DRAFT-FINAL UPLAND REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN
MARCH POINT LANDFILL
ANACORTES, WASHINGTON

JUNE 29, 2007

Draft-Final Upland Remedial Investigation/Feasibilty Study Work Plan March Point Landfill File No. 0504-037-00

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UPLAND REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN MARCHPOINT LANDFILL ANACORTES, WASHINGTON

1.0 INTRODUCTION

This work plan describes a proposed scope of services to perform a Remedial Investigation (RI)/Feasibility Study (FS) within the upland area at the March Point Landfill (landfill). In the RI/FS Statement of Work, Ecology identified the landfill (also known as the Whitmarsh Landfill) as a high priority site for cleanup under the Puget Sound Initiative, based on documented sediment contamination and the landfill's potential impact to Padilla Bay. The purpose of the Puget Sound Initiative is to improve the health and vitality of Puget Sound by 2020. According to previous investigations, which are discussed in the Summary of Existing Information and Identification of Data Gaps (SAIC, 2007a), off-shore sediments and sediments near inner and outer Padilla Bay Lagoon have been impacted by metals, chlorinated benzenes, phthalates, phenols, petroleum-related compounds, polychlorinated biphenyls (PCBs), and dioxins and furans. No information is known about the source area (landfill) for the contamination identified in the sediments. The purpose of the upland RI/FS is to evaluate the source area and establish possible remedies to decrease future impacts to surface water and groundwater in and around the landfill.

The abandoned landfill is located on the west side of March Point at 9663 S March Point Road in Anacortes, Washington (Figure 1). The landfill is located at the base of a bluff in the tidelands area of Padilla Bay. The landfill is bounded by S March Point Road and Highway 20 to the southwest, Padilla Bay and Padilla Bay Lagoon to the northeast, and the Swinomish Indian Tribe Reservation and Swinomish Channel to the east (Figures 1 and 2). The estimated boundary of the landfill was recorded by the Skagit County Health Department using global positioning equipment (GPS) equipment in 2002. This boundary is shown on Figure 2. Based on these GPS data, provided to GeoEngineers by the Skagit County Health Department, the landfill is approximately 14 acres.

Information is limited related to the contents and fill history of the landfill. Additionally, no soil and/or groundwater chemical analytical testing has been completed in the upland portion of the landfill. The landfill was used as a public dump from the 1950s until 1973. The landfill was unregulated (an uncontrolled public dump) through 1961 and not strictly regulated after that. Skagit County operated the dump from 1961 through 1973.

At the time of closure, the landfill was graded and covered with 2 to 3 feet of soil (of unknown source or quality) and has been revegetated with alders and grass. Most of the former landfill is now occupied by an operating cedar log mill which has operated at the Site since the late 1980s. The site is currently covered with hog fuel and stored saw logs.

GeoEngineers is working in collaboration as Science Application International Corporation's (SAIC's) teaming partner on this project under Ecology's "Hazardous Substances Site Investigation & Remediation for the Toxics Cleanup Program Contract # C0700034; Work Assignment # SAIC004" held between SAIC and Ecology. GeoEngineers' role on this project is to evaluate upland issues while SAIC's focus is related to aquatic and sediment issues. The aquatic and sediment RI/FS work plan is outlined in the "Draft Sediment Remedial Investigation/Feasibility Study Work Plan" (Sediment Work Plan; SAIC, 2007b).

The upland assessment activities will focus on impacts to soil, groundwater, leachate at the intertidal zone and surface water related to past filling of the landfill property. The layout of the property, including the approximate location of existing and former landfill and current sawmill facilities, is shown in Figures 2 and 3.

1.1 PURPOSE

This RI/FS work plan is based on the findings summarized in the "Summary of Existing Information and Identification of Uplands Data Gaps" report prepared by GeoEngineers, dated April 11, 2007 (Upland Data Gaps Report; GeoEngineers, 2007). The purpose of the remedial investigation (RI) study is to fill the data gaps identified in the Upland Data Gaps Report. These data gaps are related to areas of soil, groundwater, surface water, and leachate contamination. The RI will fulfill the following objectives:

- Define the nature and extent of soil and groundwater contamination,
- Define the lateral and vertical extent of the landfill,
- Identify the type and nature of wastes disposed of at the landfill,
- Assess the chemical quality of surface water entering Padilla Bay Lagoon from two primary sources: (1) the drainage ditch on the northeast side of the landfill between landfill and railroad tracks, (2) the drainage ditch/estuarine stream on the southwest and southeast sides of the landfillf landfill,
- Assess the chemical quality of leachate entering Padilla Bay Lagoon or other adjacent surface water bodies (Padilla Bay, drainage ditches, estuarine stream),
- Conduct a terrestrial ecological evaluation to determine the impact to natural resources and ecological receptors,
- Evaluate the need for, and to conduct, a source removal action (drums or contaminated soil), if necessary based on the preliminary RI results, and
- Support the development of a Feasibility Study; including identification of any opportunities for habitat restoration.

1.3 WORK PLAN ORGANIZATION

This work plan, which focuses only on the upland portion of the Site, was prepared in general accordance with Ecology guidance for RI/FS (WAC 173-340-350). The organization of the work plan is as follows:

- Section 1: Introduction
- Section 2: Site Description and History
- Section 3: Previous Investigations – Upland
- Section 4: Preliminary Conceptual Site Model
- Section 5: Upland Data Gaps
- Section 6: Sampling and Analysis Plan (presents a summary of sampling objectives, procedures, frequency and location, and analytical requirements.
- Section 7: Terrestrial Ecological Evaluation
- Section 8: Feasibility Study

- Section 9: Schedule
- Section 10: References
- Appendix A: Quality assurance project plan (QAPP),
- Appendix B: Health and safety plan (HASP), and
- Appendix C: Historic and Aerial Photographs.

2.0 SITE DESCRIPTION AND HISTORY

2.1 SITE OWNERSHIP

The site includes tax parcel numbers P19676, P19684, P19707, P19713, and P19761 (Figure 3). As of January 2007 these parcels are owned by the following:

- P19676 (4.86 acres); Snow Mountain Land Company, LLC.
- P19684 (4.82 acres); Charles and Margaret Ellen Moon.
- P19707 (1,620 feet); Washington State Department of Natural Resources.
- P19713 (1.32 acres); Snow Mountain Land Company.
- P19761 (0.04 acres); Ralph Hillestead.

According to the Skagit County Assessor's Office, Parcel P19707 consists of 1,620-feet of tidelands owned by the Washington State Department of Natural Resources.

2.2 LANDFILL WASTE TYPE AND HISTORY

Knowledge of the waste types and quantities, other than municipal wastes (household, commercial, industrial), that were buried is limited. According to Ecology documents that we reviewed, four major chemical and oil industries (Texaco and Shell refineries, Allied Chemical Sulfuric Acid Plant, and the Northwest Petrochemical Company) may have transported waste to the landfill. These industrial facilities are located on March Point and were in operation during the period of time the landfill was active. Wastes at the landfill were routinely burned until 1969 according to Skagit County's 2003 Site Hazard Assessment (SHA; Skagit County, 2003). From 1969 until 1973 the landfill was the county's primary solid waste disposal site. According to Britt Pfaff-Dunton of the Skagit County Health Department, around 1969 agencies started to ban burning at landfills and started shutting down other landfills closer to population centers. This may have increased the pressure to dump wastes at the landfill (GeoEngineers personal communication, 2007a). Skagit County Public Works records of waste accepted from 1970 indicate that waste was coming from the cities of Anacortes, Burlington, La Conner, Mt. Vernon, Sedro Woolley, rural Skagit County, Whidbey Island, Shell and Texaco Refineries.

Very little data are available from county records regarding the landfill during its operation (Skagit County, 2003). Skagit County Department of Health has not spoken directly with Texaco, Shell, Allied Chemical Sulfuric Acid Plant, or the Northwest Petrochemical Company regarding the companies' records of waste disposal at the landfill. According to Ms. Pfaff-Dunton, the best records regarding the types of waste disposed at the landfill are a series of photographs from the 1968 and 1970 and the Skagit County Public Works department records from 1970. Photographs taken by Jack Wai in 1968 and 1970 show 55-gallon and smaller drums in the landfill and waste disposed on the tidelands and in Padilla Bay Lagoon (Ecology and Skagit County Health Department files). (Appendix C, Figures 1 through 4).

According to Ken Willis, from the Skagit County Health Department, vanadium catalysts in a powdered form were dumped at the landfill (Ecology, 1986).

Skagit County Health Department interviewed a former truck driver for the Shell Refinery (Skagit County, 2003). According to the truck driver:

- Wastes from the Shell refinery were brought to the landfill from 1965 to 1971.
- Most of the waste types were unknown since they were containerized.
- Approximately every three months about 20 barrels of "heavy catalyst from the alkylating units" were dumped at the landfill.
- A large amount of asbestos containing material was dumped at the landfill.
- In general, the worst of the chemical waste from the refinery was sent to the nearby PM Northwest dump located on the Swinomish Reservation.

According to Ms. Pfaff-Dunton of the Skagit County Health Department, the truck driver also stated that generally wastes that were disposed of as liquids (i.e., not in drums) went to the PM Northwest dump and that waste in drums went to the landfill. However, drums, in varying stages of decay, were found at the PM Northwest landfill.

2.3 Geology and Hydrology

The landfill is located at the base of a bluff that lies in the tidelands of Padilla Bay. The USGS geologic map (USGS, 2000) shows that the landfill consists of "artificial fill." Nearby soil is mapped as 1) Olympia non-glacial deposits consisting of gravelly, organic-rich and/or silty sand, silt, clay and peat; 2) landslide deposits on the upslope portion of the site near southeast side of the landfill; and 3) a glacial till adjacent to west side of the landfill. Twenty nine well logs (Ecology, 2007) for monitoring wells, domestic wells, and resource protection wells within 0.5 miles of the landfill show soils to a depth of 20 feet below ground surface (bgs) generally consist of sand and gravel with some silt and clay. Well survey data are presented in Table 1 for wells within 0.5 miles of the landfill.

Information from two USGS reports on the groundwater conditions at the Swinomish Indian Reservation (USGS, 1998a and 1998b) indicate the presence of a shallow aquifer (Outwash aquifer in the USGS report) and a deep aquifer (Sea-level aquifer in the USGS report). The landfill is located at the north end of the reservation. A review of the 24 well logs within 0.5 miles of the landfill identified shallow and deep groundwater bearing zones. Based on elevation changes south of the landfill, it is not known if the shallow and deep groundwater bearing zones identified in the well logs correspond with the Outwash and Sea-level aquifers identified in the USGS reports.

Five resource protection wells approximately 2,500 feet southeast of the landfill and four groundwater monitoring wells approximately 1,000 feet northwest of the landfill identified static water levels of 4 to 5.5 feet bgs. A domestic well approximately 2,500 feet upgradient (to the south) identified a deep water bearing zone at a depth of 67 to 77 feet bgs with a static water level of 4 feet bgs. According to Ecology's 1986 site investigation report (SI), shallow groundwater was noted in the borrow pit west of the landfill at an estimated depth of 10 feet below ground surface (Ecology, 1986).

A well log from a domestic well approximately 2,000 feet upgradient (to the south) identified a deep water bearing zone at a depth of 82 to 106 feet bgs with a static water level of 84 feet bgs. A well log from a USGS domestic well approximately 2,500 feet southeast of the landfill identified a deep water bearing zone at a depth of 86 to 88 feet bgs with a static water level of 69 feet bgs.

Tide tables for the Swinomish Channel Entrance to Padilla Bay indicate that in 2006 there were tidal fluctuations in the range of 13 feet between low and high tides. According to Ecology's 1986 SI report, there is tidal incursion to the landfill along Padilla Bay that mixes with leachates at high tide (Ecology, 1986).

2.4 GROUNDWATER AND SURFACE WATER USES

The Washington State Well Log Viewer (Ecology, 2007) identified three domestic wells within 0.5 miles south and upgradient of the landfill. In addition, there are either one or two Skagit County Public Utilities District wells within 1,500 feet of the landfill (the purpose of these two wells is not noted on the well logs). Ecology's well log viewer identifies two locations 1) 1,000 feet west of the landfill and 2) 1,500 feet southwest of the landfill (Ecology, 2007). However, only one well log is provided for both locations. According to Ecology's 1986 SI report, approximately 10,000 people in a four mile radius use groundwater for drinking (Ecology, 1986). Groundwater is presumed to flow towards Padilla Bay in a northerly direction; therefore, these water wells would be located upgradient or cross-gradient of the landfill.

Padilla Bay is used for fishing, recreation, and is a National Estuary Reserve. Padilla Bay is also used extensively by the Swinomish fishing fleet and supports subsistence fishing by tribal members. According to Ecology's 1999 investigation report, the Swinomish Tribe has stated that the Padilla Bay Lagoon is not a seafood harvest area (Ecology, 1999).

2.5 HABITAT

The March Point Landfill borders or is adjacent to several critical habitats. GeoEngineers conducted a preliminary habitat survey during a field reconnaissance to the site on March 26, 2007 and documented freshwater, estuarine and marine wetland habitat as well as critical wildlife habitat in the form of a heron rookery to the west of site across from S March Point Road. Photographs taken during our March 26, 2007 site reconnaissance are included as Figure 4.

Padilla Bay Lagoon is north and east of the site and is separated from greater Padilla Bay by a BNSF railroad embankment which serves as a dike separating the lagoon from the bay. A small trestle in the railroad embankment provides for water exchange between the lagoon and the bay. The railroad spur and trestle are visible on aerial photographs dating back to 1937 (Appendix C; Figure 5). Several different species of waterfowl and shorebirds were noted directly adjacent to the site within the lagoon. Along the shoreline the edge of the site drops sharply to the lagoon with little or no topographic relief. Concrete rubble and other miscellaneous rip rap dominate the transition zone between upland and intertidal habitat along this edge. Invasive Himalayan blackberry dominants the near shore vegetation adjacent to the lagoon.

There is a shallow seasonal drainage ditch located to the north of the site along the existing BNSF railroad grade (Figure 4, Photograph 1). This ditch feature did not contain any habitat and had been recently excavated. There was flowing water in the ditch at the time of the reconnaissance. The edge of the site adjacent to this ditch was also dominated by blackberry as well as Japanese knotweed. The water from this ditch feature flows to the southeast along the tracks and enters the lagoon where the railroad embankment separates from the landfill.

Another surface water feature, which receives stormwater flow from the off-site property to the northwest, borders the site to the west. This feature starts out very narrow but gains considerable width as it drains the site from north to south along S March Point Road (Figure 4, Photographs 2). Three culverts were noted entering this feature from under S March Point Road. Wetland vegetation was observed in various locations within this stream; most notably red alder, willow, creeping buttercup and skunk cabbage. A portion of the stream between the site and S March Point Road is tidally influenced and could be considered estuarine habitat. The stream enters the tideland south of the side, turns north and flows along the eastern edge of the landfill into Padilla Bay Lagoon (Figure 4, Photographs 3 and 4). Several unidentified species of juvenile fish were noted within the stream channel on the eastern edge of the landfill, which separates the landfill from the Swinomish Indian Reservation.

On-site upland habitat is minimal because of the active sawmill operations. The extreme edges of the landfill as well as a relatively undisturbed 2 to 3 acre area along the southeast portion of the site contain the only notable upland habitat. Invasive blackberry and scotch broom were the most dominant upland species of vegetation noted on-site. Other upland species observed mostly within the southern portion included red alder, big-leaf maple, bitter cherry and possibly black hawthorn. The vegetation within this area (to the south) was not completely inventoried during the field reconnaissance.

