels)
- Groundwater Impacted by Site Conditions but at Concentrations Below the Preliminary Cleanup Levels
- Groundwater Affected by Sulfide as a Result of Decaying Wood Debris
- Surface Water Infiltration
- Localized Soil Interval with Contaminant (Arsenic, Lead, cPAHs, TPH, Dioxin/Furan) Concentrations Exceeding Preliminary Screening Levels
- Groundwater Table

Not to Scale

Reference Information

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.
2. The locations of all features shown are approximate.
3. 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.

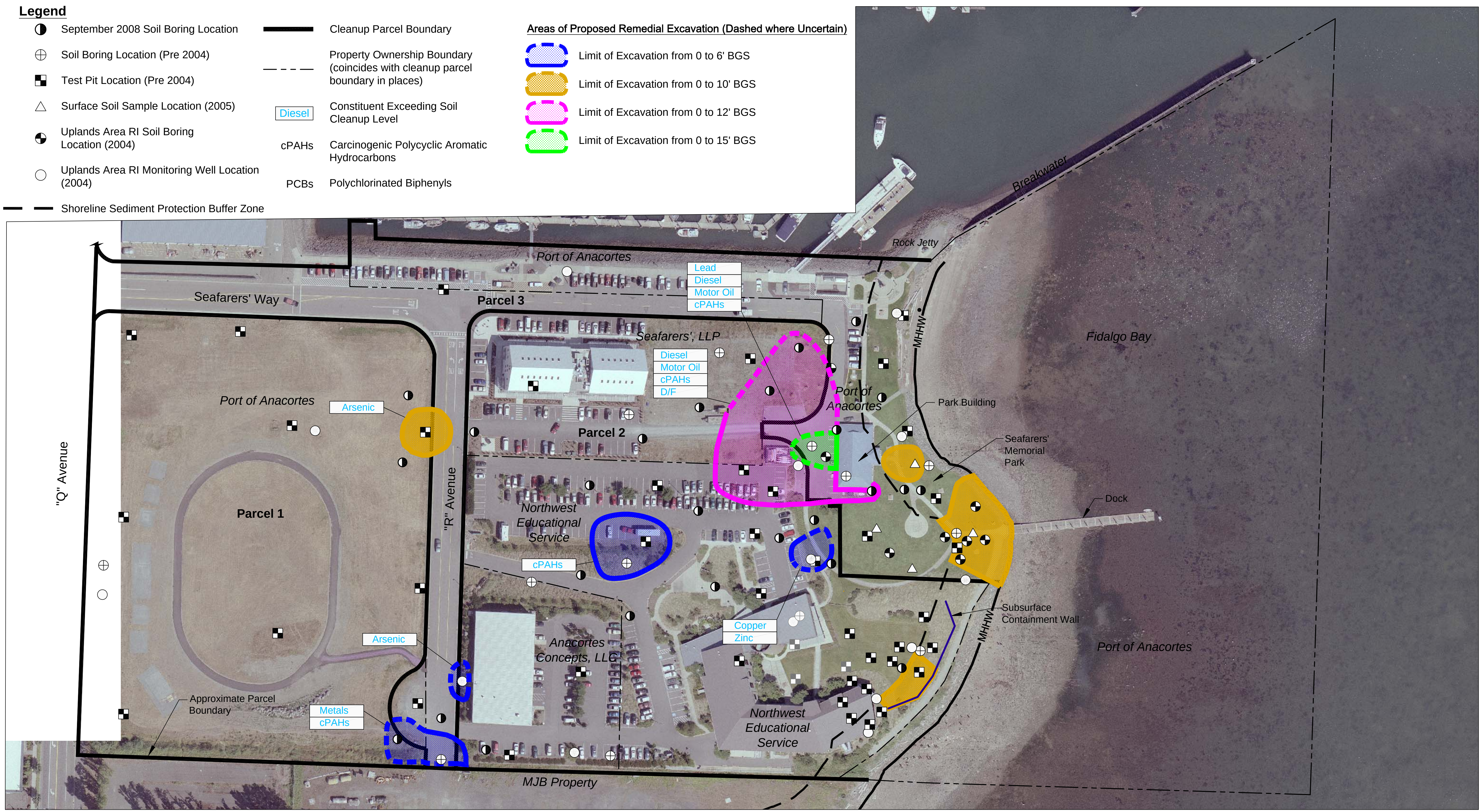
Source: AutoCAD figure provided by Landau Associates, dated September 2006.

Conceptual Site Model

Scott Paper Mill
Anacortes, Washington

Figure 12

P:\5\5147007\07\CAD\DCAP Figures\514700707F12.dwg\TAB:F12 modified by tmichaud on Nov 26, 2008 - 9:29



Notes

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. can not guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
3. Reference: AutoCAD drawing entitled "ES-4, Port Uplands Area Preliminary Soil Cleanup Level Exceedance Locations (0-2 ft BGS)", dated 9/18/2006, provided by Landau Associates. Base map source: Port of Anacortes, 2007.

N S E W

0 130 260
Scale in Feet

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Figure 13
Port Uplands Area Remedy
Former Scott Mill Site

C:\DOCUME~1\JLAPLA~1\LOCALS~1\Temp\AcPublish_2364\0010501-67.dwg Fig 13
Dec 04, 2008 4:28pm jlaplante

LEGEND

- Monitoring Well Location
- Push Probe Soil Sample Location
- Test Pit Sample Location
- Soil Sample Location
- Soil Boring Location
- Property Line
- Fence Line
- Proposed Security Fence
- Parking Area

Areas of Proposed Remedial Excavation

- Anticipated Limit of Excavation from 0 to 2' BGS
- Anticipated Limit of Excavation from 0 to 6' BGS
- Shoreline Buffer Zone Excavation (see Figure 15)

DRAFT

0 60 120

APPROXIMATE SCALE IN FEET

MJB NORTH AREA
INLAND UPLANDS REMEDY
Anacortes, Washington

By: APS with AMEC Geomatrix	Date: 12/04/08	Figure 14

Plot Date: 12/04/08 - 4:51pm, Plotted by: jlaplante
Drawing Path: C:\DOCUME~1\JLAPLA~1\LOCALS~1\Temp\AcPublish_2364\, Drawing Name: 00010501-64.dwg

Legend:

●PP42 ●GEI-15	Sample Location and I.D.
—MHHW—	Existing Mean Higher High Water Line
(orange fill)	Buffer Zone Remediation Areas
(green crosshatch)	75 ft Shoreline Buffer Zone
(yellow dashed line)	Limits of Marine Area Removal

Notes:

1. Aerial photography provided by Port of Anacortes, dated 09-2007.

0 160
Scale in Feet

N

Figure 15
Marine and Shoreline Buffer Area Excavation/Dredging Remedy
Former Scott Paper Mill

DRAFT

K:\Jobs\000105-Kimberly Clark\000105-01\00010501-65.dwg Fig 15

Dec 05, 2008 1:41pm jlaplante

Legend:

- Buffer Zone Remediation Areas
- 75 ft Shoreline Buffer Zone
- Limits of Marine Area Removal & Backfill
- Quarry Spall Armored Cap (2 ft thick)
- Rock Armored Cap (2 ft thick)
- Existing Eelgrass Bed
- Potential Eelgrass and/or Macroalgae Restoration

Notes:

1. Aerial photography provided by Port of Anacortes, dated 09-2007.

N

0 160

Scale in Feet

K:\Jobs\000105-Kimberly Clark\00010501-01\00010501-66.dwg Fig 16

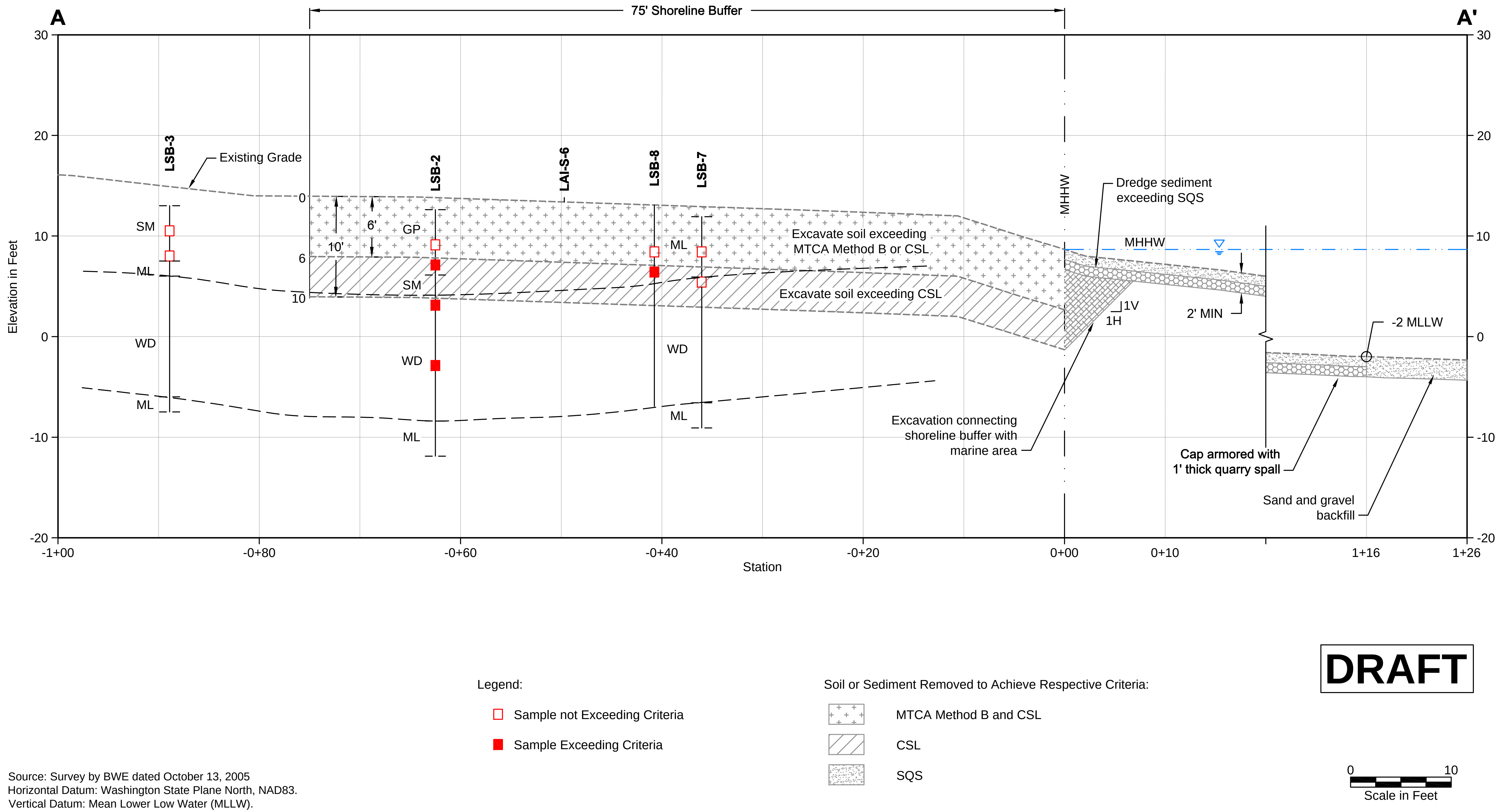
Dec 05, 2008 1:54pm jlaplante

Figure 16

Marine Area Wave Attenuation and Shoreline Capping Remedy

Former Scott Paper Mill

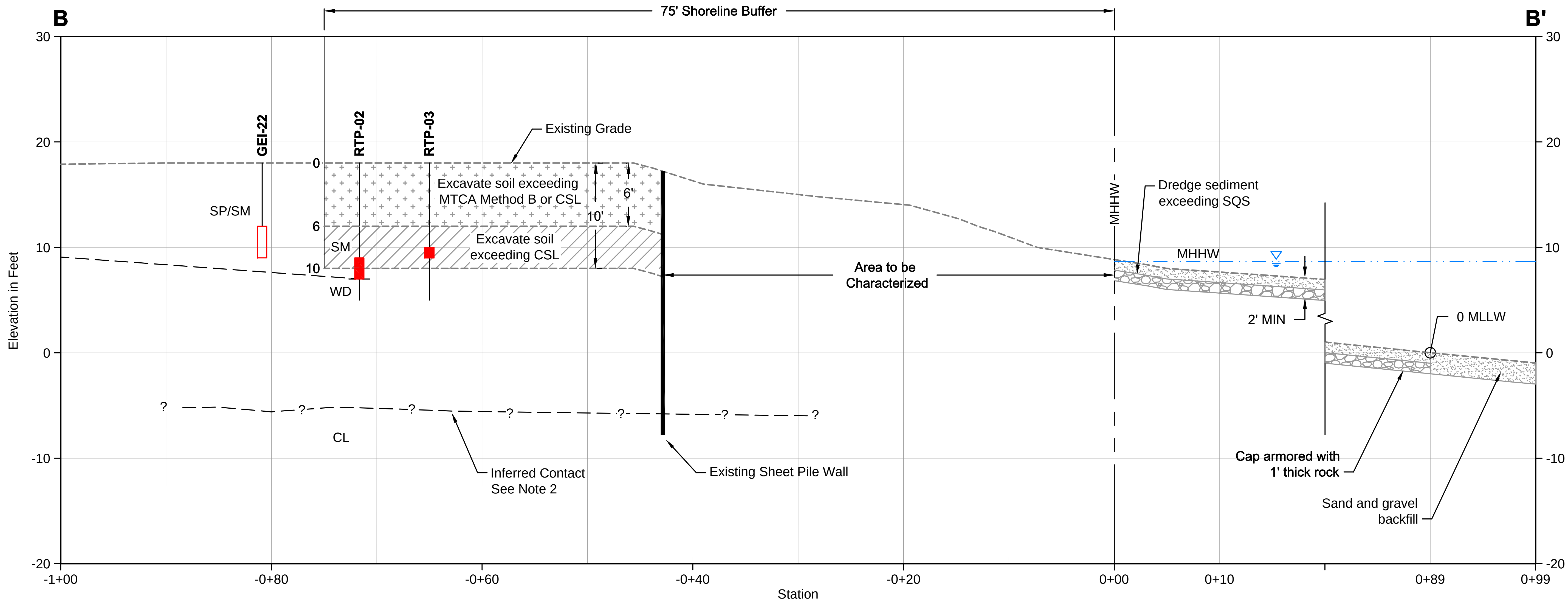
DRAFT



Source: Survey by BWE dated October 13, 2005
Horizontal Datum: Washington State Plane North, NAD83.
Vertical Datum: Mean Lower Low Water (MLLW).

K:\Jobs\000105-Kimberly Clark\000105-01\00010501-65.dwg Fig 17 Section A-A'
Dec 05, 2008 1:41pm jlaplante

Figure 17
Shoreline Transition Zone Cross-Section A-A'
Former Scott Paper Mill



Notes:

1. Vertical Datum: Mean Lower Low Water (MLLW).

2. Depth of sheet pile wall and estimated bottom of wood debris inferred from ThermoRetec Report for Port Uplands Parcel 2 (January 1999)

Legend:

- Sample not Exceeding Criteria
- Sample Exceeding Criteria

Soil or Sediment Removed to Achieve Respective Criteria:

- MTCA Method B and CSL
- CSL
- SQS

DRAFT

0 10
Scale in Feet

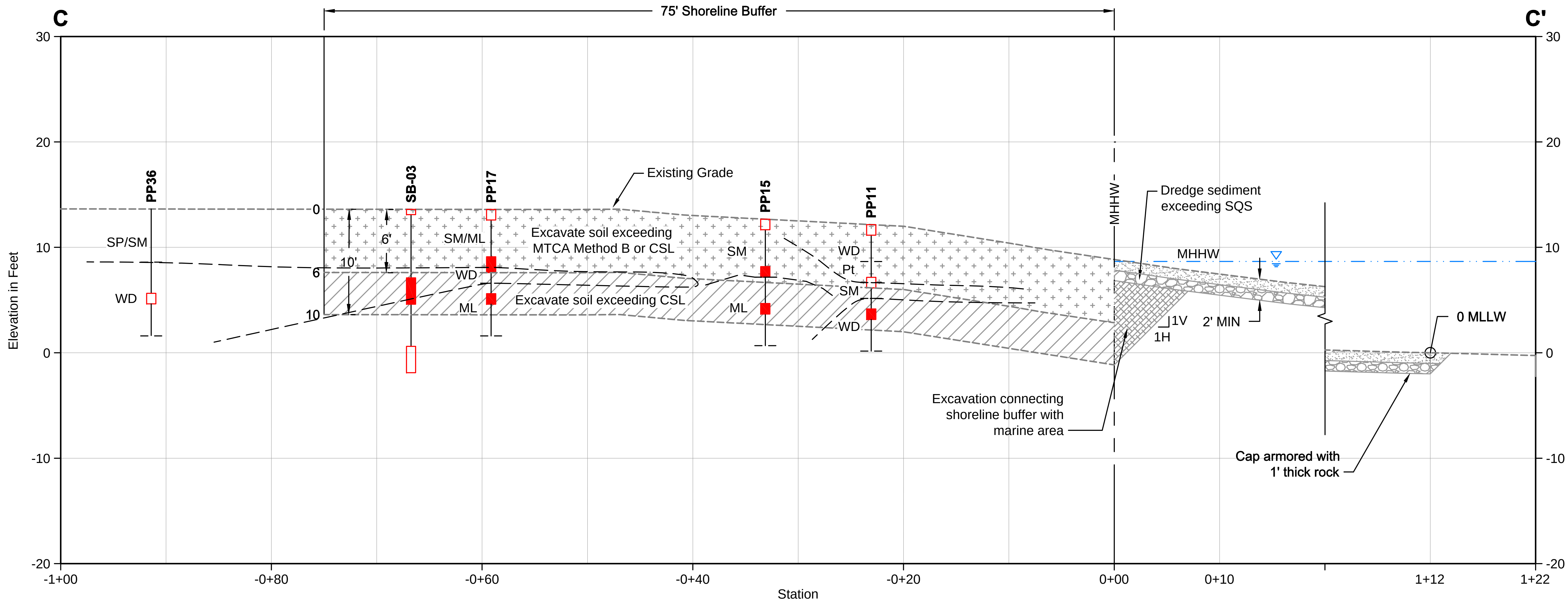
K:\Jobs\000105-Kimberly Clark\000105-01\00010501-65.dwg Fig 18 Section B-B'

Dec 05, 2008 1:41pm jlaplante

Figure 18

Shoreline Transition Zone Cross-Section B-B'

Former Scott Paper Mill



Legend:

Sample not Exceeding Criteria

Sample Exceeding Criteria

Soil or Sediment Removed to Achieve Respective Criteria:

MTCA Method B and CSL

CSL

SQS

DRAFT

0 10
Scale in Feet

Source: Survey by BWE dated October 13, 2005
Horizontal Datum: Washington State Plane North, NAD83.
Vertical Datum: Mean Lower Low Water (MLLW).

Dec 05, 2008 1:41pm jlaplante K:\Jobs\000105-Kimberly Clark\000105-01\00010501-65.dwg Fig 19 Section C-C'

Figure 19
Shoreline Transition Zone Cross-Section C-C'
Former Scott Paper Mill

Figure 20 Disproportionate Cost Analysis, Port Upland Areas

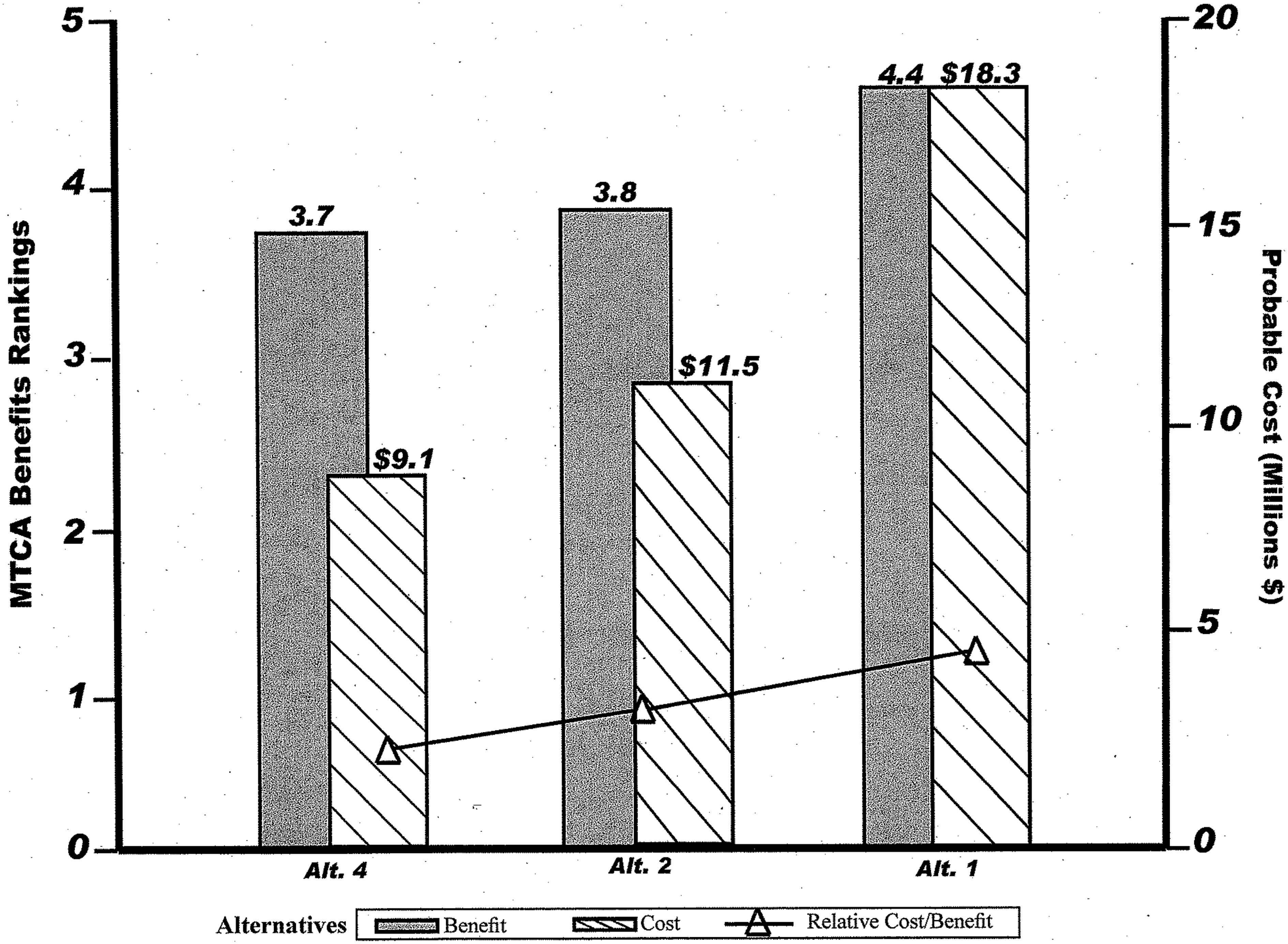
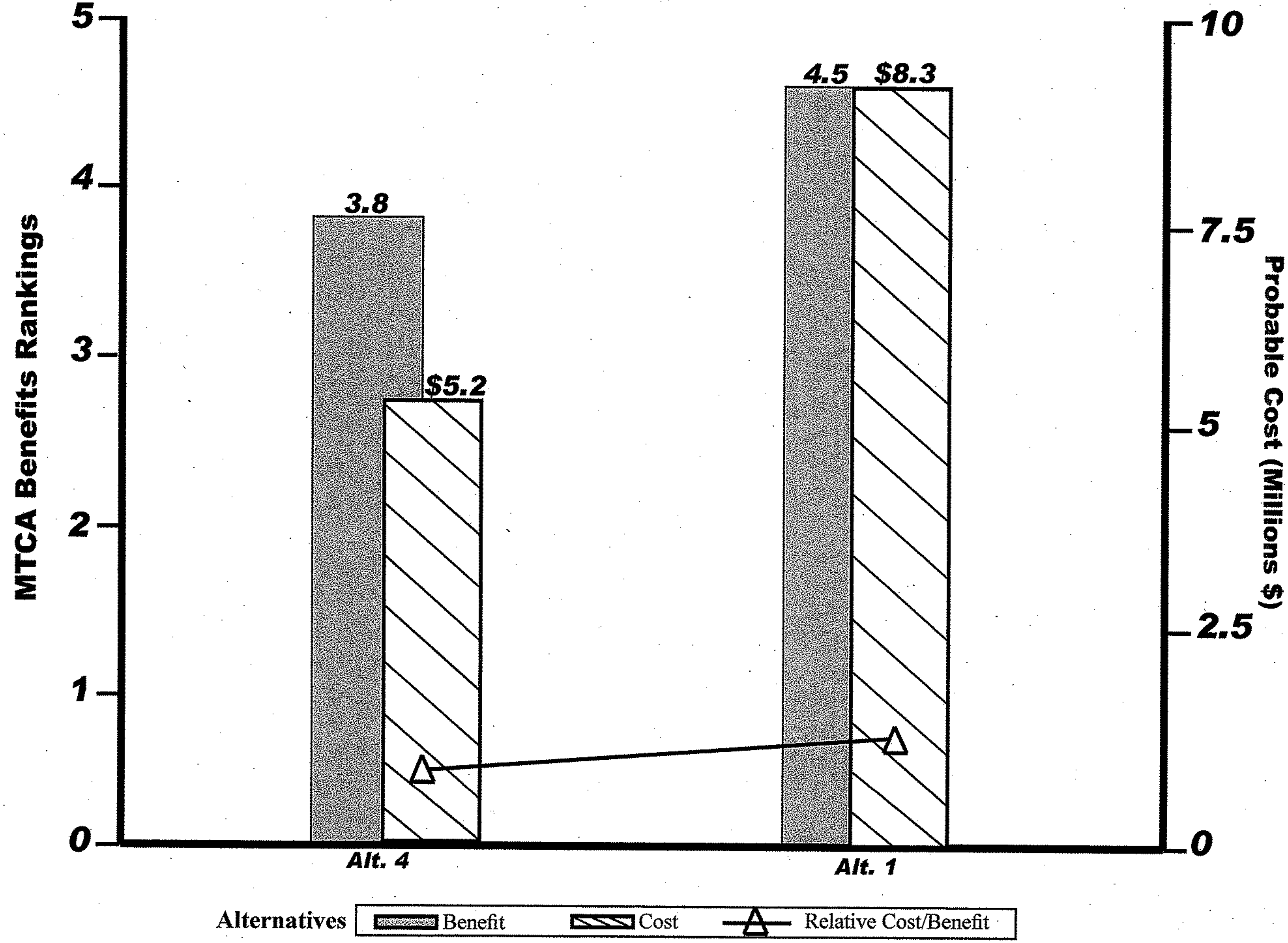


Figure 21 Disproportionate Cost Analysis, MJB North Area



APPENDIX A
SEPTEMBER 2008 PORT UPLANDS AREA SUPPLEMENTAL SOIL INVESTIGATION

INTRODUCTION

This appendix presents the results of a supplemental soil investigation completed by the Port of Anacortes (the "Port") in September 2008 at the Port Uplands Area of the Former Scott Paper Mill Site (the "Site") in Anacortes, Washington. The soil investigation supplements previous soil sampling performed at the Port Uplands Area as part of the site-wide remedial investigation (RI). The scope and results of the RI are documented in the RI report (GeoEngineers et al. 2008). The supplemental soil investigation was conducted in accordance with the Supplemental Soil Investigation Sampling and Analysis Plan (SAP) approved by the Washington State Department of Ecology (Ecology) on September 2, 2008 (GeoEngineers 2008).

OBJECTIVES

The supplemental soil investigation had two main objectives:

1. Provide data to refine estimates of the extent of soil contamination and the areas potentially requiring cleanup at the Port Uplands Area. Because of existing data gaps, there was some uncertainty regarding the extent of soil contamination that was identified during the RI.