3.0 PREVIOUS INVESTIGATIONS – UPLAND

This section discusses previous investigations where leachate and surface water sampling and testing were conducted at the landfill. Note that some of these studies also included sediment and/or biota sampling and testing but no soil or groundwater sampling has been completed at the site. These results are summarized in the Sediment Data Gaps report (SAIC, 2007). According to Ecology, the Swinomish Tribe collected a water (surface water or leachate) sample in 1997 (Ecology, 1999). The analytical results for this sample were not provided to us and have not been reviewed.

The approximate location of previous leachate/surface water samples are shown on Figure 5. The analytical data associated with these samples are included in this work plan as Tables 2 through 5. Note that the surface water criteria have changed (in general, some criteria have become more stringent) since the studies outlined below have been completed. In Sections 3.1 through 3.6, we have reiterated the conclusions of six environmental studies (primarily related to leachate sampling and testing) that have been completed at the site. We have also compared the detected leachate concentrations to current surface water criteria to evaluate whether chemicals of concern are present and are of regulatory concern based on current criteria. The surface water criteria are being used in this report for screening purposes, and are not intended to represent proposed or final cleanup levels.

3.1 PRELIMINARY ASSESSMENT (ECOLOGY, 1985)

Ecology and EPA conducted a Preliminary Assessment (PA) of the landfill in November 1984 and identified the site as a medium priority. The PA identified potentially contaminated groundwater, tidal incursion into the landfill, and leachate surfacing on the eastern landfill boundary as potential hazards to human health or the environment. The PA identified concerns regarding industries (i.e., Shell and Texaco refineries, Allied Chemical Sulfuric Acid Plant, and the Northwest Petrochemical Company) that were present in the local area at the time of unregulated dumping. Texaco, in a 103(c) notification, called March Point Landfill their "off-site No. 2," which has been interpreted as an offsite disposal facility for Texaco. The PA recommended analyzing leachate for priority pollutants and, if necessary, follow-up sampling including the installation and sampling of groundwater monitoring wells. The PA also recommended that historical data on industrial activities and waste dumping practices should be obtained from industries operating on March Point. However, we do not know if the historical data were obtained.

3.2 SITE INSPECTION (ECOLOGY, 1986)

Based on the results of the 1984 PA, Ecology conducted a site inspection (SI) at the March Point Landfill in December 1985. Ecology collected three surface water samples (NCT091, NCT092, and NCT094), one leachate sample (NCT095), and two sediment samples (surface water and leachate sample locations are shown on Figure 5). The surface water samples were collected at the following locations: 1) borrow pit upgradient of the landfill (NCT091), 2) estuarial stream southeast of landfill (NCT092), and 3) Padilla Bay lagoon surface water at the northeast side of landfill (NCT094). The location where sample NCT092 was collected is not clear. The SI report states that "sample NCT092 was taken from an estuarial stream on the southeast edge of the landfill." However, the sample location figure in the SI report (Figure 1) shows the NCT092 sample location approximately 2,500 feet southeast of the landfill (Ecology, 1986). Figure 5 shows both potential NCT092 sample locations. The leachate sample was collected at the northeast side of landfill. The surface water and leachate samples were analyzed for EPA priority pollutant metals and volatile organic compounds (VOCs). At the time that the report was produced, Ecology concluded that "sampling data do not show a significant problem at this landfill to warrant further sampling or remedial actions."

Based on a review of the 1985 sample results compared to current surface water criteria: arsenic, copper, mercury, and nickel were detected in at least two water samples at concentrations greater than their respective aquatic life or human health surface water criteria (Table 2).

3.3 ANALYSIS OF LEACHATE FROM WHITMARSH LANDFILL (ECOLOGY, 1989)

Ecology collected a grab sample of leachate (sample 88-257426) from the northeast corner of the landfill in June 1988 (Figure 5). The sample was analyzed for priority pollutant metals. The letter concluded that the results were "an indication of a heavy metals problem at Whitmarsh which will require further study."

Based on our review of the 1989 sample results as compared to current surface water criteria: arsenic, cadmium, chromium, copper, lead, nickel, thallium, and zinc were detected at concentrations greater than their respective surface water criteria (Table 3).

3.4 SKAGIT COUNTY DEPARTMENT OF HEALTH SAMPLING (SKAGIT COUNTY, 1996)

Based on Swinomish Indian Tribal Community concerns regarding potential contaminant releases from the March Point Landfill (referred to as the Whitmarsh Landfill in this 1996 letter) into Padilla Bay, the Skagit County Department of Health collected surface water and sediment samples near the landfill in October 1996. Two water sample locations were identified based on the presence of discolored water emanating from the concrete rip-rap wall along the northeast side of the landfill (Figure 5). A leachate and sediment sample were collected at each location (leachate sample numbers WMW-1 and WMW-2; see the Sediment Data Gaps report [SAIC, 2007] for sediment sample information). Samples were analyzed for VOCs, semivolatile organic compounds (SVOCs), pesticides/polychlorinated biphenyls (PCBs), and metals. No analytes were detected at concentrations greater than their respective surface water criteria (Table 4). The report concluded that "further investigation using county resources is not warranted at this time."

Based on a review of the 1996 sample results as compared to current surface water criteria, although there were detected concentrations of VOCs and SVOCs and phenols, none of the chemicals exceeded their respective surface water criteria.

3.5 Ecology Investigation of Chemical Contamination at Whitmarsh Landfill and Padilla Bay Lagoon (Ecology, 1999)

Ecology collected two leachate (samples 248005 and 248006) and two sediment samples (see the Sediment Data Gaps report [SAIC, 2007]) near the northeast corner of the landfill (Figure 5) in June 1998. The purpose of these samples was to identify contaminants of potential concern to human health and the environment and to determine if additional sampling in Padilla Bay Lagoon was necessary. This discussion focuses on the leachate analytical results. The two leachate samples were collected as grab samples from the two largest flows coming out of the landfill (Figure 5). These water samples were analyzed for approximately 400 chemicals consisting of metals, trace elements, cyanide, petroleum hydrocarbons, VOCs, PAHs, phenols, chlorinated benzene, phthalate esters, SVOCs, PCBs, organotins, pesticides, and herbicides (Table 5). According to the report a slight petroleum odor was evident in the vicinity of the landfill. However, the leachate samples appeared free of sheen. Following the analysis of the initial leachate and sediment samples, additional sediment samples were collected in Padilla Bay lagoon (sediment results are outlined in the Sediment Data Gaps report [SAIC, 2007]).

Priority pollutant metals were not detected in the leachate samples. Miscellaneous trace elements, number 2 diesel, VOCs, polycyclic aromatic hydrocarbons (PAHs), phenols, miscellaneous SVOCs, and phthalate esters were detected in the leachate samples. Manganese, benzo(a)anthracene, and PCB aroclor 1242 were detected at concentrations greater than their respective human health surface water criteria in at least one sample. No compounds were detected at concentrations greater than the aquatic life marine/chronic criteria; however, a number of metals, carcinogenic PAHs, and PCBs had elevated detection limits (i.e., they were greater than their respective surface water criteria). Number 2 diesel was detected in both seepage samples. There are no surface water quality criteria for petroleum; however, WAC 173-340-730(3)(b)(iii)(C) states that the Model Toxics Control Act (MTCA) Method A groundwater cleanup level of 500 µg/L for diesel range organics can be used to evaluate the potential noncarcinogenic effects of diesel range organics in surface water. Number 2 diesel was detected at a concentration greater than the MTCA Method A groundwater cleanup level in one of the leachate samples. High concentrations of iron (5,660 to 16,200 µg/L) were detected in the leachate samples. The EPA National Recommended Water Quality Criteria (freshwater chronic) for iron is 1,000 µg/L (EPA, 2006). There is no corresponding marine chronic criterion for iron. According to the report, high iron concentrations are expected in landfill drainage.

Chemicals of concern identified in the report include iron, petroleum, benzenes, chlorinated benzenes, toluene, xylene, ethylether, PAHs, phenols, phthalates, nitrosodiphenylamine, dibenzofuran, carbazole, dibenzothiphene, PCBs, and carbaryl.

3.6 Site Hazard Assessment (Skagit County, 2003)

Skagit County Health Department conducted a Site Hazard Assessment (SHA) in February 2003. According to Ecology, the March Point Landfill was placed on Ecology's Confirmed and Suspected Contaminated Sites List on March 1, 1988 (Ecology, 2002).

4.0 PRELIMINARY CONCEPTUAL SITE MODEL

The primary uplands pathways of concern for human health and the environment at the March Point Landfill are: direct-contact, soil to groundwater, groundwater and leachate to surface water/sediment. At this time, the most significant receptor of concern is the migration of contaminants to Padilla Bay and Padilla Bay Lagoon.

Soil. According to previous reports, the landfill was covered with 2 to 3 feet of soil of unknown quality in 1973. As noted above, the soil used to cover the landfill has not been sampled. Additionally, no soil or groundwater samples have been tested from within the bounds of the landfill. Therefore, the potential for contaminants to migrate from sources in soil and/or groundwater within the landfill to surface water and sediment is a data gap.

Groundwater. Groundwater migrating underneath the landfill to Padilla Bay or Padilla Bay Lagoon may provide a contaminant transport pathway to surface water and sediment. According to previous reports, shallow groundwater is likely present at or near the bottom of the landfill.

Surface Water. A drainage ditch is present on the southeast side of the landfill, between the landfill and S March Point Road. This ditch starts near the northern boundary of the landfill where a culvert crosses beneath S March Point Road. Two other culverts drain into this drainage ditch along the southeastern boundary of the landfill. Near the southeastern boundary of the landfill, this ditch turns into an estuarine stream that wraps around the southern tip of the landfill, merges with another estuarine stream that is fed by a fourth culvert, and follows the southeastern edge of the landfill until it eventually drains into Padilla Bay Lagoon.

A second drainage ditch is present on the northeast side of the landfill, between the landfill and the Burlington Northern railroad tracks. According to the Saw Mill owner Stein Svendsen, the ditch was dug in March 2007 by railroad employees. This ditch begins upstream of the landfill and drains into Padilla Bay Lagoon.

These ditches and stream have the potential to carry landfill-related contamination and upstream contamination to Padilla Bay Lagoon.

Leachate. As discussed above, leachate has been identified entering Padilla Bay Lagoon at a minimum of two locations near the northeast side of the landfill.

5.0 UPLAND DATA GAPS

The following outlines specific data gaps related to (a) landfill extent and (b) soil, groundwater and surface water/leachate site characterization. Data gaps for this report are defined as information that is lacking and/or information that is needed to adequately develop a remedial investigation work plan and ultimately a cleanup remedy for this site. A summary of data gaps include:

- The lateral and vertical extents of the landfill are not known (details in Sections 5.1.1 and 5.1.2).
- Knowledge regarding the nature of the wastes disposed of in the landfill is limited (details in Section 5.1.3).
- No soil sampling and testing has been completed (details in Section 5.2).
- No groundwater sampling and testing has been completed (details in Section 5.3).
- Available leachate and surface water chemical analytical data do not reflect current conditions (details in Section 5.4).
- Chemical testing programs completed to date have generally not been adequate to evaluate potential contaminants of concern (details in Section 5.5).
- Accurate landfill mapping (details in Section 5.6).

5.1 EXTENT OF LANDFILL

5.1.1 The Lateral Extent of Wastes Disposed of In The Landfill is Not Known.

The lateral extent of the area that has been filled can be approximated from a review of the aerial photographs (Appendix C; Figures 5 through 11. The 1937 aerial photograph shows the site before wastes were disposed of at the landfill and the 1975 aerial photograph shows the site approximately two years after the landfill was closed (Appendix C; Figures 5 and 8). The extent of fill in 1966 and 1969 is shown in Figures 6 and 7 of Appendix C, respectively. The approximate lateral extent of the capped landfill is evident in both the 1975 and 1981 aerial photographs (Appendix C; Figures 8 and 9). However, it is not known if wastes were disposed of throughout the entire filled area. The 1992 and 2001 aerial photographs are shown in Figure 10 and 11 of Appendix C, respectively.

5.1.2 The Vertical Extent of the Fill and Waste in the Landfill are Not Known.

The 2003 Site Hazard Assessment conducted by the Skagit County Health Department indicates that the "fill appears to be approximately 10-15 feet above the level of the adjacent Padilla Lagoon tidelands." We interpret this to mean that 10 to 15 feet of waste material exists above the mean lower low water elevation. However, this interpretation needs to be evaluated and thus represents a data gap.

5.1.3 Knowledge Regarding the Nature of the Wastes Disposed of in the Landfill is Limited.

Previous reports indicate that household waste, commercial solid waste, and industrial waste were disposed; however, details regarding the types and volumes of wastes disposed are not available. Specific wastes referenced in previous reports include:

- "Heavy catalyst" from the Shell Refinery alkylating unit; approximately 20 barrels every three months from 1965 through 1971 (Skagit County, 2003).
- Asbestos containing material (Skagit County, 2003).
- Vanadium catalysts in a powdered form (possibly vanadium pentoxide; Ecology, 1986).
- 55-gallon drums and smaller drums/cans (1968 photograph provided by Skagit County).

5.2 SOIL

Data gaps include the lack of soil quality data in the landfill "cap" and throughout the fill itself. No soil samples collected within the lateral or vertical extent of the landfill were identified during the review of existing information.

Previous reports have indicated that 2 to 3 feet of soil were placed on top of the wastes when the landfill was closed (Ecology, 1986). The 1986 Site Inspection Report indicates that this was clean soil; however, there is no indication where the soil originated or if the soil was tested prior to placement at the site (Ecology, 1986).

5.3 GROUNDWATER

Data gaps include the lack of groundwater quality data upgradient of the landfill, within the landfill itself, and adjacent to Padilla Bay and Padilla Bay lagoon. Additionally, groundwater flow characteristics such as depth to groundwater, groundwater flow direction, groundwater gradient, tidal influences and groundwater/surface water interactions have not been evaluated. If the water table intersects the landfill waste, this would cause more rapid leaching of waste and provide a more direct pathway to surface water.

Ecology collected a water sample from the borrow pit approximately 40-feet southwest of the landfill in December 1985 (Ecology, 1986). According to Ecology, the purpose of this water sample was to evaluate groundwater upgradient of the landfill. This sample was collected over 20 years ago and is not adequate for evaluating upgradient groundwater. The analytical results from this sample are included in the Uplands Data Gap Report (Table 1). Based on the review of existing information, groundwater monitoring wells have not been completed immediately upgradient of the landfill or within the landfill itself. Additionally, there are no wells within the intertidal zone to evaluate tidal influences and/or groundwater/surface water quality.

Ecology estimated that the depth to shallow groundwater was approximately 10 feet based on the elevation of water in the borrow pit. In addition, Ecology's 1986 Site Inspection Report states that a deeper aquifer may be present at a depth of 75 to 80 feet based on a review of a USGS well log from a well approximately 2,500 feet upgradient of the landfill (Ecology, 1986). However, these aquifers, if present, may be saline in the vicinity of the landfill.

5.4 Leachate/Surface Water

Data gaps include the lack of recent leachate data and surface water data in Padilla Bay lagoon. Leachate samples, or surface water samples collected at locations where the leachate enters Padilla Bay Lagoon, were collected in 1985, 1988, 1996, and 1998 (see Tables 2 through 5).

In addition to collecting leachate samples at locations where previous leachate samples were collected, the perimeter of the landfill should be investigated to identify other leachate seeps, if present, particularly during an ebbing tide. Leachate and Padilla Bay surface water data can be used as part of the aquatic ecological evaluation.

5.5 Chemical Testing Program

The chemical analytical testing program(s) that have been completed for surface water and/or leachate samples have not been adequate to evaluate potential contaminants of concern. Future sampling and testing of media should include a list of chemicals at least as comprehensive as the testing program completed during Ecology's 1998 study. Additional chemicals of concern that directly relate to industrial processes from the industries that transported wastes to this landfill should be consulted to compile the potential chemicals of concern list (for example, at least the known hazardous substances outlined in Section 4.1.3). Additionally, current and appropriate regulatory screening criteria should be consulted for future site characterization and/or remedial investigation actions at this Site.

5.6 Accurate Site Mapping

An accurate map depicting site boundaries and important features is not available. Such a map is needed as part of the RI/FS and would include (at a minimum) the following features:

- Property boundaries,
- Saw mill buildings,
- Saw mill roadways,
- Sampling locations and monitoring wells,

- Surface water features (drainage ditches, estuarine stream, culverts, etc),
- Topography.

6.0 SAMPLING AND ANALYSIS PLAN

Soil, groundwater, surface water, and leachate samples will be obtained from the Site during this RI. These samples will be obtained from upland areas and will be collected using the methods described in Section 6.4.

Samples obtained during this study will be submitted to an Ecology-certified laboratory for analysis of the chemicals of concern outlined below. To accomplish this goal, samples obtained from the Site will be submitted for analysis of one or more of the following.

- Priority Pollutant Metals using EPA 6000/7000 Series Methods;
- Miscellaneous Metals (iron, manganese and vanadium) using EPA 6000/7000 Series Methods;
- VOCs using EPA Method 8260;
- SVOCs (including phenols, phthalates, nitrosodiphenylamine, dibenzofuran, carbazole, dibenzthiophene) using EPA Method 8270C;
- PAHs using EPA Method 8270-SIM;
- PCBs using EPA Method 8082;
- Dioxins and Furans using EPA Method 8290;
- Hydrocarbon Identification using Ecology Method NWTPH-HCID;
- Diesel- and heavy oil-range hydrocarbons using Ecology Method NWTPH-Dx (with silica gel cleanup).
- Gasoline-range hydrocarbons using Ecology Method NWTPH-Gx;
- Volatile petroleum hydrocarbons (VPHs) and extractable petroleum hydrocarbons (EPH) by WDOE-VPH and WDOE-EPA, respectively.
- Orgaonchlorine pesticides using EPA Method 8081;
- Organophosphorous pesticides (including carbaryl) using EPA Method 8141;
- Herbicides using EPA Method 8151; and
- Asbestos using gravimetric and/or transmission electron microscopy.

Analytical results for dioxins and furans will be presented in the RI report two different ways: as individual congeners and as toxic equivalencies (TEQ). EPA's recommended TEQ approach will be used to evaluate potential effects associated with complex mixtures of chlorinated dioxins and furans. This approach is based on the use of toxicity equivalency factors (TEFs), which, when applied, convert congener-specific concentrations into 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) equivalent concentrations (EPA, 1989). This approach requires multiplying dioxin and furan congener results by their respective TEFs to obtain a total 2,3,7,8-TCDD equivalent concentration in each sample. TEQ values will be calculated for individual samples using only those congeners that are detected, as recommended by Ecology (1996). This approach recommends that the total concentration for chemical groups that are expressed as the sum of individual compounds should be derived by adding the concentrations of only those individual compounds that are detected. The TEFs developed by the World Health Organization (WHO) in the June 1997 Stockholm meeting, and as summarized in Van den Berg, et al. (1998), will be used to calculate TEQ concentrations. A similar TEF, TEQ approach will be followed for carcinogenic PAH compounds. Note that Ecology is reviewing this approach, which could change by the time the RI is implemented.

The rationale for including each of these analyses is presented in Table 6. A general summary of the sampling and analysis plan is presented in Table 7. The specific compounds for which analytical data will be obtained are identified in the tables associated with the QAPP (Appendix B). Proposed sampling locations are shown in Figure 6.

The analytical results obtained during the RI will be used to identify constituents of potential concern (COPC) at the Site. These COPCs will be the focus of FS activities.

6.1 SOIL

6.1.1 Sampling Objective

During this study, subsurface explorations and test pits will be completed in the upland area to evaluate the nature, extent and potential sources of soil contamination. These explorations and test pits will evaluate surface soil conditions, landfill contents, and the landfill/native silt contact. As noted previously, knowledge of the landfill contents is limited. Historical photographs indicate that much of the landfill contents consist of garbage and drums of various sizes. Therefore, the focus of the soil sampling will be to characterize the soil in the landfill cap and the native silt/clay beneath the landfill. However, because the lateral and vertical extent of the waste is not known, soil may be present from the landfill cap to the native soil in portions of the landfill; soil in these portions of the landfill will also be characterized.

The specific objectives of these explorations and test pits are to further evaluate the following:

- Soil in the landfill cap,
- Lateral and vertical extent of the landfill,
- Landfill contents, and
- Native silt/clay beneath the landfill.

6.1.2 Sampling Locations, Frequency And Analyses

Approximately 13 soil borings will be completed using hollow stem auger drilling equipment at the approximate locations shown in Figure 6. Twelve borings will be completed in the landfill and one boring will be completed upgradient of the site (southwest of the landfill along S March Point Road). Soil conditions will be evaluated in the hollow stem auger borings using field screening techniques and/or analytical testing. In addition, permanent groundwater monitoring wells will be constructed in each of the 13 soil borings (Section 6.2). The borings will extend to specific depths to accomplish the groundwater sampling objectives, as described in Section 6.2.

Soil samples will be obtained at approximately 2-foot-depth intervals for geologic description and evaluated for the potential presence of hydrocarbon-related and volatile chemical-related contamination using visual, water sheen and headspace vapor field screening techniques. Soil samples from the hollow stem auger borings will be submitted for chemical analysis in general accordance with the frequency presented in Table 7. The chemical analytical testing protocol assumes testing six soil samples from the landfill cap, at least one soil sample within the landfill mass from each boring (a minimum of 13 soil samples), and 13 soil samples from the native soil. Soil samples not submitted for chemical analysis will be archived at the laboratory and can be analyzed, if within holding times presented in Appendix A, Table 16, if necessary based on the results of the initial six soil samples.

In addition to the soil borings described above, approximately 13 test pits will be excavated at the approximate locations shown in Figure 6. The approximate dimensions of the test pits are 3 feet wide, 8 feet long and 15 feet deep. The primary purposes of the test pits are to evaluate the landfill contents and the landfill/native soil contact. Soil samples from each test pit will be submitted for chemical analysis (in general, one sample within the landfill mass and one sample from the upper 2 feet of native soil beneath the landfill from each test pit and one sample obtained from the landfill cap from every other test pit, see Table 7). If it is not possible to collect a native soil sample due to water intrusion, a Baker Tank may be required to dewater the test pits. Soil samples not submitted for chemical analysis will be archived at the laboratory and can be analyzed, if within holding times presented in Appendix A, Table 16, if necessary based on the results of the initial six soil samples.

The soil samples obtained from the explorations and test pits will be submitted for chemical analysis of metals (priority pollutant metals plus iron, manganese and vanadium), VOCs, SVOCs, PAHs, PCBs, gasoline-range hydrocarbons, diesel-range and oil-range hydrocarbons, organochlorine pesticides, organophosphorous pesticides, herbicides, dioxins and furans and asbestos as indicated in Table 7. VPH/EPH analysis will be performed on the soil sample with the highest evidence of petroleum contamination based on field screening. If multiple petroleum types are observed, one soil sample for each identified petroleum type will be analyzed.

6.2 GROUNDWATER

6.2.1 Sampling Objective

During this study, one groundwater monitoring event will be conducted to evaluate the nature and extent of dissolved-phase contaminants in the shallow aquifer beneath the landfill and to evaluate whether the shallow aquifer is tidally influenced. Groundwater samples will be collected upgradient of the landfill, on the upgradient side of the landfill, in the middle of the landfill, near the point where groundwater may discharge to tidelands southeast of the landfill, and near the point where groundwater discharges to Padilla Bay and Padilla Bay Lagoon.

Groundwater monitoring activities will focus on the following key issues:

- The concentration and distribution of dissolved-phase contaminants within the shallow aquifer.
- The potential migration of dissolved-phase constituents into tidelands southeast of the landfill, Padilla Bay, and Padilla Bay Lagoon.
- Potential contaminant transport pathways onto the landfill from adjacent properties.
- Hydraulic conductivity in the landfill. Slug tests will be conducted at seven monitoring wells (MW-2, MW-3, MW-5, MW-7, MW-8, MW-10, and MW-12) to determine a range of hydraulic conductivities and an average (geometric mean) hydraulic conductivity at the landfill.
- The potential for tidal influence on the shallow aquifer. A 72-hour tidal study will be conducted to determine the exten of tidal influence. Automatic transducers will be installed in monitoring wells MW-9, MW-11, and MW-12 (near shore), MW-7 (middle of landfill), and MW-3 (upgradient side of landfill) and in Padilla Bay and Padilla Bay Lagoon.

6.2.2 Sampling Locations, Frequency and Analyses

Thirteen groundwater monitoring wells will be constructed in soil borings completed during this study. These monitoring wells will be constructed at on-site and off-site locations at the proposed locations shown in Figure 6.

The monitoring wells will be constructed in hollow stem auger soil borings. The monitoring wells will be constructed to depths of approximately 15 feet to evaluate groundwater conditions in the shallow aquifer or to the native soils if deeper than 15 feet. Wells will be screened from the base of the well to 5 feet above the measured groundwater level. Wells will be constructed using 2-inch-diameter polyvinyl chloride (PVC) well casing with 10-slot well screens. The screens in the new wells will be installed across the landfill/native soil contact and the top of the perched groundwater table. A perched aquifer is assumed to be present above the lower permeable native soils and within the higher permeable fill material. The well screen intervals may be modified based on field screening results or variations in soil type.

Groundwater samples will be obtained from groundwater monitoring wells, as summarized below.

Monitoring Well Locations	Groundwater Sampling Points	Total
Upgradient of Landfill	MW-1	1
Upgradient side of Landfill	MW-2, MW-3, MW-4, MW-5	4
Middle of Landfill	MW-6, MW-7	2
Adjacent to Padilla Bay and Padilla Bay Lagoon	MW-8. MW-9, MW-10, MW-11, MW-12	5
Adjacent to Tidelands Seast of Landfill	MW-13	1
	Total	13

During the groundwater monitoring event, groundwater levels will be measured as described in Section 6.4.4. The groundwater samples will be submitted for chemical analysis of metals (priority pollutant metals plus iron, manganese and vanadium), VOCs, SVOCs, PAHs, PCBs, gasoline-range hydrocarbons, diesel-range hydrocarbons, organochlorine pesticides, organophosphorous pesticides and herbicides as indicated in Table 7. Groundwater samples collected from MW-7 and MW-10 will be submitted for chemical analysis of dioxins and furans. Groundwater samples collected from MW-9 and MW-12 (near shore), MW-7 (middle of landfill), and MW-3 (upgradient side of landfill) will also be submitted for analysis of total dissolved solids to evaluate the potability of the groundwater.

6.3 Leachate

6.3.1 Sampling Objective

Previously, leachate samples have been collected at two locations at the northeast side of the landfill (see Figure 5). Metals, #2 diesel, benzo(a)anthracene, and PCBs (aroclor 1242) were detected in these leachate samples at concentrations greater than applicable surface water criteria. VOCs, SVOCs, and pesticides have also been detected in previous leachate sampling events. Specific objectives of the leachate sampling are as follows:

- Collect leachate samples (if leachate is present) along the perimeter of the landfill, and
- Evaluate whether landfill contaminants are leaching from the landfill into Padilla Bay, Padilla Bay Lagoon, nearby tidelands, or the drainage ditch/estuarine stream on the southwest, south, and southeast sides of the landfill at concentrations that could pose a risk to human health and the environment.

6.3.2 Sampling Locations, Frequency and Analyses

The collection of leachate samples is dependant on the presence of leachate during the sampling event. As noted previously, leachate samples have been collected previously at two locations near the northeast side of the landfill (see Figure 5). If present, leachate will be collected from these two locations. We have assumed that up to three more leachate samples will be collected at other locations along the landfill perimeter. Leachate has not been previously noted at other locations.

The leachate samples will be submitted for chemical analysis of metals (priority pollutant metals plus iron and manganese), VOCs, SVOCs, PAHs, PCBs, gasoline-range hydrocarbons, diesel-range hydrocarbons, organochlorine pesticides, organophosphorous pesticides, herbicides, and dioxins and furans.

6.4 SURFACE WATER

6.3.1 Sampling Objective

Previously, surface water samples have been obtained west of the landfill and S March Point Road, from the estuarine stream southeast of the landfill (note that the location of this sample is not clear), and from Padilla Bay Lagoon near the northeast side of the landfill (see Figure 5). Metals (arsenic, copper, mercury, and nickel) were detected in at least one of these surface water samples at concentrations greater than applicable surface water criteria. Beryllium, selenium, tellurium, zinc, and phenol have also been detected in the previous surface water sampling event.

Specific objectives of the surface water sampling are as follows:

- Collect surface water samples from the drainage ditch between the railroad tracks and the landfill on the north and from the drainage ditch/estuarine stream on the southwest, south, and southeast sides of the landfill,
- Evaluate whether the drainage ditch and drainage ditch/estuarine stream are a source of contamination to Padilla Bay Lagoon,
- Evaluate whether surface water contaminants, if detected, are present in surface water at concentrations that could pose a risk to human health and the environment.

6.3.2 Sampling Locations, Frequency and Analyses

Surface water samples will be collected at the four locations shown on Figure 6.

Two surface water samples will be collected from the railroad drainage ditch. Surface water in this ditch flows from northwest to southeast and into Padilla Bay Lagoon. One sample will be collected just upstream of where the surface water discharges to Padilla Bay Lagoon. The second sample will be collected further upstream, near the assumed northwestern boundary of the landfill.

Two surface water samples will also be collected from the drainage ditch/estuarine stream. Surface water in this ditch/stream flows from northwest to southeast between S March Point Road and the landfill, wraps around the southeastern toe of the landfill, and flows to north into Padilla Bay Lagoon. One sample will be collected just upstream of where the surface water discharges to Padilla Bay Lagoon. The second sample will be collected near the southeastern toe of the landfill. The purpose of this second sample is to evaluate surface water quality in the drainage ditch/estuarine stream upstream of water from a culver southeast of the landfill merges with the estuarine stream.

The surface water samples will be submitted for chemical analysis of metals (priority pollutant metals plus iron and manganese), VOCs, SVOCs, PAHs, PCBs, gasoline-range hydrocarbons, diesel-range hydrocarbons, organochlorine pesticides, organophosphorous pesticides, and herbicides.

6.5 General Sampling Procedures and Equipment

This section specifies the field procedures, field quality assurance/quality control (QA/QC) protocol, and the chemical testing program to be implemented during the RI. The RI field and sampling procedures will include the following

- Collection of soil samples from hollow stem auger borings;
- Collection of soil samples from test pit excavations;
- Collection of surface water and leachate samples;
- Monitoring well construction and surveying;
- Monitoring well groundwater elevations and groundwater sampling;
- Field screening methods;
- Decontamination procedures; and
- Handing of investigation-derived waste.

6.5.1 Underground Utility Locate

Prior to drilling and test pit activities, an underground utility locate will be conducted in the area of the proposed boring and test pit locations to identify any subsurface utilities and/or potential underground physical hazards.

6.5.2 Soil Sampling

The planned soil boring and test pit locations described in this section may be modified if necessary to circumvent problems associated with surface access, utilities, or subsurface obstructions.

Hollow Stem Auger Borings. Eleven hollow stem auger soil borings (designated HSA01 through HSA11) will be advanced using a track mounted hollow stem auger drilling rig at the locations shown on Figure 6. The borings will be advanced into the native silt/clay beneath the landfill. If subsurface contamination is observed by field screening methods at depth, the borings will be continued to the limits of contamination, as determined by field screening methods, or until the drilling method encounters refusal.