2. Provide data to evaluate the potential waste designation of lead-impacted soil that may be removed during future cleanup actions. Toxicity characteristic leaching procedure (TCLP) testing was performed on selected soil samples to support the evaluation of soil disposal options and costs during remedial design.

FIELD PROGRAM

Twenty-five soil borings (GEI-1 through GEI-25) were completed at the Port Uplands Area on September 8, 9, and 10, 2008. Twenty-two of these borings were proposed in the SAP. Three borings (GEI-23, GEI-24, and GEI-25) were added to the scope based on conditions encountered in the field (two were step-out borings, and the third was intended to augment a nearby boring that had poor sample recovery). Figure A-1 shows the approximate locations of the soil borings. The boring locations were measured in the field using a portable Trimble® global positioning system instrument.

The soil borings were completed by Cascade Drilling of Woodinville, Washington, using a direct-push drilling rig. A small, mobile attachment to the drilling rig was used to advance boring GEI-22 due to limited access at this location. The borings were advanced to depths between 6 and 14 feet below ground surface (bgs). An attempt was made to collect continuous soil cores at each location for lithologic description and initial field screening; however, subsurface conditions precluded continuous core sampling at some locations. Soil observations and field screening data recorded on boring logs included soil lithology (color, grain size, moisture content, etc.), results of sheen testing, and results of headspace organic vapor screening using a photoionization detector (PID). Field screening procedures are described in the SAP. The boring logs are contained in Attachment 1.

SOIL SAMPLING

Soil sampling was conducted according to the procedures described in the SAP. Soil obtained from each target depth interval was placed in a decontaminated stainless steel bowl and mixed with a stainless steel spoon. Particles of wood, gravel, and other material larger than approximately 2 millimeters in size were removed from the mixed soil sample. A subsample of the mixed soil was placed in a laboratory-supplied glass sample jar, and the filled sample jar was stored in a cooler with ice. Remaining soil in the stainless steel bowl was then field-screened for organic vapors using a PID.

The stainless steel bowl and spoon were decontaminated prior to obtaining each sample by washing with an aqueous solution of Alconox® detergent and rinsing with distilled water. Soil cuttings and decontamination water were placed in two 55-gallon drums. The drums were marked and staged near the southeastern corner of Parcel 1.

WATER SAMPLING

Two water samples were collected for chemical analysis during the supplemental soil investigation. One groundwater grab sample was collected from boring GEI-24 to assess petroleum hydrocarbon concentrations in groundwater near the southeastern corner of the Seafarers' Park Building. This sample was obtained using a peristaltic pump, and was collected in laboratory-supplied sample containers. In addition, one equipment rinsate blank (field quality control sample) was collected to assess the effectiveness of the equipment decontamination procedure. The rinsate blank was obtained by swirling a small amount of distilled water in the decontaminated stainless steel mixing bowl, and then slowly pouring the water into laboratory-supplied sample containers.

ANALYTICAL TESTING

The soil and water samples were submitted for chemical analysis to Analytical Resources, Inc. (ARI) in Tukwila, Washington, using standard chain-of-custody protocols. The soil samples were analyzed for one or more of the following parameters in accordance with the soil sampling and analysis matrix (Table 1) contained in the SAP:

- Diesel- and motor oil-range total petroleum hydrocarbons (TPH) by Ecology Method NWTPH-Dx.
- Total metals (arsenic, copper, lead and/or zinc) by U.S. Environmental Protection Agency (EPA) Method 6020. ARI subcontracted the metal analyses to Fremont Analytical, Inc. (Fremont) in Seattle, Washington.
- Carcinogenic polycyclic aromatic hydrocarbons (cPAHs) by EPA Method 8270C-SIM. ARI subcontracted some of the cPAH analyses to Fremont.
- Dioxins and furans by EPA Method 8290. ARI subcontracted the dioxin and furan analyses to Pace Analytical Services, Inc. in Minneapolis, Minnesota.
- Lead by TCLP, EPA Method 1311. ARI subcontracted the TCLP lead analyses to Fremont.

The groundwater grab sample (GEI24-W) was analyzed for diesel- and motor oil-range TPH. The rinsate blank sample (RINSATE) was analyzed for TPH, total metals, and cPAHs.

The analytical results for the soil samples collected at Parcels 1, 2, and 3 are summarized in Tables A-1, A-2, and A-3, respectively. The analytical results for the groundwater and rinsate blank samples are summarized in Table A-4. A data quality assessment summary is included in Attachment 2.

RESULTS

This section summarizes the physical characteristics of the soil encountered in the supplemental soil borings and the analytical testing results for soil and water samples.

SOIL PHYSICAL CHARACTERIZATION

Soil samples obtained from each boring were visually inspected and field-screened (sheen and headspace organic vapor screening) to identify potential soil contamination as described in the SAP. Soil descriptions and field screening results are summarized below.

Parcel 1

Three borings (GEI-15, GEI-18, and GEI-20) were advanced to depths of 6 to 10 feet bgs on Parcel 1. Soils generally consisted of approximately 5 to 10 feet of silty sand with gravel, interpreted as fill material. An approximately 1- to 3-foot-thick, dark grey to dark brown silt horizon was encountered between approximately 5 and 8 feet bgs at borings GEI-18 and GEI-20. At GEI-20, wood debris was encountered between approximately 8 and 9 feet bgs. Silty sand and gravelly sand were encountered below the silt horizon and wood debris.

No field screening evidence of potential soil contamination was observed in borings GEI-15, GEI-18, or GEI-20.

Parcel 2

Fifteen borings (GEI-1, GEI-2, GEI-6 through GEI-14, GEI-16, GEI-19, GEI-22, and GEI-23) were advanced to depths of 10 to 14 feet bgs on Parcel 2. Soils generally consisted of approximately 5 to 10 feet of silty sand with gravel (interpreted as fill material), underlain by up to 5 feet of dark brown silt with varying amounts of wood debris. Wood debris consisting of sawdust, wood chips, and shredded wood was encountered at approximately 10 feet bgs and deeper. A white, decomposed, sawdust-like material was noted between 9.5 and 10 feet bgs in borings GEI-8 and GEI-9, and between 2.5 and 6.5 feet bgs in boring GEI-19. At two locations where borings extended through the wood debris layer (borings GEI-7 and GEI-13), silt interpreted as native marine sediment deposits was encountered at a depth of approximately 13 to 14 feet bgs.

Evidence of potential petroleum contamination (petroleum-like odors and moderate to heavy sheens) was observed in borings GEI-5, GEI-6, GEI-14, GEI-21, GEI-23, and GEI-24. In general, the petroleum-like odors and sheens observed in these borings were present at depths ranging from 10 to 13 feet bgs in a sand and silt horizon overlying wood debris. Although three of these borings (GEI-5, GEI-21, and GEI-24) are located on Parcel 3, they are included in this Parcel 2 discussion because the area of petroleum contamination identified during the RI appears to be continuous in the northeastern portion of the Site, which includes parts of Parcels 2 and 3.

The white, decomposed, sawdust-like material encountered at depths between 2.5 and 10 feet bgs in borings GEI-8, GEI-9, and GEI-19 had a rancid odor. Field screening of this material did not yield evidence of potential contamination; no organic vapors or sheens were noted. However, a moderate to heavy sheen and petroleum-like odor were noted at approximately 4.5 to 5.5 feet bgs in GEI-9. This sheen and petroleum-like odor appeared to be associated with a thin (3-inch) horizon of black-stained wood debris.

Parcel 3

Seven borings (GEI-3 through GEI-5, GEI-17, GEI-21, GEI-24, and GEI-25) were advanced to depths of 6 to 14 feet bgs on Parcel 3. Soils on the eastern portion of Parcel 3 generally consisted of sand, silt, and peat to a depth of approximately 7 to 10 feet bgs. Wood debris consisting of sawdust, wood chips, and shredded wood was encountered at approximately 10 feet bgs and deeper. Hydrogen sulfide-like odors were noted within the wood debris. Concrete and brick debris were encountered in boring GEI-3 from just below ground surface to 12.5 feet bgs, and in boring GEI-25 where drilling refusal was met at 5 feet bgs.

Evidence of potential petroleum contamination was noted in borings GEI-5, GEI-21, and GEI-24 as described in the Parcel 2 discussion, above. No field screening evidence of potential soil contamination was observed in borings GEI-3, GEI-4, GEI-17, or GEI-25.

SOIL ANALYTICAL RESULTS

The soil analytical data for the Port Uplands Area were evaluated in the RI report (GeoEngineers et al. 2008) by comparing the detected chemical concentrations directly to the protective soil concentrations that were considered in the development of the preliminary soil cleanup levels presented in Table 1 of the RI report. These protective soil concentrations include concentrations protective of direct human contact and terrestrial ecological receptors. The soil analytical data from the September 2008 supplemental soil investigation were evaluated in the same manner, as discussed below.

Locations at the Port Uplands Area where one or more constituents were detected in soil during the RI at a concentration exceeding the preliminary cleanup levels protective of direct human contact and terrestrial ecological receptors are shown in Figures 13 through 16 of the RI report. These figures have been updated with the September 2008 supplemental soil data, and are included in the Cleanup Action Plan (CAP) as Figures 3 through 6. The locations of preliminary soil cleanup level exceedances are displayed for four different depth intervals in the CAP figures: 0 to 2 feet bgs (Figure 3), 2 to 6 feet bgs (Figure 4), 6 to 10 feet bgs (Figure 5), and 10 to 15 feet bgs (Figure 6).

Parcel 1

The soil analytical results for Parcel 1 are summarized in Table A-1. Copper, lead, and zinc were detected at concentrations above the preliminary cleanup levels in soil between 2 and 6 feet bgs at boring GEI-15 (CAP Figure 4).

TCLP lead was analyzed in the soil sample obtained from 2 to 6 feet bgs at GEI-15; lead was not detected in the TCLP leachate.

Parcel 2

The soil analytical results for Parcel 2 are summarized in Table A-2. Diesel- and motor oil-range TPH were detected at concentrations above the preliminary cleanup levels in soil between 10 and 14 feet bgs at borings GEI-6 and GEI-23 (CAP Figure 6). At boring GEI-6, total cPAHs (toxicity equivalent quotient [TEQ]) also were detected above the preliminary cleanup level in soil between 10 and 14 feet bgs. The TPH detected at borings GEI-6 and GEI-23 appears to be connected with the area of petroleum contamination immediately west of the Seafarers' Park Building.

Total furans (TEQ) were detected at concentrations above the preliminary cleanup level in soil between 6 and 10 feet bgs at borings GEI-10 and GEI-13 (CAP Figure 5). Total dioxins (TEQ) were detected at a concentration above the preliminary cleanup level in soil between 10 and 14 feet bgs at boring GEI-1 (CAP Figure 6). Copper was detected at a concentration above the preliminary cleanup level in soil between 10 and 14 feet bgs at borings GEI-1 and GEI-13 (CAP Figure 6).

Parcel 3

The soil analytical results for Parcel 3 are summarized in Table A-3. Diesel-range TPH, copper, and zinc were detected at concentrations above the preliminary cleanup levels in soil between 6 and 14 feet bgs at boring GEI-24 (CAP Figures 5 and 6). Motor oil-range TPH also was detected at a concentration above the preliminary cleanup level at boring GEI-24, in soil between 6 and 10 feet bgs (CAP Figure 5). The TPH detected at boring GEI-24 appears to be connected with the area of petroleum contamination immediately west of the Seafarers' Park Building. Total furans (TEQ) were detected at concentrations above the preliminary cleanup level in soil between 6 and 10 feet bgs at boring GEI-5 (CAP Figure 5).

TCLP lead was analyzed in the primary and duplicate soil samples obtained from 10 to 14 feet bgs at GEI-24; lead was not detected in the TCLP leachate for either sample.

WATER ANALYTICAL RESULTS

The analytical results for the groundwater and rinsate blank samples are summarized in Table A-4. Diesel- and motor oil-range TPH were detected at concentrations above the preliminary cleanup levels in the groundwater grab sample obtained from boring GEI-24.

Copper was detected at a concentration equal to the method reporting limit of 0.004 milligrams per liter in the rinsate blank sample. This detection is suspect, as copper had elevated spike recoveries in the laboratory control sample (107%), matrix spike sample (125%), and matrix spike duplicate sample (113%). No other analytes were detected in the rinsate blank sample.

SUMMARY

The September 2008 supplemental investigation was conducted to address data gaps regarding the extent of soil contamination at the Port Uplands Area. The supplemental investigation data are combined with previous RI data in CAP Figures 3 through 6. A summary of constituents detected at concentrations above the RI preliminary cleanup levels in the September 2008 and previous soil samples collected at the Port Uplands Area is presented below.

- **0 to 2 feet bgs (CAP Figure 3).** Arsenic was the only constituent detected at concentrations above the preliminary cleanup levels. Arsenic exceeded the preliminary cleanup level at one location in Seafarers' Memorial Park on Parcel 3.
- **2 to 6 feet bgs (CAP Figure 4).** Metals (arsenic, lead, zinc, copper, and mercury), dioxins/furans, and cPAHs were detected at concentrations above the preliminary cleanup levels. Copper and dioxins/furans exceeded preliminary cleanup levels in the southern portion of Seafarers' Memorial Park on Parcel 3. Metals (arsenic, lead, zinc, and copper) and cPAHs exceeded preliminary cleanup levels at three locations at the southern end of "R" Avenue. On Parcel 2, cPAHs exceeded the preliminary cleanup level at two locations, copper and zinc exceeded preliminary cleanup levels at one location, and mercury exceeded the preliminary cleanup level at one location.
- **6 to 10 feet bgs (CAP Figure 5).** Diesel- and motor oil-range TPH, metals (arsenic, antimony, copper, lead, chromium, nickel, mercury, and zinc), dioxins/furans, polychlorinated biphenyls (PCBs), and cPAHs were detected at concentrations above the preliminary cleanup levels at multiple

locations on Parcels 2 and 3. Arsenic was detected at a concentration above the preliminary cleanup level at one location on Parcel 1.

- **10 to 15 feet bgs (CAP Figure 6).** Diesel- and motor oil-range TPH, metals (copper, lead, and zinc), dioxins/furans, and cPAHs were detected at concentrations above the preliminary cleanup levels at multiple locations on Parcels 2 and 3. TPH impacts are primarily located in an area west and northwest of the Seafarers' Park Building. With one exception (lead at location LSB-5), all of the metal exceedances in the 10 to 15-foot depth interval were south of the Seafarers' Park Building.

One of the objectives of the supplemental soil investigation was to provide data to evaluate the potential waste designation of lead-impacted soil that may be removed during future cleanup actions. TCLP lead analyses were performed on two primary soil samples (GEI15-2-6 and GEI24-10-14) and one field duplicate sample (DUP-2; duplicate of GEI24-10-14). These samples that had total lead concentrations of the order of 100 milligrams per kilogram (mg/kg) or greater. Lead was not detected above method reporting limits (0.4 to 4.0 milligrams per liter) in the TCLP leachate for these samples. These results suggest that soil at the Port Uplands Area with total lead concentrations as high as 680 mg/kg (the concentration reported in sample GEI15-2-6) likely would not exhibit the toxicity characteristic for lead, and thus would not be designated as a dangerous waste under Washington State Dangerous Waste Regulations (Washington Administrative Code Chapter 173-303-090).

REFERENCES

GeoEngineers et al. 2008. Final Remedial Investigation Report – Port Uplands Area, MJB North Area, and Marine Area, Former Scott Paper Company Mill Site, Anacortes, Washington. November 7, 2008.

GeoEngineers. 2008. Final Supplemental Soil Investigation Sampling and Analysis Plan, Former Scott Paper Mill Site, Anacortes, Washington. September 4, 2008.

Tables

Table A-1. Soil Analytical Data Summary, Port Parcel 1 – September 2008
Table A-2. Soil Analytical Data Summary, Port Parcel 2 – September 2008
Table A-3. Soil Analytical Data Summary, Port Parcel 3 – September 2008
Table A-4. Water Analytical Data Summary – September 2008

Figures

Figure A-1. September 2008 Supplemental Sampling Boring Locations

Attachments

Attachment 1 Boring Logs
Attachment 2 Data Quality Assessment Summary

DRAFT

TABLE A-1
SOIL ANALYTICAL DATA SUMMARY, PORT PARCEL 1 - SEPTEMBER 2008
FORMER SCOTT PAPER COMPANY MILL SITE

	Preliminary Soil Cleanup Level*		GEI-15		GEI-18		GEI-20	
		Sample Location	GEI-15		GEI-18		GEI-20	
		Sample Name	GEI15-2-6		GEI18-6-10		GEI20-6-10	
		Depth (ft)	2-6		6-10		6-10	
		Sample Date	09-Sep-08		09-Sep-08		09-Sep-08	
Metals (mg/kg)								
Arsenic	20		11		4.9		8.9	
Copper	100		**160**		--		--	
Lead	220		**680**		--		--	
Zinc	270		**630**		--		--	
TCLP Lead (mg/L)	--		< 4.0	U	--		--	
Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs) (ug/kg)								
Benzo(a)anthracene	--		82		--		--	
Benzo(a)pyrene	--		93		--		--	
Benzo(b)fluoranthene	--		100		--		--	
Benzo(k)fluoranthene	--		76		--		--	
Chrysene	--		110		--		--	
Dibenzo(a,h)anthracene	--		18		--		--	
Indeno(1,2,3-cd)pyrene	--		35		--		--	
Total cPAHs TEQ	140		130		--		--	

Notes:

*Preliminary soil cleanup levels are discussed in the Remedial Investigation (RI) report. See Table 1 of RI report.

mg/kg = Milligrams per kilogram

ug/kg = Micrograms per kilogram

TCLP = Toxicity Characteristic Leaching Procedure

TEQ = Toxicity Equivalent Quotient

TEF = Toxicity Equivalency Factor

MTCA = Model Toxics Control Act

cPAH TEQ values for samples with at least one positive cPAH detection were calculated using MTCA TEF values in effect as of January 2008 (see Table 2, Draft Final RI).

Blue text = Value exceeds MTCA terrestrial ecological criteria only (criteria are in Table 1 of RI report).

Red text = Value exceeds MTCA terrestrial ecological and human health criteria, or human health criteria only if no terrestrial ecological criteria established or if terrestrial ecological criteria are greater than the human health criteria (criteria are in Table 1 of RI report).

-- = Not analyzed/site-specific cleanup level not established

U = The constituent was analyzed, but was not detected above the specified method reporting limit.

TABLE A-2
SOIL ANALYTICAL DATA SUMMARY, PORT PARCEL 2 - SEPTEMBER 2008
FORMER SCOTT PAPER COMPANY MILL SITE

DRAFT

		Sample Location	GEI-1	GEI-1	GEI-2	GEI-2	GEI-6	GEI-6	GEI-7	GEI-7	GEI-8	GEI-9	GEI-9	GEI-10	GEI-10	GEI-11	GEI-11	GEI-12	GEI-12
		Sample Name	GEI1-2-6	GEI1-10-14	GEI2-6-10	GEI2-10-14	GEI6-6-10	GEI6-10-12	GEI7-6-10	GEI7-10-14	GEI8-6-10	GEI9-2-6	GEI9-6-10	GEI10-2-4	GEI10-6-10	GEI11-2-6	GEI11-6-10	GEI12-2-6	GEI12-6-10
	Preliminary Soil	Depth (ft)	2-6	10-14	6-10	10-14	6-10	10-12	6-10	10-14	6-10	2-6	6-10	2-4	6-10	2-6	6-10	2-6	6-10
	Cleanup Level*	Sample Date	10-Sep-08	10-Sep-08	08-Sep-08	08-Sep-08	08-Sep-08	08-Sep-08	09-Sep-08	09-Sep-08	09-Sep-08	09-Sep-08	09-Sep-08	09-Sep-08	09-Sep-08	09-Sep-08	09-Sep-08	09-Sep-08	09-Sep-08
Total Petroleum Hydrocarbons (mg/kg)																			
Diesel-range	460		--	--	12	25	200	**5,300**	32	230	--	--	28	--	23	--	29	--	36
Motor oil-range	2,000		--	--	21	96	1,200	**34,000**	85	460	--	--	57	--	70	--	88	--	140
Metals (mg/kg)																			
Arsenic	20		6.6	6.4	--	2.2	2.0	2.3	--	--	--	--	--	--	--	--	--	--	--
Copper	100		63	**170**	--	43	36	32	--	--	--	--	--	--	--	--	--	--	--
Lead	220		22	65	--	11	19	37	--	--	--	--	--	--	--	--	--	--	--
Zinc	270		100	120	--	29	24	93	--	--	--	--	--	--	--	--	--	--	--
TCLP Lead (mg/L)	--		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs) (ug/kg)																			
Benzo(a)anthracene	--		--	--	27	36	--	< 190 U	--	38	--	61	--	< 4.8 U	--	10	--	< 4.6 U	--
Benzo(a)pyrene	--		--	--	27	52	--	290	--	60	--	27	--	< 4.8 U	--	14	--	< 4.6 U	--
Benzo(b)fluoranthene	--		--	--	20	38	--	< 190 U	--	40	--	30	--	< 4.8 U	--	16	--	< 4.6 U	--
Benzo(k)fluoranthene	--		--	--	20	59	--	< 190 U	--	48	--	24	--	< 4.8 U	--	12	--	< 4.6 U	--
Chrysene	--		--	--	32	50	--	230	--	50	--	75	--	< 4.8 U	--	12	--	6.0	--
Dibenzo(a,h)anthracene	--		--	--	< 4.8 U	14	--	< 190 U	--	8.7	--	5.6	--	< 4.8 U	--	< 4.6 U	--	< 4.6 U	--
Indeno(1,2,3-cd)pyrene	--		--	--	15	28	--	< 190 U	--	19	--	13	--	< 4.8 U	--	7.4	--	< 4.6 U	--
Total cPAHs TEQ	140		--	--	36	70	--	**340**	--	76	--	41	--	<3.6 U	--	19	--	3.5	--
Dioxins/Furans (ng/kg)																			
1,2,3,4,6,7,8-HpCDD	--		9.3	220	2.8 J	--	5	--	--	--	20	--	--	--	120	--	--	--	13
1,2,3,4,7,8-HxCDD	--		0.26 J	3.6 J	< 0.33 U	--	< 0.54 U	--	--	--	< 0.55 U	--	--	--	1.6 J	--	--	--	< 0.18 UJ
1,2,3,6,7,8-HxCDD	--		0.63 J	10	< 0.33 UJ	--	0.84 J	--	--	--	1.3 J	--	--	--	5.4	--	--	--	0.82 J
1,2,3,7,8,9-HxCDD	--		< 0.069 UJ	4.8 J	< 0.27 U	--	< 0.65 U	--	--	--	1.6 J	--	--	--	2.8 J	--	--	--	< 0.21 UJ
1,2,3,7,8-PeCDD	--		< 0.15 U	< 1.0 UJ	< 0.26 UJ	--	< 0.42 U	--	--	--	< 0.60 UJ	--	--	--	1.5 J	--	--	--	< 0.28 U
2,3,7,8-TCDD	--		< 0.14 U	< 2.1 U	< 0.082 U	--	0.32 J	--	--	--	< 0.28 U	--	--	--	< 0.47 U	--	--	--	< 0.27 U
OCDD	--		77	2,000	21	--	41	--	--	--	220	--	--	--	1,200	--	--	--	110
1,2,3,4,6,7,8-HpCDF	--		2.6 J	< 1.6 UJ	< 0.21 UJ	--	1.6 J	--	--	--	4.8 J	--	--	--	21	--	--	--	4.5
1,2,3,4,7,8,9-HpCDF	--		0.24 J	3.1 J	< 0.31 U	--	< 0.7 U	--	--	--	< 0.48 UJ	--	--	--	1.7 J	--	--	--	0.95 J
1,2,3,4,7,8-HxCDF	--		< 0.12 UJ	< 1.5 UJ	< 0.15 UJ	--	< 0.51 UJ	--	--	--	< 0.51 U	--	--	--	1.9 J	--	--	--	2.0 J
1,2,3,6,7,8-HxCDF	--		< 0.11 UJ	4.9 J	< 0.16 UJ	--	< 0.35 U	--	--	--	< 0.60 U	--	--	--	< 0.43 UJ	--	--	--	0.65 J
1,2,3,7,8,9-HxCDF	--		< 0.11 U	< 2.3 U	< 0.16 U	--	< 0.43 U	--	--	--	< 0.29 U	--	--	--	1.1 J	--	--	--	0.64 J
1,2,3,7,8-PeCDF	--		< 0.15 UJ	< 2.4 U	< 0.072 U	--	0.66 J	--	--	--	< 0.65 U	--	--	--	1.5 J	--	--	--	< 0.29 UJ
2,3,4,6,7,8-HxCDF	--		0.44 J	< 1.9 UJ	0.50 J	--	< 0.43 U	--	--	--	< 0.34 UJ	--	--	--	0.96 J	--	--	--	0.47 J
2,3,4,7,8-PeCDF	--		0.44 J	< 1.3 UJ	< 0.20 UJ	--	< 0.17 UJ	--	--	--	< 0.36 U	--	--	--	2.3 J	--	--	--	1.3 J
2,3,7,8-TCDF	--		0.37 J	< 1.1 UJ	0.95 J	--	< 0.37 UJ	--	--	--	0.47 J	--	--	--	1.5	--	--	--	0.65 J
OCDF	--		5.4 J	62	1.6 J	--	< 4.9	--	--	--	12	--	--	--	48	--	--	--	13
Total Dioxins/Furans TEQ (human health)	11		0.62	7.3	0.45	--	0.91	--	--	--	1.3	--	--	--	5.8	--	--	--	1.4
Total Dioxins TEQ (mammals)	5		0.35	**6.2**	0.25	--	0.74	--	--	--	1.0	--	--	--	4.3	--	--	--	0.54
Total Furans TEQ (mammals)	3		0.26	1.1	0.20	--	0.17	--	--	--	0.25	--	--	--	1.5	--	--	--	0.89
Total Furans TEQ (birds)	3		0.91	2.1	1.1	--	0.44	--	--	--	0.82	--	--	--	**4.6**	--	--	--	2.4

TABLE A-2
SOIL ANALYTICAL DATA SUMMARY, PORT PARCEL 2 - SEPTEMBER 2008
FORMER SCOTT PAPER COMPANY MILL SITE

		Sample Location	GEI-13	GEI-13	GEI-13	GEI-14	GEI-14	GEI-14	GEI-16	GEI-19	GEI-22	GEI-23	GEI-23
		Sample Name	GEI13-2-6	GEI13-6-10	GEI13-10-14	GEI14-2-4	GEI14-6-8	GEI14-10-14	GEI16-2-6	GEI19-7-10	GEI22-6-9	GEI23-6-10	GEI23-10-14
	Preliminary Soil	Depth (ft)	2-6	6-10	10-14	2-4	6-8	10-14	2-6	7-10	6-9	6-10	10-14
	Cleanup Level*	Sample Date	10-Sep-08	10-Sep-08	10-Sep-08	09-Sep-08	09-Sep-08	09-Sep-08	09-Sep-08	08-Sep-08	08-Sep-08	09-Sep-08	09-Sep-08
Total Petroleum Hydrocarbons (mg/kg)													
Diesel-range	460		--	41	48	--	< 6.0 U	98	--	--	--	8.9	**1,300**
Motor oil-range	2,000		--	280	120	--	15	220	--	--	--	25	**7,500**
Metals (mg/kg)													
Arsenic	20		7.8	--	11	--	--	8.3	9.6	1.4	--	2.5	1.1
Copper	100		30	--	**113**	--	--	56	46	--	--	35	39
Lead	220		6.2	--	52	--	--	36	32	--	35 J	27	11
Zinc	270		77	--	240	--	--	100	99	--	--	45	14
TCLP Lead (mg/L)	--		--	--	--	--	--	--	--	--	--	--	--
Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs) (ug/kg)													
Benzo(a)anthracene	--		< 4.8 U	--	--	< 4.6 U	--	53	56	--	--	< 5.0 R	8.0 J
Benzo(a)pyrene	--		< 4.8 U	--	--	< 4.6 U	--	73	80	--	--	14 J	12 J
Benzo(b)fluoranthene	--		< 4.8 U	--	--	4.6	--	62	97	--	--	30 J	28 J
Benzo(k)fluoranthene	--		< 4.8 U	--	--	< 4.6 U	--	52	80	--	--	14 J	12 J
Chrysene	--		6.3	--	--	6.5	--	100	72	--	--	22 J	17 J
Dibenzo(a,h)anthracene	--		< 4.8 U	--	--	< 4.6 U	--	17	16	--	--	16 J	10 J
Indeno(1,2,3-cd)pyrene	--		< 4.8 U	--	--	< 4.6 U	--	33	27	--	--	26 J	14 UJ
Total cPAHs TEQ	140		3.7	--	--	3.7	--	96	110	--	--	23	19
Dioxins/Furans (ng/kg)													
1,2,3,4,6,7,8-HpCDD	--		--	42	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8-HxCDD	--		--	< 0.28 UJ	--	--	--	--	--	--	--	--	--
1,2,3,6,7,8-HxCDD	--		--	1.9 J	--	--	--	--	--	--	--	--	--
1,2,3,7,8,9-HxCDD	--		--	1.7 J	--	--	--	--	--	--	--	--	--
1,2,3,7,8-PeCDD	--		--	0.65 J	--	--	--	--	--	--	--	--	--
2,3,7,8-TCDD	--		--	< 0.34 U	--	--	--	--	--	--	--	--	--
OCDD	--		--	530	--	--	--	--	--	--	--	--	--
1,2,3,4,6,7,8-HpCDF	--		--	5.8	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8,9-HpCDF	--		--	< 0.66 U	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8-HxCDF	--		--	1.3 J	--	--	--	--	--	--	--	--	--
1,2,3,6,7,8-HxCDF	--		--	1.2 J	--	--	--	--	--	--	--	--	--
1,2,3,7,8,9-HxCDF	--		--	1.0 J	--	--	--	--	--	--	--	--	--
1,2,3,7,8-PeCDF	--		--	< 0.40 UJ	--	--	--	--	--	--	--	--	--
2,3,4,6,7,8-HxCDF	--		--	1.2 J	--	--	--	--	--	--	--	--	--
2,3,4,7,8-PeCDF	--		--	2.5 J	--	--	--	--	--	--	--	--	--
2,3,7,8-TCDF	--		--	1.4	--	--	--	--	--	--	--	--	--
OCDF	--		--	9.7	--	--	--	--	--	--	--	--	--
Total Dioxins/Furans TEQ (human health)	11		--	3.2	--	--	--	--	--	--	--	--	--
Total Dioxins TEQ (mammals)	5		--	1.8	--	--	--	--	--	--	--	--	--
Total Furans TEQ (mammals)	3		--	1.4	--	--	--	--	--	--	--	--	--
Total Furans TEQ (birds)	3		--	**4.5**	--	--	--	--	--	--	--	--	--

Notes:

*Preliminary soil cleanup levels are discussed in the Remedial Investigation (RI) report. See Table 1 of RI report.

mg/kg = Milligrams per kilogram

ug/kg = Micrograms per kilogram

ng/kg = Nanograms per kilogram

TCLP = Toxicity Characteristic Leaching Procedure

TEQ = Toxicity Equivalent Quotient

TEF = Toxicity Equivalency Factor

MTCA = Model Toxics Control Act

cPAH and dioxin/furan TEQ values for samples with at least one positive cPAH or dioxin/furan detection were calculated using MTCA TEF values in effect as of January 2008 (see Table 2, Draft Final RI).

Blue text = Value exceeds MTCA terrestrial ecological criteria only (criteria are in Table 1 of RI report).

Red text = Value exceeds MTCA terrestrial ecological and human health criteria, or human health criteria only if no terrestrial ecological criteria established or if terrestrial ecological criteria are greater than the human health criteria (criteria are in Table 1 of RI report).

-- = Not analyzed/site-specific cleanup level not established

U = The constituent was analyzed, but was not detected above the specified method reporting limit.

J = Estimated value reported below method reporting limit, or estimated based on data quality assessment.

R = Data value rejected based on data quality assessment.

TABLE A-3
SOIL ANALYTICAL DATA SUMMARY, PORT PARCEL 3 - SEPTEMBER 2008
FORMER SCOTT PAPER COMPANY MILL SITE

	Preliminary Soil Cleanup Level*	Sample Location	GEI-3	GEI-3	GEI-3	GEI-4	GEI-5	GEI-5	GEI-17	GEI-21	GEI-21	GEI-24	GEI-24	GEI-24
		Sample Name	GEI3-0-2	GEI3-6-10	GEI3-10-14	GEI4-6-10	GEI5-6-10	GEI5-11-12	GEI17-2-6	GEI21-6-10	GEI21-10-14	GEI24-6-10	GEI24-10-14	DUP-2 (GEI24-10-14)
		Depth (ft)	0-2	6-10	10-14	6-10	6-10	11-12	2-6	6-10	10-14	6-10	10-14	10-14
		Sample Date	08-Sep-08	08-Sep-08	08-Sep-08	08-Sep-08	08-Sep-08	08-Sep-08	09-Sep-08	08-Sep-08	08-Sep-08	10-Sep-08	10-Sep-08	10-Sep-08
Total Petroleum Hydrocarbons (mg/kg)														
Diesel-range	460		--	< 5.8 U	6.0	8.6	--	33	--	24	150	**1,800**	**670**	**480**
Motor oil-range	2,000		--	< 12.0 U	35	26	--	67	--	100	610	**3,900**	1,400	1,200
Metals (mg/kg)														
Arsenic	20		6.0	4.1	3.6	5.7	1.6	--	11	4.0	3.6	9.2	11	9.6
Copper	100		--	21	22	40	20	--	73	48	38	**130**	**160**	**140**
Lead	220		--	8.7	3.2	28	14	--	37	35	9.0	47	93	160
Zinc	270		--	55	49	80	36	--	170	63	30	**280**	**340**	**290**
TCLP Lead (mg/L)	--		--	--	--	--	--	--	--	--	--	--	< 0.4 U	< 0.4 U
Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs) (ug/kg)														
Benzo(a)anthracene	--		--	5.3	< 4.7 U	--	--	--	34	32	44	35	21	22
Benzo(a)pyrene	--		--	4.8	< 4.7 U	--	--	--	38	33	72	31	34	38
Benzo(b)fluoranthene	--		--	7.2	< 4.7 U	--	--	--	37	32	70	42	36	35
Benzo(k)fluoranthene	--		--	< 4.8 U	< 4.7 U	--	--	--	30	26	70	26	32	41
Chrysene	--		--	6.7	< 4.7 U	--	--	--	44	53	74	67	37	42
Dibenzo(a,h)anthracene	--		--	< 4.8 U	< 4.7 U	--	--	--	5.9	5.3	6.5	5.5	9.9	13
Indeno(1,2,3-cd)pyrene	--		--	< 4.8 U	< 4.7 U	--	--	--	13	15	24	11	17	22
Total cPAHs TEQ	140		--	6.8	<3.5 U	--	--	--	50	45	94	44	46	52
Dioxins/Furans (ng/kg)														
1,2,3,4,6,7,8-HpCDD	--		--	4.4 J	3.5 J	3.7 J	25	--	--	--	--	--	--	--
1,2,3,4,7,8-HxCDD	--		--	0.59 J	0.18 J	< 0.20 U	3.1 J	--	--	--	--	--	--	--
1,2,3,6,7,8-HxCDD	--		--	0.85 J	0.36 J	< 0.31 UJ	5.4	--	--	--	--	--	--	--
1,2,3,7,8,9-HxCDD	--		--	0.68 J	< 0.16 UJ	0.40 J	4.4 J	--	--	--	--	--	--	--
1,2,3,7,8-PeCDD	--		--	1.1 J	0.13 J	< 0.19 UJ	< 0.47 UJ	--	--	--	--	--	--	--
2,3,7,8-TCDD	--		--	0.51 J	< 0.032 U	< 0.17 U	< 0.32 UJ	--	--	--	--	--	--	--
OCDD	--		--	23	36	23	66	--	--	--	--	--	--	--
1,2,3,4,6,7,8-HpCDF	--		--	2.4 J	< 0.044 UJ	< 0.21 UJ	7.6	--	--	--	--	--	--	--
1,2,3,4,7,8,9-HpCDF	--		--	< 0.23 U	0.12 J	< 0.23 U	0.87 J	--	--	--	--	--	--	--
1,2,3,4,7,8-HxCDF	--		--	< 0.25 J	0.20 J	< 0.14 U	< 0.23 UJ	--	--	--	--	--	--	--
1,2,3,6,7,8-HxCDF	--		--	0.79 J	0.24 J	< 0.13 UJ	1.7 J	--	--	--	--	--	--	--
1,2,3,7,8,9-HxCDF	--		--	< 0.30 U	< 0.085 U	< 0.10 U	0.58 J	--	--	--	--	--	--	--
1,2,3,7,8-PeCDF	--		--	3.1 J	< 0.095 UJ	< 0.22 U	1.8 J	--	--	--	--	--	--	--
2,3,4,6,7,8-HxCDF	--		--	0.46 J	< 0.069 UJ	< 0.10 UJ	2.8 J	--	--	--	--	--	--	--
2,3,4,7,8-PeCDF	--		--	< 0.25 J	< 0.078 UJ	0.26 J	5.3	--	--	--	--	--	--	--
2,3,7,8-TCDF	--		--	< 0.13 J	< 0.14 U	0.32 J	4.5	--	--	--	--	--	--	--
OCDF	--		--	2.1 J	1.2 J	1.5 J	12	--	--	--	--	--	--	--
Total Dioxins/Furans TEQ (human health)	11		--	2.2	0.33	0.43	4.7	--	--	--	--	--	--	--
Total Dioxins TEQ (mammals)	5		--	1.9	0.25	0.29	2.0	--	--	--	--	--	--	--
Total Furans TEQ (mammals)	3		--	0.32	0.074	0.14	2.7	--	--	--	--	--	--	--
Total Furans TEQ (birds)	3		--	0.68	0.17	0.62	**11**	--	--	--	--	--	--	--

Notes:

*Preliminary soil cleanup levels are discussed in the Remedial Investigation (RI) report. See Table 1 of RI report.

mg/kg = Milligrams per kilogram

ug/kg = Micrograms per kilogram

ng/kg = Nanograms per kilogram

TCLP = Toxicity Characteristic Leaching Procedure

TEQ = Toxicity Equivalent Quotient

TEF = Toxicity Equivalency Factor

MTCA = Model Toxics Control Act

cPAH and dioxin/furan TEQ values for samples with at least one positive cPAH or dioxin/furan detection were calculated using MTCA TEF values in effect as of January 2008 (see Table 2, Draft Final RI).

Blue text = Value exceeds MTCA terrestrial ecological criteria only (criteria are in Table 1 of RI report).

Red text = Value exceeds MTCA terrestrial ecological and human health criteria, or human health criteria only if no terrestrial ecological criteria established or if terrestrial ecological criteria are greater than the human health criteria (criteria are in Table 1 of RI report).

-- = Not analyzed/site-specific cleanup level not established

U = The constituent was analyzed, but was not detected above the specified method reporting limit.

J = Estimated value reported below method reporting limit, or estimated based on data quality assessment.

TABLE A-4
WATER ANALYTICAL DATA SUMMARY - SEPTEMBER 2008
FORMER SCOTT PAPER COMPANY MILL SITE

	Preliminary Groundwater Cleanup Level*					
		Sample Location	GEI-24 (a)		-- (b)	
		Sample Name	GEI24-W		RINSATE	
		Sample Date	10-Sep-08		09-Sep-08	
Total Petroleum Hydrocarbons (mg/L)						
Diesel-range	0.5		**1.8**		<0.25	U
Motor oil-range	0.5		**3.2**		<0.50	U
Metals (mg/L)						
Arsenic	--		--		<0.002	U
Copper	--		--		0.004	
Lead	--		--		<0.002	U
Zinc	--		--		<0.01	U
Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs) (ug/L)						
Benzo(a)anthracene	--		--		<0.10	U
Benzo(a)pyrene	--		--		<0.10	U
Benzo(b)fluoranthene	--		--		<0.10	U
Benzo(k)fluoranthene	--		--		<0.10	U
Chrysene	--		--		<0.10	U
Dibenzo(a,h)anthracene	--		--		<0.10	U
Indeno(1,2,3-cd)pyrene	--		--		<0.10	U

Notes:

(a) Groundwater grab sample obtained from direct-push boring

(b) Equipment rinsate blank (field quality control sample)

*Preliminary groundwater cleanup levels are discussed in the Remedial Investigation (RI) report. See Table 4 of RI report.

mg/L = Milligrams per liter

ug/L = Micrograms per liter

MTCA = Model Toxics Control Act

Red text = Value exceeds MTCA human health criteria (criteria are in Table 4 of RI report).

-- = Not analyzed/not applicable

U = The constituent was analyzed, but was not detected above the specified method reporting limit.

P:\5\5147007\03\CAD\Report Parts\514700703F1.dwg\TAB:Fig 1 modified by tmichaud on Nov 26, 2008 - 14:25

Reference Information

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.

Source: AutoCAD drawing entitled "ES-4, Port Uplands Area Preliminary Soil Cleanup Level Exceedance Locations (0-2 ft BGS)", dated 9/18/2006, provided by Landau Associates. Base map source: Port of Anacortes, June 2004.

Legend

◑ September 2008 Soil Boring Location

DRAFT

N W E S

0 120 240
Scale in Feet

September 2008 Supplemental Soil Sampling Locations

Scott Paper Mill
Anacortes, Washington

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Figure A-1

ATTACHMENT 1
BORING LOGS

SOIL CLASSIFICATION CHART

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

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

ADDITIONAL MATERIAL SYMBOLS

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

Measured groundwater level in exploration, well, or piezometer

Groundwater observed at time of exploration

Perched water observed at time of exploration

Measured free product in well or piezometer

Stratigraphic Contact

Distinct contact between soil strata or geologic units

Gradual change between soil strata or geologic units

Approximate location of soil strata change within a geologic soil unit

Sampler Symbol Descriptions

2.4-inch I.D. split barrel

Standard Penetration Test (SPT)

Shelby tube

Piston

Direct-Push

Bulk or grab

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

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

Laboratory / Field Tests

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

Sheen Classification

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

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

KEY TO EXPLORATION LOGS

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Figure A-1

Date(s) Drilled	09/10/08	Logged By		Checked By	CB
Drilling Contractor	Cascade Drilling	Drilling Method	Direct Push	Sampling Methods	
Auger Data		Hammer Data		Drilling Equipment	
Total Depth (ft)	14	Surface Elevation (ft)		Groundwater Level (ft. bgs)	10
Vertical Datum		Datum/ System		Easting(x): Northing(y):	

Depth feet	SAMPLES: Interval	SAMPLES: Recovered (in)	SAMPLES: Blows/foot	SAMPLES: Sub-Sample Number	SAMPLES: Testing	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor TLV (ppm)	NOTES
0								TS	Grass and topsoil	NS	--	
								SP	Medium brown fine sand, poorly sorted (medium dense, moist)			Color change to dark gray at possible depth of black geomembrane (membrane not intact; black fibers-fabric present)
		36						ML/PT	Dark gray and green slightly mottled silt, occasional coarse gravel and trace fine sand (medium stiff, moist)	NS	--	
5				1					Dark gray to black silt with abundant, fine, decomposed organic material (moist to dry)			
		40								NS	--	
						▼		GP-GW	Gravel with rock fragments			
10								SM	Black medium to very coarse sand with silt and trace organic matter (medium dense, wet)			
		30						WD	Black to dark brown wood	NS	--	
									Becomes brown to light brown	NS	--	
		24		2						SS	--	
15												
20												

Note: See Figure A-1 for explanation of symbols.

LOG OF BORING GEI-1

GeoEngineers

Project: Former Scott Paper Mill

Project Location: Anacortes, Washington

Project Number: 5147-007-03

Figure A-2

Sheet 1 of 1

V6_ENVBORING W:\SEATTLE\PROJECTS\5\5147007\03\FINALS\514700703.GPJ GEIV6_1.GDT 10/24/08

Date(s) Drilled	09/08/08	Logged By		Checked By	CB
Drilling Contractor	Cascade Drilling	Drilling Method	Direct Push	Sampling Methods	
Auger Data		Hammer Data		Drilling Equipment	
Total Depth (ft)	16	Surface Elevation (ft)		Groundwater Level (ft. bgs)	10
Vertical Datum		Datum/ System		Easting(x): Northing(y):	

Depth feet	SAMPLES: Interval	SAMPLES: Recovered (in)	SAMPLES: Blows/foot	SAMPLES: Sub-Sample Number	SAMPLES: Testing	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor TLV (ppm)	NOTES
0								TS	3 inches grass and topsoil			
								SP	Gray gravelly fine to coarse sand with fine gravel (medium dense, dry)			
								SM	Dark brown fine to medium sand with silt (loose, moist)			
								WD	Black to brown hard wood			
								RX	Light gray rock			
		36								NS	0	
5								SM	Black silt with gravel; brick and glass debris and trace sand; some organic matter (peat lenses) (medium dense, dry)			
				1				SM/ML	Black fine to medium silty sand; some organic matter (loose, moist)			
		48								NS	0	
10				2		▼		PT	Black silty peat with some sand (wet)			
								SP	Black medium to coarse sand with trace fine gravel; trace organic matter (loose, wet)			
		42								NS	0	
								OL	Black to dark brown organic silt (very soft)	NS	0	
15								WD	Dark brown wood pieces and sawdust			
		36								NS	0	
20												

Note: See Figure A-1 for explanation of symbols.

V6_ENVBORING W:\SEATTLE\PROJECTS\5\514700703\FINALS\514700703.GPJ GEIV6_1.GDT 10/24/08

LOG OF BORING GEI-2

GEOENGINEERS

Project: Former Scott Paper Mill
Project Location: Anacortes, Washington
Project Number: 5147-007-03

Figure A-3
Sheet 1 of 1

Date(s) Drilled	09/08/08	Logged By		Checked By	CB
Drilling Contractor	Cascade Drilling	Drilling Method	Direct Push	Sampling Methods	
Auger Data		Hammer Data		Drilling Equipment	
Total Depth (ft)	14	Surface Elevation (ft)		Groundwater Level (ft. bgs)	10
Vertical Datum		Datum/ System		Easting(x): Northing(y):	

Depth feet	SAMPLES: Recovered (in)	SAMPLES: Blows/foot	SAMPLES: Sub-Sample Number	SAMPLES: Testing	Water Level	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor TLV (ppm)	NOTES
0						TS	4 inches grass and topsoil			
						TS	4 inches black topsoil and organic matter			
1			1			CC	Concrete with gravel; brown sand			
							Brick fragments			
						SM	Medium brown fine sand with silt; trace gravel (dry)			Very easy-soft drilling
3	32							NS	0	
						GP	Dark gray and orange sandy gravel with medium sand			Orange color - possible brick dust
5										
7	48						No recovery	NS	0	
9						GP	Medium brown and gray sandy gravel, poorly sorted light gray rock fragments (dense, wet)			Rock fragments - (graywacke) possible rip-rap (?)
10			2		▼			NS	0	
11	24						No recovery	NS	0	
12						GP	Dark gray medium to coarse rock fragments (2 inches sand lens)			
						WD	Medium brown solid wood (wet)			
14	36		3							
15										
20										

Note: See Figure A-1 for explanation of symbols.

LOG OF BORING GEI-3

GeoEngineers

Project: Former Scott Paper Mill
Project Location: Anacortes, Washington
Project Number: 5147-007-03

Figure A-4
Sheet 1 of 1

Date(s) Drilled	09/08/08	Logged By		Checked By	CB
Drilling Contractor	Cascade Drilling	Drilling Method	Direct Push	Sampling Methods	
Auger Data		Hammer Data		Drilling Equipment	
Total Depth (ft)	12	Surface Elevation (ft)		Groundwater Level (ft. bgs)	7
Vertical Datum		Datum/ System		Easting(x): Northing(y):	

Depth feet	SAMPLES: Interval	SAMPLES: Recovered (in)	SAMPLES: Blows/foot	SAMPLES: Sub-Sample Number	SAMPLES: Testing	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor TLV (ppm)	NOTES
0								TS	4 inches grass and topsoil			
								ML	Dark brown silt with fine sand and organic matter (slight plasticity, stiff)			
									Becomes mottled orange and light brown	NS	0	
		36										
5				1				SP	Black gravelly sand, coarse to fine, poorly graded, trace silt; some organic matter, shell fragments (medium dense, wet)			
						▼				NS	0	
		40										
								OL	Black silt with fine sand; organic material; some rock fragments and wood chips			
10												
								WD	Light brown to orange solid wood; thin silt lenses			
		48								NS	0	Slight sulfur odor
15												
20												

Note: See Figure A-1 for explanation of symbols.

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LOG OF BORING GEI-4

GeoEngineers

Project: Former Scott Paper Mill
Project Location: Anacortes, Washington
Project Number: 5147-007-03

Figure A-5
Sheet 1 of 1

Date(s) Drilled	09/08/08	Logged By		Checked By	CB
Drilling Contractor	Cascade Drilling	Drilling Method	Direct Push	Sampling Methods	
Auger Data		Hammer Data		Drilling Equipment	
Total Depth (ft)	12	Surface Elevation (ft)		Groundwater Level (ft. bgs)	7
Vertical Datum		Datum/ System		Easting(x): Northing(y):	

Depth feet	SAMPLES: Interval	SAMPLES: Recovered (in)	SAMPLES: Blows/foot	SAMPLES: Sub-Sample Number	SAMPLES: Testing	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor TLV (ppm)	NOTES
0								AC	Asphalt			
								GP	Base course gravel			
								GP/SP	Medium brown fine to medium gravelly sand with coarse gravel and some silt (medium dense, dry)	NS	0	
		30										
5				1						NS	0	
						▼ (7 ft)		SP	Black fine to medium sand with gravel with small wood pieces (medium dense, wet)			
		40						SP	Medium brown to dark brown wood pieces with interbedded sand	NS	0	
10				2				WD	Light brown small (<1/4 to 1/8 inch) wood pieces			Strong sulfur odor and other odor
		36								NS	0	
15												
20												

Note: See Figure A-1 for explanation of symbols.

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LOG OF BORING GEI-5

GEOENGINEERS

Project: Former Scott Paper Mill
Project Location: Anacortes, Washington
Project Number: 5147-007-03

Figure A-6
Sheet 1 of 1

Date(s) Drilled	09/08/08	Logged By		Checked By	CB
Drilling Contractor	Cascade Drilling	Drilling Method	Direct Push	Sampling Methods	
Auger Data		Hammer Data		Drilling Equipment	
Total Depth (ft)	12	Surface Elevation (ft)		Groundwater Level (ft. bgs)	Not Encountered
Vertical Datum		Datum/ System		Easting(x): Northing(y):	

Depth feet	SAMPLES: Interval	SAMPLES: Recovered (in)	SAMPLES: Blows/foot	SAMPLES: Sub-Sample Number	SAMPLES: Testing	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor TLV (ppm)	NOTES
0								TS	2 inches grass and topsoil with gravel			
								SM	Light to medium brown fine poorly sorted sand with trace silt (loose, dry)			
										NS	0	
		48										
5								SM-SP	Black fine to coarse sand with gravel/rock fragments and wood (medium dense, moist)			
				1								
												Slight petroleum odor
		48						WD	Wood	NS	0	
								SM/SP-SM	Black fine to coarse sand with gravel/rock fragments and wood (medium dense, moist)			
10				2						NS	<5	
								WD	Light brown large pieces of wood with silt lense (moist)			Strong petroleum and sulfur odors
		48								NS	0	
									Refusal at 12 feet			
15												
20												

Note: See Figure A-1 for explanation of symbols.

LOG OF BORING GEI-6

GEOENGINEERS

Project: Former Scott Paper Mill
Project Location: Anacortes, Washington
Project Number: 5147-007-03

Figure A-7
Sheet 1 of 1

Date(s) Drilled	09/09/08	Logged By		Checked By	CB
Drilling Contractor	Cascade Drilling	Drilling Method	Direct Push	Sampling Methods	
Auger Data		Hammer Data		Drilling Equipment	
Total Depth (ft)	14	Surface Elevation (ft)		Groundwater Level (ft. bgs)	12.5
Vertical Datum		Datum/ System		Easting(x): Northing(y):	

Depth feet	SAMPLES: Interval	SAMPLES: Recovered (in)	SAMPLES: Blows/foot	SAMPLES: Sub-Sample Number	SAMPLES: Testing	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor TLV (ppm)	NOTES
0								SP	Light brown poorly sorted fine sand with trace silt (loose, dry)			
		44							Becomes moist, dark gray	NS	0	
5								GP	Medium gray well sorted fine to coarse gravel with sand (moist)			
								ML	Light brown to black silt with sand; organic matter (medium stiff, moist)			
		48								NS	0	
								SP				
								ML	Dark brown silt with trace fine sand; wood			
10												
								WD	Medium to dark reddish brown wood chips (moist)	NS	0	
		48						ML	Dark brown to black silt (stiff, moist)			
						▼		GP	Dark gray to black fine to coarse gravel with sand and silt (loose, wet)			
		24						ML	Dark brown to black silt with wood			
15												
20												

Note: See Figure A-1 for explanation of symbols.

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LOG OF BORING GEI-7

GEOENGINEERS

Project: Former Scott Paper Mill
Project Location: Anacortes, Washington
Project Number: 5147-007-03

Figure A-8
Sheet 1 of 1

Date(s) Drilled	09/09/08	Logged By		Checked By	CB
Drilling Contractor	Cascade Drilling	Drilling Method	Direct Push	Sampling Methods	
Auger Data		Hammer Data		Drilling Equipment	
Total Depth (ft)	10	Surface Elevation (ft)		Groundwater Level (ft. bgs)	Not Encountered
Vertical Datum		Datum/ System		Easting(x): Northing(y):	

Depth feet	SAMPLES: Interval	SAMPLES: Recovered (in)	SAMPLES: Blows/foot	SAMPLES: Sub-Sample Number	SAMPLES: Testing	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor TLV (ppm)	NOTES
0		40						SP	Light brown poorly sorted fine sand (loose, dry)	NS	0	
								GP-GW	2-inch gravel lens			
5								SP	Dark gray sand (loose, moist)	NS	0	
				1				ML	Dark brown to black silt with wood; trace sand and gravel (soft, moist)	SS	0	
10				2				WD	Light brown to white sawdust, decomposed material			Strong rancid odor
15												
20												

Note: See Figure A-1 for explanation of symbols.

LOG OF BORING GEI-8

GEOENGINEERS

Project: Former Scott Paper Mill
Project Location: Anacortes, Washington
Project Number: 5147-007-03

Figure A-9
Sheet 1 of 1

Date(s) Drilled	09/09/08	Logged By		Checked By	CB
Drilling Contractor	Cascade Drilling	Drilling Method	Direct Push	Sampling Methods	
Auger Data		Hammer Data		Drilling Equipment	
Total Depth (ft)	10	Surface Elevation (ft)		Groundwater Level (ft. bgs)	Not Encountered
Vertical Datum		Datum/ System		Easting(x): Northing(y):	

Depth feet	SAMPLES: Interval	SAMPLES: Recovered (in)	SAMPLES: Blows/foot	SAMPLES: Sub-Sample Number	SAMPLES: Testing	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor TLV (ppm)	NOTES
0								AC	3 inches asphalt			
								GP	Base course gravel			
								SM	Medium brown well sorted silty fine sand and few rootlets (medium dense, dry)			
				1						NS	--	
									Becomes dark gray (moist)			
								SP	Dark gray fine to coarse sand with gravel; trace silt (dense, moist)			
		40								NS	--	
										MS	--	
5												
								WD	3 inches of wood	HS	--	Strong petroleum odor
				2				ML	Dark gray to black clayey silt with shell fragments and trace fine sand; occasional organic matter (soft, moist)			
		24								NS	--	
10								WD	Light brown to white sawdust (soft, moist)	NS	--	Rancid odor
15												
20												

Note: See Figure A-1 for explanation of symbols.