Boring activities will be monitored continuously by a technical representative from GeoEngineers who will observe and classify the soil encountered, and prepare detailed field notes. Soil samples obtained from the borings will be visually classified in general accordance with American Society of Testing and Materials (ASTM) Standard D-2488. The samples also will be evaluated for the potential presence of hydrocarbon contamination using field screening techniques (see Section 6.4.7). Observations of soil and groundwater conditions and soil field screening results for each exploration will be included in a boring log.

Soil samples will be collected from the hollow stem auger soil borings at approximately 2.5-foot intervals using an SPT sampler. The sampler will be driven by a 140-pound hammer falling a vertical distance of approximately 30-inches. The number of blows required to advance the sampler the final 18 inches will be recorded on the boring logs. Soil samples will be obtained from the lower 12 inches of the driven sample. Soil will be immediately removed from the sampler for analysis of gasoline-range petroleum hydrocarbons and VOCs. VOC samples will be collected following EPA Method 5035A. The remaining sample volume will be removed from the sampler and homogenized, placed into laboratory supplied containers, lightly packed, and capped with a plastic lid. The sand-sized and finer fractions of the soil will be targeted for collection.

Sample containers will be labeled in the field and stored in an iced cooler prior to and during shipment to the chemical analytical laboratory. Soil cuttings from the borings will be placed in labeled 55-gallon drums. Section 6.5 addresses the disposition of investigation-derived waste such as soil cuttings.

Test Pits. Soil samples also will be obtained from test pit excavations. The test pits will be excavated using a rubber-tire backhoe or track-mounted excavator. The approximate dimensions of the test pit are 3 feet wide, 8 feet long and 15 feet long. A member of GeoEngineers' staff will observe subsurface conditions in the test pits, and classify soil in general accordance with ASTM Standard D-2488. A log will be prepared for each test pit exploration. The log will include a summary of the soil and groundwater conditions observed, and field screening results. After completion of a test pit, the spoils will be returned to the pit in the order they were excavated and compacted to a dense, nonyielding state using the backhoe or excavator bucket. The existing landfill cap will be scraped of and kept in a separate stockpile so that it can be replaced on top of the excavation.

Soil samples obtained at depths shallower than 3 feet bgs will be obtained directly from the test pit sidewalls using a stainless steel sampling spoon. Soil in the exposed test pit sidewall will not be sampled because it has been contacted by the excavator bucket. This "surficial" soil will be removed using a stainless steel sampling spoon. The "fresh" soil exposed during this process will then be sampled using a decontaminated sampling spoon or newly gloved (nitrile or latex) hand.

Test pit soil samples from depths greater than 3 feet bgs will be obtained directly from the backhoe/excavator bucket. These samples will be obtained from the center of the bucket using the procedures described above.

The samples will be placed into laboratory supplied containers, lightly packed, and capped with a plastic lid. The sand-sized and finer fractions of the soil will be targeted for collection. Sample containers will be labeled in the field and stored in an iced cooler prior to and during shipment to the chemical analytical laboratory.

6.5.3 Monitoring Well Construction and Development

The monitoring wells will be constructed in hollow stem auger soil borings. Installation of the monitoring wells will be observed by a GeoEngineers field scientist/engineer, who will maintain a detailed log of the materials and depths of the well. The monitoring wells will be constructed to depths of approximately 15 feet, or native soils if deeper than 15 feet, to evaluate groundwater conditions in the shallow aquifer. Wells will be screened from the base of the well to 5 feet above the measured groundwater level. Wells will be constructed using 2-inch-diameter schedule 40 PVC well casing with 10 or 20-slot well screens. The screens in the new wells will be installed across the landfill/native soil contact and the top of the perched groundwater table. The well screen intervals may be modified based on field screening results or variations in soil type. Medium sand will be placed in the borehole annulus surrounding the slotted portion of the well. Each well will be completed by placing a bentonite seal and above-ground monument protected by three bollards. A lockable "Thermos"-type cap will be installed in the top of the PVC well casing.

Each monitoring well will be developed to remove water introduced into the well during drilling (if any), stabilize the filter pack and formation materials surrounding the well screen, and restore the hydraulic connection between the well screen and the surrounding soil. The well screen will be gently surged with a decontaminated stainless steel bailer several times after installation.

The depth to water in the monitoring well will be measured prior to development. The total depth of the well will also be measured and recorded. Groundwater monitoring wells will be developed by purging the well until conventional field parameters (such as temperature, conductivity and pH) stabilize to within 10% over three consecutive measurements and/or until 5 well volumes have been removed. The removal rate and amount of groundwater removed will be recorded during well development procedures. Additionally, achievement of a turbidity value of 10 will be a goal of well development. During well development, water will be collected and stored in labeled 55-gallon drums for subsequent characterization. Section 6.7 addresses the disposition of investigation-derived waste. Groundwater monitoring wells will be professionally surveyed to identify their lateral position and vertical elevation of the top of well casing (above ground completion), top of well casing (PVC), and at ground level. The vertical datum will be carried from a standard USGS NGVD benchmark, which will be used to establish a permanent benchmark at the landfill. A survey reference notch will be established on each monitoring well casing.

6.5.4 Groundwater Sampling

Groundwater levels will be measured in each monitoring well during each monitoring event. Groundwater levels will be measured to the nearest 0.01 foot using an electric water level indicator. The water levels will be measured relative to the casing rim elevations. The direction of shallow groundwater flow beneath the landfill will be interpreted based on field measurements.

Groundwater samples will be obtained from monitoring wells using a submersible and dedicated polyethylene tubing. Groundwater samples will not be submitted for analysis if visible product or sheen is present in the sample container.

Groundwater samples will be obtained using low-flow/low-turbidity sampling techniques to minimize the suspension of sediment in groundwater samples. The flow rate will be less than one liter per minute. A Horiba U-22 water quality measuring system (with flow-through-cell) will be used to monitor the following water quality parameters during purging: electrical conductivity, dissolved oxygen, pH, salinity, total dissolved solids, turbidity, oxidation-reduction potential and temperature. Ambient groundwater conditions will have been reached once these parameters vary by less than 10 percent on three consecutive measurements. The stabilized field measurements will be documented in the field log book (for subsequent use in the RI), and then groundwater samples will be obtained. Purge water will be stored in labeled 55-gallon drums for subsequent characterization. Section 6.5 addresses the disposition of investigation-derived waste such as purge water.

Groundwater samples will be obtained after the wells are purged. The samples will be obtained by flowing water directly from the tubing into sample containers provided by the analytical laboratory. The samples will be free of bubbles and headspace will not be present in the containers. Each sample container will be securely capped, labeled, and placed in a cooler with ice immediately upon collection. The well casing plug and monument cover lid will be secured after each sampling event.

Samples collected for the analysis of total and dissolved metals (priority pollutant metals plus iron, manganese and vanadium). Samples collected for the analysis of dissolved metals will be filtered using a 0.45 micrometer (μm) in-line filter.

6.5.5 Leachate Sampling

Leachate samples will be collected by placing a clean, glass sample collection container in the seep allowing the water to enter. The sample collection container will be decanted into the appropriate laboratory-prepared sample containers for transport and analysis. Samples will be placed in a cooler with ice and delivered to the analytical laboratory within laboratory-specified holding times. Standard chain-of-custody procedures will be observed during transport of the samples to the laboratory.

Field parameters, including temperature, pH, conductivity, hardness, acidity, and alkalinity, will be measured at each leachate sampling point.

6.5.6 Surface Water Sampling

Surface water samples will be collected by placing a clean, capped, glass sample collection container as close as possible to the drainage ditch/estuarine stream bottom, at a maximum depth between 1 and 2 feet below the water surface. The sample container will then be uncapped, allowing the water to enter, and then recapped prior to removal from the sampling location. The sample collection container will be decanted into the appropriate laboratory-prepared sample containers for transport and analysis. Samples will be placed in a cooler with ice and delivered to the analytical laboratory within laboratory-specified holding times. Standard chain-of-custody procedures will be observed during transport of the samples to the laboratory.

Field parameters, including temperature, pH, conductivity, hardness, acidity, and alkalinity, will be measured at each surface water sampling point.

6.5.7 Decontamination

The drilling equipment will be decontaminated before beginning each boring using a hot-water pressure washer. Reusable sampling/monitoring equipment (trowels, split spoons, bowls, etc.) that come in contact with soil or groundwater will be decontaminated before each use. Decontamination procedures for the equipment will consist of the following: 1) wash with nonphosphate detergent solution (Liqui-Nox and distilled water), 2) rinse with distilled water, and 3) place the decontaminated equipment on clean plastic sheeting or in a plastic bag. Wash water used to decontaminate the sampling equipment will be stored on-site in labeled 55-gallon drums for subsequent characterization and disposal.

6.5.8 Sample Handling

Sample handling procedures, including labeling, container and preservation requirements, and holding times are described in the QAPP (Sections 8).

6.5.9 Field Screening

Soil samples obtained from the borings will be field screened for evidence of possible contamination. Field screening results will be recorded on the field logs and the results will be used as a general guideline to delineate areas of possible contamination. Screening results will be used to aid in the selection of soil samples to be submitted for chemical analysis. The following screening methods will be used: 1) visual screening, 2) water sheen screening and 3) headspace vapor screening. Visual screening and water sheen screening are qualitative methods; therefore, precision, accuracy and detection limits are not quantified for these methods. Headspace vapor screening is a semi-quantitative method; however, precision and accuracy will not be quantified for this method. Instrument accuracy and detection limits are described below. Field screening results are site- and location-specific. The results may vary with temperature, moisture content, soil type and chemical constituent.

Visual Screening. The soil will be observed for unusual color and stains and/or odor indicative of possible contamination.

Water Sheen Screening. A portion of the soil sample will be placed in a pan containing distilled water. The water surface will be observed for signs of sheen. The following sheen classifications will be used:

Classification	Identifier	Description
No Sheen	(NS)	No visible sheen on the water surface
Slight Sheen	(SS)	Light, colorless, dull sheen; spread is irregular, not rapid; sheen dissipates rapidly
Moderate Sheen	(MS)	Light to heavy sheen; may have some color/iridescence; spread is irregular to flowing, may be rapid; few remaining areas of no sheen on the water surface
Heavy Sheen	(HS)	Heavy sheen with color/iridescence; spread is rapid; entire water surface may be covered with sheen

Headspace Vapor Screening. A portion of the soil sample placed into a resealable plastic bag for headspace vapor screening. Ambient air will be captured in the bag; the bag will be sealed and then shaken gently to expose the soil to the air trapped in the bag. The bag will remain closed for approximately 5 minutes at ambient temperature before the headspace vapors are measured. Vapors present within the sample bag's headspace will be measured by inserting the probe of a photoionization detector (PID) in a small opening in the bag. A PID measures the concentration of organic vapors ionizable by a 10.6 electron volt (eV) lamp in parts per million (ppm) and quantifies organic vapor concentrations in the range between 0.1 ppm and 2,000 ppm (isobutylene equivalent) with an accuracy of 1 ppm between 0 ppm and 100 ppm. The maximum value on the instrument and the ambient air temperature will be recorded on the field log for each sample. The PID will be calibrated to 100 ppm isobutylene.

6.5.10 Surveying

Professional Land Survey

A professional land surveyor registered in Washington State will conduct a topographic and boundary survey of the landfill. The surveyor will carry the vertical datum from a standard USGS NGVD benchmark to establish a permanent benchmark at the landfill. In addition, the surveyor will survey key buildings and other significant landmarks.

- **Vertical Controls:** Each monitoring well casing rim and ground surface elevation will be surveyed by GeoEngineers field personnel relative to the permanent benchmark. Elevations will be surveyed using a laser level, which has an accuracy of 0.01 feet.
- **Horizontal Controls:** GeoEngineers field personnel will record the exact boring/monitoring well, test pit, and surface water and leachate sampling locations, and other pertinent information, using hand held Trimble GeoXT GPS units with sub-meter accuracy during sampling activities. Sub-meter accuracy standards will be used during data collection to record latitude and longitudinal data. A minimum of four satellites will be required for a position dilution of precision (PDOP) value of less than 6. Satellite elevation must be at least 15 degrees above the horizon and a minimum signal-to-noise ratio (SNR) of 39 bBHz. GPS data collected in the field will be post processed in the office using measurements from the nearest reference station to each collection point.

Geophysical Survey

A non-intrusive geophysical survey will be conducted to identify the lateral and vertical extent of the landfill and to identify objects (e.g., 55-gallon drums) within the landfill prior to drilling. Geophysical methods will include ground penetrating radar, electromagnetics, and/or other appropriate techniques.

6.5.11 Field Equipment Calibration Procedures

Field equipment requiring calibration will be calibrated to known standards in accordance with manufacturers' recommended schedules and procedures for each instrument. Calibration checks of the vapor measurement equipment will be conducted daily and the instruments will be recalibrated if required. Calibration measurements will be recorded in the daily field logs. If field equipment becomes inoperable, it will be replaced with a properly calibrated instrument.

6.6 DISPOSITION OF INVESTIGATION-DERIVED MATERIALS

6.6.1 Soil Disposition

Soil removed from the test pit excavations will be replaced in the excavations. Soil cuttings from borings completed during this study will be placed in labeled and sealed 55-gallon drums. The drums will be stored temporarily in an existing containment area until appropriate disposal is identified. Soil samples may need to be submitted for asbestos analysis based on knowledge of the landfill contents.

6.6.2 Groundwater and Decontamination Water Disposal

Purge water removed from the monitoring wells and decontamination water generated during all sampling activities will be stored on-site in labeled 55-gallon drums. The drums of water will be stored temporarily in the existing containment area.

6.6.3 Disposition of Exploration-Derived Waste

Incidental waste generated during sampling activities may include gloves, Tyvek suits, spent respirator cartridges, disposable bailers, plastic sheeting, paper towels and similar expended and discarded field supplies. These materials also will be temporarily stored in a 55-gallon drum in the containment area.

7.0 TERRESTRIAL ECOLOGICAL RISK

As part of the RI, a terrestrial ecological evaluation (TEE) will be conducted consistent with WAC 173-340-7490. The purpose of the terrestrial ecological evaluation is to:

- Determine whether site-related soil contamination poses a unacceptable risk to the terrestrial environment,
- Characterize the potential threat to terrestrial plants and animals exposed to the site-related soil contamination, and
- Establish cleanup levels for protection of terrestrial plants and animals.

The terrestrial ecological risk assessment will follow the evaluation process outlined in WAC 173-340-7490. Specifically, the landfill will be evaluated to determine if it qualifies for a TEE exclusion, a simplified TEE or if a site-specific TEE is required. If required based on the appropriate TEE evaluation, cleanup levels will be established following the simplified or site-specific TEE process. Under the simplified and site-specific TEE processes, cleanup levels can be established using values in WAC 173-340-7490 Tables 749-2 and 749-3, respectively or cleanup levels can be established using a site-specific evaluation.

8.0 FEASIBILITY STUDY

The feasibility study (FS) will be conducted consistent with WAC 173-340-350(8). The scope of the FS will be determined based on the results of the RI. The FS will evaluate a reasonable number of cleanup action alternatives that "protect human health and the environment." A permanent alternative will be evaluated unless not required as detailed in WAC 173-340-350(8)(c)(ii)(B).

This section lists the specific tasks that will be completed as part of the FS.

8.1 DEVELOP CLEANUP STANDARDS (SOIL AND GROUNDWATER)

Cleanup standards will be developed in accordance with MTCA. Table 8 presents preliminary soil and groundwater cleanup levels. The preliminary soil and groundwater cleanup levels were identified using the following sources:

- Soil: MTCA Method B soil cleanup levels (Direct Contact).
- Groundwater: MTCA Method B groundwater cleanup levels (potable water).

Surface water cleanup levels will be identified following WAC 173-340-730 pending the results of the RI.