LOG OF BORING GEI-9

GeoEngineers

Project: Former Scott Paper Mill
Project Location: Anacortes, Washington
Project Number: 5147-007-03

Figure A-10
Sheet 1 of 1

Date(s) Drilled	09/09/08	Logged By		Checked By	CB
Drilling Contractor	Cascade Drilling	Drilling Method	Direct Push	Sampling Methods	
Auger Data		Hammer Data		Drilling Equipment	
Total Depth (ft)	10	Surface Elevation (ft)		Groundwater Level (ft. bgs)	Not Encountered
Vertical Datum		Datum/ System		Easting(x): Northing(y):	

Depth feet	SAMPLES: Recovered (in)	Blows/foot	Sub-Sample Number	Testing	Water Level	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor TLV (ppm)	NOTES
0						TS	Topsoil - light brown sand with grass and rootlets (loose, dry)			
			1			SP	Medium brown fine to medium gravelly sand with rock fragments (loose)	NS	--	
	36						No recovery			
5			2			ML	Dark gray to black silt with wood and occasional shell fragments (moist)			
	24							NS	--	
						SP	Light brown to gray fine to medium sand with gravel (loose, moist)			
						ML				
10	24					WD		NS	--	

Note: See Figure A-1 for explanation of symbols.

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LOG OF BORING GEI-10

GEOENGINEERS

Project: Former Scott Paper Mill
Project Location: Anacortes, Washington
Project Number: 5147-007-03

Figure A-11
Sheet 1 of 1

Date(s) Drilled	09/09/08	Logged By		Checked By	CB
Drilling Contractor	Cascade Drilling	Drilling Method	Direct Push	Sampling Methods	
Auger Data		Hammer Data		Drilling Equipment	
Total Depth (ft)	10	Surface Elevation (ft)		Groundwater Level (ft. bgs)	Not Encountered
Vertical Datum		Datum/ System		Easting(x): Northing(y):	

Depth feet	SAMPLES: Interval	SAMPLES: Recovered (in)	SAMPLES: Blows/foot	SAMPLES: Sub-Sample Number	SAMPLES: Testing	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor TLV (ppm)	NOTES
0								TS	Topsoil and gravel			
								SP/SM	Light to medium brown poorly sorted fine to medium sand with silt (loose, moist)			1 foot recovery loss, likely from compression
				1						NS	--	
		40						SP	Brown to gray fine to coarse sand with gravel (medium dense, moist)	NS	--	
5								SW	Sand with crushed rock and granite			
				2				ML	Black silt	NS	--	
								RX	Light gray rock chips (chert)			
								ML	Black to dark gray silt with wood and trace shell fragments (moist)			
		48										
		24						WD	Black to dark brown shredded wood (moist)	NS	--	
10												
15												
20												

Note: See Figure A-1 for explanation of symbols.

LOG OF BORING GEI-11

GeoEngineers

Project: Former Scott Paper Mill
Project Location: Anacortes, Washington
Project Number: 5147-007-03

Date(s) Drilled	09/09/08	Logged By		Checked By	CB
Drilling Contractor	Cascade Drilling	Drilling Method	Direct Push	Sampling Methods	
Auger Data		Hammer Data		Drilling Equipment	
Total Depth (ft)	10	Surface Elevation (ft)		Groundwater Level (ft. bgs)	Not Encountered
Vertical Datum		Datum/ System		Easting(x): Northing(y):	

Depth feet	SAMPLES Interval	Recovered (in)	Blows/foot	Sub-Sample Number	Testing	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor TLV (ppm)	NOTES
0								TS	1 to 2 inches of topsoil			
								SM	Medium brown fine to medium sand with silt (medium dense to dense, moist)	NS	--	
				1								
									Becomes brownish-gray			
		36										
5								SP-GP	Dark gray fine to very coarse sand with gravel and trace silt (dense, moist)			Rock chips (cobbles?)
				2						NS	--	
		48										
		24								NS	--	
10												
15												
20												

Note: See Figure A-1 for explanation of symbols.

LOG OF BORING GEI-12

GeoEngineers

Project: Former Scott Paper Mill
Project Location: Anacortes, Washington
Project Number: 5147-007-03

Date(s) Drilled	09/10/08	Logged By		Checked By	CB
Drilling Contractor	Cascade Drilling	Drilling Method	Direct Push	Sampling Methods	
Auger Data		Hammer Data		Drilling Equipment	
Total Depth (ft)	14	Surface Elevation (ft)		Groundwater Level (ft. bgs)	14
Vertical Datum		Datum/ System		Easting(x): Northing(y):	

Depth feet	SAMPLES: Recovered (in)	SAMPLES: Blows/foot	SAMPLES: Sub-Sample Number	SAMPLES: Testing	Water Level	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor TLV (ppm)	NOTES
0						AC	3 inches asphalt			
						GP	1 inch of gravel base course			
						SM	Dark gray fine sand with silt (loose, dry)			
			1					NS	--	
							Becomes medium dense, dry			
	48									
5										
						SP-GP	Green-gray fine to very coarse sand with gravel and trace silt (medium dense, dry)	NS	--	
						SM	Silty sand (loose, dry)			
			2			ML	Dark gray to black silt with occasional shells and sawdust (medium dense, dry)			
	48							NS	--	Slight petroleum odors
						SP/SW	Sand interbed			
						ML	Black silt with wood (medium dense, dry)			
10			3					NS	--	
							Becomes harder			
	48						No recovery			
	4				▼	ML	Dark gray to green slightly mottled silt (soft, wet)	NS	--	
15										
20										

Note: See Figure A-1 for explanation of symbols.

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LOG OF BORING GEI-13

GeoEngineers

Project: Former Scott Paper Mill
Project Location: Anacortes, Washington
Project Number: 5147-007-03

Figure A-14
Sheet 1 of 1

Date(s) Drilled	09/09/08	Logged By		Checked By	CB
Drilling Contractor	Cascade Drilling	Drilling Method	Direct Push	Sampling Methods	
Auger Data		Hammer Data		Drilling Equipment	
Total Depth (ft)	14	Surface Elevation (ft)		Groundwater Level (ft. bgs)	6
Vertical Datum		Datum/ System		Easting(x): Northing(y):	

Depth feet	SAMPLES: Recovered (in)	Blows/foot	Sub-Sample Number	Testing	Water Level	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor TLV (ppm)	NOTES
0						AC	3 inches asphalt			
						GP	1 inch base course gravel			
						SM	Medium brown fine sand with silt (medium dense, dry)	NS	--	
			1				Becomes dark gray (moist)			
						ML	Black to dark gray silt with gravel			
	40					GP/SP	Gray fine to coarse poorly sorted gravelly sand (dense, moist)	NS	--	
5							No recovery			
			2		▼	SP	Dark gray fine to medium sand with trace silt (medium dense, wet)			
	24						No recovery	NS	--	
10			3			ML	Black silt with trace sand and some organic matter (medium stiff, moist)	NS	--	
						SP	Dark gray fine to medium sand with trace gravel (dense, wet)	MS	--	
	24					ML	Black clayey silt with shell fragments and trace sand (soft, moist)			
						SP	Dark gray fine to coarse gravelly sand with gravel (dense, wet)			
	24					WD	Dark brown fine wood with light brown wood pieces at 14 feet	NS	--	
15										
20										

Note: See Figure A-1 for explanation of symbols.

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LOG OF BORING GEI-14

GeoEngineers

Project: Former Scott Paper Mill
Project Location: Anacortes, Washington
Project Number: 5147-007-03

Figure A-15
Sheet 1 of 1

Date(s) Drilled	09/09/08	Logged By		Checked By	CB
Drilling Contractor	Cascade Drilling	Drilling Method	Direct Push	Sampling Methods	
Auger Data		Hammer Data		Drilling Equipment	
Total Depth (ft)	6	Surface Elevation (ft)		Groundwater Level (ft. bgs)	Not Encountered
Vertical Datum		Datum/ System		Easting(x): Northing(y):	

Depth feet	SAMPLES: Interval	SAMPLES: Recovered (in)	SAMPLES: Blows/foot	SAMPLES: Sub-Sample Number	SAMPLES: Testing	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor TLV (ppm)	NOTES
0				1				ML/SM	Medium brown fine sand with silt and gravel (moist)	NS	--	Low recovery possibly from compression
		24						GP-GW	4 inches of light gray gravel			
								SP-SM	Dark gray to black fine sand with fine gravel (wet)			
5								WD	Black hard wood	NS	--	Thin (1 to 2 inches) fine sand seam at top of clay
		24						ML/CL	Dark gray high plasticity, slightly mottled gray to green silty clay with trace fine sand (soft)			
10												
15												
20												

Note: See Figure A-1 for explanation of symbols.

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LOG OF BORING GEI-15

GeoEngineers

Project: Former Scott Paper Mill
Project Location: Anacortes, Washington
Project Number: 5147-007-03

Figure A-16
Sheet 1 of 1

Date(s) Drilled	09/09/08	Logged By		Checked By	CB
Drilling Contractor	Cascade Drilling	Drilling Method	Direct Push	Sampling Methods	
Auger Data		Hammer Data		Drilling Equipment	
Total Depth (ft)	6	Surface Elevation (ft)		Groundwater Level (ft. bgs)	Not Encountered
Vertical Datum		Datum/ System		Easting(x): Northing(y):	

Depth feet	SAMPLES: Interval	SAMPLES: Recovered (in)	SAMPLES: Blows/foot	SAMPLES: Sub-Sample Number	SAMPLES: Testing	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor TLV (ppm)	NOTES
0								AC	Asphalt			
								GP	Gravel base course			
								SM	Medium brown well sorted fine sand with silt (medium dense, dry)			PID not used (not working)
				1						NS	--	
		48										
								ML	Dark brown low plasticity silt with occasional wood fragments and gravel (stiff)			
5										NS	--	
		24										
10												
15												
20												

Note: See Figure A-1 for explanation of symbols.

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LOG OF BORING GEI-16

GEOENGINEERS

Project: Former Scott Paper Mill
Project Location: Anacortes, Washington
Project Number: 5147-007-03

Figure A-17

Date(s) Drilled	09/09/08	Logged By		Checked By	CB
Drilling Contractor	Cascade Drilling	Drilling Method	Direct Push	Sampling Methods	
Auger Data		Hammer Data		Drilling Equipment	
Total Depth (ft)	6	Surface Elevation (ft)		Groundwater Level (ft. bgs)	Not Encountered
Vertical Datum		Datum/ System		Easting(x): Northing(y):	

Depth feet	SAMPLES: Interval	SAMPLES: Recovered (in)	SAMPLES: Blows/foot	SAMPLES: Sub-Sample Number	SAMPLES: Testing	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor TLV (ppm)	NOTES
0								AC	5 inches asphalt			
								GP	Base course gravel			
				1				SM	Medium brown fine to very coarse silty sand with gravel (medium dense, moist)			
									Becomes gray (wet)	NS	--	
		36						ML	Dark gray, slightly mottled gray to green low plasticity silt with trace sand (stiff, moist)			
5									1 to 2 inches dark gray fine to coarse sand interbeds			
		24						WD	Dark brown to black wood	NS	--	
10												
15												
20												

Note: See Figure A-1 for explanation of symbols.

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LOG OF BORING GEI-17

GeoEngineers

Project: Former Scott Paper Mill
Project Location: Anacortes, Washington
Project Number: 5147-007-03

Figure A-18

Date(s) Drilled	09/09/08	Logged By		Checked By	CB
Drilling Contractor	Cascade Drilling	Drilling Method	Direct Push	Sampling Methods	Grab
Auger Data		Hammer Data		Drilling Equipment	
Total Depth (ft)	10	Surface Elevation (ft)		Groundwater Level (ft. bgs)	9
Vertical Datum		Datum/ System		Easting(x): Northing(y):	

Depth feet	SAMPLES: Interval	SAMPLES: Recovered (in)	SAMPLES: Blows/foot	SAMPLES: Sub-Sample Number	SAMPLES: Testing	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor TLV (ppm)	NOTES
0								TS	3 inches grass and topsoil			
								SP	Brownish gray fine to medium sand (loose, dry) (thin layers of orange sand)	NS	--	PID not used (not working)
								RX	Rock fragments			
								SP	Brown and gray gravelly fine to medium sand (dense, dry)	NS	--	
		48										
5									Gray gravelly fine to medium sand with trace silt (medium dense, moist)			
				1						NS	--	
								ML	Dark brown silt with organic matter (loose, moist)			
		48						SP	Brown gravelly sand (loose, moist)			
						▼			Dark brown to black fine to medium gravelly sand (loose, wet)			
10		24								NS	--	
15												
20												

Note: See Figure A-1 for explanation of symbols.

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LOG OF BORING GEI-18

GEOENGINEERS

Project: Former Scott Paper Mill
Project Location: Anacortes, Washington
Project Number: 5147-007-03

Figure A-19
Sheet 1 of 1

Date(s) Drilled	09/09/08	Logged By		Checked By	CB
Drilling Contractor	Cascade Drilling	Drilling Method	Direct Push	Sampling Methods	
Auger Data		Hammer Data		Drilling Equipment	
Total Depth (ft)	10	Surface Elevation (ft)		Groundwater Level (ft. bgs)	9
Vertical Datum		Datum/ System		Easting(x): Northing(y):	

Depth feet	SAMPLES: Interval	SAMPLES: Recovered (in)	SAMPLES: Blows/foot	SAMPLES: Sub-Sample Number	SAMPLES: Testing	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor TLV (ppm)	NOTES
0								AC	3 inches asphalt			PID not used (not working)
								GP	Base course gravel			
								SP	Medium brown fine sand (loose, dry)	NS	--	
									Becomes dark gray, moist			
								ML	Dark gray to black silt with trace fine sand; some organic matter			
		36						WD	Light brown to white sawdust, decomposed fine wood chips	NS	--	Rancid odor
5										NS	--	
		36		1 2				ML	Black silt, slight plasticity with fine sand and trace organic matter (soft)	NS	--	
								SM	Dark gray fine silty sand with trace gravel (medium dense, moist)			
						▼		SP-GP	Dark gray coarse gravel with fine to coarse sand; well sorted; trace silt (dense, wet)	NS NS	-- --	
10		30										
15												
20												

Note: See Figure A-1 for explanation of symbols.

LOG OF BORING GEI-19

GEOENGINEERS

Project: Former Scott Paper Mill
Project Location: Anacortes, Washington
Project Number: 5147-007-03

Figure A-20
Sheet 1 of 1

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Date(s) Drilled	09/09/08	Logged By		Checked By	CB
Drilling Contractor	Cascade Drilling	Drilling Method	Direct Push	Sampling Methods	Grab
Auger Data		Hammer Data		Drilling Equipment	
Total Depth (ft)	10	Surface Elevation (ft)		Groundwater Level (ft. bgs)	9
Vertical Datum		Datum/ System		Easting(x): Northing(y):	

Depth feet	SAMPLES: Interval	SAMPLES: Recovered (in)	SAMPLES: Blows/foot	SAMPLES: Sub-Sample Number	SAMPLES: Testing	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor TLV (ppm)	NOTES
0								TS	3 inches grass and topsoil			
								SP	Brownish gray fine to medium sand (loose, dry)	NS	--	PID not used (not working)
								ROCK	Layer of rocks			
								SM	Dark brown silty sand with organic matter, wood fragments (medium dense, dry)	NS	--	
								SP	Gray gravelly fine to medium sand (dense, dry)	SS	--	
		48										
5								ML	Brown silt with roots and occasional gravel (medium stiff, moist)			
				1					Gray sandy and gravelly silt (medium stiff, moist)	NS	--	
								WD	Wood layer	NS	--	
		48						ML	Dark brown to black silt with gravel (medium stiff, moist)			
						▼		SP	Dark brown to black fine to medium gravelly sand (loose, wet)	NS	--	
10		24										
15												
20												

Note: See Figure A-1 for explanation of symbols.

V6_ENVBORING W:\SEATTLE\PROJECTS\5\514700703\FINALS\514700703.GPJ GEIV6_1.GDT 10/24/08

LOG OF BORING GEI-20

GEOENGINEERS

Project: Former Scott Paper Mill
Project Location: Anacortes, Washington
Project Number: 5147-007-03

Figure A-21
Sheet 1 of 1

Date(s) Drilled	09/08/08	Logged By		Checked By	CB
Drilling Contractor	Cascade Drilling	Drilling Method	Direct Push	Sampling Methods	
Auger Data		Hammer Data		Drilling Equipment	
Total Depth (ft)	16	Surface Elevation (ft)		Groundwater Level (ft. bgs)	9
Vertical Datum		Datum/ System		Easting(x): Northing(y):	

Depth feet	SAMPLES: Interval	Recovered (in)	Blows/foot	Sub-Sample Number	Testing	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor TLV (ppm)	NOTES
0								AC	Asphalt			
								GP	Base course gravel			
								SP	Dark gray fine to medium sand with silt (loose, dry)			
		36						SP/SM	Grades to silty sand (moist)	NS	0	
5								PT	Black peat with silt and wood fragments			
				1								
										NS	0	
		48										
						▼		SM	Gray fine silty sand lens (moist)			
								SM	Black fine to coarse silty sand (medium dense, wet)			
10				2								
								SM	Black coarse to very coarse sand with wood chips (medium dense, wet)	NS	0	
		48										
										MS		
								WD	Light brown wood fragments with silt with larger (2 to 3 inches) wood pieces			Strong sulfur odor
15												
		48									0	
20												

Note: See Figure A-1 for explanation of symbols.

LOG OF BORING GEI-21

GEOENGINEERS

Project: Former Scott Paper Mill
Project Location: Anacortes, Washington
Project Number: 5147-007-03

Figure A-22
Sheet 1 of 1

Date(s) Drilled	09/08/08	Logged By		Checked By	CB
Drilling Contractor	Cascade Drilling	Drilling Method	Direct Push	Sampling Methods	GP 420
Auger Data		Hammer Data		Drilling Equipment	
Total Depth (ft)	9	Surface Elevation (ft)		Groundwater Level (ft. bgs)	Not Encountered
Vertical Datum		Datum/ System		Easting(x): Northing(y):	

Depth feet	SAMPLES: Interval	SAMPLES: Recovered (in)	SAMPLES: Blows/foot	SAMPLES: Sub-Sample Number	SAMPLES: Testing	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor TLV (ppm)	NOTES
0								TS	4 inches grass and topsoil			
								SP/SM	Dark gray fine to medium sand (loose, moist)			
								SM	Dark gray to black fine silty sand with gravel (loose, moist)			Hard drilling, no pavement
		32							No recovery	NS	0	Rock in shoe
5		10		1				SM-SP	Black fine to very coarse silty sand with gravel and organic material; rock fragments (loose, dry)	NS	0	Very easy/soft drilling
		16						SP-SM	Black fine to very coarse sand with gravel; trace shell fragments, brick fragments and wood pieces (medium dense, moist)	NS	0	
10												
15												
20												

Note: See Figure A-1 for explanation of symbols.

V6_ENVBORING W:\SEATTLE\PROJECTS\5\514700703\FINALS\514700703.GPJ GEIV6_1.GDT 10/24/08

LOG OF BORING GEI-22

GEOENGINEERS	Project:	Former Scott Paper Mill
	Project Location:	Anacortes, Washington
	Project Number:	5147-007-03

Figure A-23
Sheet 1 of 1

Date(s) Drilled	09/09/08	Logged By		Checked By	CB
Drilling Contractor	Cascade Drilling	Drilling Method	Direct Push	Sampling Methods	
Auger Data		Hammer Data		Drilling Equipment	
Total Depth (ft)	14	Surface Elevation (ft)		Groundwater Level (ft. bgs)	9
Vertical Datum		Datum/ System		Easting(x): Northing(y):	

Depth feet	SAMPLES: Interval	SAMPLES: Recovered (in)	SAMPLES: Blows/foot	SAMPLES: Sub-Sample Number	SAMPLES: Testing	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor TLV (ppm)	NOTES
0								SP	Light brown poorly sorted fine sand with gravel (loose to medium dense, dry)			
									Becomes dark gray (moist)	NS	--	
		48										
5												
				1				SM	Dark gray to black fine to coarse silty sand with trace gravel and organic matter; wood (dense)	NS	--	
		48										
						▼			Becomes wet			
10				2						NS	--	
								WD	Light brown and black solid wood (moist)			
		48								HS	--	
								ML	Silt lens with fine wood	MS	--	
		24						WD	Light brown wood (soft, moist)	NS	--	
15												
20												

Note: See Figure A-1 for explanation of symbols.

V6_ENVBORING W:\SEATTLE\PROJECTS\5\514700703\FINALS\514700703.GPJ GEIV6_1.GDT 10/24/08

LOG OF BORING GEI-23

GEOENGINEERS

Project: Former Scott Paper Mill
Project Location: Anacortes, Washington
Project Number: 5147-007-03

Figure A-24
Sheet 1 of 1

Date(s) Drilled	09/10/08	Logged By		Checked By	CB
Drilling Contractor	Cascade Drilling	Drilling Method	Direct Push	Sampling Methods	
Auger Data		Hammer Data		Drilling Equipment	
Total Depth (ft)	16	Surface Elevation (ft)		Groundwater Level (ft. bgs)	11
Vertical Datum		Datum/ System		Easting(x): Northing(y):	

Depth feet	SAMPLES: Interval	SAMPLES: Recovered (in)	SAMPLES: Blows/foot	SAMPLES: Sub-Sample Number	SAMPLES: Testing	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor TLV (ppm)	NOTES
0								TS	6 inches grass and topsoil			
								FILL	Sand, silt and gravel with bricks (fill)			
								ML	Dark brown to black silt with wood chips (soft)			
		36							Trace gray/brown sand			
5									Shell fragments			
				1								
								SM	Dark gray to black medium to very coarse silty sand with fine gravel; trace silt and organic matter (medium dense, wet)			
		36										
10				2								
						▼		WD	Medium brown small pieces of wood (soft, wet)			Sulfur odor
		48							Dark gray to black silt with gravel			
									Fine wood chips			
15												
		48										
20												

Note: See Figure A-1 for explanation of symbols.

V6_ENVBORING W:\SEATTLE\PROJECTS\5\514700703\FINALS\514700703.GPJ GEIV6_1.GDT 10/24/08

LOG OF BORING GEI-24

GEOENGINEERS

Project: Former Scott Paper Mill
Project Location: Anacortes, Washington
Project Number: 5147-007-03

Figure A-25
Sheet 1 of 1

Date(s) Drilled	09/10/08	Logged By		Checked By	CB
Drilling Contractor	Cascade Drilling	Drilling Method	Direct Push	Sampling Methods	
Auger Data		Hammer Data		Drilling Equipment	
Total Depth (ft)	5	Surface Elevation (ft)		Groundwater Level (ft. bgs)	Not Encountered
Vertical Datum		Datum/ System		Easting(x): Northing(y):	

Depth feet	SAMPLES: Interval	SAMPLES: Recovered (in)	SAMPLES: Blows/foot	SAMPLES: Sub-Sample Number	SAMPLES: Testing	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor TLV (ppm)	NOTES
0								SOD	4 inches grass			
									No recovery			
								FILL	Sand, silt and gravel mix with brick debris			
		24		1				SP	Light brown fine to coarse gravelly sand with gravel (loose, dry)			
								CC	Refusal, concrete debris at 5 feet			
5												
10												
15												
20												

Note: See Figure A-1 for explanation of symbols.

V6_ENVBORING W:\SEATTLE\PROJECTS\5\514700703\FINALS\514700703.GPJ GEIV6_1.GDT 10/24/08

LOG OF BORING GEI-25

GeoEngineers

Project: Former Scott Paper Mill
Project Location: Anacortes, Washington
Project Number: 5147-007-03

Figure A-26

ATTACHMENT 2
DATA QUALITY ASSESSMENT SUMMARY

GEOENGINEERS

MEMORANDUM

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TO: Cindy Bartlett and Rob Leet

FROM: Tonya Kauhi

DATE: October 29, 2008

FILE: 5147-007-03

SUBJECT: Former Scott Paper Mill Site – Data Quality Assessment Summary

This memorandum presents a summary of the analytical data quality assessment for soil and water samples collected by GeoEngineers, Inc. on September 8-10, 2008, at the Port Uplands Area of the Former Scott Paper Mill Site in Anacortes, Washington. The samples were submitted to Analytical Resources, Inc. (ARI) in Tukwila, Washington. Chemical analyses were performed by ARI and two laboratories subcontracted by ARI: Fremont Analytical (Seattle, Washington) and Pace Analytical (Minneapolis, Minnesota). Thirty-nine (39) soil samples and two (2) water samples were analyzed by one or more of the following analytical methods:

- Total metals by EPA Method 6020
- Lead by EPA Method 1311/6020 (TCLP extraction)
- Petroleum hydrocarbons by Ecology Method NWTPH-D
- Polycyclic aromatic hydrocarbons by EPA Method 8270-SIM
- Dioxin/furans by EPA Method 8290

OBJECTIVE

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

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

DATA ASSESSMENT CRITERIA

The following QC elements were reviewed:

- Chain-of-custody (COC) documentation
- Temperature preservation and holding times
- Method blanks
- Surrogate recoveries

- Matrix spikes/matrix spike duplicates (MS/MSD)
- Laboratory control samples
- Laboratory replicates/duplicates

DATA QUALITY ASSESSMENT SUMMARY

The results for each of the QC elements are summarized below. The data assessment was performed using guidance in *the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (USEPA 2002) and *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review* (USEPA 1999).

Chain-of-Custody Documentation:

COC forms were provided with the laboratory analytical reports. There were no anomalies noted on the COC forms; proper COC protocols appear to have been followed.

Temperature Preservation and Holding Times:

According to the cooler receipt form, the measured cooler temperatures were 20.8 (cooler #1) and 18.6 (cooler #2) degrees Celsius. Guidance suggests that when temperatures exceed the acceptable range, non-detect results should be qualified as unusable ("R" flag) and detected results should be considered estimated values and qualified with a "J" flag, based on the reviewer's professional judgment. The basis for rejection depends on a variety of factors including the duration of elevated temperatures, the magnitude of the temperature exceedance, the matrix being analyzed, the amount of head space in the sample container, and the class of target analytes (i.e., non-volatile or semivolatile compounds versus volatile compounds).

In this instance, the samples were stored on ice from the time the samples were collected until they were delivered to the analytical laboratory. On the afternoon that the samples were delivered to the laboratory, the samples were transferred to different coolers and repacked with ice approximately 2 hours before the coolers were dropped off at the laboratory. The laboratory measured and recorded the ambient cooler temperatures, not the temperature of the samples. Since it can take approximately 6 to 8 hours for ambient cooler temperatures to reach the recommended temperature range of 2 to 6 degrees Celsius after being loaded with ice, the measured cooler temperatures likely did not accurately reflect the temperature of the samples. Accordingly, no data were qualified based on temperature preservation.

Samples GEI23-6-10 and GEI23-10-14 were extracted and analyzed outside of the recommended holding time of 14 days. The samples were extracted within 41 days of sampling. Guidance suggests that if holding times are grossly exceeded (e.g., by greater than two times the recommended holding time), non-detect results should be qualified as unusable ("R" flag) and detected results should be considered estimated values and qualified with a "J" flag. Based on these criteria the following actions were taken:

- The non-detect results for benzo(a)anthracene in sample GEI23-6-10 were qualified as unusable ("R" flag), and the detected results for benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)-fluoranthene, indeno(1,2,3-cd)pyrene, and dibenzo(a,h)anthracene in sample GEI23-6-10 were qualified as estimated ("J" flag).

- The detected results for benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, and dibenzo(a,h)anthracene in sample GEI23-10-14 were qualified as estimated ("J" flag).

All other samples were analyzed within recommended holding times.

Method Blanks:

Several polychlorodibenzo-p-dioxins/polychlorodibenzofurans (PCDD/PCDF) congeners were detected in an associated method blank sample (Blank-17755). Since the sample results for these congeners were greater than five times the blank result, the sample results were not qualified.

No additional method blank detections were reported.