Cleanup standards will consist of two components: cleanup levels and points of compliance. For each medium, the following process will be followed to identify cleanup levels:

- Identify potential exposure pathways for human and ecological receptors based on beneficial uses of land, groundwater and surface water.
- Evaluate the highest beneficial use and reasonable maximum exposure pathway(s).
- Select indicator hazardous substances.
- Select cleanup level for each indicator hazardous substance and medium.
- Evaluate cleanup levels relative to other applicable or relevant state and federal laws where appropriate.

Points of compliance will be proposed based on potential exposure pathways, technical practicability and consistency relative to similar sites, where appropriate.

8.2 IDENTIFY AND SCREEN TECHNOLOGIES

Technologies with potential applicability to the cleanup of the Site will be identified and screened. Only those technologies with proven applicability for treatment of the identified indicator hazardous substances will be screened. The following approach will be used to identify and initially screen technologies:

- Identify cleanup technologies based on cost, net environmental benefit and technical feasibility.
- Evaluate implementability of the identified cleanup technologies. Specific identified cleanup technologies will be eliminated from further consideration on the basis of technical implementability or if the cost of the technology is disproportionate to the resulting environmental benefit. This initial screening step will consider the following information:
  - Contaminant distribution
  - Contaminant concentrations
  - Physical characteristics of the Site and affected media

8.3 DEVELOP AND EVALUATE CLEANUP ALTERNATIVES

Those technologies selected in Section 8.2 will be assembled into cleanup action alternatives and further evaluated against criteria specified in WAC 173-340-360. The "No Action" alternative will also be evaluated to provide a basis for comparison to the other proposed alternatives. The general process for this task will be:

- Develop remedial action objectives.
- Develop general response actions that satisfy the remedial action objectives, MTCA and other applicable or relevant state and federal laws, where appropriate.
- Assemble selected technologies into specific cleanup alternatives and identify remediation levels as appropriate.
- Develop preliminary design and order of magnitude cost estimates for each alternative.
- Evaluate cleanup alternatives based on criteria specified in MTCA, WAC 173-340-360.
- Identify a preferred alternative and presented it in the FS report.

9.0 HABITAT RESTORATION OPPORTUNITIES

When possible, habitat restoration will be incorporated into the cleanup action alternatives evaluated in the FS. The best opportunities for restoration exist along the S March Point Road and the seasonal stream and wetland. The habitat that would benefit the most is in the area where the stream enters and is tidally influenced by the lagoon. The intertidal edge here and along the eastern side of the landfill where the stream channel enters the lagoon provides the best topographic relief and is not as abrupt as along the northern portions of the site and the lagoon. The single best opportunity for restoration in this area is invasive species removal and enhancement of the shoreline buffer with native near shore plants. The seasonal drainage ditch to the north along the BNSF railroad grade offers little opportunity for habitat restoration. Near shore habitat along the north side of the landfill where it borders the bay could also benefit from invasive species removal but would need extensive grading and the addition of soil in order to create an environment in which native near shore vegetation could succeed.

Initial tasks that would be needed prior to developing a restoration plan or habitat management plan include delineating both the ordinary high water mark (OHWM) along the edge of the landfill and the lagoon as well as delineating the wetland habitat within the stream feature between S March Point Road and the site. An approximation of the area that contains invasive species should also be determined if replanting with native near shore species is a goal of the restoration plan.

Local critical areas review would be required by Skagit County prior to implementing the restoration plan. Depending on the activities occurring below the OHWM there may also be a need for Washington Department of Fish and Wildlife and U.S. Army Corps of Engineers approval (NWP27 – Stream and Wetland Restoration Activities).

10.0 LIMITATIONS

This plan has been prepared for use by SAIC (GeoEngineers is subcontracted to SAIC for Ecology Contract # C0700034), its authorized agents and Washington State Department of Ecology. The information contained herein is not intended for use by others and it is not applicable to other sites. No other (third) party may rely on the product of our services unless we agree in advance and in writing to such reliance. This plan can be provided to contractors, maintenance and utility personnel or other third parties for informational purposes only. This is to provide our firm with reasonable protection against open-ended liability claims by third parties with whom there would otherwise be no contractual limits to their actions.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted environmental science practices in this area at the time this report was prepared. No warranty or other conditions, express or implied should be understood.

Any electronic form, facsimile or hard copy of the original document (email, text, table and/or figure), if provided, and any attachments are only a copy of the original document. The original document is stored by GeoEngineers Inc. and will serve as the official document of record.

11.0 REFERENCES

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TABLE 1
WELL SURVEY DATA
DRAFT-FINAL UPLAND RI/FS WORK PLAN
MARCH POINT LANDFILL, ANACORTES, WASHINGTON

Well Location	Property Address	Owner	Type of Well	Well Details			Approximate Distance to Landfill (feet)
				Total Depth (feet)	Screening Interval (feet)	Depth to Groundwater (feet)	
1	Skagit County, WA	Texaco	Resource Protection	2	1.5 - 2.0	0	2,100
2a - 2d	Skagit County, WA	not available	Monitoring	20	5 - 20	4	1,300
3	Skagit County, WA	Skagit County PUD #1	Unknown	19	15 - 18.5	1.5	650
4	Skagit County, WA	Skagit County PUD #1	Unknown	200	140 - 170	132	1,300
5	Skagit County, WA	not available	Domestic	110	100 - 105	84	1,800
6a - 6n	12885 Casino Drive, Anacortes, WA	Swinomish Reservation	Resource Protection	10	5 - 10	no water	2,000
7a	Skagit County, WA	U.S. Geological Survey	Domestic	100	85 - 90	69	1,300
7b	Skagit County, WA	Swinomish Reservation	Monitoring	5	2 - 5	4	1,300
7c	Skagit County, WA	Swinomish Reservation	Monitoring	15	10 - 15	5	1,300
7d	Skagit County, WA	Swinomish Reservation	Monitoring	15	10 - 15	5	1,300
7e	Skagit County, WA	Swinomish Reservation	Monitoring	18	5 - 18	5.5	1,300
7f	Skagit County, WA	Swinomish Reservation	Monitoring	20	15 - 20	5.5	1,300
8	Skagit County, WA	Nancy Mack	Domestic	77	67 - 77	4	2,600

Note: Well logs obtained for wells within approximately 0.5 miles of the March Point Landfill from Ecology's Well Log website (ttp://apps.ecy.wa.gov/welllog/index/asp)

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TABLE 2

1986 ECOLOGY SITE INSPECTION REPORT - WATER SAMPLES[1]

MARCH POINT LANDFILL
ANACORTES, WASHINGTON

Analytes	NCT091 (Surface Water) Figure 9 - Location 1A	NCT092 (Surface Water) Figure 9 - Location 1B	NCT094 (Surface Water) Figure 9 - Location 1C	NCT095 (Leachate) Figure 9 - Location 1D	Surface Water Criteria[2] Aquatic Life Marine/Chronic[3]	Human Health Marine[4]	MTCA Method B[5]
Dissolved Metals - EPA Method Not Known (µg/L)							
Antimony	<1	<1	<1	<1	--	640	1000
Arsenic	**5**	<u><1</u>	**74**	**2**	36	0.14	0.098
Beryllium	<0.1	<0.1	**14.2**	<0.1	--	--	270
Cadmium	<0.2	<0.2	<0.2	<0.2	8.8	--	20
Chromium	<1	<1	<1	<1	50	--	490
Copper	**7**	**11**	**2**	**1**	2.4	--	2700
Lead	<1	<1	<1	<1	8.1	--	--
Mercury	**0.06**	**0.06**	<u><0.06</u>	<u><0.06</u>	0.025	0.15	--
Nickel	**5**	**100**	**40**	**6**	8.2	4600	1100
Selenium	**2**	<1	**62**	**5**	71	4200	2700
Silver	<0.1	<0.1	<0.1	<0.1	--	--	26000
Telurium	**1**	<1	**24**	**3**	--	--	--
Zinc	<1	**32**	**3**	**22**	81	26000	17000
Phenolics - EPA Method Not Known (mg/L)							
Phenolics	0.030	0.005	0.010	0.020	--	--	--
Volatile Organic Compounds - EPA Method Not Known (µg/L)							
Benzene	<1	<1	<1	13	--	51	23

Notes:
[1]Ecology, 1986
[2]Surface water criteria identified in WAC 173-340-730(3)(b)(i). The surface water criteria are being used in this report for screening purposes, and are not intended to represent proposed or final cleanup levels.
[3]Lowest available aquatic life marine chronic criteria from Chapter 173-201A, Clean Water Act Section 304, and National Toxics Rule (40 CFR 131)
[4]Lowest available human health marine criteria from Clean Water Act Section 304 and National Toxics Rule (40 CFR 131)
[5]MTCA Method B surface water cleanup level [WAC 173-340-730(3)(b)(iii)]
-- = not available
nd = not detected
n/a = not analyzed or not applicable
bold indicates a detected concentration
underline indicates that detection limit is greater than at least one surface water criteria
shading indicates that detected concentration is greater than at least one surface water criteria

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TABLE 3

1989 ECOLOGY LETTER - LEACHATE SAMPLES[1]

MARCH POINT LANDFILL

ANACORTES, WASHINGTON

Analytes	Sample ID 88-257426 Figure 9 - Location 2	Surface Water Criteria[2] Aquatic Life Marine/Chronic[3]	Human Health Marine[4]	MTCA Method B[5]
Metals - EPA Method Unknown (µg/L)				
Antimony[6]	1U	--	640	1,000
Arsenic[6]	**91**	36	0.14	0.098
Beryllium[7]	**8.5**	--	--	270
Cadmium[7]	**9.9**	8.8	--	20
Chromium[7]	**324**	50	--	490
Copper[7]	**357**	2.4	--	2,700
Lead[6]	**126**	8.1	--	--
Mercury[6]	--	0.025	0.15	--
Nickel[7]	**959**	8.2	4,600	1,100
Selenium[6]	1U	71	4,200	2,700
Silver[6]	**2.2**	--	--	26,000
Thallium[6]	**1.8**	--	0.47	--
Zinc[7]	**779**	81	26,000	17,000

Notes:

[1]Ecology, 1989

[2]Surface water criteria identified in WAC 173-340-730(3)(b)(i). The surface water criteria are being used in this report for screening purposes, and are not intended to represent proposed or final cleanup levels.

[3]Lowest available aquatic life marine chronic criteria from Chapter 173-201A, Clean Water Act Section 304, and National Toxics Rule (40 CFR 131)

[4]Lowest available human health marine criteria from Clean Water Act Section 304 and National Toxics Rule (40 CFR 131)

[5]MTCA Method B surface water cleanup level [WAC 173-340-730(3)(b)(iii)]

-- = not available

nd = not detected

n/a = not analyzed or not applicable

bold indicates a detected concentration

shading indicates that detected concentration is greater than at least one surface water criteria

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TABLE 4

1996 SKAGIT COUNTY HEALTH DEPARTMENT LETTER - LEACHATE SAMPLES[1]

MARCH POINT LANDFILL
ANACORTES, WASHINGTON

	Sample ID		Surface Water Criteria[2]		
	WMW-1	WMW-2			
Analytes	Figure 9 - Location 3A	Figure 9 - Location 3B	Aquatic Life Marine/Chronic[3]	Human Health Marine[4]	MTCA Method B[5]
Volatile Organic Compounds - EPA Method 8260 (µg/L)					
Benzene	**6**	**2J**	--	51	23
Chlorobenzene	**15**	**1J**	--	1,600	5,000
m,p-xylenes	**3**	**1J**	--	--	--
o-xylene	**3**	3U	--	--	--
acetone	5U	5U	--	--	--
Carbon disulfide	3U	3U	--	--	--
Methylene chloride	3U	3U	--	--	--
2-Butanone	5U	5U	--	--	--
4-Methyl-2-pentanone	5U	5U	--	--	--
Toluene	**2J**	3U	--	15,000	19,000
2-Hexanone	5U	5U	--	--	--
Semivolatile Organic Compounds - EPA Method 8270 (µg/L)					
2,4-Dimethylphenol	**3**	1U	--	850	550
Naphthalene	**2**	1U	--	--	4,900
2-Methylnaphthalene	**1**	1U	--	--	--
n-Nitrosodiphenylamine	1U	**1**	--	6	9.7
Bis(2-ethylhexyl)phthalate	1U	**1**	--	2.2	3.6
Fluoranthene	1U	1U	--	140	90
Pyrene	1U	1U	--	4,000	2,600
Benzo(a)anthracene	1U	1U	--	0.018	0.03
Chrysene	1U	1U	--	0.018	0.03
Benzo(b)fluoranthene	1U	1U	--	0.018	0.03
Benzo(k)fluoranthene	1U	1U	--	0.018	0.03
Pesticides/PCBs - EPA Method 8080	nd	nd	--	--	--
Phenol - EPA Method 420.2 (mg/L)					
Total phenol (mg/L)	**10**	5U	--	--	--
Metals - EPA 6000/7000 Series Methods (µg/L)					
Antimony	6U	3U	--	640	1,000
Arsenic	5U	5U	36	0.14	0.098
Beryllium	10U	10U	--	--	270
Cadmium	10U	10U	8.8	--	20
Chromium	10U	10U	50	--	490
Copper	10U	10U	2.4	--	2,700
Cyanide	5U	5U	--	--	--
Lead	50U	50U	8.1	--	--
Mercury	0.2U	0.2U	0.025	0.15	--
Nickel	20U	20U	8.2	4,600	1,100
Selenium	5U	5U	71	4,200	2,700
Silver	10U	10U	--	--	26,000
Thallium	1U	1U	--	--	--
Zinc	**26**	**31**	81	26000	17000
Cyanide - EPA Method 335.3 (mg/L)					
Cyanide	5U	5U	--	--	--

Notes:

[1]Skagit County, 1996

[2]Surface water criteria identified in WAC 173-340-730(3)(b)(i). The surface water criteria are being used in this report for screening purposes, and are not intended to represent proposed or final cleanup levels.