Surrogate Recoveries:

Surrogates are only evaluated for organic analyses. No surrogate recovery exceedances were reported.

Matrix Spikes/Matrix Spike Duplicates (MS/MSD):

No MS/MSD spike exceedances were reported.

Laboratory Control Samples (LCS):

No laboratory control sample spike exceedances were reported.

Laboratory Replicates/Duplicates:

The relative percent difference (RPD) values for lead exceeded the control limit of 30% in sample GEI22-6-9 due to sample matrix effects. Guidance suggests if the results from a duplicate analysis exceed the control limit, detected results should be qualified as estimated ("J" flag), and the reporting limit for non-detect results should be qualified as estimated ("UJ" flag). Based on these criteria, the detected lead result in sample GEI22-6-9 was qualified as estimated ("J" flag).

No additional laboratory replicate exceedances were reported.

Additional Data Quality Issues:

The laboratory flagged several PCDD and PCDF results with an "I" (interference present) or "E" (polychlorinated diphenyl ether [PCDE] interference) where interfering substances reduced confidence in the sample result. Consequently, we qualified the results for the samples listed below as estimated ("J" flag).

Sample Location	Start Depth (Feet)	End Depth (Feet)	Analyte
GEI-1	2	6	1,2,3,7,8,9-HxCDD
GEI-1	10	14	1,2,3,7,8-PeCDD
GEI-1	10	14	2,3,7,8-TCDF

GEI-1	10	14	2,3,4,7,8-PeCDF
GEI-1	2	6	1,2,3,7,8-PeCDF
GEI-1	2	6	1,2,3,6,7,8-HxCDF
GEI-1	10	14	2,3,4,6,7,8-HxCDF
GEI-1	10	14	1,2,3,4,6,7,8-HpCDF
GEI-1	2	6	1,2,3,4,7,8-HxCDF
GEI-1	10	14	1,2,3,4,7,8-HxCDF
GEI-2	6	10	1,2,3,6,7,8-HxCDF
GEI-2	6	10	2,3,4,7,8-PeCDF
GEI-2	6	10	1,2,3,6,7,8-HxCDD
GEI-2	6	10	1,2,3,7,8-PeCDD
GEI-2	6	10	1,2,3,4,7,8-HxCDF
GEI-2	6	10	1,2,3,4,6,7,8-HpCDF
GEI-3	6	10	1,2,3,4,7,8-HxCDF
GEI-3	6	10	2,3,4,7,8-PeCDF
GEI-3	10	14	2,3,4,7,8-PeCDF
GEI-3	6	10	2,3,7,8-TCDF
GEI-3	10	14	1,2,3,7,8,9-HxCDD
GEI-3	10	14	1,2,3,4,6,7,8-HpCDF
GEI-3	10	14	2,3,4,6,7,8-HxCDF
GEI-3	10	14	1,2,3,7,8-PeCDF
GEI-4	6	10	1,2,3,6,7,8-HxCDF
GEI-4	6	10	2,3,4,6,7,8-HxCDF
GEI-4	6	10	1,2,3,6,7,8-HxCDD
GEI-4	6	10	1,2,3,7,8-PeCDD
GEI-4	6	10	1,2,3,4,6,7,8-HpCDF
GEI-5	6	10	1,2,3,4,7,8-HxCDF
GEI-5	6	10	1,2,3,7,8-PeCDD
GEI-5	6	10	2,3,7,8-TCDD
GEI-6	6	10	2,3,7,8-TCDF
GEI-6	6	10	2,3,4,7,8-PeCDF
GEI-6	6	10	1,2,3,4,7,8-HxCDF
GEI-8	6	10	2,3,4,6,7,8-HxCDF
GEI-8	6	10	1,2,3,4,7,8,9-HpCDF
GEI-10	6	10	1,2,3,6,7,8-HxCDF
GEI-12	6	10	1,2,3,7,8-PeCDF
GEI-12	6	10	1,2,3,7,8,9-HxCDD
GEI-12	6	10	1,2,3,4,7,8-HxCDD
GEI-13	6	10	1,2,3,4,7,8-HxCDD
GEI-13	6	10	1,2,3,7,8-PeCDF

CONCLUSIONS

The analytical data generated during the September 2008 supplemental soil investigation at the Port Uplands Area of the Former Scott Paper Mill Site are useable for decision-making purposes. This data quality assessment was performed by GeoEngineers, Inc. using best professional judgment. Data users may review and re-interpret data quality for specific uses.

APPENDIX B

2007 AND 2008 SUPPLEMENTAL SEDIMENT CHEMISTRY AND BIOLOGICAL TESTING DATA

FORMER SCOTT PAPER MILL SITE
ANACORTES, WASHINGTON

Prepared for

Kimberly Clark Corporation

Port of Anacortes

MJB Properties

Prepared by

Anchor Environmental, L.L.C.

1423 Third Avenue, Suite 300

Seattle, Washington 98101

December 2008

ANCHOR ENVIRONMENTAL, L.L.C.

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Table B-3 Summary of 2007 and 2008 Sediment Bioassay Results

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Figure B-1 Supplemental Sediment Sampling Stations

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Appendix B-1 Laboratory Chemistry Data Reports
Appendix B-2 Laboratory Bioassay Data Reports
Appendix B-3 Data Validation Review Reports

1 INTRODUCTION

The Kimberly-Clark Corporation (K-C), the Port of Anacortes (Port), and MJB Properties (MJB) conducted an integrated Remedial Investigation/Feasibility Study (RI/FS) at the former Scott Paper Mill Site (Site) in Anacortes, Washington. Supplemental sediment sampling and chemical/bioassay analyses were designed to address RI/FS and Cleanup Action Plan (CAP) data gaps for determining sediment remedial action boundaries. Data collection was conducted in 2007 and 2008 in accordance with their respective Sampling and Analysis Plans and Quality Assurance Project Plans (SAP and QAPP; Anchor 2007 and 2008). The results described in this document (submitted as Appendix B to the Draft CAP) include both 2007 and 2008 sediment sampling data to verify delineation of the nature and extent of contamination in the Marine Area and to determine the appropriate scope of remedial actions to minimize the potential for adverse impacts to human health and the environment.

2 SUMMARY OF SEDIMENT TEST RESULTS

Chemical analyses of sediment samples were performed at Analytical Resources, Inc. (ARI), in Tukwila, Washington, according to procedures specified in the SAPs. Bioassay analyses were performed at Newfields Northwest, L.L.C. in Port Gamble, Washington. Sampling locations are depicted in Figure B-1. Tables B-1 and B-2 present the sediment chemistry analytical results for the 2007 and 2008 sampling events, respectively. Table B-3 presents bioassay results performed for both 2007 and 2008 sampling events. These results are compared to the Sediment Quality Standards (SQS; Chapter 173-204 WAC) criteria in sediments and the results that exceed criteria are highlighted. Appendix B-1 contains the chemistry reports, Appendix B-2 contains the bioassay reports, and Appendix B-3 contains the data validation reviews of the chemistry results.

2.1 2007 Chemistry Results

The samples collected in 2007 were analyzed and screened for all SMS criteria. Porewater ammonia concentrations ranged from 0.9 milligrams per liter (mg/L) to 16.3 mg/L. Porewater sulfide concentrations ranged from 14 mg/L to 43 mg/L. Three samples were not tested for porewater sulfides and one of the samples was not tested for porewater ammonia due to insufficient porewater sample volume. Total chromium, copper, lead, nickel, and zinc were detected in all bulk samples. Mercury was detected in eight samples and arsenic was detected in sample AN-SS-04. Antimony and silver were not detected in any samples. The mercury result for sample AN-SS-09 exceeded the SMS Cleanup Screening Level (CSL). The CSL value for mercury is 0.59 milligrams per kilogram (mg/kg; dry weight basis). The sample result was 3.24 mg/kg. Semivolatile organic compounds were detected in all samples below screening levels. PCBs were detected in nine samples and exceeded SMS Sediment Quality Standards (SQS) levels in two of these samples. Sample results for AN-SED-10 and AN-SED-11 were 21.5 mg/kg organic carbon (OC) and 19.1 mg/kg-OC, respectively. The SQS value for total PCBs is 12 mg/kg-OC. The samples were below the CSL value of 65 mg/kg-OC.

2.2 2008 Chemistry Results

Samples collected in 2008 were analyzed for grain size and conventional parameters only. Porewater ammonia concentrations ranged from 6.26 mg/L to 14.7 mg/L. Porewater sulfide concentrations ranged from 3.76 mg/L to 33.8 mg/L.

2.3 2007 Bioassay Results

Three bioassay tests were performed on all samples: benthic chronic abundance test, amphipod acute toxicity test, and *Mytilus* larvae acute toxicity test. Three samples (AN-SS-02, -07, and -10) passed SQS biological criteria for all bioassay tests for the samples collected in 2007. Sample AN-SS-01 exceeded CSL biological criteria for the benthic chronic abundance test and exceeded SQS criteria but was below CSL biological criteria for the amphipod acute toxicity test. This sample was below screening criteria for the *Mytilus* larvae acute toxicity test. Sample AN-SS-03 exceeded SQS criteria but was below CSL biological criteria for the amphipod acute toxicity test and passed screening criteria for the other two bioassay tests. Sample AN-SS-11 exceeded CSL criteria for the *Mytilus* larvae acute toxicity test and passed criteria for the remaining two tests.

2.4 2008 Bioassay Results

The same bioassay testing was performed on the 2008 samples as the 2007 samples with the exception that the *Neanthes* chronic growth test was performed in place of the benthic chronic abundance test. Four samples (AN-SB-01, -02, -03, and -06) passed SQS biological criteria for all tests for samples collected in 2008 and all samples passed the amphipod acute toxicity test. Samples AN-SB-04 and AN-SB-05 exceeded SQS criteria but passed CSL criteria for the *Neanthes* chronic growth test and the *Mytilus* larvae acute toxicity test, respectively. Sample AN-SB-07 exceeded CSL criteria for the *Mytilus* larvae acute toxicity test. These samples passed SQS criteria for the remaining two tests.

3 REFERENCES

Anchor Environmental, L.L.C. (Anchor). 2008. Sampling and Analysis Plan and Quality Assurance Project Plan for Former Scott Paper Mill Site. August.

Anchor Environmental, L.L.C. (Anchor). 2007. Sampling and Analysis Plan and Quality Assurance Project Plan for Former Scott Paper Mill Site. August.

TABLES

Table B-1
Sediment Physical and Chemical Data Summary: 2007 Samples

		Sample Station		AN-SED-01	AN-SED-02	AN-SED-03	AN-SED-04	AN-SED-05	AN-SED-06	AN-SED-07	AN-SED-08	AN-SED-09	AN-SED-10	AN-SED-11	AN-SED-REF-01
		Sample ID		AN-SS-01	AN-SS-02	AN-SS-03	AN-SS-04	AN-SS-05	AN-SS-06	AN-SS-07	AN-SS-08	AN-SS-09	AN-SS-10	AN-SS-11	AN-SS-REF-01
		Sample Date		9/27/2007	9/27/2007	9/28/2007	9/28/2007	9/27/2007	9/28/2007	9/28/2007	9/27/2007	9/27/2007	9/28/2007	9/28/2007	9/28/2007
		SMS													
Parameters	Units	SQS	CSL												
Conventionals															
Gravel	%	--	--	**26**	**7**	**4**	**42**	**4**	**51**	**7**	**4**	**57**	**43**	**6**	**0**
Sand	%	--	--	**42**	**68**	**80**	**48**	**89**	**48**	**82**	**89**	**43**	**46**	**77**	**90**
Silt	%	--	--	**24**	**16**	**12**	**6**	**4**	**0**	**9**	**5**	**0**	**8**	**13**	**7**
Clay	%	--	--	**8**	**9**	**4**	**4**	**3**	**0**	**3**	**3**	**0**	**3**	**4**	**4**
Fines	%	--	--	**32**	**25**	**16**	**10**	**7**	**1**	**12**	**7**	**0**	**11**	**17**	**10**
Wood volume	%	--	--	**38**	**34**	**75**	**5**	**55**	**< 5**	**5**	**80**	**67**	**5**	**34**	**< 5**
Porewater ammonia	mg-N/L	--	--	**8.1**	**7.4**	**9.8**	**0.9**	**16.3**	**10.0**	**13.0**	--	**8.5**	**13.1**	**2.3**	**6.1**
Porewater sulfide	mg/L	--	--	**26**	**34**	**23**	--	**43**	**14**	**39**	--	--	**44**	**30**	--
Total volatile solids	%	--	--	**17.0**	**7.8**	**3.8**	**9.0**	**6.4**	**16.6**	**2.5**	**1.4**	**11.0**	**2.0**	**9.7**	--
Total organic carbon	%	--	--	**1.43 J**	**4.84 J**	**2.53 J**	**6.13 J**	**2.42 J**	**1.40 J**	**1.35 J**	**1.75 J**	**3.99 J**	**1.07 J**	**1.15 J**	**0.951 J**
Total solids	%	--	--	**61.4**	**53.8**	**67.2**	**66.9**	**61.7**	**75.7**	**70.2**	**60.8**	**74.7**	**74.9**	**66.4**	**74.2**
Metals															
Antimony	mg/kg	--	--	9 U	9 U	7 U	20 U	8 U	7 U	7 U	8 U	6 U	7 U	8 U	--
Arsenic	mg/kg	57	93	9 U	9 U	7 U	**20**	8 U	7 U	7 U	8 U	6 U	7 U	8 U	--
Cadmium	mg/kg	5.1	6.7	**0.9**	**0.9**	**0.4**	0.8 U	**0.5**	**0.3**	**0.4**	**0.7**	**0.3**	**0.5**	**0.5**	--
Chromium	mg/kg	260	270	**20**	**20**	**12**	**42**	**14**	**34**	**15**	**41**	**35**	**18**	**26**	--
Copper	mg/kg	390	390	**26**	**153**	**58**	**215**	**138**	**46**	**70**	**106**	**59**	**42**	**38**	--
Lead	mg/kg	450	530	**8**	**33**	**6**	**388**	**39**	**136**	**15**	**61**	**117**	**9**	**26**	--
Mercury	mg/kg	0.41	0.59	0.07 U	**0.19**	0.07 U	**0.31**	0.06 U	**0.28**	**0.14**	**0.36**	**3.24**	**0.12**	**0.15**	--
Nickel	mg/kg	--	--	**14**	**16**	**10**	**46**	**10**	**23**	**13**	**55**	**38**	**18**	**19**	--
Silver	mg/kg	6.1	6.1	0.5 U	0.6 U	0.4 U	1 U	0.5 U	0.4 U	0.4 U	0.5 U	0.4 U	0.4 U	0.5 U	--
Zinc	mg/kg	410	960	**45**	**65**	**30**	**267**	**33**	**65**	**35**	**106**	**122**	**37**	**48**	--
Aromatic Hydrocarbons															
Total LPAH	mg/kg-OC	370	780	**13**	**7.6**	**3.4**	**0.55**	**1.7**	**1.9**	**2.1**	**86**	**21**	1.87 U	**63**	--
Naphthalene	mg/kg-OC	99	170	**7.0**	**1.5**	**1.5**	0.33 U	0.83 U	1.43 U	1.48 U	**7.4**	**1.3**	1.87 U	**8.7**	--
Acenaphthylene	mg/kg-OC	66	66	1.4 U	**0.48**	0.79 U	0.33 U	0.83 U	1.43 U	1.48 U	**4.6**	0.50 U	1.87 U	**2.8**	--
Acenaphthene	mg/kg-OC	16	57	1.4 U	0.41 U	0.79 U	0.33 U	0.83 U	1.43 U	1.48 U	**3.1**	**1.8**	1.87 U	**2.8**	--
Fluorene	mg/kg-OC	23	79	1.4 U	**0.45**	0.79 U	0.33 U	0.83 U	1.43 U	1.48 U	**7.4**	**2.5**	1.87 U	**4.3**	--
Phenanthrene	mg/kg-OC	100	480	**6.3**	**4.3**	**1.9**	**0.55**	**1.7**	**1.9**	**2.1**	**51**	**13**	1.87 U	**37**	--
Anthracene	mg/kg-OC	220	1,200	1.4 U	**0.85**	0.79 U	0.33 U	0.83 U	1.43 U	1.48 U	**13**	**3.3**	1.87 U	**8.0**	--
2-Methylnaphthalene	mg/kg-OC	38	64	1.4 U	**0.50**	0.79 U	0.33 U	0.83 U	1.43 U	1.48 U	**4.0**	**3.5**	1.87 U	**2.7**	--
Total HPAH	mg/kg-OC	960	5,300	**32**	**17**	**6.9**	**1.7**	**20**	**10.0**	**3.0**	**299**	**52**	**5.4**	**215**	--
Fluoranthene	mg/kg-OC	160	1,200	**13**	**7.0**	**2.8**	**0.72**	**11**	**2.9**	**3.8**	**69**	**17**	**3.2**	**73**	--
Pyrene	mg/kg-OC	1,000	1,400	**8.4**	**3.5**	**2.4**	**0.54**	**3.5**	**1.8**	**3.0**	**80**	**11**	**2.2**	**48**	--
Benzo(a)anthracene	mg/kg-OC	110	270	**1.8**	**1.2**	0.79 U	0.33 U	**1.2**	**1.6**	1.48 U	**30**	**4.0**	1.87 U	**17**	--
Chrysene	mg/kg-OC	110	460	**2.8**	**1.6**	**0.87**	**0.42**	**1.4**	**2.1**	1.48 U	**40**	**5.5**	1.87 U	**22**	--
Total Benzofluoranthenes	mg/kg-OC	230	450	**4.5**	**2.9**	**0.87**	0.33 U	**2.4**	**1.6**	1.48 U	**43**	**8.5**	1.87 U	**30**	--
Benzo(a)pyrene	mg/kg-OC	99	210	**2.0**	**1.5**	0.79 U	0.33 U	**1.2**	1.43 U	1.48 U	**26**	**3.8**	1.87 U	**15**	--
Indeno(1,2,3-cd)pyrene	mg/kg-OC	34	88	1.4 U	**0.60**	0.79 U	0.33 U	0.83 U	1.43 U	1.48 U	**5.7**	**1.1**	1.87 U	**5.7**	--
Dibenzo(a,h)anthracene	mg/kg-OC	12	33	1.4 U	0.41 U	0.79 U	0.33 U	0.83 U	1.43 U	1.48 U	**2.1**	0.50 U	1.87 U	**2.3**	--
Benzo(g,h,i)perylene	mg/kg-OC	31	78	1.4 U	**0.56**	0.79 U	0.33 U	0.83 U	1.43 U	1.48 U	**3.5**	**0.68**	1.87 U	**3.7**	--
Chlorinated Benzenes															
1,2-Dichlorobenzene	mg/kg-OC	2.3	2.3	1.4 U	0.41 U	0.79 U	0.33 U	0.83 U	1.43 U	1.48 U	1.14 U	0.50 U	1.87 U	1.74 U	--
1,3-Dichlorobenzene	mg/kg-OC	--	--	1.4 U	0.41 U	0.79 U	0.33 U	0.83 U	1.43 U	1.48 U	1.14 U	0.50 U	1.87 U	1.74 U	--
1,4-Dichlorobenzene	mg/kg-OC	3.1	9	1.4 U	0.41 U	0.79 U	0.33 U	0.83 U	1.43 U	1.48 U	1.14 U	0.50 U	1.87 U	1.74 U	--
1,2,4-Trichlorobenzene	mg/kg-OC	0.81	1.8	1.4 U	0.41 U	0.79 U	0.33 U	0.83 U	1.43 U	1.48 U	1.14 U	0.50 U	1.87 U	1.74 U	--
Hexachlorobenzene	mg/kg-OC	0.38	2.3	1.4 U	0.41 U	0.79 U	0.33 U	0.83 U	1.43 U	1.48 U	1.14 U	0.50 U	1.87 U	1.74 U	--
Phthalate Esters															
Dimethylphthalate	mg/kg-OC	53	53	1.4 U	0.41 U	0.79 U	0.33 U	0.83 U	1.43 U	1.48 U	1.14 U	0.50 U	1.87 U	1.74 U	--

Table B-1
Sediment Physical and Chemical Data Summary: 2007 Samples

Parameters	Units	SMS SQS	SMS CSL	AN-SED-01 AN-SS-01 9/27/2007	AN-SED-02 AN-SS-02 9/27/2007	AN-SED-03 AN-SS-03 9/28/2007	AN-SED-04 AN-SS-04 9/28/2007	AN-SED-05 AN-SS-05 9/27/2007	AN-SED-06 AN-SS-06 9/28/2007	AN-SED-07 AN-SS-07 9/28/2007	AN-SED-08 AN-SS-08 9/27/2007	AN-SED-09 AN-SS-09 9/27/2007	AN-SED-10 AN-SS-10 9/28/2007	AN-SED-11 AN-SS-11 9/28/2007	AN-SED-REF-01 AN-SS-REF-01 9/28/2007
Diethylphthalate	mg/kg-OC	61	110	1.4 U	0.41 U	0.79 U	**0.54**	0.83 U	1.43 U	1.48 U	1.14 U	0.50 U	1.87 U	1.74 U	--
Di-n-butylphthalate	mg/kg-OC	220	1,700	1.4 U	0.41 U	0.79 U	0.33 U	8.26 U	1.43 U	1.48 U	2.8 U	0.50 U	1.87 U	3.65 U	--
Butylbenzylphthalate	mg/kg-OC	4.9	64	1.4 U	0.41 U	0.79 U	0.33 U	0.83 U	1.43 U	1.48 U	6.28 U	0.50 U	1.87 U	3.9 U	--
bis(2-ethylhexyl)phthalate	mg/kg-OC	47	78	1.4 U	0.41 U	0.79 U	1.79 U	0.83 U	1.43 U	1.48 U	**28**	**3.8**	1.87 U	**24**	--
Di-n-octylphthalate	mg/kg-OC	58	4,500	1.4 U	0.41 U	0.79 U	0.33 U	0.83 U	1.43 U	1.48 U	1.14 U	0.50 U	1.87 U	1.74 U	--
Miscellaneous															
Dibenzofuran	mg/kg-OC	15	58	1.4 U	**0.43**	0.79 U	0.33 U	0.83 U	1.43 U	1.48 U	**4.8**	**2.2**	1.87 U	**3.2**	--
Hexachlorobutadiene	mg/kg-OC	3.9	6.2	1.4 U	0.41 U	0.79 U	0.33 U	0.83 U	1.43 U	1.48 U	1.14 U	0.50 U	1.87 U	1.74 U	--
Hexachloroethane	mg/kg-OC	--	--	1.4 U	0.41 U	0.79 U	0.33 U	0.83 U	1.43 U	1.48 U	1.14 U	0.50 U	1.87 U	1.74 U	--
n-Nitroso-di-phenylamine	mg/kg-OC	11	11	1.4 U	0.41 U	0.79 U	0.33 U	0.83 U	1.43 U	1.48 U	1.14 U	0.50 U	1.87 U	1.74 U	--
PCBs															
Total PCBs	µg/kg dry wt			**9**	**12**	4 U	**180**	4 U	**45**	**73**	**100**	**99**	**230**	**220**	
Total PCBs (SMS)	mg/kg-OC	12	65	**0.6**	**0.2**	0.2 U	**2.9**	0.2 U	**3.2**	**5.4**	**5.7**	**2.5**	**21.5**	**19.1**	--
Ionizable Organic Compounds (µg/kg dry weight)															
Phenol	µg/kg	420	1,200	**49**	**29**	**33**	**20**	**69**	**46**	20 U	**45**	**52**	**31**	**24**	--
2-Methylphenol	µg/kg	63	63	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	--
4-Methylphenol	µg/kg	670	670	**7.7**	**390**	**200**	20 U	**60**	**230**	**33**	**110**	**22**	20 U	**66**	--
2,4-Dimethylphenol	µg/kg	29	29	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	--
Pentachlorophenol	µg/kg	360	690	99 U	99 U	99 U	99 U	100 U	98 U	98 U	98 U	99 U	99 U	98 U	--
Benzyl alcohol	µg/kg	57	73	20 U	20 U	20 U	20 U	20 U	20 U	20 U	**38**	20 U	20 U	20 U	--
Benzoic acid	µg/kg	650	650	200 U	200 U	200 U	200 U	**280**	200 U	200 U	200 U	**210**	200 U	200 U	--

Notes:
2-Methylnaphthalene is not included in the calculation for total LPAH
Total Benzofluoranthenes is the sum of Benzo(b)fluoranthene and Benzo(k)fluoranthene
= Represents a value that exceeds the Sediment Management SQS
= Represents a value that exceeds the Sediment Management CSL
SMS = Sediment Management Standards
SQS = Sediment Quality Standards
CSL = Cleanup Screening Level
U = Indicates the target analyte was undetected at the reported concentration
J = Estimated concentration

Table B-2
Sediment Physical and Chemical Data Summary: 2008 Samples

Sample Station:		AN-SB-01	AN-SB-02	AN-SB-03	AN-SB-04	AN-SB-05	AN-SB-06	AN-SB-07
Sample ID:		AN-SB-01-080908	AN-SB-02-080908	AN-SB-03-080908	AN-SB-04-080908	AN-SB-05-080908	AN-SB-06-080908	AN-SB-07-080908
Sample Date:		9/8/2008	9/8/2008	9/8/2008	9/8/2008	9/8/2008	9/8/2008	9/8/2008
Depth:		0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm
Parameters	**Units**							
Conventional Parameters								
Total organic carbon	%	**0.749**	**0.402**	**3.42**	**3.04**	**2.63**	**2.13**	**3.41**
Total solids	%	**66.2**	**62.4**	**50.4**	**70.2**	**66.2**	**67.6**	**39.1**
Total volatile solids	%	**3.89**	**7.74**	**12.2**	**3.36**	**3.15**	**3.98**	**31.92**
Porewater ammonia	mg-N/mL	**10.7**	**6.26**	**8.88**	**12.4**	**14.7**	**9.1**	**6.4**
Porewater sulfide	mg/L	**3.76**	**14.8**	**33.8**	**31**	**19.2**	**19.3**	**30.2**
Grain Size (pct)								
Gravel	%	**4.4**	**5.9**	**6.8**	**14.2**	**4.9**	**3.4**	**6.7**
Sand, Very Coarse	%	**0.9**	**2.8**	**5**	**6.8**	**1.6**	**1.6**	**4.8**
Sand, Coarse	%	**1.4**	**2.2**	**3.7**	**4.1**	**2.1**	**2.4**	**11**
Sand, Medium	%	**2.3**	**2.6**	**5.1**	**11.4**	**26.1**	**25.7**	**10.2**
Sand, Fine	%	**4.8**	**12.9**	**31.9**	**41.8**	**52.3**	**47.5**	**4.9**
Sand, Very Fine	%	**45.7**	**38.4**	**11.1**	**6.8**	**6.2**	**5.8**	**18.7**
Silt, Coarse	%	**26.4**	**16.3**	**3.7**	**4.1**	**1**	**3.8**	**16.7**
Silt, Medium	%	**5.2**	**7.4**	**6.8**	**3.4**	**1.1**	**2.6**	**8.4**
Silt, Fine	%	**2.2**	**3**	**6.9**	**1.9**	**0.8**	**1.9**	**4.9**
Silt, Very Fine	%	**1.4**	**2**	**5.4**	**1.3**	**0.8**	**1.4**	**3.3**
Clay, Coarse	%	**1**	**1.4**	**3.2**	**1**	**0.6**	**0.9**	**2.1**
Clay, Medium	%	**1**	**1.5**	**3.2**	**0.9**	**0.5**	**0.8**	**2.3**
Clay, Fine	%	**3.4**	**3.7**	**7**	**2.2**	**1.9**	**2.2**	**5.9**
Fines (silt + clay)	%	**40.6**	**35.3**	**36.4**	**14.9**	**6.7**	**13.6**	**43.7**

Notes:

Bold = Detected result

Validated Data

Table B-3
Summary of 2007 and 2008 Sediment Bioassay Results

Station	Neanthes Chronic Growth Mean Individial Growth Rate (mg/ind/d)	Benthic Chronic Abundance Significant Difference from Reference	Amphipod Acute Toxicity Mean Percent Survival	Mytilus Larvae Acute Toxicity Mean Combined Mortality	Chemistry and Field Measurements					Sample Reference Match
					TVS (% dry)	Volumetric Wood Debris (%)	Percent Fines	Porewater Ammonia (mg-N/L)	Porewater Sulfide (mg/L)	
2007 Samples										
AN-SS-REF-1	N/A		85	27	--	< 5	10	6.1	--	
AN-SS-01	N/A	Low molluscs and polychaetes	66	28	17.0	38	32	8.1	26.4	SS-REF-1
AN-SS-02	N/A	< 50% Difference	90	26	7.8	34	25	7.4	34.2	SS-REF-1
AN-SS-03	N/A	< 50% Difference	74	24	3.8	75	16	9.8	22.8	SS-REF-1
AN-SS-07	N/A	< 50% Difference	75	24	2.5	5	12	13.0	38.7	SS-REF-1
AN-SS-10	N/A	< 50% Difference	80	21	2.0	5	11	13.1	44.0	SS-REF-1
AN-SS-11	N/A	< 50% Difference	75	43	9.7	34	17	2.3	30.2	SS-REF-1
2008 Samples										
CR-REF-1	0.63	N/A	100	18		< 1	53			
CR-REF-22	0.73	N/A	98	9		< 1	15			
SB-REF-35	0.58	N/A	100	28		< 1	30			
AN-SB-01	0.68	N/A	92	20	3.9	< 1	41	10.7	3.8	CR-1
AN-SB-02	0.51	N/A	98	12	7.7	20	35	6.3	14.8	SB-35
AN-SB-03	0.45	N/A	100	23	12.2	10 to 35	36	8.9	33.8	SB-35
AN-SB-04	0.50	N/A	98	11	3.4	< 10	15	12.4	31.0	CR-22
AN-SB-05	0.71	N/A	100	24	3.2	0 *	7	14.7	19.2	CR-22
AN-SB-06	0.58	N/A	97	20	4.0	12	14	9.1	19.3	CR-22
AN-SB-07	0.74	N/A	97	46	31.9	18	44	6.4	30.2	CR-1

Note:

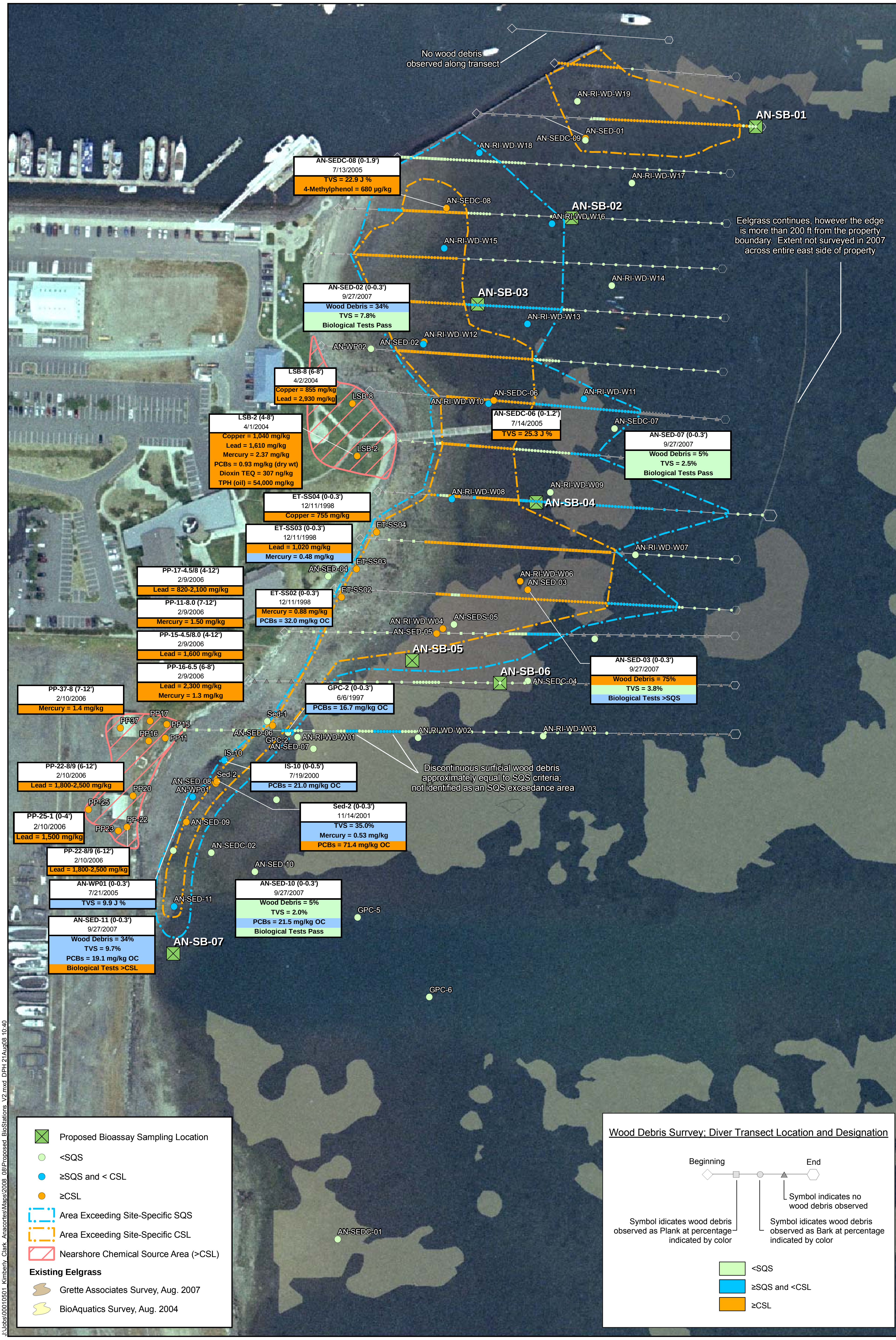
* 70% wood debris observed at depths between 0.2 and 0.7 ft below mudline

Green shading denotes that test(s) passed SQS biological criteria

Yellow shading denotes that test(s) exceeded SQS biological criteria but passed CSL biological criteria

Orange shading denotes that test(s) exceeded CSL biological criteria

FIGURES



ANCHOR ENVIRONMENTAL, L.L.C.

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Scale in Feet

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Figure B-1
Supplemental Sediment Sampling Stations
Former Scott Paper Mill Site

APPENDIX B-1

LABORATORY CHEMISTRY DATA REPORTS

APPENDIX B-2

LABORATORY BIOASSAY DATA REPORTS

BIOLOGICAL ASSESSMENT OF SCOTT MILL SITE IN ANACORTES, WASHINGTON

NOVEMBER 2008

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NEWFIELDS

1.0 Introduction

Anchor Environmental requested NewFields in Port Gamble, Washington to conduct three bioassays from a former Scott Paper Mill site operated by Kimberly-Clark in Anacortes, Washington. This was a supplemental sediment characterization to expand upon data from an assessment completed in 2007. The goal of the biological testing was to refine the SQS boundaries in areas with wood debris so that appropriate remediation efforts could be determined. This report presents the results of the biological evaluation of the sediment collected.

2.0 Methods

This section summarizes the test methods that were followed for this biological characterization. Test methods followed guidance provided by the Puget Sound Estuary Program (PSEP 1995), the WDOE Sampling and Analysis Plan Appendix (Ecology 2008), and the various updates presented during the Annual Sediment Management Review meetings (SMARM). Sediment toxicity was evaluated using three standard PSEP bioassays, the 10-day amphipod test, the 20-day juvenile polychaete growth test, and the 48-96 hour larval development test.

2.1 Site Sample and Animal Receipt

Sediment samples were collected by Anchor Environmental on September 8, 2008 and were delivered directly to the NewFields laboratory on September 10, 2008. Bioassay samples were stored under nitrogen headspace in a walk-in cold room at 4 ± 2ºC in the dark. All tests were conducted within the eight week holding time.

Amphipods (*Eohaustorius estuarius*) were supplied by Northwestern Aquatic Sciences in Newport, Oregon. Animals were held in native sediment at 15°C prior to test initiation. Polychaetes (*Neanthes arenaceodentata)* were acquired from Don Reish in Alamitos, California and held in native sediment at 20°C. *Mytilus* sp. (mussel) broodstock were provided by Carlsbad Aquafarm in Carlsbad, California. Broodstock were held in unfiltered seawater from Hood Canal at 16°C prior to spawning.

Native *Eohaustorius* sediment from Newport, Oregon was also provided by Northwestern Aquatic Sciences for use in control replicates for the amphipod and polychaete tests.

Seawater for the tests was collected from Hood Canal and was then filtered through a 0.2-µm filter and diluted with deionized water to 28 ppt for use in the bioassays.

2.2 Bioassay Reference Sample Collection

Three reference sediments for the bioassays were collected by NewFields, two from Carr Inlet, Washington on September 12, 2008 and one from Sequim Bay, Washington on September 15, 2008. Reference stations were chosen from a list of commonly used sites and selected based on grain size. Samples were collected using a Van Veen grab sampler from the upper 10 cm of the sediment surface. Multiple grabs were necessary to collect enough sediment. Sediment was wet sieved in the field to determine appropriate grain sizes. The two references from Carr Inlet were CR-1 (53% fines) and CR-22 (15% fines). The reference from Sequim Bay (SB Ref35) consisted of 35% fines. Sediment was stored in an insulated cooler in the field. Upon arrival at the NewFields laboratory, reference sediment was stored in a walk-in cold room at 4 ± 2ºC in the dark. The coordinates for the reference sites were as follows:

CR-1:	Latitude:	47º 20.04" N
	Longitude:	122º 39.88" W
CR-22:	Latitude:	47º 19.90" N
	Longitude:	122º 40.62" W
SB Ref35:	Latitude:	48º 04.13" N
	Longitude:	123º 02.24" W

2.3 Amphipod Bioassay

The 10-day acute toxicity test with *Eohaustorius estuarius* was initiated on October 3, 2008. To prepare the test exposures, approximately 175 mL of sediment was placed in clean, acid and solvent-rinsed 1-L glass jars, which were then filled with 750 mL of filtered seawater. Seven replicate chambers were prepared for each test treatment, the three reference sediments, and the native control sediment. Five of the replicates were used to evaluate sediment toxicity; the sixth and the seventh replicates were used to measure daily water quality, as well as porewater and overlying ammonia and sulfides at test initiation and termination. Total ammonia as nitrogen was monitored using an Orion meter fitted with an ammonia ion-specific probe. Total sulfides as S^{2-} were monitored using a HACH DR/4000V Spectrophotometer.

Test chambers were placed in randomly assigned positions in a 15°C water bath and allowed to equilibrate overnight. Trickle-flow aeration was provided to prevent dissolved oxygen concentrations from dropping below acceptable levels.

Immediately prior to test initiation, water quality parameters were measured in the surrogate chamber for each treatment. Dissolved oxygen (DO), temperature, salinity, and pH were then monitored in the surrogate chambers daily until test termination. Target test parameters were:

Dissolved Oxygen:	≥5.0 mg/L
Temperature:	15 ± 1°C
Salinity:	28 ± 1‰
pH:	7.8 ± 0.5 units

The test was initiated by randomly allocating 20 *E. estuarius* into each test chamber, ensuring that each of the amphipods successfully buried into the sediment. The 10-day amphipod bioassay was conducted as a static test with no feeding during the exposure period. Daily observations were made to note abnormalities on the sediment surface and animal behavior (emergence). At test termination, sediment from each test chamber was sieved through a 0.5-mm screen and all recovered amphipods transferred into a plastic cup. The number of surviving and dead amphipods was then determined. A water-only, 4-day reference-toxicant test was conducted with cadmium chloride concurrently with the sediment test. The cadmium reference-toxicant test was used to ensure animals used in the test were healthy and of similar sensitivity to those tested previously at NewFields.

2.4 Juvenile Polychaete Growth Test

The 20-day polychaete growth bioassay was initiated on September 30, 2008. Test exposures were prepared using the same method as described for the amphipod bioassay. 175 mL of sediment and 750 mL of filtered seawater were placed in each 1-L glass jar. There were seven replicates per treatment, the control, and the three references. Five of those were test replicates, and the other two were used for water quality monitoring and to measure sulfide and ammonia levels at test initiation and termination. Total ammonia as nitrogen was monitored using an Orion meter fitted with an ammonia ion-specific probe. Total sulfides as S^{2-} were monitored using a HACH DR/4000V Spectrophotometer.

Test chambers were placed in randomly assigned positions in a water bath at 20°C and allowed to equilibrate overnight. Trickle-flow aeration was provided to prevent dissolved oxygen concentrations from dropping below acceptable levels. Water quality monitoring and observations were made daily and surface abnormalities and animal emergence were noted. Target test parameters were:

Dissolved Oxygen:	≥6.0 mg/L
Temperature:	20 ± 1°C
Salinity:	28 ± 1‰
pH:	8.0 ± 1.0 units

The test was initiated by randomly allocating five *N. arenaceodentata* into each test chamber, ensuring that each of the polychaetes successfully buried into the sediment. The 20-day test was conducted as a static-renewal test, with exchanges of 300 mL of water occurring every third day. *N. arenaceodentata* were fed every other day with 40 mg of TetraMarin® (approximately 8 mg dry weight per worm). Daily observations were made to note abnormalities on the sediment surface and animal behavior.

At test termination, sediment from each test chamber was sieved through a 0.5-mm screen and all recovered polychaetes were transferred into a plastic cup. Survival was recorded and worms were placed in pre-weighed foil boats and dried in a drying oven at 60°C for approximately 24 hours. Each weigh-boat was removed, cooled in a dessicator, and then weighed on a microbalance to 0.01 mg. Individual worm weight and growth rates were calculated. A water-only, 4-day reference-toxicant test was conducted with cadmium chloride concurrently with the sediment test. The cadmium reference-toxicant test was used to ensure animals used in the test were healthy and of similar sensitivity to prior tests.

2.5 Larval Developmental Bioassay

Test sediment was evaluated using the 48-96 hour acute toxicity test with the mussel, *Mytilus* sp. The larval test was initiated on October 22, 2008.

To prepare the test exposures, 18 g (±1 g) of test sediment were placed in clean, acid and solvent-rinsed 1-L glass jars, which were then filled to 900 mL with filtered seawater. Six replicate chambers were prepared for each test treatment and the three reference sediments. The six control replicates consisted of filtered seawater with no sediment. Five of the replicates were used to evaluate the test; the sixth replicate was used as a water quality surrogate. Each chamber was shaken for 10 seconds and then placed in predetermined randomly-assigned positions in a water bath at 16°C.

To collect gametes mussels were placed in clean seawater and acclimated at 12°C for approximately 20 minutes. The water bath temperature was then increased over a period of 15 minutes to 20°C. Mussels were held at 20°C and monitored for spawning individuals. Spawning females were removed from the water bath and placed in individual containers with seawater. Spawning males were removed and placed in a separate water bath with other males. Gametes from at least two males and one female were used to initiate the test. Egg-sperm solutions were periodically homogenized with a perforated plunger during the fertilization process. Approximately one hour after fertilization, embryo solutions were checked for fertilization rate. Only those embryo stocks with >90% fertilization were used to initiate the tests. Embryo solutions were rinsed free of excess sperm and then combined to create one embryo stock solution. Density of the embryo stock solution was determined by counting the number of embryos in a subsample of homogenized stock solution. This was used to determine the volume of embryo stock solution to deliver approximately 27,000 embryos to each test chamber.

The test was initiated by randomly allocating an aliquot of the embryo stock solution into each test chamber four hours after sediments were shaken and within two hours of egg fertilization. Embryos were held in suspension during initiation using a perforated plunger. The actual stocking density was 27.4 embryos/mL, within the target stocking density of 20 - 40 embryos/mL.

Dissolved oxygen, temperature, salinity, and pH were monitored daily in water quality surrogates to prevent loss or transfer of larvae by adhesion to water-quality probes. Overlying water ammonia and sulfides were measured on Day 0 and Day 3. Total ammonia as nitrogen was monitored using an Orion meter fitted with an ammonia ion-specific probe. Total sulfides as S^{2-} were monitored using a HACH DR/4000V Spectrophotometer. Target test parameters were:

Dissolved Oxygen:	≥4.0 mg/L
Temperature:	16 ± 1°C
Salinity:	28 ± 2‰
pH:	8.0 ± 0.5 units

The 48-96 hour test was conducted as a static test without aeration. The test was terminated approximately 69 hours after initiation, when 90% of the control larvae had achieved the prodissoconch I stage. At termination, the overlying seawater was decanted into a clean 1-L jar and mixed with a perforated plunger. From this container, a 10 mL subsample was transferred to a scintillation vial and preserved in 5% buffered formalin. Larvae were subsequently stained with a dilute solution of Rose Bengal in 70% alcohol to help visualization of larvae. The number of normal and abnormal larvae was enumerated using an inverted microscope. Normal larvae included all D-shaped prodissoconch I stage larvae. Abnormal larvae included abnormally shaped prodissoconch I larvae and all early stage larvae. A 48-hour water-only reference-toxicant test with copper sulfate was conducted concurrently with the sediment test.

2.6 Data Analysis and Quality Assurance / Quality Control (QA/QC)

All water quality and endpoint data were entered into Excel spreadsheets. Water quality parameters were summarized by calculating the mean, minimum, and maximum values for each test treatment. Endpoint data were calculated for each replicate and then mean values and standard deviations were determined for each test treatment. Data were also entered into EIM format for all three bioassays and submitted electronically to Anchor Environmental.

The endpoint used for the amphipod test was survival only, while both survival and growth were analyzed for the polychaete test. For the larval test, the normalized combined mortality and abnormality endpoint was used to evaluate the test sediment. This was based on the number of normal larvae in the treatment or reference divided by the number of normal larvae in the control, as defined in Ecology (2005).

All hand-entered data were reviewed for data entry errors, which were corrected prior to summary calculations. A minimum of 10% of all calculations and data sorting were reviewed for errors. Review counts were conducted on any apparent outliers.

Data reported as percent survival or mortality were transformed using an arcsine square root transformation prior to statistical analysis. All data were tested for normality using the Wilk-Shapiro test and equality of variance using Levene's test. Determinations of statistical significance were based on one-tailed Student's t-tests with an alpha of 0.05. A comparison of the larval endpoint, relative to the reference was made using an alpha level of 0.10. For samples failing to meet assumptions of normality, a Mann-Whitney test was conducted to determine significance. For those samples failing to meet the assumptions of normality and equality of variance, a t-test on Rankits was used.

For SMS suitability determinations, comparisons were made according to SAPA and Fox et al. (1998). Treatments were compared to one of the three references. The selected references were chosen to most closely match the grain size of the treatment. A summary of the grain size data is located in Appendix E.

3.0 Results

The results of the sediment testing, including a summary of test results and water quality observations, are presented in this section. Data for each of the replicates, as well as laboratory benchsheets and statistical analyses are provided in the appendices.

3.1 Amphipod Bioassay

A summary of *E. estuarius* survival is presented in Table 1 and water quality observations are summarized in Table 2. Laboratory data sheets are included in Appendix A. Statistical results are located in Appendix D.

Mean percent survival in the controls was 98%, above the 90% acceptable limit. Mean survival in the reference treatments were also high: 100% in CR-1, 98% in CR-22, and 100% in SB Ref35. These all met the SMS (<25% mortality) performance criteria and indicated that the reference sediments were acceptable for suitability determination. Mean percentage survival in the test treatments ranged from 92-100% survival.

The LC50 for the cadmium reference-toxicant test was 9.37 mg Cd/L, which is within the control chart limits (3.48 to 11.79 mg Cd/L), indicating that the test organisms used in this study were of similar sensitivity to those previously tested at NewFields.

With the exception of minor deviations, water quality measurements were within target parameters during the test and remained within the tolerance ranges for this species. These deviations did not appear to have affected the test results as survival was above 90% in all treatments. Initial and final overlying and interstitial ammonia levels were well below the no observable effects concentrations (NOEC) for this species. Interstitial sulfide levels were elevated at test initiation in AN-SB-03 and AN-SB-07 treatments, which contained 7.3 and 10.0 mg/L respectively. Levels dropped to within acceptable parameters at test termination. These deviations did not affect test results as evidenced by the high survival rates.

3.2 Juvenile Polychaete Growth Test

A summary of *N. arenaceodentata* survival is presented in Table 3 and water quality observations are summarized in Table 4. Laboratory data sheets are included in Appendix B. Statistical results are presented in Appendix D.

Mean percent survival in the controls was 100%. Mean survival in references CR-1 and SB Ref35 were both 100%, and CR-22 had 96% survival. These were all above the SMS (<20% mortality) performance criteria indicating that the reference sediments were acceptable for suitability determination. Mean percentage survival in the test treatments ranged from 92-100% survival.

Mean individual growth weight (MIG) in the control was 0.73 mg/ind/day, above the performance criteria of 0.72 mg/ind/day. To pass performance standards a reference must be ≥ 80% of the control MIG. CR-1 was 87% (0.63 mg/ind/day), CR-22 was 100% (0.73 mg/ind/day), and SB Ref-35 was 80% (0.58 mg/ind/day). Thus all three references were acceptable to use for treatment comparisons. MIG in the test treatments ranged from 0.45 – 0.74 mg/ind/day.

The LC50 for the cadmium reference-toxicant test was 5.55 mg Cd/L, which is within the control chart limits (2.44 to 17.27 mg Cd/L), indicating that the test organisms used in this study were of similar sensitivity to those previously tested at NewFields.

DO was above the minimum limit throughout the test with the exception of one control chamber (the water quality surrogate) that was found without air and the level had dropped to 2.2 mg/L on Day 18. Aeration was restored in this chamber and DO came back up immediately. Only minor deviations were observed otherwise during the test, and measurements were within the tolerance range for this species. Initial and final overlying and interstitial ammonia levels were well below the no observable effects concentrations (NOEC) for this species. However, interstitial sulfide levels were above the 3.4 mg/L recommended concentration at test initiation in three treatments (Kendall and Barton 2004). Measurements were 8.9, 16.3, and 14.1 mg/L in AN-SB-03, AN-SB-05, and AN-SB-07 respectively (Appendix Table B4). Sulfide levels fell to below NOEC levels during the test, and measurements at termination in all treatments were less than 1 mg/L. Sulfide levels do not appear to have affected the results illustrated by high survival and lack of statistically significant differences in growth relative to references.

3.3 Larval Development Bioassay

The summary of the test results from the *Mytilus* sp. test is presented in Table 5 and a summary of water quality observations is shown in Table 6. Data sheets are included in Appendix C. Statistical results are presented in Appendix D.

The larval test was validated by 5.9% mean combined mortality in the control treatment, within the acceptability criteria of 30%. Water quality parameters remained within the target limits throughout the test with the exception of a slight drop in temperature in some treatments to as low as 14.5°C. pH also dropped on Days 2 and 3 to as low as 7.2 mg/L. DO and salinity were within acceptable ranges.

The EC50 for the copper reference-toxicant test for proportion normal was 8.6 µg Cu/L, within the control chart limits (3.3 to 19.3 µg Cu/L). The results of the reference-toxicant test indicate that the test organisms used in this study were similar in sensitivity to those previously tested at NewFields. Ammonia and sulfide values in the test chambers were below the NOEC values for *Mytilus* sp.

Mean normalized combined mortality and abnormality (NCMA) in the reference sediments were 17.8%, 8.6%, and 28.2% for CR-1, CR-22, and SB Ref-35 respectively. They all fell within the performance criteria of 65% normal development (35% abnormal) relative to the control. Mean NCMA in the test treatments ranged from 11.0% to 45.5%.

4.0 Discussion

Sediments were evaluated based on Sediment Management Standards (SMS) criteria for the three bioassays. The biological criteria were based on both statistical significance (a statistical comparison) and the degree of biological response (a numerical comparison). The SMS criteria used were from the Washington Department of Ecology Sampling and Analysis Plan Appendix (Ecology 2008). Suitability determinations were based on a comparison of responses observed in the test treatments versus those in the corresponding reference treatments. Tables 7 – 9 present the criteria results for each of the bioassays. Table 10 contains a summary of all three tests. For SMS comparisons, treatments were compared to the reference which most closely matched the grain size of sediment collected at a given station. AN-SB-01, AN-SB-02, and AN-SB-03 were compared to SB Ref35. AN-SB-04, AN-SB-05, and AN-SB-06 were compared to CR-22. AN-SB-07 was compared to CR-1 (Appendix E.1).

4.1 Amphipod Test Suitability Determination

Under the SMS program, a test treatment will fail SQS if mean mortality is statistically significantly higher than that of the reference treatment and mean mortality in the test sediment is >25%. Treatments fail CSL if the test treatment mortality is more than 30% greater than the reference sediment and a significant difference is found.

All treatments passed SQS and CSL criteria (Table 7).

4.2 Juvenile Polychaete Suitability Determination

SMS criteria states that a treatment fails SQS standards if MIG is less than 70% of the associated reference and a statistical difference exists. To pass CSL criteria the MIG of the treatment must be greater than 50% of the reference and not significantly different from the reference.

AN-SB-04 failed SQS criteria. All other treatments passed both SQS and CSL standards in this bioassay (Table 8).

4.3 Larval Test Suitability Determination

Larval test treatments fail SQS criteria if the percentage of normal larvae in the test treatment is significantly lower than that of the reference and if the normal larval development in the test treatment is less than 85% of the normal development in the reference. Treatments fail CSL criteria when a statistical difference is found between the treatment and the reference and if the control normalized development in the treatment is less than 70% of that observed in the control normalized reference.

Station AN-SB-05 failed SQS standards, while Station AN-SB-07 failed both SQS and CSL criteria. All other treatments passed the SMS criteria (Table 9).

REFERENCES

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Fox, D, DA Gustafson, and TC Shaw. 1998. Biostat Software for the Analysis of DMP/SMS. Presented at the 10th Annual Sediment Management Annual Review Meeting.

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Table 1. Summary of Test Results for the 10-day Acute Toxicity Test with *Eohaustorius estuarius.*

Treatment	Mean Percentage Survival	SD
Control	98	2.7
CR-1	100	0.0
CR-22	98	2.7
SB Ref-35	100	0.0
AN-SB-01	92	4.5
AN-SB-02	98	2.7
AN-SB-03	100	0.0
AN-SB-04	98	2.7
AN-SB-05	100	0.0
AN-SB-06	97	2.7
AN-SB-07	97	2.7

Table 2. Water Quality Summary for the 10-Day Acute Test with *Eohaustorius estuarius*.