[3]Lowest available aquatic life marine chronic criteria from Chapter 173-201A, Clean Water Act Section 304, and National Toxics Rule (40 CFR 131)

[4]Lowest available human health marine criteria from Clean Water Act Section 304 and National Toxics Rule (40 CFR 131)

[5]MTCA Method B surface water cleanup level [WAC 173-340-730(3)(b)(iii)]

-- = not available
nd = not detected
n/a = not analyzed or not applicable
bold indicates a detected concentration
underline indicates that detection limit is greater than at least one surface water criteria
shading indicates that detected concentration is greater than at least one surface water criteria

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TABLE 5

1999 ECOLOGY REPORT - LEACHATE SAMPLES[1]

MARCH POINT LANDFILL
ANACORTES, WASHINGTON

Analytes	Sample ID		Surface Water Criteria[2]		
	248005	248006			
	Figure 9 - Location 4A	Figure 9 - Location 4B	Aquatic Life Marine/Chronic[3]	Human Health Marine[4]	MTCA Method B[5]
Priority Pollutant Metals - EPA Method 200.7 (µg/L)					
Antimony	30 UJ	30 U	--	640	1000
Arsenic	30 U	30 U	36	0.14	0.098
Beryllium	1 U	1 U	--	--	270
Cadmium	4 U	4 U	8.8	--	20
Chromium	5 U	5 U	50	--	490
Copper	5 U	5 U	2.4	--	2700
Lead	20 U	20 U	8.1	--	--
Mercury - EPA Method 245.1	0.05 U	0.05 U	0.025	0.15	--
Nickel	15 U	15 U	8.2	4600	1100
Selenium	40 U	40 U	71	4200	2700
Silver	4 U	4 U	--	--	26000
Thallium	50 U	50 U	--	0.47	--
Zinc	5 U	5 U	81	26000	17000
Miscellaneous Trace Elements - EPA Method 200.7 (µg/L)					
Aluminum	**106**	**39**	--	--	--
Barium	**103**	**162**	--	--	--
Calcium	**43,400**	**54,500**	--	--	--
Cobalt	5 U	5 U	--	--	--
Iron	**5,660**	**16,200**	--	--	--
Magnesium	**37,300**	**31,400**	--	--	--
Manganese	**127**	**234**	--	100	--
Molybdenum	**7.4**	5 U	--	--	--
Potassium	**17,400**	**15,500**	--	--	--
Carbaryl	**4.5 J**	**0.13 J**	--	--	--
Organophosphoruous Pesticides - EPA Me	nd	nd	--	--	--
Organochlorine Pesticides - EPA Method 8	nd	nd	--	--	--
Carbamate Pesticides - EPA Method 531.1 (µg/L)					
Carbaryl	**5.8 J**	**0.12 J**	--	--	--
Herbicides - EPA Method 8085 (µg/L)	nd	nd	--	--	--

Notes:
[1]Ecology, 1999
[2]Surface water criteria identified in WAC 173-340-730(3)(b)(i). The surface water criteria are being used in this report for screening purposes, and are not intended to represent proposed or final cleanup levels.
[3]Lowest available aquatic life marine chronic criteria from Chapter 173-201A, Clean Water Act Section 304, and National Toxics Rule (40 CFR 131)
[4]Lowest available human health marine criteria from Clean Water Act Section 304 and National Toxics Rule (40 CFR 131)
[5]MTCA Method B surface water cleanup level [WAC 173-340-730(3)(b)(iii)]
-- = not available
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TABLE 6
ANALYTE LIST AND CHEMICAL ANALYTICAL TESTING RATIONALE
DRAFT UPLAND RI/FS WORK PLAN
MARCH POINT LANDFILL, ANACORTES, WASHINGTON

Analyte Group	Method	Rationale for Analysis
Priority Pollutant Metals	EPA 6000/7000 Series	Arsenic, cadmium, chromium, copper, lead, nickel, thallium, and zinc were detected in at least one leachate sample at a concentration greater than appropriate aquatic or human heatlh surface water criteria.
Other metals (Fe, Mn)	EPA 6000/7000 Series	Manganese was detected in two leachate samples at concentrations greater than human health surface water criteria. Ecology concluded that the March Point Landfill was somewhat responsible for elevated iron in sediment (Ecology, 1999). Iron was detected in leachate at concentrations greater than freshwater aquatic surface water criteria.
Volatile Organic Compounds	EPA 8260	Ecology identified the landfill as a source of benzene, chlorinated benzenes, toluene, xylenes, and ethylether (Ecology, 1999) based on detections in leachate and/or sediment.
Semivolatile Organic Compounds & Polycyclic Armomatic Hydrocarbons	EPA 8270C and EPA 8270-SIM	Ecology identified the landfill as a source of PAHs, phenols, phthalates, nitrosodiphenylamine, dibenzofuran, carbazole, and dibenzothiophene. Benzo(a)anthracene was detected in leachate at a concentration greater than human health surface water critera. 2-methylphenol, 4-methylphenol, and 2,4-dimethylphenol detections in lagoon sediments exceed Cleanup Screening Levels.
Polychlorinated Biphenyls	EPA 8082	Ecology identified the landfill as source of PCBs. Aroclor 1242 detected in leachate at concentration greater than HH SW Criteria
Dioxins and Furans	EPA 8290	Ecology identified the landfill as source of dioxins and furans. 2,3,7,8-TCDD was detected in sediments collected adjacent to the landfill.
Hydrocarbon Identification	NWTPH - HCID	Based on the proximity of Texaco and Shell refineries to the landfill and interviews conducted by Ecology, there is evidence to suggest that Texaco and Shell disposed of wastes at the landfill. #2 Diesel was detected at a concentration of 850 µg/L in a leachate sample collected adjacent to the landfill.
Diesel and Heavy Oil	NWTPH - Dx	Based on the proximity of Texaco and Shell refineries to the landfill and interviews conducted by Ecology, there is evidence to suggest that Texaco and Shell disposed of wastes at the landfill. #2 Diesel was detected at a concentration of 850 µg/L in a leachate sample collected adjacent to the landfill.
Gasoline	NWTPH - Gx	Based on the proximity of Texaco and Shell refineries to the landfill and interviews conducted by Ecology, there is evidence to suggest that Texaco and Shell disposed of wastes at the landfill.
Organochlorine Pesticides	EPA 8081	Because of limited knowledge of disposal activities at the landfill and the agricultural nature of the surrounding county, pesticides could have been disposed of at landfill
Organophosphorus Pesticides	EPA 8141	Ecology identified the landfill as a source of carbaryl, which was detected in Ecology leachate samples. Ecology stated that sensitive marine species could be adversely affected by carbaryl levels in the immediate vicinity of the landfill. Because of limited knowledge of disposal activities, pesticides could have been disposed of at landfill
Herbicides	EPA 8151	Because of limited knowledge of disposal activities at the landfill and the agricultural nature of the surrounding county, herbicides could have been disposed of at landfill

SEAT:\0\0504037\00\Finals\WP Tables 5 and 6 and 7.xls

TABLE 7
SAMPLING AND ANALYSIS PLAN
DRAFT UPLAND RI/FS WORK PLAN
MARCH POINT LANDFILL, ANACORTES, WASHINGTON

						Type and Number of Chemical Analyses[2,3]													
							Petroleum Hydrocarbons[4]												
Sampling Area	Sample Matrix	Type of Exploration	Number of Explorations or Sample Locations	Exploration Location[1]	Sample Depth	PP Metals (plus Fe, Mn, Va)	HCID	Gasoline	Diesel & Oil	SVOCs[3]	PAHs	VOCs	PCBs	OC Pest	OP Pest	Herb	Asbestos	Total Dissolved Solids	Dioxins & Furans
Upland	Soil	Boring completed for monitoring well construction	13	Dispersed locations on site	0 - 2 feet (landfill cap)	6	6	6	6	6	6	6	6	6	6	6	0	0	0
			13	Dispersed locations on site	2-10 feet (fill)	13	13	13	13	13	13	13	13	13	13	13	13	0	6
			13	Dispersed locations on site	10 - 15 feet (native silt/clay)	13	13	13	13	13	13	13	13	13	13	13	0	0	0
	Soil	Test pit	13	Dispersed locations on site	0 - 2 feet (landfill cap)	6	6	6	6	6	6	6	6	6	6	6	0	0	0
			13	Dispersed locations on site	2-10 feet (fill)	13	13	13	13	13	13	13	13	13	13	13	13	0	6
			13	Dispersed locations on site	10 - 15 feet (native silt/clay)	13	13	13	13	13	13	13	13	13	13	13	0	0	0
	Ground-water	Monitoring well (proposed)	13	On-site	Shallow groundwater	13	0	13	13	13	13	13	13	13	13	13	0	4	2
	Surface Water	Surface water sampling point	NA	Drainage ditches/estuarine stream	NA	4	0	4	4	4	4	4	4	4	4	4	0	0	0
Intertidal Zone	Ground-water Seep	Seep Sampling point	2	Northeast edge of landfill	NA	2	2	2	2	2	2	2	2	2	2	2	0	0	2

Notes:
[1] Proposed exploration locations are shown in Figure 6.
[2] The number of analyses shown does not include chemical analyses that will be completed for quality assurance/quality control (QA/QC) purposes.
[3] Analytical methods are outlined in Section 6.0. It may be necessary to test more than one sample in the "fill" horizon (2-10 feet).
[4] VPH/EPH analysis will be performed on the sample with the highest evidence of petroleum contamination based on field screening. If multiple petroleum types are observed, one sample for each identified petroleum type will be analyzed.
PP = priority pollutant; Fe = iron; Mn = manganese; Va = vanadium; HCID = hydrocarbon identification; SVOCs = semivolatile organic compounds; PAHs = polycyclic aromatic hydrocarbons; VOCs = volatile organic compounds;
PCBs = polychlorinated biphenyls; OC = organochlorine; OP = organophosphorus; Herb = herbicide; NA = not applicable or not determined at this time

SEAT:\0\0504037\00\Finals\WP Tables 5 and 6 and 7.xls

TABLE 8

PRELIMINARY SOIL AND GROUNDWATER CLEANUP LEVELS[1,2]

DRAFT UPLAND RI/FS WORK PLAN

MARCH POINT LANDFILL, ANACORTES, WASHINGTON

Analyte	CAS Registry Number	Soil - MTCA Method B Direct Contact (mg/kg)	Groundwater - MTCA Method B Potable Water (µg/L)
Metals			
arsenic	7440-38-2	7.0E-01	5.8E-02
beryllium	7440-41-7	1.6E+02	3.2E+01
cadmium	7440-43-9	8.0E+01	8.0E+00
chromium	7440-47-3	2.4E+02	4.8E+01
copper	7440-50-8	3.0E+03	5.9E+02
iron	7439-89-6	--	--
lead	7439-92-1	--	--
manganese	7439-96-5	1.1E+04	2.2E+03
mercury	7439-97-6	2.4E+01	4.8E+00
nickel	7440-02-0	1.6E+03	3.2E+02
selenium	7782-49-2	4.0E+02	8.0E+01
silver	7440-22-4	4.0E+02	8.0E+01
thallium	7440-28-0	5.6E+00	1.1E+00
zinc	7440-66-6	2.4E+04	4.8E+03
Volatile Organic Compounds			
1,1,1,2-tetrachloroethane	630-20-6	3.8E+01	1.7E+00
1,1,1-trichloroethane	71-55-6	7.2E+04	7.2E+03
1,1,2,2-tetrachloroethane	79-34-5	5.0E+00	2.2E-01
1,1,2-trichloro-1,2,2-trifluoroethane	76-13-1	--	--
1,1,2-trichloroethane	79-00-5	1.8E+01	7.7E-01
1,1-dichloroethane	75-34-3	8.0E+03	8.0E+02
1,1-dichloroethene	75-35-4	1.7E+00	7.3E-02
1,2,3-trichlorobenzene	87-61-6	--	--
1,2,3-trichloropropane	96-18-4	1.4E-01	4.8E+01
1,2,4-trichlorobenzene	120-82-1	8.0E+02	8.0E+01
1,2,4-trimethylbenzene	95-63-6	4.0E+03	4.0E+02
1,2-dibromo-3-chloropropane	96-12-8	7.1E-01	3.1E-02
1,2-dibromoethane	106-93-4	1.2E-02	5.1E-04
1,2-dichlorobenzene	95-50-1	7.2E+03	7.2E+02
1,2-dichloroethane	107-06-2	1.1E+01	4.8E-01
1,2-dichloropropane	78-87-5	1.5E+01	6.4E-01
1,3,5-trimethylbenzene	108-67-8	4.0E+03	4.0E+02
1,3-dichlorobenzene	541-73-1	--	--
1,4-dichlorobenzene	106-46-7	4.2E+01	1.8E+00
2-butanone	78-93-3	4.8E+04	4.8E+03
2-chloroethyl vinyl ether	110-75-8	--	--
2-hexanone	591-78-6	--	--
4-chlorotoluene	106-43-4	--	--
4-methyl-2-pentanone	108-10-1	6.4E+03	6.4E+02
acetone	67-64-1	8.0E+03	8.0E+02
acrylonitrile	107-13-1	1.9E+00	8.1E-02
benzene	71-43-2	1.8E+01	8.0E-01
bromobenzene	108-86-1	--	--
bromodichloromethane	75-27-4	1.6E+01	7.1E-01
bromoform	75-25-2	1.3E+02	5.5E+00
bromomethane	74-83-9	1.1E+02	1.1E+01
carbon disulfide	75-15-0	8.0E+03	8.0E+02
carbon tetrachloride	56-23-5	7.7E+00	3.4E-01
chlorobenzene	108-90-7	1.6E+03	1.6E+02
chloroethane	75-00-3	3.5E+02	1.5E+01
chloroform	67-66-3	1.6E+02	7.2E+00
chloromethane	74-87-3	7.7E+01	3.4E+00
cis-1,2-dichloroethene	156-59-2	8.0E+02	8.0E+01
cis-1,3-dichloropropene	10061-01-5	--	--
cyclohexane	110-82-7	--	--
dibromochloromethane	124-48-1	1.2E+01	5.2E-01
dichlorodifluoromethane	75-71-8	1.6E+04	1.6E+03
ethylbenzene	100-41-4	8.0E+03	8.0E+02
hexachlorobutadiene	87-68-3	1.3E+01	5.6E-01
hexachloroethane	67-72-1	7.1E+01	3.1E+00
isopropylbenzene	98-82-8	8.0E+03	8.0E+02
m,p-xylenes	1330-20-7	1.6E+05	1.6E+04
methyl acetate	79-20-9	--	8.0E+03
methyl acrylate	96-33-3	2.4E+03	2.4E+02
methyl tert-butyl ether	1634-04-4	5.6E+02	2.4E+01
methylcyclohexane	108-87-2	--	--
methylene chloride	75-09-2	1.3E+02	5.8E+00
n-butylbenzene	104-51-8	--	--
n-propylbenzene	103-65-1	--	--
o-chlorotoluene	95-49-8	1.6E+03	1.6E+02
o-xylene	95-47-6	1.6E+05	1.6E+04
p-isopropyltoluene	99-87-6	--	--
sec-butylbenzene	135-98-8	--	--
styrene	100-42-5	3.3E+01	1.5E+00
tert-butylbenzene	98-06-6	--	--
tetrachloroethene	127-18-4	1.9E+00	8.1E-02
toluene	108-88-3	7.0E+00	6.4E+02
trans-1,2-dichloroethene	156-60-5	1.6E+03	1.6E+02
trans-1,3-dichloropropene	10061-02-6	--	--
trichloroethene	79-01-6	2.5E+00	1.1E-01
trichlorofluoromethane	75-69-4	2.4E+04	2.4E+03
vinyl chloride	75-01-4	6.7E-01	2.9E-02
Semivolatile Organic Compounds			
1-methylnaphthalene	90-12-0	2.4E+01	2.4E+00
2,4,5-trichlorophenol	95-95-4	8.0E+03	8.0E+02
2,4,6-trichlorophenol	88-06-2	9.1E+01	4.0E+00
2,4-dichlorophenol	120-83-2	2.4E+03	2.4E+01
2,4-dimethylphenol	105-67-9	1.6E+03	1.6E+02
2,4-dinitrophenol	51-28-5	1.6E+02	3.2E+01
2,4-dinitrotoluene	121-14-2	1.6E+02	3.2E+01
2,6-dinitrotoluene	606-20-2	8.0E+01	1.6E+01
2-chloronaphthalene	91-58-7	6.4E+03	6.4E+02

TABLE 8

PRELIMINARY SOIL AND GROUNDWATER CLEANUP LEVELS[1,2]

DRAFT UPLAND RI/FS WORK PLAN

MARCH POINT LANDFILL, ANACORTES, WASHINGTON

Analyte	CAS Registry Number	Soil - MTCA Method B Direct Contact (mg/kg)	Groundwater - MTCA Method B Potable Water (µg/L)
2-chlorophenol	95-57-8	4.0E+02	4.0E+01
2-methylnaphthalene	91-57-6	3.2E+02	3.2E+01
2-methylphenol	95-48-7	4.0E+03	4.0E+02
2-nitroaniline	88-74-4	--	--
2-nitrophenol	88-75-5	--	--
3-nitroaniline	99-09-2	--	--
3,3'-dichlorobenzidine	91-94-1	2.2E+00	1.9E-01
4,6-dinitro-2-methylphenol	534-52-1	--	--
4-bromophenyl phenyl ether	101-55-3	--	--
4-chloro-3-methylphenol	59-50-7	--	--
4-chloroaniline	106-47-8	3.2E+02	3.2E+01
4-chlorophenyl phenyl ether	7005-72-3	--	--
4-methylphenol	106-44-5	4.0E+02	4.0E+01
4-nitroaniline	100-01-6	--	--
4-nitrophenol	100-02-7	--	--
acenaphthene	83-32-9	4.8E+03	9.6E+02
acenaphthylene	208-96-8	--	--
aniline	62-53-3	1.8E+02	7.7E+00
anthracene	120-12-7	2.4E+04	4.8E+03
benzidine	92-87-5	4.3E-03	3.8E-04
benzo(a)anthracene	56-55-3	1.4E-01	1.2E-02
benzo(a)pyrene	50-32-8	1.4E-01	1.2E-02
benzo(b)fluoranthene	205-99-2	1.4E-01	1.2E-02
benzo(ghi)perylene	191-24-2	--	--
benzo(k)fluoranthene	207-08-9	1.4E-01	1.2E-02
benzoic acid	65-85-0	3.2E+05	6.4E+04
benzyl alcohol	100-51-6	2.4E+04	2.4E+03
bis(2-chloroethoxy)methane	111-91-1	--	--
bis(2-chloroethyl) ether	111-44-4	9.1E-01	4.0E-02
bis(2-chloroisopropyl) ether	108-60-1	3.2E+03	3.2E+02
bis(2-ethylhexyl) phthalate	117-81-7	7.1E+01	6.3E+00
butyl benzyl phthalate	85-68-7	1.6E+04	3.2E+03
carbazole	86-74-8	5.0E+01	4.4E+00
chrysene	218-01-9	1.4E-01	1.2E-02
dibenz(a,h)anthracene	53-70-3	1.4E-01	1.2E-02
dibenzofuran	132-64-9	1.6E+02	3.2E+01
diethyl phthalate	84-66-2	6.4E+04	1.3E+04
dimethyl phthalate	131-11-3	8.0E+04	1.6E+04
di-n-butyl phthalate	84-74-2	8.0E+02	1.6E+03
di-n-octyl phthalate	117-84-0	1.6E+03	3.2E+02
fluoranthene	206-44-0	3.2E+03	6.4E+02
fluorene	86-73-7	3.2E+03	6.4E+02
hexachlorobenzene	118-74-1	6.3E-01	5.5E-02
hexachlorobutadiene	87-68-3	1.3E+01	5.6E-01
hexachlorocyclopentadiene	77-47-4	4.8E+02	4.8E+01
hexachloroethane	67-72-1	7.1E+01	3.1E+00
indeno(1,2,3-cd)pyrene	193-39-5	1.4E-01	1.2E-02
isophorone	78-59-1	1.1E+03	4.6E+01
naphthalene	91-20-3	1.6E+03	1.6E+02
nitrobenzene	98-95-3	4.0E+01	4.0E+00
n-nitrosodimethylamine	62-75-9	2.0E-02	8.6E-04
n-nitrosodi-n-propylamine	621-64-7	1.4E-01	--
n-nitrosodiphenylamine	86-30-6	2.0E+02	--
pentachlorophenol	87-86-5	8.3E+00	7.3E-01
phenanthrene	85-01-8	--	--
phenol	108-95-2	4.8E+04	4.8E+03
pyrene	129-00-0	2.4E+03	4.8E+02
pyridine	110-86-1	8.0E+01	8.0E+00
Polychlorinate Biphenyls			
Aroclor 1016	12674-11-2	5.6E+00	1.1E+00
Aroclor 1221	11104-28-2	--	--
Aroclor 1232	11141-16-5	--	--
Aroclor 1242	53469-21-9	--	--
Aroclor 1248	12672-29-6	--	--
Aroclor 1254	11097-69-1	1.6E+00	3.2E-01
Aroclor 1260	11096-82-5	--	--
Total polychlorinated biphenyls	1336-36-3	5.0E-01	4.4E-02
Dioxins and Furans			
2,3,7,8-TCDD	1746-01-6	6.7E+00	5.8E-07
1,2,3,7,8-PeCDD	40321-76-4	--	--
1,2,3,6,7,8-HxCDD	54653-85-7	--	--
1,2,3,4,7,8-HxCDD	39227-28-6	--	--
1,2,3,7,8,9-HxCDD	19408-74-3	1.6E+02	--
1,2,3,4,6,7,8-HpCDD	35822-46-9	--	--
OCDD	3268-87-9	--	--
2,3,7,8-TCDF	51207-31-9	--	--
1,2,3,7,8-PeCDF	57117-41-6	--	--
2,3,4,7,8-PeCDF	57117-31-4	--	--
1,2,3,6,7,8-HxCDF	57117-44-9	--	--
1,2,3,7,8,9-HxCDF	72918-21-9	--	--
1,2,3,4,7,8-HxCDF	70648-26-9	--	--
2,3,4,6,7,8-HxCDF	60851-34-5	--	--
1,2,3,4,6,7,8-HpCDF	67562-39-4	--	--
1,2,3,4,7,8,9-HpCDF	55673-89-7	--	--
OCDF	39001-02-0	--	--
Total Petroleum Hydrocarbons			
Gasoline Range Organics	--	--	--
Diesel Range Organics	--	--	--
Heavy Oil rane Organics	--	--	--
Organochlorine Pesticides			
aldrin	309-00-2	5.9E-02	2.6E-03
chlordane	57-74-9	2.9E+00	2.5E-01
4,4'-DDD	72-54-8	4.2E+00	3.6E-01

TABLE 8

PRELIMINARY SOIL AND GROUNDWATER CLEANUP LEVELS[1,2]

DRAFT UPLAND RI/FS WORK PLAN

MARCH POINT LANDFILL, ANACORTES, WASHINGTON

Analyte	CAS Registry Number	Soil - MTCA Method B Direct Contact (mg/kg)	Groundwater - MTCA Method B Potable Water (µg/L)
4,4'-DDE	72-55-9	2.9E+00	2.6E-01
4,4'-DDT	50-29-3	2.9E+00	2.6E-01
dieldrin	60-57-1	6.3E-02	5.5E-03
endosulfan I	959-98-8	4.8E+02	9.6E+01
endosulfan II	33213-65-9	4.8E+02	9.6E+01
endosulfan sulfate	1031-07-8	4.8E+02	9.6E+01
endrin	72-20-8	2.4E+01	4.8E+00
endrin aldehyde	7421-93-4	2.4E+01	4.8E+00
endrin ketone	53494-70-5	2.4E+01	4.8E+00
heptachlor	76-44-8	2.2E-01	1.9E-02
heptachlor epoxide	1024-57-3	1.1E-01	4.8E-03
a-hexachlorocyclohexane	319-84-6	1.6E-01	1.4E-02
b-hexachlorocyclohexane	319-85-7	5.6E-01	4.9E-02
d-hexachlorocyclohexane	319-86-8	--	--
lindane	58-89-9	7.7E-01	6.7E-02
methoxychlor	72-43-5	4.0E+02	8.0E+01
toxaphene	8001-35-2	9.1E-01	8.0E-02
Organophosphorus Pesticides			
alachlor	15972-60-8	1.2E+01	1.1E+00
methyl azinphos	86-50-0	--	--
bolstar (sulfopros)	35400-43-2	--	--
carbaryl	63-25-2	8.0E+03	1.6E+03
chlorpyrifos	2921-88-2	2.4E+02	4.8E+01
chlorfenvinphos	470-90-6	--	--
coumaphos	56-72-4	--	--
crotoxyphos	7700-17-6	--	--
o,s-demeton	8065-48-3	3.2E+00	6.4E-01
diazinon	333-41-5	7.2E+01	1.4E+01
dichlorvos	62-73-7	3.4E+00	1.5E-01
dicrotophos	141-66-2	8.0E+00	1.6E+00
dimethoate	60-51-5	1.6E+01	3.2E+00
disulfoton	298-04-4	3.2E+00	6.4E-01
ethion	563-12-2	4.0E+01	8.0E+00
ethoprop	13194-48-4	--	--
ethyl p-nitrophenyl phenylphosphorothioate	2104-64-5	8.0E-01	1.6E-01
fensulfothion	115-90-2	2.0E+01	4.0E+00
fenthion	55-38-9	--	--
malathion	121-75-5	1.6E+03	3.2E+02
merphos	150-50-5	2.4E+00	--
methyl parathion	298-00-1	2.0E+01	4.0E+00
mevinphos	7786-34-7	2.0E+01	4.0E+00
monocrotophos	2157-98-4	--	--
parathion	56-38-2	4.8E+02	9.6E+01
phorate	298-02-2	1.6E+01	3.2E+00
ronnel	299-84-3	4.0E+03	8.0E+02
sulfotepp	3689-24-5	4.0E+01	8.0E+00
tetrachlorvinphos	961-11-5	4.2E+01	4.8E+02
tokuthion	34643-46-4	--	--
trichloronate	327-98-0	--	--
Herbicides			
dalapon	75-99-0	2.4E+03	2.4E+02
2,4-db	94-82-6	6.4E+02	1.3E+02
dicamba	1918-00-9	2.4E+03	4.8E+02
2,4-dichlorophenoxyacetic acid	94-75-7	8.0E+02	1.6E+02
dichloroprop	120-36-5	--	--
dinoseb	88-85-7	8.0E+01	--
2-methyl-4-chlorophenoxy-acetic acid	94-74-6	4.0E+01	8.0E+00
(2-methyl-4-chlorophenoxy)-2-propionic acid	93-65-2	8.0E+01	1.6E+01
2,4,5-tp	93-72-1	6.4E+02	--
2,4,5-trichlorophenoxyacetic acid	93-76-5	8.0E+02	--

Notes:

[1] MTCA Method B soil cleanup levels for direct contact and MTCA Method B groundwater cleanup levels for potable water (WAC 173-340-740 and WAC 173-340-720)

[2] Surface water cleanup levels cleanup levels will be identified following WAC 173-340-730 pending the results of the remedial investigation.

mg/kg = milligram per kilogram; µg/L = microgram per liter; -- = not available

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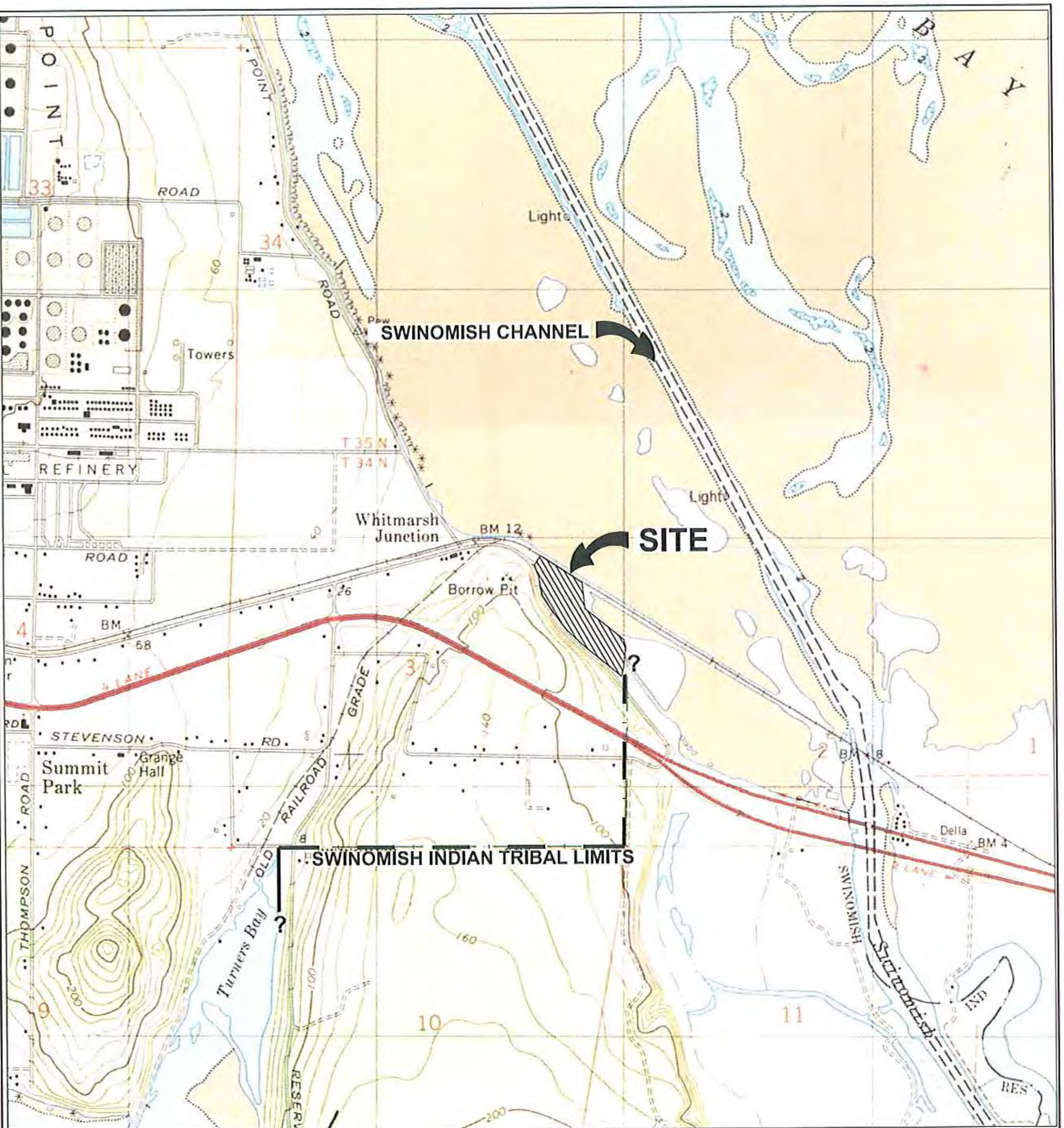

Vicinity Map

March Point Landfill
Anacortes, Washington

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Figure 1

Reference: USGS 7.5' topographic quadrangle map
"Anacotres South, Wa. 1978

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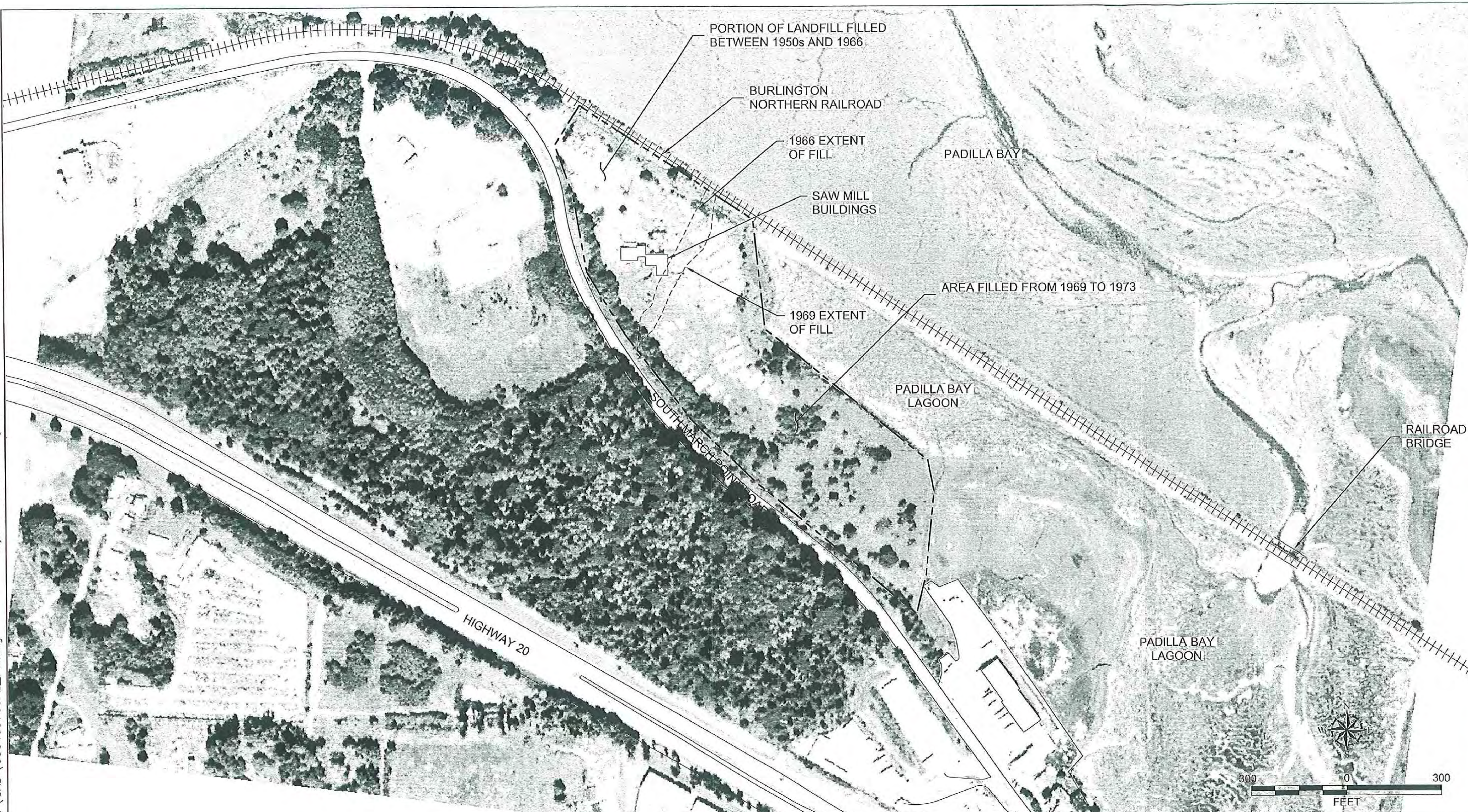

SEAT \P:\ 0504037\00\CAD\0504037OOF2_F9.dwg Layout Tab Name:Figure 2 NFM:SES 04/20/07 Xref:N/A Image:YES

Notes:

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

Reference: Drawing base from aerial photographs from Aero-Metric/Seattle.