Treatment	Dissolved Oxygen (mg/L)			Temperature (°C)			Salinity (ppt)			pH (units)		
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Control	8.2	5.7	9.4	15.2	14.5	17.3	29.5	28.0	30.0	8.0	7.8	8.2
CR-1 Ref	8.0	5.6	9.4	15.1	14.1	17.3	29.5	28.0	30.0	8.0	7.9	8.1
CR-22 Ref	8.2	5.4	10.0	15.1	13.9	17.4	29.5	28.0	30.0	8.0	7.8	8.1
SB Ref-35	8.1	5.1	9.9	15.1	14.3	17.4	29.5	28.0	30.0	8.0	7.9	8.2
AN-SB-01	8.4	7.3	9.9	15.1	14.1	17.3	29.3	28.0	30.0	8.1	7.9	8.2
AN-SB-02	8.5	7.8	9.4	15.0	13.9	17.3	29.4	28.0	30.0	8.0	7.8	8.1
AN-SB-03	8.4	7.6	10.0	15.1	14.1	17.3	29.4	28.0	30.0	8.0	7.9	8.1
AN-SB-04	8.4	7.6	9.4	15.0	14.0	17.3	29.4	28.0	30.0	8.0	7.9	8.1
AN-SB-05	8.3	7.6	9.4	15.2	14.2	17.3	29.5	28.0	31.0	8.0	7.8	8.1
AN-SB-06	8.2	7.0	9.4	15.3	14.0	17.3	29.1	28.0	30.0	7.8	7.5	8.0
AN-SB-07	7.9	3.8	9.4	15.1	14.2	17.4	29.4	28.0	30.0	7.9	7.4	8.2

Table 3. Summary Endpoint Results for the 20-day Toxicity Test with *Neanthes arenaceodentata*

Treatment	Mean Percent Survival	SD	Mean Individual Biomass (mg)	SD	Mean Individial Growth Rate (mg/ind/d)	SD
Control	100	0.0	15.22	3.7	0.733	0.2
CR-1	100	0.0	13.25	4.9	0.634	0.2
CR-22	96	8.9	15.17	4.1	0.730	0.2
SB Ref-35	100	0.0	12.23	1.4	0.584	0.1
AN-SB-01	96	8.9	14.10	5.0	0.677	0.2
AN-SB-02	100	0.0	10.80	3.5	0.512	0.2
AN-SB-03	96	8.9	9.65	2.8	0.454	0.1
AN-SB-04	100	0.0	10.63	3.2	0.503	0.2
AN-SB-05	96	8.9	14.72	4.3	0.708	0.2
AN-SB-06	92	11.0	12.12	2.3	0.578	0.1
AN-SB-07	100	0.0	15.31	2.6	0.737	0.1

Table 4. Water Quality Summary Test Results for the 20-day Chronic Toxicity Test with *Neanthes arenaceodentata*

Treatment	Dissolved Oxygen (mg/L)			Temperature (°C)			pH (units)			Salinity (ppt)		
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Control	7.1	2.2	8.8	20.1	18.8	20.9	7.9	7.6	8.1	28.4	28.0	30.0
CR-1	7.2	6.6	8.7	20.1	18.7	20.5	7.9	7.7	8.5	28.3	28.0	29.0
CR-22	7.3	6.5	8.7	20.1	18.6	20.5	7.9	7.6	8.0	28.3	28.0	30.0
SB Ref-35	7.2	6.6	8.8	20.0	18.5	20.4	7.9	7.7	8.1	28.4	28.0	30.0
AN-SB-01	7.3	6.5	8.7	20.2	18.8	20.5	8.1	7.7	8.4	28.6	28.0	30.0
AN-SB-02	7.2	6.7	8.7	20.2	18.9	20.6	8.1	7.8	8.3	28.3	28.0	29.0
AN-SB-03	7.0	6.4	8.5	20.2	18.6	20.5	8.0	7.7	8.2	28.4	28.0	30.0
AN-SB-04	7.3	6.3	9.0	20.1	18.6	20.6	8.2	7.8	8.4	28.5	28.0	29.0
AN-SB-05	7.3	6.4	8.8	19.9	18.5	20.4	7.9	7.5	8.1	28.5	28.0	30.0
AN-SB-06	7.3	6.7	8.8	20.2	18.8	20.4	8.0	7.6	8.2	28.4	28.0	29.0
AN-SB-07	7.2	6.0	8.8	20.2	18.8	20.5	8.0	7.6	8.2	28.5	28.0	29.0

Table 5. Summary of Test Results for the PSEP Larval Test with *Mytilus sp*.

Treatment	Mean Normal	Mean Percentage Combined Mortality	SD	Mean Percentage Mortality	SD	Mean Percentage Abnormal	SD
Control	233.4	5.9	3.7	2.7	2.2	3.9	0.5
CR-1	191.8	17.8	8.0	15.8	8.1	2.4	0.7
CR-22	214.2	8.6	7.5	7.2	7.6	1.6	1.0
SB Ref-35	167.6	28.2	3.9	25.2	3.8	4.0	0.9
AN-SB-01	187.0	19.9	5.3	13.2	4.0	7.8	2.5
AN-SB-02	205.2	12.1	6.7	9.5	6.8	2.8	0.7
AN-SB-03	179.0	23.3	7.6	19.3	7.9	5.0	1.8
AN-SB-04	207.8	11.0	4.9	8.9	4.8	2.3	0.9
AN-SB-05	176.6	24.3	3.5	15.4	4.8	10.5	1.3
AN-SB-06	186.2	20.2	6.6	13.5	7.5	7.8	2.3
AN-SB-07	127.2	45.5	5.2	20.1	4.8	31.6	8.4

Table 6. Water Quality Summary for the 48-96h Acute Test with *Mytilus* sp.

Treatment	Dissolved Oxygen (mg/L)			Temperature (°C)			Salinity (ppt)			pH (units)		
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Control	8.7	7.0	10.5	15.4	14.7	16.6	27.5	27.0	28.0	7.7	7.6	7.8
CR-1 Ref	6.9	5.8	7.6	15.6	15.0	16.8	28.0	28.0	28.0	7.5	7.3	7.7
CR-22 Ref	8.6	7.5	10.1	15.5	14.9	16.6	28.0	28.0	28.0	7.7	7.5	7.8
SB Ref-35	6.8	5.8	7.7	15.3	14.5	16.1	27.8	27.0	28.0	7.6	7.4	7.7
AN-SB-01	7.7	6.4	8.9	15.4	14.8	16.1	27.8	27.0	28.0	7.6	7.5	7.7
AN-SB-02	7.0	5.6	7.6	15.1	14.6	16.1	27.8	27.0	28.0	7.6	7.4	7.7
AN-SB-03	5.6	0.0	7.8	11.3	0.0	15.4	21.0	0.0	28.0	5.7	0.0	7.7
AN-SB-04	6.5	5.5	7.1	15.5	14.8	16.3	28.0	28.0	28.0	7.6	7.4	7.7
AN-SB-05	6.0	0.0	8.6	11.4	0.0	15.6	20.8	0.0	28.0	5.6	0.0	7.6
AN-SB-06	6.8	5.9	7.1	15.5	14.7	16.8	27.5	27.0	28.0	7.6	7.3	7.7
AN-SB-07	6.6	5.7	7.3	15.5	14.8	16.7	28.0	28.0	28.0	7.5	7.2	7.6

Table 7. Performance Summary Results for the 10-Day Amphipod Test with *Eohaustorius estuarius.*

Treatment	Mean survival (%)	Statistically Less than Reference	M_T-M_R	Pass / Fail SQS?	Pass / Fail CSL?
Control	98	NA	NA	NA	NA
CR-1 Ref	100	NA	NA	NA	NA
CR-22 Ref	98	NA	NA	NA	NA
SB Ref-35	100	NA	NA	NA	NA
AN-SB-01	92	Yes	8%	Pass	Pass
AN-SB-02	98	No	2%	Pass	Pass
AN-SB-03	100	No	0%	Pass	Pass
AN-SB-04	98	No	0%	Pass	Pass
AN-SB-05	100	No	0%	Pass	Pass
AN-SB-06	97	No	1%	Pass	Pass
AN-SB-07	97	Yes	3%	Pass	Pass

SQS: Statistical Significance; M_T-M_R >25%

CSL: Statistical Significance; M_T-M_R >30%

Table 8. Performance Summary Results for the 20-Day Juvenile Polychaete Growth Test with *Neanthes arenaceodentata*.

Treatment	Survival (%)	Mean Individual Growth Rate (mg/ind/day)	Statistically Less than Associated Reference	MIG_T/MIG_R	Fails SQS?	Fails CSL?
Control	100	0.733	NA	NA	NA	NA
CR-1	100	0.634	NA	NA	NA	NA
CR-22	96	0.730	NA	NA	NA	NA
SB Ref35	100	0.584	NA	NA	NA	NA
AN-SB-01	96	0.677	No	1.16	Pass	Pass
AN-SB-02	100	0.512	No	0.88	Pass	Pass
AN-SB-03	96	0.454	Yes	0.78	Pass	Pass
AN-SB-04	100	0.503	Yes	0.69	Fail	Pass
AN-SB-05	96	0.708	No	0.97	Pass	Pass
AN-SB-06	92	0.578	No	0.91	Pass	Pass
AN-SB-07	100	0.737	No	1.16	Pass	Pass

SQS: Statistical Significance; $MIG_T < 0.7*MIG_R$

CSL: Statistical Significance; $MIG_T < 0.5*MIG_R$

Table 9. Performance Summary Results of the 48-96 Hour Larval Development Test with *Mytilus* sp.

Treatment	Normal Survival	Statistically Less than Associated Reference	$(N_T/N_C)/(N_R/N_C)$	Pass / Fail SQS?	Pass / Fail CSL?
Control	94.1	NA	NA	NA	NA
CR-1 Ref	82.2	NA	NA	NA	NA
CR-22 Ref	91.4	NA	NA	NA	NA
SB Ref-35	71.8	NA	NA	NA	NA
AN-SB-01	80.1	No	1.12	Pass	Pass
AN-SB-02	87.9	No	1.22	Pass	Pass
AN-SB-03	76.9	No	1.07	Pass	Pass
AN-SB-04	89.0	No	0.97	Pass	Pass
AN-SB-05	75.7	Yes	0.83	Fail	Pass
AN-SB-06	79.8	Yes	0.87	Pass	Pass
AN-SB-07	54.5	Yes	0.66	Fail	Fail

SQS: Statistical Significance and $N_{CT}<0.85*N_{CR}$

CSL: Statistical Significance and $N_{CT}<0.70*N_{CR}$

Table 10. Summary of SMS Suitability Criteria for the PSEP Bioassays

Treatment	Amphipod		Polychaete		Larval	
	Pass SQS?	Pass CSL?	Pass SQS?	Pass CSL?	Pass SQS?	Pass CSL?
AN-SB-01	Pass	Pass	Pass	Pass	Pass	Pass
AN-SB-02	Pass	Pass	Pass	Pass	Pass	Pass
AN-SB-03	Pass	Pass	Pass	Pass	Pass	Pass
AN-SB-04	Pass	Pass	Fail	Pass	Pass	Pass
AN-SB-05	Pass	Pass	Pass	Pass	Fail	Pass
AN-SB-06	Pass	Pass	Pass	Pass	Pass	Pass
AN-SB-07	Pass	Pass	Pass	Pass	Fail	Fail

BIOLOGICAL ASSESSMENT OF SEDIMENT FROM KIMBERLY- CLARK PAPER MILL, ANACORTES, WASHINGTON

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1.0 Introduction

Anchor Environmental requested NewFields Northwest LLC, in Port Gamble, Washington to evaluate sediment from a paper mill site operated by Kimberly-Clark in Anacortes, Washington. Wood waste is a concern at the mill, and sampling was conducted to assess whether cleanup action needs to be taken at this site with respect to Sediment Management Standards (SMS) criteria. This report presents the results of the biological evaluation of the sediment collected.

2.0 Methods

This section summarizes the test methods that were followed for this biological characterization. Test methods followed guidance provided by the Puget Sound Estuary Program (PSEP 1995), the WDOE Sampling and Analysis Plan Appendix (SAPA), and the various updates presented during the Annual Sediment Management Review meetings (SMARM). Sediment toxicity was evaluated using two standard PSEP bioassays, the 10-day amphipod test and the 48-96 hour larval development test, as well as a benthic community analysis.

2.1 Site Sample and Animal Receipt

Bioassay and benthic samples were collected by Anchor Environmental on September 28, 2007 and were delivered directly to the NewFields laboratory on September 29, 2007. Bioassay samples were stored in a walk-in cold room at 4 ± 2ºC in the dark, and both tests were conducted within the eight week holding time.

Benthic community samples were received preserved in buffered 10% formalin in seawater. Benthic samples were transferred to 70% ethanol in seawater on October 8, 2007 and delivered to Dr. Sandy Lipovski in BC, Canada for enumeration and identification to the lowest possible taxonomic level.

Amphipods (*Ampelisca abdita*) were supplied by Brezina & Associates in Dillon Beach, California. Animals were held in native sediment at 20°C prior to test initiation. *Mytilus galloprovincialis* (mussel) broodstock were provided by two different suppliers, Taylor Shellfish Farms in Quilcene, Washington and Marine Research & Educational Products in Carlsbad, California. Broodstock were held in unfiltered seawater at 15°C from Hood Canal prior to spawning.

Native *Ampelisca* sediment from Dillon Beach, California was also provided by Brezina & Associates for use in control replicates for the amphipod test.

Seawater from Hood Canal was filtered through a 0.45-µm filter and diluted with deionized water to 28 ppt for use in the bioassays.

2.2 Bioassay Reference Sample Collection

Reference sediment for the bioassays was collected from Sequim Bay by NewFields on October 4, 2007. Samples were collected using a Van Veen grab sampler from the upper 10 cm of the sediment surface. Multiple grabs were necessary to collect enough sediment.

Sediment was stored in an insulated cooler in the field. Upon arrival at the NewFields laboratory, reference sediment was stored in a walk-in cold room at 4 ± 2ºC in the dark.

2.3 10-day Amphipod Bioassay

The 10-day acute toxicity test with *Ampelisca abdita* was initiated on November 6, 2007. To prepare the test exposures, approximately 175 mL of sediment were placed in clean, acid and solvent-rinsed 1-L glass jars, which were then filled with 750 mL of filtered seawater. Seven replicate chambers were prepared for each test treatment, the Sequim Bay reference sediment, and the native control sediment. Five of the replicates were used to evaluate sediment toxicity; the sixth and the seventh replicates were used to measure daily water quality, as well as porewater and overlying ammonia and sulfides at test initiation and termination. Total ammonia as nitrogen was monitored using an Orion meter fitted with an ammonia ion-specific probe. Total sulfides as S^{2-} were monitored using a HACH DR/4000V Spectrophotometer.

Test chambers were placed in randomly assigned positions in a 20°C water bath and allowed to equilibrate overnight. Trickle-flow aeration was provided to prevent dissolved oxygen concentrations from dropping below acceptable levels.

Immediately prior to test initiation, water quality parameters were measured in the surrogate chamber for each treatment. Dissolved oxygen (DO), temperature, pH, and salinity were then monitored in the surrogate chambers daily until test termination. Target test parameters were:

Dissolved Oxygen:	≥4.6 mg/L
pH:	8.0 ± 1.0 units
Temperature:	20 ± 1°C
Salinity:	28 ± 1‰

The test was initiated by randomly allocating 20 *A. abdita* into each test chamber, ensuring that each of the amphipods successfully buried into the sediment. The 10-day amphipod bioassay was conducted as a static test with no feeding during the exposure period. At test termination, sediment from each test chamber was sieved through a 0.5-mm screen and all recovered amphipods transferred into a Petri dish. The number of surviving and dead amphipods was then determined under a dissecting microscope. A water-only, 4–day reference-toxicant test was conducted concurrently with the sediment test with cadmium chloride. The cadmium reference-toxicant test was used to ensure animals used in the test were healthy and of similar sensitivity to prior tests.

2.4 Larval Developmental Bioassay

Test sediment was evaluated using the 48-96 hour acute toxicity test with the mussel, *Mytilus galloprovincialis*. The larval test was initiated on November 14, 2007.

To prepare the test exposures, 18 g (±1 g) of test sediment was placed in clean, acid and solvent-rinsed 1-L glass jars, which were then filled to 900 mL with filtered seawater. Six replicate chambers were prepared for each test treatment and the Sequim Bay reference sediment. The six control replicates consisted of filtered seawater. Five of the replicates were used to evaluate the test; the sixth replicate was used as a water quality surrogate. Each chamber was shaken for 10 seconds and then placed in predetermined randomly-assigned positions in a water bath at 16°C.

To collect gametes for each test, mussels were placed in clean seawater and acclimated at 12°C for approximately 20 minutes. The water bath temperature was then increased over a period of 15 minutes to 20°C. Mussels were held at 20°C and monitored for spawning individuals. Spawning females were removed from the water bath and placed in individual containers with seawater. Spawning males were removed and placed in a separate water bath with other males. Gametes from at least two males and one female were used to initiate the test. Egg-sperm solutions were periodically homogenized with a perforated plunger during the fertilization process. Approximately one hour after fertilization, embryo solutions were checked for fertilization rate. Only those embryo stocks with >90% fertilization were used to initiate the tests. Embryo solutions were rinsed free of excess sperm and then combined to create one embryo stock solution. Density of the embryo stock solution was determined by counting the number of embryos in a subsample of homogenized stock solution. This was used to determine the volume of embryo stock solution to deliver approximately 27,000 embryos to each test chamber.

The test was initiated by randomly allocating an aliquot of the embryo stock solution into each test chamber four hours after sediments were shaken and within two hours of egg fertilization. Embryos were held in suspension during initiation using a perforated plunger. The actual stocking density was 22.5 embryos/mL, within the target stocking density of 20 - 40 embryos/mL.

Dissolved oxygen, temperature, pH, and salinity were monitored daily in water quality surrogates to prevent loss or transfer of larvae by adhesion to water-quality probes. Overlying water ammonia and sulfides were measured on Day 0 and Day 2. Total ammonia as nitrogen was monitored using an Orion meter fitted with an ammonia ion-specific probe. Total sulfides as S^{2-} were monitored using a HACH DR/4000V Spectrophotometer. Target test parameters were:

Dissolved Oxygen:	≥4.0 mg/L
pH:	8.0 ± 0.5 units
Temperature:	16 ± 1°C
Salinity:	28 ± 2‰

The 48-96 hour test was conducted as a static test without aeration. The test was terminated approximately 48 hours after initiation, when 90% of the control larvae had achieved the prodissoconch I stage. At termination, the overlying seawater was decanted into a clean 1-L jar and mixed with a perforated plunger. From this container, a 10 mL subsample was transferred to a scintillation vial and preserved in 5% buffered formalin. Larvae were subsequently stained with a dilute solution of Rose Bengal in 70% alcohol to help visualization of larvae. The number of normal and abnormal larvae was enumerated on an inverted microscope. Normal larvae included all D-shaped prodissoconch I stage larvae. Abnormal larvae included abnormally shaped prodissoconch I larvae and all early stage larvae. A 48-hour water-only reference-toxicant test with copper sulfate was conducted concurrently with the sediment test.

2.5 Benthic Community Analysis

There were five replicates for each station, including the reference, and each sample was sieved through standard nested 3 mm and 0.5 mm sieves to separate the larger bark/pebble fraction from the finer fraction. The material retained on the 3 mm sieve was rinsed into a sorting tray and examined under a 10X magnifying light. The samples were then viewed under a dissecting microscope to confirm that all invertebrates were removed. The fraction from the 0.5mm standard sieve was sorted under a dissecting microscope.

Animals from each station were sorted into glass vials by taxonomic groups including polychaetes, oligochaetes, mollusks, crustaceans, echinoderms, nematodes, and a miscellaneous group. After sorting was complete, all animals were identified to the lowest possible taxonomic level by a regional expert.

2.6 Data Analysis and Quality Assurance / Quality Control (QA/QC)

All water quality and endpoint data were entered into Excel spreadsheets. Water quality parameters were summarized by calculating the mean, minimum, and maximum values for each test treatment. Endpoint data were calculated for each replicate and then mean values and standard deviations were determined for each test treatment.

All hand-entered data was reviewed for data entry errors, which were corrected prior to summary calculations. A minimum of 10% of all calculations and data sorting were reviewed for errors. Review counts were conducted on any apparent outliers.

For the larval test, the normalized combined mortality and abnormality endpoint was used to evaluate the test sediment. This was based on the number of normal larvae in the treatment or reference divided by the number of normal larvae in the control, as defined in Ecology (2005).

For SMS suitability determinations, comparisons were made according to SAPA and Fox et al. (1998). All data were tested for normality using the Wilk-Shapiro test and equality of variance using Levene's test. Determinations of statistical significance were based on one-tailed Student's t-tests with an alpha of 0.05. A comparison of the larval endpoint, relative to the reference was made using an alpha level of 0.10. For samples failing to meet assumptions of normality, a Mann-Whitney test was conducted to determine significance. For those samples failing to meet the assumptions of normality and equality of variance, a t-test on rankits was used.

For the benthic enumerations, at least 20 percent of the sorted residue was resorted for QA. Samples that did not pass a 95% QA criteria were resorted and inspected in a second QA. Representative substrate aliquots of each sorted sample were archived into 100 ml containers.

3.0 Results

The results of the sediment testing and the benthic community analysis, including a summary of test results and water quality observations, are presented in this section. Data for each of the replicates, as well as laboratory benchsheets are provided in the appendices.

3.1 10-day Amphipod Bioassay

A summary of *A. abdita* survival is presented in Table 1 and water quality observations are summarized in Table 2. Statistical results and laboratory data sheets are included in Appendix A.

Mean percent survival in the controls was 96%, above the 90% acceptable limit. Mean survival in the reference treatments was 85%, which met the SMS (<25% mortality) performance criteria and indicated that the reference sediment was acceptable for suitability determination. Mean percentage survival in the test treatments ranged from 66-90% survival.

The LC50 for the cadmium reference-toxicant test was 0.24 mg Cd/L, which is within the control chart limits (0.18 to 0.61 mg Cd/L), indicating that the test organisms used in this study were of similar sensitivity to those previously tested at NewFields.

Dissolved oxygen, temperature, and pH remained within acceptable limits throughout the test. Salinity was slightly higher (1-2 ppt) than the target limits in all treatments, controls, and references; however, it was within the tolerance range for this species. Initial and final interstitial ammonia and sulfide levels were well below the no observable effects concentrations (NOEC) for this species.

3.2 Larval Development Bioassay

The summary of the test results from the *Mytilus galloprovincialis* test is presented in Table 3 and a summary of water quality observations is shown in Table 4. Statistical results and data sheets are included in Appendix B.

The larval test was validated by 26.6% mean combined mortality in the control treatment, within the acceptability criteria of 30%. Water quality parameters remained within the target limits throughout the 48-hour test with the exception of a drop in pH on the day of initiation to 7.2. The low mortality rates suggest that this drop did not have an adverse effect on the test.

The EC50 for the copper reference-toxicant test for proportion normal was 3.9 µg Cu/L, within the control chart limits (2.6 to 14.9 µg Cu/L). The results of the reference-toxicant test indicate that the test organisms used in this study were similar in sensitivity to those previously tested at NewFields. Ammonia and sulfide values detected in the test chambers were below the NOEC values for *M. galloprovincialis*.

Mean normalized combined mortality and abnormality (NCMA) in the reference sediment was 25.9%, within the performance criteria of 65% normal development (35% abnormal), relative to the control. Mean NCMA in the test treatments ranged from 4.3% to 34.8%.

3.3 Benthic Community Analysis

The benthic enumeration is summarized in Table 5. A complete list of species present at each station is included in Appendix C. The reference samples contained little sand, and debris consisted mainly of empty polychaete tubes, including Chaetopteridae. The reference site was dominated by mollusks and annelids, comprising 43.6% and 39.6% of the total individuals, respectively.

Wood debris was present in all of the treatments, and nematodes dominated all of the stations with the exception of SS-10. At SS-01 and SS-02 nematodes comprised 50.3% and 60.9% of the total population, respectively. Stations SS-03, SS-07, and SS-11 were dominated by nematodes and annelid worms in approximately equal percentages. SS-10 was the only station primarily dominated by annelid worms, including both polychaetes and oligochaetes, which made up 52.6% of the population.

4.0 Discussion

Sediments were evaluated based on Sediment Management Standards (SMS) criteria for the two bioassays and the benthic enumeration. The biological criteria were based on both statistical significance (a statistical comparison) and the degree of biological response (a numerical comparison). The SMS criteria were derived from the Washington Department of Ecology Sampling and Analysis Plan Appendix (WDOE 2003). Suitability determinations were based on a comparison of responses observed in the test treatments versus those in the reference treatments. Tables 6 – 8 present the criteria results for each of the bioassays and the benthic enumeration. Table 9 contains a summary of all three analyses.

4.1 Amphipod Test Suitability Determination

Under the SMS program, a test treatment will fail SQS if mean mortality is statistically significantly higher than that of the reference treatment; and mean mortality in the test sediment is >25%. Treatments fail the CSL if the test treatment mortality is more than 30% greater than the reference sediment.

Relative to the Sequim Bay reference, mortality at stations SS-01 and SS-03 were statistically significant. Survival in SS-01 and SS-03 treatments failed to meet SQS, but all treatments passed CSL criteria (Table 6).

4.2 Larval Test Suitability Determination

Larval test treatments fail SQS criteria if the percentage of abnormal larvae in the test treatment is significantly higher than that of the reference and if the normal larval development in the test treatment is at least 85% of the normal development in the reference. Treatments fail CSL criteria if the normal development is less than 70% of the response observed in the reference.

Station SS-11 was significantly different from the reference and failed the numeric thresholds for both SQS and CSL criteria. However, no significant differences were observed in development in the other treatments relative to the Sequim Bay reference (Table 7).

4.3 Benthic Community Suitability Determination

Benthic samples fail SQS criteria if the treatment has less than 50% of the reference station mean abundance for any of the three major taxonomic groups (polychaetes, mollusks, or crustaceans) and if the abundance for any of the three major taxa in a treatment is statistically different from the reference station abundances.

Table 8 presents a summary of the SQS determination for the benthic community analysis. All stations were statistically different than the SS-Ref samples in at least one of the taxonomic comparison groups. With the exception of SS-10, all stations failed the numerical comparison criteria in mollusk abundance, and stations SS-01, SS-03, and SS-07 also failed in polychaete abundance in relation to the reference.

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Table 1. Survival Results for the 10-day Acute Toxicity Test with *Ampelisca abdita.*

Treatment	Replicate	Number Initiated	Number Surviving	Number Missing or Dead	Percentage Survival	Mean Percentage Survival	SD
Control	1	20	19	1	95		
	2	20	19	1	95		
	3	20	20	0	100		
	4	20	18	2	90		
	5	20	20	0	100	96.0	4.2
Sequim Bay Reference	1	20	17	3	85		
	2	20	16	4	80		
	3	20	17	3	85		
	4	20	18	2	90		
	5	20	17	3	85	85.0	3.5
SS-01	1	20	17	3	85		
	2	20	8	12	40		
	3	20	17	3	85		
	4	20	14	6	70		
	5	20	10	10	50	66.0	20.4
SS-02	1	20	20	0	100		
	2	20	17	3	85		
	3	20	18	2	90		
	4	20	17	3	85		
	5	20	18	2	90	90.0	6.1
SS-03	1	20	16	4	80		
	2	20	15	5	75		
	3	20	16	4	80		
	4	20	10	10	50		
	5	20	17	3	85	74.0	13.9
SS-07	1	20	14	6	70		
	2	20	12	8	60		
	3	20	17	3	85		
	4	20	14	6	70		
	5	20	18	2	90	75.0	12.2
SS-10	1	20	20	0	100		
	2	20	13	7	65		
	3	20	16	4	80		
	4	20	16	4	80		
	5	20	15	5	75	80.0	12.7
SS-11	1	20	15	5	75		
	2	20	10	10	50		
	3	20	16	4	80		
	4	20	16	4	80		
	5	20	18	2	90	75.0	15.0

Table 2. Water Quality Summary for the 10-Day Acute Test with *Ampelisca abdita*.