Legend:

— — — — — Approximate Landfill Boundary

Site Plan

March Point Landfill
Anacortes, Washington

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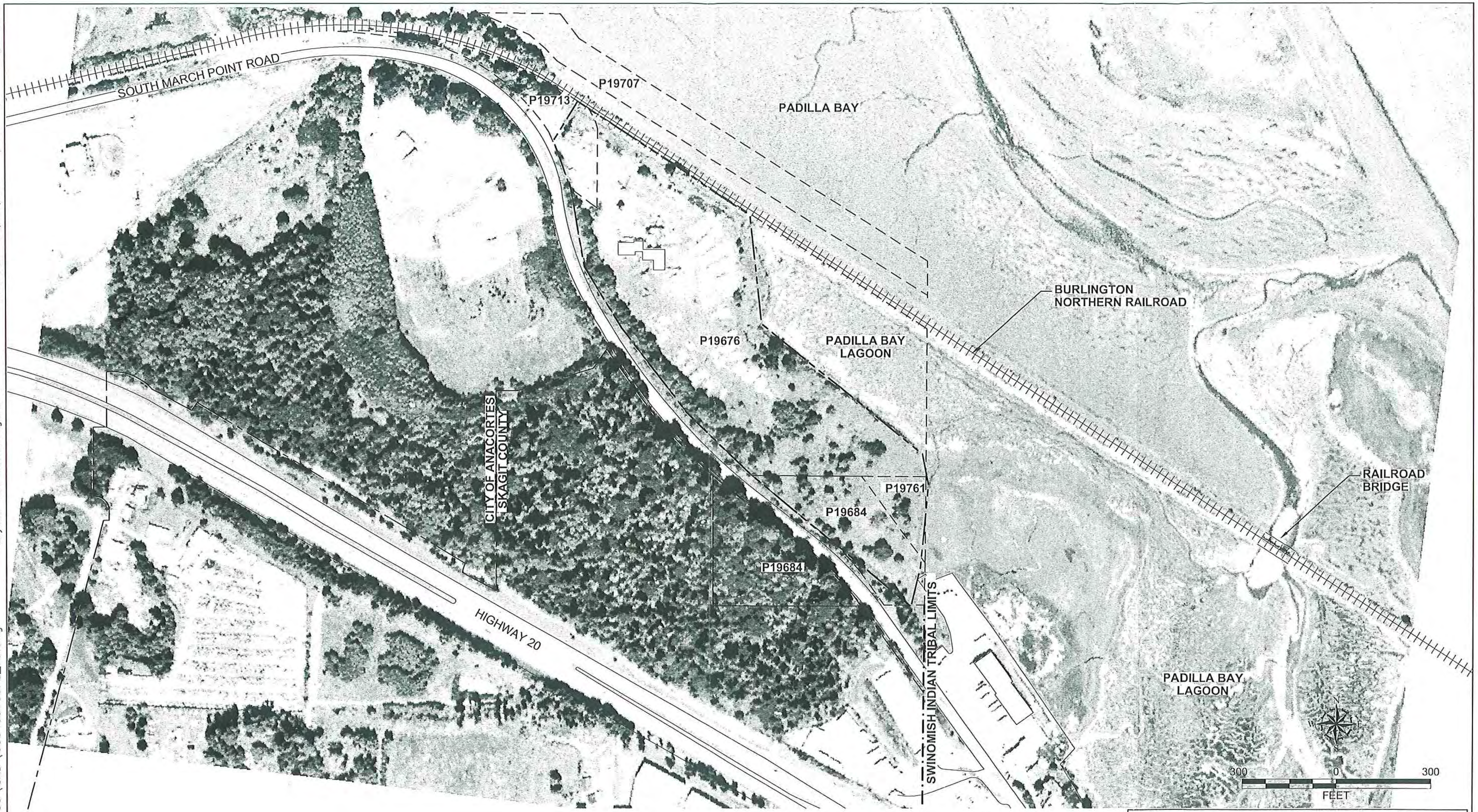
Figure 2



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Notes:

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

Reference: Drawing base from aerial photographs from Aero-Metric/Seattle.

Legend:

- Approximate Landfill Boundary
- Parcel Boundary
- P 19713 Parcel Number
- City / County Line
- Tribal Boundary

Tax Parcels

March Point Landfill
Anacortes, Washington

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Figure 3

Photo 1: Drainage ditch on northeast side of landfill looking southeast

Photo 2: Drainage ditch on southwest side of landfill looking east

Photo 3: Drainage ditch/estuarine stream on southeast side of landfill looking northwest

Photo 4: Estuarine stream on southeast side of landfill draining into Padilla Bay Lagoon looking north

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FIGURE 4 – March 2007 Site Photographs

March Point Landfill, Anacortes, Washington

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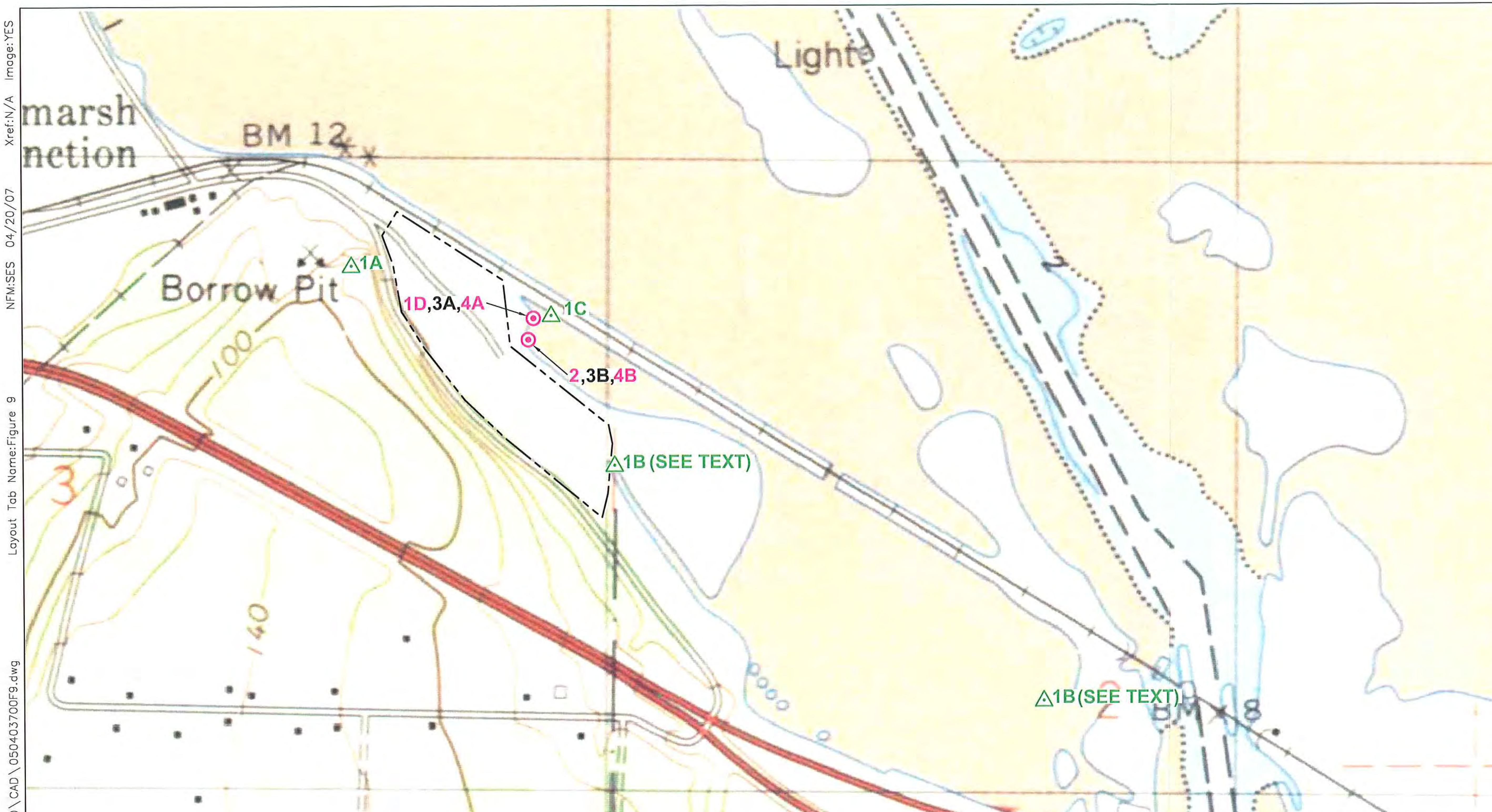

Notes:
1. The locations of all features shown are approximate. 2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. can not guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers,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

Reference: Drawing base USGS 7.5 topographic quadrangle map, Anacortes South, WA. 1978.

Legend:

- Approximate Landfill Boundary
- 1D ◉ Location of Previous Leachate Water Sample
- 1A △ Location of Previous Surface Water Sample
- 1A △ Surface Water Exceedance
- 1D ◉ Leachate Exceedance

Key

1 = Ecology, 1986
2 = Ecology, 1988
3 = Skagit County, 1996
4 = Ecology, 1999

N W E S

500 0 500
FEET

Previous Leachate / Surface Water Sample Locations

March Point Landfill
Anacortes, Washington

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Figure 5

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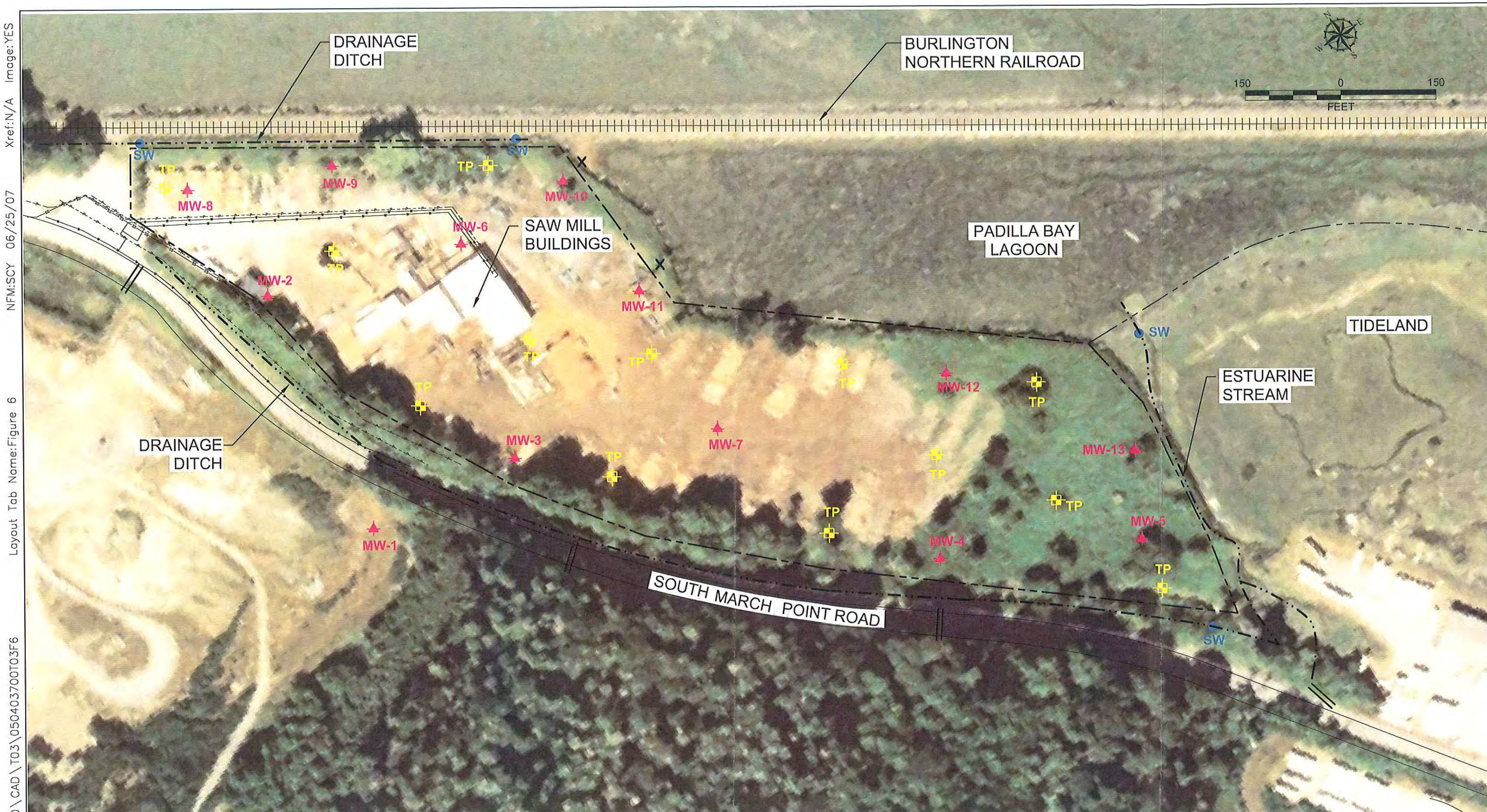

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. can not guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers,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

Reference: Drawing base from aerial photographs from Aero-Metric/Seattle.

Legend:

X	Leachate Sample Location	— - - —	Approximate Landfill Boundary
TP	Test Pit	- -P- - -P-	Power Line
MW-1	Monitoring Well	——W——	Water Line
SW	Surface Water Sample Location	—SS——SS—	Sanitary Sewer Line
═	Culvert		

Proposed Sample Locations

March Point Landfill
Anacortes, Washington

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Figure 6

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