Treatment	Dissolved Oxygen (mg/L)			Temperature (°C)			pH (units)			Salinity (ppt)		
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Control	7.7	7.4	7.9	19.6	18.8	20.4	8.0	7.7	8.2	30.0	29.0	31.0
Sequim Bay Reference	7.7	7.5	7.9	19.7	19.1	20.4	8.0	7.9	8.1	30.1	29.0	31.0
SS-01	7.7	7.5	7.9	19.7	19.2	20.5	8.2	8.0	8.4	30.1	29.0	31.0
SS-02	7.7	7.5	7.9	19.7	19.2	20.4	8.2	8.0	8.4	29.9	29.0	31.0
SS-03	7.6	7.4	7.8	19.4	18.5	20.4	8.1	7.8	8.3	29.7	29.0	31.0
SS-07	7.6	7.4	7.9	19.6	19.2	20.4	8.1	7.9	8.4	29.7	29.0	31.0
SS-10	7.7	7.5	7.9	19.7	19.2	20.5	8.2	7.9	8.4	29.7	29.0	31.0
SS-11	7.7	7.5	7.9	19.8	19.3	20.5	8.1	7.9	8.2	29.9	29.0	31.0

Table 3. Test Results for the PSEP Larval Test with *Mytilus galloprovincialis*

Treatment	Replicate	Normal	Abnormal	Total	Percent Combined Mortality	Percent Mortality	Percent Abnormal	Mean Percentage Combined Mortality	SD	Mean Percentage Mortality	SD	Mean Percentage Abnormal	SD
Control	1	221	13	234	23.5	19.0	5.6						
	2	190	14	204	34.2	29.4	6.9						
	3	212	17	229	26.6	20.7	7.4						
	4	215	14	229	25.6	20.7	6.1						
	5	222	15	237	23.1	17.9	6.3	26.6	4.5	21.5	4.5	6.5	0.7
	Mean	**212.0**											
Sequim Bay Reference	1	158	3	161	25.5	24.1	1.9						
	2	168	5	173	20.8	18.4	2.9						
	3	130	6	136	38.7	35.8	4.4						
	4	96	3	99	54.7	53.3	3.0						
	5	189	4	193	10.8	9.0	2.1	30.1	17.0	28.1	17.1	2.9	1.0
	Mean	**148.2**											
SS-01	1	153	2	155	27.8	26.9	1.3						
	2	115	2	117	45.8	44.8	1.7						
	3	162	1	163	23.6	23.1	0.6						
	4	150	2	152	29.2	28.3	1.3						
	5	143	1	144	32.5	32.1	0.7	31.8	8.4	31.0	8.3	1.1	0.5
	Mean	**144.6**											
SS-02	1	167	5	172	21.2	18.9	2.9						
	2	80	0	80	62.3	62.3	0.0						
	3	169	4	173	20.3	18.4	2.3						
	4	162	3	165	23.6	22.2	1.8						
	5	200	6	206	5.7	2.8	2.9	26.6	21.1	24.9	22.2	2.0	1.2
	Mean	**155.6**											
SS-03	1	148	0	148	30.2	30.2	0.0						
	2	188	1	189	11.3	10.8	0.5						
	3	169	2	171	20.3	19.3	1.2						
	4	144	4	148	32.1	30.2	2.7						
	5	190	3	193	10.4	9.0	1.6	20.8	10.2	19.9	10.2	1.2	1.0
	Mean	**167.8**											

Table 3. Test Results for the PSEP Larval Test with *Mytilus galloprovincialis*

Treatment	Replicate	Normal	Abnormal	Total	Percent Combined Mortality	Percent Mortality	Percent Abnormal	Mean Percentage Combined Mortality	SD	Mean Percentage Mortality	SD	Mean Percentage Abnormal	SD
	1	154	2	156	27.4	26.4	1.3						
	2	165	3	168	22.2	20.8	1.8						
SS-07	3	173	2	175	18.4	17.5	1.1						
	4	146	2	148	31.1	30.2	1.4						
	5	218	3	221	**0.0**	**0.0**	1.4	19.8	12.1	19.0	11.7	1.4	0.2
	Mean	**171.2**											
	1	164	3	167	22.6	21.2	1.8						
	2	216	3	219	**0.0**	**0.0**	1.4						
SS-10	3	180	2	182	15.1	14.2	1.1						
	4	197	3	200	7.1	5.7	1.5						
	5	210	21	231	0.9	**0.0**	9.1	9.2	9.7	8.2	9.3	3.0	3.4
	Mean	**193.4**											
	1	122	51	173	42.5	18.4	29.5						
	2	77	56	133	63.7	37.3	42.1						
SS-11	3	103	71	174	51.4	17.9	40.8						
	4	87	3	90	59.0	57.5	3.3						
	5	78	9	87	63.2	59.0	10.3	55.9	9.0	38.0	20.1	25.2	17.7
	Mean	**93.4**											

Stocking Density = 22.5 embryos/mL

Table 4. Water Quality Summary for the 48-h Acute Test with *Mytilus galloprovincialis*

Treatment	Dissolved Oxygen (mg/L)			Temperature (°C)			pH (units)			Salinity (ppt)		
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Control	7.1	6.9	7.3	15.8	15.2	16.2	7.4	7.2	7.6	28.7	28.0	29.0
Sequim Bay Reference	6.4	6.2	6.7	15.4	15.2	15.9	7.5	7.3	7.6	29.0	29.0	29.0
SS-01	5.5	5.3	5.6	15.6	15.4	15.8	7.4	7.3	7.4	29.0	29.0	29.0
SS-02	5.7	5.5	5.8	15.2	15.1	15.3	7.4	7.2	7.5	29.0	29.0	29.0
SS-03	5.6	5.3	5.8	15.4	15.2	15.5	7.4	7.3	7.5	29.0	29.0	29.0
SS-07	5.5	5.2	5.8	15.2	15.1	15.2	7.5	7.3	7.6	29.0	29.0	29.0
SS-10	5.6	5.3	5.9	15.2	15.1	15.3	7.4	7.2	7.6	29.0	29.0	29.0
SS-11	5.6	5.4	5.8	15.3	15.3	15.4	7.3	7.2	7.4	29.0	29.0	29.0

Table 5. Benthic Community Summary by Major Taxa

Station	Taxonomic Group	Total Animals per Taxa	Total Animals	Abundance by Station (# Animals/m^2)	Abundance by Taxa (# Animals/m^2)	% of Total Abundance
SS-REF	Arthropods	11			110	1.9
SS-REF	Miscellaneous	86			860	14.9
SS-REF	Mollusks	251			2510	43.6
SS-REF	Annelids	228	576	5760	2280	39.6
SS-01	Arthropods	43			430	25.7
SS-01	Mollusks	17			170	10.2
SS-01	Miscellaneous	85			850	50.9
SS-01	Annelids	22	167	1670	220	13.2
SS-02	Arthropods	96			960	12.3
SS-02	Mollusks	31			310	4.0
SS-02	Miscellaneous	476			4760	60.9
SS-02	Annelids	179	782	7820	1790	22.9
SS-03	Arthropods	116			1160	19.5
SS-03	Mollusks	39			390	6.5
SS-03	Miscellaneous	254			2540	42.6
SS-03	Annelids	187	596	5960	1870	31.4
SS-07	Arthropods	11			110	3.4
SS-07	Mollusks	73			730	22.3
SS-07	Miscellaneous	135			1350	41.3
SS-07	Annelids	108	327	3270	1080	33.0
SS-10	Arthropods	132			1320	8.4
SS-10	Mollusks	133			1330	8.5
SS-10	Miscellaneous	477			4770	30.4
SS-10	Annelids	825	1567	15670	8250	52.6
SS-11	Arthropods	8			80	2.4
SS-11	Mollusks	51			510	15.0
SS-11	Miscellaneous	153			1530	45.0
SS-11	Annelids	128	340	3400	1280	37.6

Table 6. SMS Suitability Criteria for *Ampelisca abdita* Bioassay

Treatment	Statistically Less than Sequim Bay Reference?	Mortality (%)	Pass SQS?	$Mortality_{Treatment}$ - $Mortality_{Reference}$ (%)	Pass CSL?
Control	—	4	—	—	—
Sequim Bay Reference	—	15	—	—	—
SS-01	Yes	34	Fail	19	Pass
SS-02	No	10	Pass	-5	Pass
SS-03	Yes	26	Fail	11	Pass
SS-07	No	25	Pass	10	Pass
SS-10	No	20	Pass	5	Pass
SS-11	No	25	Pass	10	Pass

SQS: Mortality > 25%

CSL: $Mortality_{Treatment}$ - $Mortality_{Reference}$ > 30%

Table 7. SMS Suitability Criteria for *Mytilus galloprovincialis* Bioassay

Treatment	Mean NCMA (%)	Statistically Less than Sequim Bay Reference?	$NCMA_{Treatment}$ / $NCMA_{Reference}$ (%)	Pass SQS?	Pass CSL?
Control	26.6	—	—	—	—
Sequim Bay Reference	30.1	—	—	—	—
SS-01	31.8	No	97.6	Pass	Pass
SS-02	26.6	No	105.0	Pass	Pass
SS-03	20.8	No	113.3	Pass	Pass
SS-07	19.8	No	115.6	Pass	Pass
SS-10	9.2	No	130.5	Pass	Pass
SS-11	55.9	Yes	62.9	Fail	Fail

SQS: $NCMA_{Treatment}$ / $NCMA_{Reference}$ < 85%

CSL: $NCMA_{Treatment}$ / $NCMA_{Reference}$ < 70%

Table 8. SQS Suitability Criteria for Benthic Community Analysis

Station	Class / Phylum	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Mean	Statistically Different from Reference?	Mean $Abundance_{Treatment}$ (#Animals/m^2)	Allowed 50% of Mean $Abundance_{Reference}$ (#Animals/m^2)	Pass SQS?
SS-REF	Crustacea	1	2	3	4	1	2.2	—	22	—	—
SS-REF	Mollusca	52	34	41	66	58	50.2	—	502	—	—
SS-REF	Polychaeta	46	46	47	49	40	45.6	—	456	—	—
SS-01	Crustacea	16	6	10	5	6	8.6	No	86	> 11	Pass
SS-01	Mollusca	3	6	4	2	2	3.4	Yes	34	> 251	Fail
SS-01	Polychaeta	10	0	8	2	0	4	Yes	40	> 228	Fail
SS-02	Crustacea	58	19	8	6	5	19.2	No	192	> 11	Pass
SS-02	Mollusca	8	7	2	6	8	6.2	Yes	62	> 251	Fail
SS-02	Polychaeta	33	12	81	14	19	31.8	No	318	> 228	Pass
SS-03	Crustacea	40	7	22	7	40	23.2	No	232	> 11	Pass
SS-03	Mollusca	3	3	8	18	7	7.8	Yes	78	> 251	Fail
SS-03	Polychaeta	7	3	14	9	15	9.6	Yes	96	> 228	Fail
SS-07	Crustacea	2	0	1	2	6	2.2	No	22	> 11	Pass
SS-07	Mollusca	9	12	12	31	9	14.6	Yes	146	> 251	Fail
SS-07	Polychaeta	12	11	16	12	21	14.4	Yes	144	> 228	Fail
SS-10	Crustacea	11	14	10	13	84	26.4	No	264	> 11	Pass
SS-10	Mollusca	24	34	30	21	24	26.6	Yes	266	> 251	Pass
SS-10	Polychaeta	75	69	108	65	159	95.2	No	952	> 228	Pass
SS-11	Crustacea	1	0	0	0	7	1.6	No	16	> 11	Pass
SS-11	Mollusca	4	18	11	10	8	10.2	Yes	102	> 251	Fail
SS-11	Polychaeta	16	7	57	11	24	23	No	230	> 228	Pass

SQS: Mean $abundance_{Treatment}$ < 50% of Mean $abundance_{Reference}$ (for each taxonomic group)

Table 9. Summary of Test Results

Station	Amphipod Test Criteria			Larval Test Criteria			Benthic Analysis Criteria	
	Statistical Difference?	Numerical		Statistical Difference?	Numerical		Statistical Difference?	Numerical SQS
		SQS	CSL		SQS	CSL		
SS-01	**Yes**	**Fail**	Pass	No	Pass	Pass	**Yes (M, P)**	**Fail (M, P)**
SS-02	No	Pass	Pass	No	Pass	Pass	**Yes (M)**	**Fail (M)**
SS-03	**Yes**	**Fail**	Pass	No	Pass	Pass	**Yes (M, P)**	**Fail (M, P)**
SS-07	No	Pass	Pass	No	Pass	Pass	**Yes (M, P)**	**Fail (M, P)**
SS-10	No	Pass	Pass	No	Pass	Pass	**Yes (M)**	Pass
SS-11	No	Pass	Pass	**Yes**	**Fail**	**Fail**	**Yes (M)**	**Fail (M)**

M = Mollusca, P = Polychaeta

APPENDIX B-3

DATA VALIDATION REVIEW REPORTS

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Data Validation Review Report- EPA Level 2

Project: Kimberly Clark- Former Scott Paper Mill Site

Project Number: 000105-01

Date: November 13, 2008

This report summarizes the review of analytical results for seven sediment samples collected on September 8th 2008. Samples were collected by Anchor Environmental and submitted to Analytical Resources, Inc. (ARI) in Tukwila, Washington. On September 11th and 12th porewater was extracted from all samples. Samples were analyzed for the following:

- Sulfides by United States Environmental Protection Agency (USEPA) method 376.2
- Ammonia by USEPA method 350.1M
- Total solids (TS) by USEPA method 160.3
- Total organic carbon (TOC) by Plumb (1981)
- Total volatile solids (TVS) by USEPA method 160.4
- Grainsize by method Plumb 1981

ARI sample data group (SDG) numbers NN88 (sediment samples) and NO68 (porewater samples) were reviewed in this report. The samples reviewed in this report are presented in Table 1.

Table 1
Samples Reviewed

Sample ID	Lab ID	Matrix	Analysis Requested
AN-SB-01-080908	NN88A/ NO68A	Sediment/Pore Water	TS,TOC,TVS,Grainsize,Porewater Ammonia, Porewater Sulfide
AN-SB-02-080908	NN88B/ NO68B	Sediment/Pore Water	TS,TOC,TVS,Grainsize,Porewater Ammonia, Porewater Sulfide
AN-SB-03-080908	NN88C/ NO68C	Sediment/Pore Water	TS,TOC,TVS,Grainsize,Porewater Ammonia, Porewater Sulfide

Sample ID	Lab ID	Matrix	Analysis Requested
AN-SB-04-080908	NN88D/ NO68D	Sediment/Pore Water	TS,TOC,TVS,Grainsize,Porewater Ammonia, Porewater Sulfide
AN-SB-05-080908	NN88E/ NO68E	Sediment/Pore Water	TS,TOC,TVS,Grainsize,Porewater Ammonia, Porewater Sulfide
AN-SB-06-080908	NN88F/ NO68F	Sediment/Pore Water	TS,TOC,TVS,Grainsize,Porewater Ammonia, Porewater Sulfide
AN-SB-07-080908	NN88G/ NO68G	Sediment/Pore Water	TS,TOC,TVS,Grainsize,Porewater Ammonia, Porewater Sulfide

Data Validation and Qualifications

The following comments refer to the laboratory's performance in meeting the quality assurance/quality control (QA/QC) guidelines outlined in the analytical procedures and data quality objective section of the Sampling and Analysis Plan (SAP) and Quality Assurance Project Plan (QAPP) Addendum (Anchor 2008). Laboratory results were reviewed following USEPA guidelines using *USEPA Contract Laboratory Program National Functional Guidelines for Inorganics Data Review (USEPA, 2004)* and *USEPA Contract Laboratory National Functional Guidelines for Organics Data Review* (*USEPA, 1999*) as guidelines, and applying laboratory and method QC criteria as stated in SW 846, Third Edition, Test Methods for Evaluating Solid Waste, update 1, July 1992; update IIA, August 1993; update II, September 1994; update IIB, January 1995; update III, December 1996; update IIIA, April 1998. Unless noted in this report, laboratory results for the samples listed above were within QC criteria.

Field Documentation

Field documentation was checked for completeness and accuracy. The chain-of-custody (COC) was signed by ARI at the time of sample receipt; the samples were received cold and in good condition.

Holding Times and Sample Preservation

Samples were appropriately preserved and analyzed within holding times. TOC was prepared within the 14 day holding time, but not analyzed until 10/22/08 (30 days past the holding time). Because the laboratory applies the holding time to the preparation date, and the dried samples were stored in a dessicator until analysis, samples were not qualified.

Analytical Methods

The laboratory followed the recommended analytical methods specified in the QAPP with the following exceptions:

- Total solids- the lab used 160.3 instead of PSEP
- Total volatile solids- the lab used 160.4 instead of ASTM-D2974
- Total organic carbon- the lab used Plumb, 1981 instead of 9060

The difference between the recommended methods and the actual methods is sample size used. Both PSEP and ASTM-D2974 use larger volumes than the 160 methods. For TOC the Plumb, 1981 method uses a larger sample size than the 9060 method. Because data quality would not be significantly affected by this discrepancy no data were qualified.

Porewater Extraction

The laboratory indicated that the samples contained "floaters" (material that was floating on the top or within the water) and could not be separated by centrifuging.

Grain size Analysis

The laboratory indicated that all samples contained shell fragments and organic debris which may have broken down during the sieve process, possibly affecting the grain size distribution.

Laboratory Method Blanks

Laboratory method blanks were analyzed at the required frequencies. All method blanks were free of target analytes.

Field Quality Control

Field Blanks

No field blanks were collected with this set of samples.

Field Duplicates

No field duplicates were collected with this set of samples.

Matrix Spike (MS) and Matrix Spike Duplicate (MSD)

MS and MSD samples were performed at the required frequencies. All associated MS/MSD samples yielded percent recoveries (%R) values and relative percent difference (RPD) values within the laboratory control limits.

Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSDs were analyzed at the required frequencies and resulted in recoveries within laboratory control limits.

Laboratory Replicates

Laboratory replicates were analyzed at the required frequencies yielding %RPDs within the laboratory control limits.

Method Reporting Limits

Reporting limits were deemed acceptable as reported. All values were reported using the laboratory's reporting limits. Values were reported as undiluted, or when diluted, the reporting limit accurately reflects the dilution factor.

Overall Assessment

As was determined by this evaluation, the laboratory followed the specified analytical methods with the exception noted above and all requested sample analyses were completed. Accuracy was acceptable, as demonstrated by LCS and MS %R values. Precision was acceptable, as demonstrated by the lab replicate analyses %RPD values. All data were deemed acceptable as reported; no data were qualified.

REFERENCES

Anchor. 2008. Sediment Sampling and Analysis Plan (SAP) and Quality Assurance Project Plan (QAPP) Addendum 2008 Supplemental Sediment Bioassays. August 2008.

USEPA. 1983. Methods for Chemical Analysis of Water and Wastes. U.S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Cincinnati, Ohio. EPA-600/4-79-020.

USEPA. 1986. Test methods for Evaluating Solid Waste: Physical/Chemical Methods. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. EPA-530/SW-846.

USEPA. 1999. USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review. U.S. Environmental Protection Agency, Office of Emergency Response. EPA 540/R-99/008. October.

USEPA. 2004. USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review. U.S. Environmental Protection Agency, Office of Superfund Remediation and Technology Innovation (OSRTI). EPA 540-R-04-004. October 2004.

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Data Validation Review Report

Project: Kimberly Clark Anacortes

Project Number: 000105-01

Date: November 15, 2007

This report summarizes the review of analytical results for twelve sediment samples collected on September 27 and 28 of 2007. Samples were collected by Anchor Environmental and submitted to Analytical Resources, Inc. (ARI) in Tukwila, Washington. Pore water samples were extracted from sediment samples. Samples were analyzed for the following:

- Total metals by United States Environmental Protection Agency (USEPA) methods 6010B, and 7471A(Hg).
- Semivolatile organic compounds (SVOCs) by USEPA method 8270D full scan.
- Polychlorinated biphenyls (PCBs) by USEPA 8082
- Total solids (TS) by method USEPA 160.3
- Total volatile solids (TVS) by method ASTM-D2974
- Total organic carbon (TOC) by Plumb, 1981/PSEP
- Grainsize by ASTM D422
- Ammonia by USEPA method 350.1 (pore water)
- Total sulfides by USEPA 376.2 (pore water)

ARI sample data group numbers LT50 and LR71 were reviewed in this report. The samples reviewed in this report are presented in Table 1.

Table 1
Samples Reviewed

Sample ID	Lab ID	Matrix	Analysis Requested
AN-SS-01-070927	LR71A, LT50A	Sediment	Metals,SVOC,PCB,TS,TVS,TOC, Ammonia,Sulfide, Grainsize
AN-SS-02-070927	LR71B, LT50B	Sediment	Metals,SVOC,PCB,TS,TVS,TOC, Ammonia,Sulfide, Grainsize
AN-SS-03-070928	LR71C, LT50C	Sediment	Metals,SVOC,PCB,TS,TVS,TOC, Ammonia,Sulfide, Grainsize
AN-SS-07-070928	LR71D, LT50D	Sediment	Metals,SVOC,PCB,TS,TVS,TOC, Ammonia,Sulfide, Grainsize
AN-SS-10-070928	LR71E, LT50E	Sediment	Metals,SVOC,PCB,TS,TVS,TOC, Ammonia,Sulfide, Grainsize
AN-SS-11-070928	LR71F, LT50F	Sediment	Metals,SVOC,PCB,TS,TVS,TOC, Ammonia,Sulfide, Grainsize
AN-SS-REF-070928	LR71G, LT50G	Sediment	TS,TOC, Ammonia, Grainsize
AN-SS-04	LR71H, LT50H	Sediment	Metals,SVOC,PCB,TS,TVS,TOC, Ammonia, Grainsize
AN-SS-05	LR71I, LT50I	Sediment	Metals,SVOC,PCB,TS,TVS,TOC, Ammonia,Sulfide, Grainsize
AN-SS-06	LR71J, LT50J	Sediment	Metals,SVOC,PCB,TS,TVS,TOC, Ammonia,Sulfide, Grainsize
AN-SS-08	LR71K	Sediment	Metals, SVOC, PCB,TS,TVS,TOC, Grainsize
AN-SS-09	LR71L, LT50L	Sediment	Metals, SVOC, PCB, TS, TVS, TOC, Ammonia, Grainsize

Data Validation and Qualifications

The following comments refer to the laboratory's performance in meeting the quality assurance/quality control (QA/QC) guidelines outlined in the analytical procedures and data quality objective section of the Sampling and Analysis Plan (SAP). Laboratory results were reviewed following USEPA guidelines using *USEPA Contract Laboratory Program National Functional Guidelines for Inorganics Data Review (USEPA, 2004)* and *USEPA Contract Laboratory National Functional Guidelines for Organics Data Review* (*USEPA, 1999*) as guidelines, and applying laboratory and method QC criteria as stated in SW 846, Third Edition, Test Methods for Evaluating Solid Waste, update 1, July 1992; update IIA, August 1993; update II, September 1994; update IIB, January 1995; update III, December 1996; update IIIA, April 1998. Unless noted in this report, laboratory results for the samples listed above were within QC criteria.

Laboratory Data Package and Field Documentation

Field documentation was checked for completeness and accuracy. The chain-of-custody was signed by ARI at the time of sample receipt; the samples were received cold and in good condition. Ammonia and sulfide analyses were requested for all pore water samples, however, neither analysis was performed on sample AN-SS-08 and sulfide analyses were not performed on samples AN-SS-REF-070928, AN-SS-04, and AN-SS-09 due to limited or no sample volume.

Holding Times and Sample Preservation

Samples were appropriately preserved and analyses were conducted within holding times with the exception of TOC analysis. Samples were analyzed three to four days past the fourteen day holding time. All TOC results have been qualified with a "J" to indicate results are estimated. Samples were re-extracted for SVOC analyses due to low LCS and MS/MSD recoveries. The re-extraction was within holding time for samples stored frozen.

Laboratory Method Blanks

Laboratory method blanks were analyzed at the required frequencies. All method blanks were free of target analytes with the following exceptions:

- Analysis of SVOC method blank LR71MBS2 resulted in the detection of bis(2-ethylhexyl)phthalate above the RL. The sample concentrations were compared to that found in the method blank. All sample concentrations were either not detected or were significantly greater (>5x) than the method blank with the following exceptions:

Sample	Analyte	Reported Concentration	Modified Concentration
AN-SS-07-070928	Bis (2-Ethylhexyl) phthalate	50 ug/kg	50U ug/kg
AN-SS-10-070928	Bis (2-Ethylhexyl) phthalate	20 ug/kg	20U ug/kg
AN-SS-04	Bis (2-Ethylhexyl) phthalate	110 ug/kg	110U ug/kg

Field Quality Control

Field Duplicates

No field duplicates were collected with this sample set.

Surrogate Recoveries

Surrogate recoveries for organic analyses were performed at the required frequencies. Surrogate recoveries were within laboratory control limits for all surrogates with the exception of 2-fluorobiphenyl in the first SVOC extraction of the method blank and LCS. Surrogate recoveries are not considered out of control unless two acid or two base pairs recover outside of control limits. No data from this extraction batch was reported.

Matrix Spike (MS) and Matrix Spike Duplicate (MSD)

MS/MSD samples were analyzed at the required frequencies. All MS/MSD analyses yielded percent recoveries (%Rs) and relative percent difference (RPD) values within the project data quality objectives with the following exceptions:

- Ammonia and Sulfides - No MS/MSD analyses were performed due to limited sample volume.
- SVOC - Analyses of samples AN-SS-10-070928 MS and MSD yielded low %Rs for benzo (g,h,i) perylene in both the first and second extraction. . This analyte has been qualified in the parent sample result with a "UJ" to indicate a potential low bias. Hexachloroethane also recovered low in the first extraction of the MS sample. No data are reported from this extraction batch.
- Metals - Analysis of sample AN-SS-01-070928 MS yielded a low %R for antimony. All associated sample results have been qualified with a "J" or "UJ" to indicate a potential low bias.

Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

An LCS and LCSD were analyzed at the required frequencies. All LCS and LCSD analyses were within laboratory control limits.

Laboratory Duplicates/ Triplicates

Laboratory duplicates/triplicates were analyzed at the required frequencies. All %RPD values were within the project control limits.

Method Reporting Limits

All results were reported using the laboratory's reporting limits and were reported as undiluted, or when diluted, the reporting limit accurately reflects the dilution factor. Reporting limits were deemed acceptable as reported. Aroclor 1248 was reported at elevated reporting limits for samples AN-SS-070928 and AN-SS-04.

Overall Assessment

The original SVOC analyses of all samples were rejected due to poor recoveries in the LCS. The laboratory performed valid re-extractions/re-analyses as instructed per the project sampling and analysis plan. Data from the re-extraction/re-analyses are reviewed in this report. All other data are judged to be acceptable as qualified. Table 3 summarizes the qualifiers applied to samples reviewed in this report.

Precision, Accuracy, and Completeness

Precision: All precision goals were met.

Accuracy: All accuracy goals were met.

Completeness: Completeness was 100 percent.

Table 3
Data Qualification Summary

Sample ID	Parameter	Analyte	Reported Result	Qualified Result	Reason
AN-SS-01-070927	Conventionals	TOC	1.43%	1.43%J	Analysis outside of hold time
AN-SS-02-070927	Conventionals	TOC	4.84%	4.84%J	Analysis outside of hold time
AN-SS-03-070928	Conventionals	TOC	2.53%	2.53%J	Analysis outside of hold time
AN-SS-07-070927	SVOC	Bis(2-Ethylhexyl)phthalate	50 ug/kg	50U ug/kg	Method Blank

Sample ID	Parameter	Analyte	Reported Result	Qualified Result	Reason
AN-SS-07-070928	Conventionals	TOC	1.35%	1.35%J	Analysis outside of hold time
AN-SS-10-070928	SVOC	Bis(2-Ethylhexyl)phthalate	20 ug/kg	20U ug/kg	Method Blank
	SVOC	Benzo(g,h,i)perylene	20U ug/kg	20UJ ug/kg	MS/MSD %R outside criteria
	Conventionals	TOC	1.07%	1.07%J	Analysis outside of hold time
AN-SS-11-070928	Conventionals	TOC	1.15%	1.15%J	Analysis outside of hold time
AN-SS-REF-070928	Conventionals	TOC	0.951%	0.951%J	Analysis outside of hold time
AN-SS-04	SVOC	Bis (2-Ethylhexyl)phthalate	110 ug/kg	110U ug/kg	Method Blank
AN-SS-04	Conventionals	TOC	6.13%	6.13%J	Analysis outside of hold time
AN-SS-05	Conventionals	TOC	2.42%	2.42%J	Analysis outside of hold time
AN-SS-06	Conventionals	TOC	1.40%	1.40%J	Analysis outside of hold time
AN-SS-08	Conventionals	TOC	1.75%	1.75%J	Analysis outside of hold time
AN-SS-09	Conventionals	TOC	3.99%	3.99%J	Analysis outside of hold time

REFERENCES

USEPA. 1983. Methods for Chemical Analysis of Water and Wastes. U.S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Cincinnati, Ohio. EPA-600/4-79-020.

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